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KNOWLEDGE MODEL FOR POST-DISASTER MANAGEMENT

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ABSTRACT. The main aim of this research is to help post-disaster managers to find most rational solutions by using advanced knowledge and developed Model. Post-disaster management is shared, purposeful activities based upon the development of common understandings and interpretations of means and ends. Stakeholders generate the personal and group decisions which contribute to post-disaster management success. This article describes the development (during EurAsia project) of a Knowledge Model for Post-disaster Management based upon multiple criteria decision making theory. The developed Model involves six stages that help to determine rational post-disaster management alternatives by evaluating post-disaster management' life cycle, stakeholders, micro and macro environment.

1. INTRODUCTION

Post-disaster management has various approaches and different priorities in different countries. It is not surprising that there are widely divergent views and interpretations in various countries, with marked differences between countries that have a developed market economies, those with transition economies and in developing countries. Not all countries with one of theses three development levels, understand post-disaster management in the same way and so have different strategies.

Successful strategies for post-disaster management should be more-or-less compatible with disaster level, economic, social, cultural, institutional, technological, technical, cultural, environmental and legal/regulatory situations in the country under consideration. A varied spectrum of strategies can be launched, while keeping in mind that the mix of influencing factors and the relative emphasis is on one or other of the factors and overall will depend on local conditions.

Therefore, the best post-disaster management strategy of another country cannot just

be copied. Strategies may only be adapted into a real disaster situation, economic, social, cultural, institutional, technological, technical, cultural, environmental and legal/regulatory circumstances of the existing state. There is no such thing as a single post-disaster management strategy that could be applied to all countries.

The trends of post-disaster management and modelling were investigated by researchers from various countries. For example, Ruangrassamee and Saelem (2009) described effect of Tsunamis generated in the Manila Trench on the Gulf of Thailand. Scheffers et al. (2008) analysed Late Holocene tsunami traces on the Western and Southern coastlines of the Peloponnesus (Greece). Barbier (2008) presented lessons learned from the household decision to replant mangroves in Thailand. Cochard et al. (2008) reviewed the 2004 tsunami in Aceh and Southern Thailand with special emphasis on coastal ecosystems, wave hazards and vulnerability. Alongi (2008) studied mangrove forests with special emphasis on resilience, protection from tsunamis, and responses to global climate change. Morton et al. (2007) presented physical criteria for distinguishing sandy tsunami and storm deposits using modern examples. Pérez-Maqueo et al. (2007) examined coastal disasters from the perspective of ecological economics. Rose (2007) analysed economic resilience to natural and man-made disasters. Altay and Green (2006) applied OR/MS research in disaster operations management. Benson and Clay (2006) analysed disasters, vulnerability and the global economy with special emphasis on implications for less-developed countries and poor populations. Galbraith and Stiles (2006) reviewed disasters and entrepreneurship. Hassan (2005) performed simplified two-dimensional numerical modelling of coastal flooding. Bates et al. (2004) analysed mitigating impacts on tourism. Alcántara-Ayala (2002) studied geomorphology, natural hazards, vulnerability and prevention of natural

disasters in developing countries. Jayaraman et al. (1997) analysed management of the natural disasters from space technology inputs.

It can be noticed that above researchers engaged in the analysis of a post-disaster management and modelling but did not consider the research's object as was analyzed by the authors of the present investigation. A life cycle of a post-disaster management may be described as follows: post-disaster management life cycle, the stakeholders involved in a post-disaster management as well as the micro and macro environments, having a particular impact on it and making an integral whole.

The paper is structured as follows. Following this introduction, Section 2 describes the knowledge model for post-disaster management. In Section 3 we determining the best practice for post-disaster management as based on the actual conditions. Performance of transformational learning and redesigning the manager' mental and practical behaviour are presented in Section 4. Finally, some concluding remarks are provided in Section 5.

2. KNOWLEDGE MODEL FOR POST-DISASTER MANAGEMENT

There are two essential branches of knowledge management – explicit and tacit. Explicit knowledge is widely used in information technologies. Explicit knowledge is comprised of the documents and data (for example, estimate for building costs) that are stored within the memory of computers. This information must be easily accessible, so that stakeholders could get all the necessary knowledge without disturbances. Tacit knowledge is knowledge housed in the human brain, such as: expertise, understanding, skills, professional intuition, competence, experience, organizational culture, informal organizational communication networks, intellectual capital of an organization, ideals, traditions, values, emotions, etc (see Figure 1).
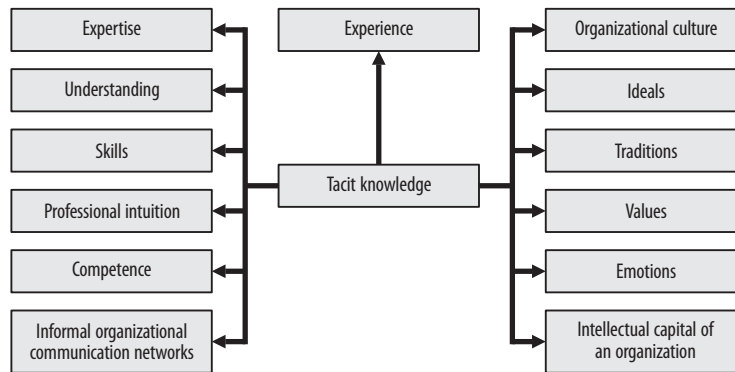
Figure 1. Tacit knowledge

The research's aim was to develop a Knowledge Model for Post-disaster Management by undertaking a complex analysis of micro and macro environment factors affecting post-disaster life cycle and to present recommendations on efficient eliminating disaster's subsequences. The research was performed by studying the most advanced expertise in the field. A simulation was undertaken to provide insight into creating an effective micro and macro environment.

The level of efficiency of the post-disaster management depends on the many micro and macro-level variable factors and all these variable factors can be optimized. The main objective of this Model is to analyze the best experiences in the field, to compare it and consequently to present particular recommendations.

The word 'model' implies 'a system of game rules', which the post-disaster management development could use to its best advantage. The stakeholders of the post-disaster management cannot correct or alter the micro and macrolevel variables, but they can go into the essence of their effect and take them into consideration in their activities. Stakeholders, by knowing the environment affecting their activities, can organize their present and future actions more successfully.

This research included the following six stages.

Stage I. Comparative description of the post-disaster management:

- A system of criteria characterizing the efficiency of post-disaster management was determined by means of using relevant literature and experts methods;
- Based on a system of criteria, a description of the present state of post-disaster management is given in conceptual (textual, graphical, numerical, etc.) and quantitative forms.

Stage II. A comparison and contrast of post-disaster management:

- Identifying the global development trends (general regularities) of the post-disaster management;
- Identifying post-disaster management differences between countries under analysis;
- Determining pluses and minuses of these differences for countries under analysis;
- Determining the best practice of post-disaster management for countries under analysis as based on the actual conditions.
- Estimating the deviation between post-disaster managers' knowledge of worldwide best practice and their practice-in-use.

Stage III. A development of some of the general recommendations as how to improve the efficiency levels for post-disaster management.

Stage IV. Submission of particular recommendations for post-disaster management. Each of the general recommendations proposed in the fifth stage carry several particular alternatives.

Stage V. A multiple criteria analysis of post-disaster management's components and a selection of the most efficient version of post-disaster's management life cycle were determined at this stage. After this stage, the received compatible and rational components of a post-disaster management are joined into the full post-disaster management process.

Stage VI. Performance of transformational learning and redesigning the mental and practical behaviour of post-disaster managers:

- Post-disaster managers (stakeholders) becoming aware and conceptualize of their practice-in-use;
- Post-disaster managers' (firms') becoming aware and conceptualize of their knowledge of worldwide best practice;
- Post-disaster managers (stakeholders) estimating the deviation between knowledge of worldwide best practice and their practice-in-use;
- Performance of best practice learning;
- Fulfilling of best practice actions (understanding what the recurring motives caused manager' initial behaviour are; redesigning managers' core patterns of thought and behaviour);
- Performance of transformational learning (acquiring new manners of technological, social, ethical, etc. behaviour, get better understanding of how to interact with micro and macro environment) and redesigning the behaviour.

In order to throw more light on the Knowledge Model for Post-disaster Management, further follow more detailed description of the

some above mentioned stages of analysis (determining the best practice for post-disaster management as based on the actual conditions and performance of transformational learning and redesigning the manager' mental and practical behaviour).

3. DETERMINING THE BEST PRACTICE FOR POST-DISASTER MANAGEMENT AS BASED ON THE ACTUAL CONDITIONS

Perception, that much more attention has to be paid to the knowledge creation and spread in the form of the knowledge bases of best practice, have been recently set in a post-disaster management field. Knowledge bases of the best practice are knowledge-obtaining tools, which allow to save a lot of time, provide information on the best post-disaster management practice in different forms (regulations, e-books, slide presentations, structural schemes, text, video and audio material, etc.).

Tacit knowledge base of best practice consists of informal and unrecorded procedures, practices, and skills. Knowledge management systems are of value to the extent that it can codify "best practices" in a post-disaster management, store them, and disseminate them as needed. Tacit knowledge is highly personal, context-specific, and therefore hard to formalize and communicate. Tacit knowledge is extremely important to the post-disaster management because, once a tsunami subsequences are eliminate, professionals tend to forget it and start something new. Therefore, knowledge utilization is a key factor in effectively executing a post-disaster management.

Education involves the enhancement and use of indigenous knowledge for protecting people, habitat, livelihoods, and cultural heritage from natural hazards. Educational practices can be conducted through direct learning, information technology, staff training, electronic and print media and other in-

novative actions to facilitate the management and transfer of knowledge and information to citizens, professionals, organizations, community stakeholders and policymakers. History teaches that inadequate disaster reduction awareness and preparation repeatedly leads to preventable loss of life and damage in all major natural disasters. Preparation through education is less costly than learning through tragedy. There is strong need for experience and knowledge sharing at different levels as well as need for knowledge networking and partnership building to support policy making and recovery planning (Thematic Discussion Paper Cluster 3, 2005).

Knowledge is at its most effective when linked to community needs. Knowledge for implementing risk reduction activities at the individual, household, community and policy levels should be the ultimate target, keeping in mind that building a culture of safety and resilience requires time, effort, resources and continued cooperation and understanding amongst all actors. This calls for the application of knowledge and behavioral change on disaster risk promotion and information strengthening and dissemination on disaster risk and safety actions. This focuses on four themes (Thematic Discussion Paper Cluster 3, 2005):

- Education: formal, informal education;
- Increased Knowledge base: information management, multi-discipline, and cross sectoral cooperation, research and development;
- Information and public awareness: media, civil society involvement for dissemination and implementation;
- Community empowerment: capacity building, and community resilience by building knowledge bases.

Tsunami recovery by public and private sector partnerships can benefit to (IBM Crisis Response Team, 2005):

- Identify Gaps: lack of service, support, and resources compared against victim, community, and government needs;
- Examine local available skill base – keep as much work local as possible;
- Identify minimal standards and best practices;
- Examine rebuilding issues including priorities, cost, resources, and labor;
- Understand the social, political, and environmental impact;
- Learn from prior disasters and mistakes to reduce exposures;
- Communicate and share information with partners on a regular basis.

Knowledge sharing has to be developed in regional and national levels in disaster recovery phases. As Sri Lanka reviews its coastal zone management and development plans in the light of lessons learned from the tsunami, it would be wise as well to find out as much as possible about the manner in which other tsunami-prone and typhoon-prone countries in the Asia-Pacific region undertake coastal zone planning. Various governments have been working for some time on ecological restoration in their coastal zones. Practical knowledge on what works can be made accessible to Sri Lanka through exchange visits and study tours with these countries. Since other countries affected by the tsunami may also conclude that they need to take similar measures in their own coastal zones, sharing of relevant knowledge would increase the effectiveness of the whole regional process, with benefits for each country (UNEP, 2005).

In Sri Lanka, regional knowledge sharing of development planning would be enhanced through exchange among experts and institutions that have experience of ecological reconstruction, planning and construction of sustainable urban environments, use of digital terrain mapping to guide investment in coastline defence, and in waste management. Environmental education and awareness is needed

to increase public understanding of the environments where communities live, so that they can be encouraged and enabled to participate in their own development (UNEP, 2005).

The sharing of experience during reconstruction, which is considered as an educational process play an important role. Awareness raising on people's participation to respond to early warning system is also of utmost importance. Therefore, the combination of high-tech knowledge with low or no-tech disaster education will be required in most cases. A world list on disaster reduction technologies (with specific relevance to implementation) might be a good database for field practitioners. Therefore the primary issues on knowledge are to identify, recognize the importance of traditional and indigenous knowledge bases, and utilize these bases effectively (Thematic Discussion Paper Cluster 3, 2005).

In the countries affected by Asian tsunami the lack of knowledge management is apparent. Food is not reaching the affected victims, logistics is a nightmare and coordination is needed among the nations offering aid. It would be timely to proactively design such a knowledge system that could be used in any kind of disaster – natural or manmade. A sound knowledge management system would help tremendously. This knowledge system would be a coordination framework that could be put up immediately no matter where disaster strikes. Affected countries can immediately plug in local information – maps, population demographics, hospital locations and so on – into this coordination framework. The resources of countries offering aid can also be plugged into the system, and the logistics mapped out by the system, aided by observation satellites that can give visuals of altered coastlines and the extent of the damage (Republic of the Maldives, 2005).

In the countries suffering from various natural disasters there is a conscious effort for Disaster Risk Reduction at national, provincial and sub-provincial level. Thousands of organi-

zations are supporting the effort from last few decades. However there is a felt gap in information coordination and sharing. The knowledge and experiences of disaster practitioners are remaining in individual or institutional domain. There is an urgent need of an organized common platform to capture, organize and share this knowledge and to create a versatile interface among policy-makers in the Government and disaster managers at all administrative level (National/State/District/Sub-District/Community). Acknowledging the need for a disaster knowledge networking platform to facilitate interaction and have simultaneous dialogue with all related expertise dealing with disaster management, the knowledge management initiative should be thoughtfully envisaged as a tool to store, retrieve, disseminate and manage information related to disaster management (National Disaster Management Division, 2006).

In order to enhance the information sharing and management of the knowledge generated in these institutions, it is highly essential to closely knit the organizations/ institutions and moreover people. The network of these institutions would create a common platform and enable its stakeholders and people to capture, organize, share and reuse the knowledge generated in the area of disaster management. The network would use various tools to connect the Government, Institutions and people (National Disaster Management Division, 2006).

Some trends of the best practice for post-disaster management as based on the actual conditions are following:

- Integrate disaster risk reduction into education at all levels. Disaster risk reduction should be integrated into education at all levels and public awareness initiatived and including school curricula, dissemination of knowledge, especially local knowledge (Main results and recommendations, 2005).
- Provide easily understandable information on disaster risks and protection op-

tions, especially to citizens in high-risk areas, to encourage and enable people to take action to reduce risks and build resilience. The information should incorporate relevant traditional and indigenous knowledge and culture heritage and be tailored to different target audiences, taking into account cultural and social factors (Masamvu, 2005).

- Improve land use planning. Goverments bare prime responsibilities for enforcing and improving land use planning through risk mapping. Practices to include participatory approaches, risk mapping and conflict resolution at all levels (Main results and recommendations, 2005).
- Strengthen networks among disaster experts, managers and planners across sectors and between regions, and create or strengthen procedures for using available expertise when agencies and other important actors develop local risk reduction plans (Fernandez, 2006).
- Appropriate warning systems for communities. National government bodies to cooperate with local government and community organisations to promote timely dissemination to communities, establish and maintain monitoring systems and provide appropriate shelters and escape routes (Main results and recommendations, 2005).
- Promote and improve dialogue and cooperation among scientific communities and practitioners working on disaster risk reduction, and encourage partnerships among stakeholders, including those working on the socioeconomic dimensions of disaster risk reduction (Main results and recommendations, 2005).

Integrated explicit and tacit analysis provides the exhaustive knowledge about various aspects of a post-disaster management:

- economical,
- legislative,
- social,
- management,
- ethical,
- technical,
- technological,
- infrastructural,
- qualitative (architectural, aesthetic, comfortability, etc.).

By using of Knowledge Base of Experts it is possible to search for experts and facilitates communication with those experts by using internet technology. Logging into Knowledge Base of Experts, stakeholders can search for an expert with the relevant knowledge, and will connect with him in real time by using instant messaging, e-mail, telephone, or Internet conferencing. As a result, stakeholder could receive direct tacit help from an expert who had recently experienced a similar problem. At the time of communication, experts' tacit knowledge will be transferred in the most appropriate forms and applied in business processes. Their dialogue would be audited and stored in enterprise database systems to be searched by others. In this way, the stakeholder extracts valuable tacit knowledge from employees' human brains and applies those assets to the work process. In this way, higher performance levels theoretically can be achieved by accelerating the knowledge transfer processes.

4. PERFORMANCE OF TRANSFORMATIONAL LEARNING AND REDESIGNING THE POST-DISASTER MANAGER' MENTAL AND PRACTICAL BEHAVIOUR

Performance of transformational learning and redesigning the post-disaster manager' mental and practical behaviour included six stages (see Figure 2).

Once post-disaster managers become aware and conceptualize of their practice-in-use, they can begin the process of changing their practice-in-use to become aligned with their knowledge of worldwide best practice.
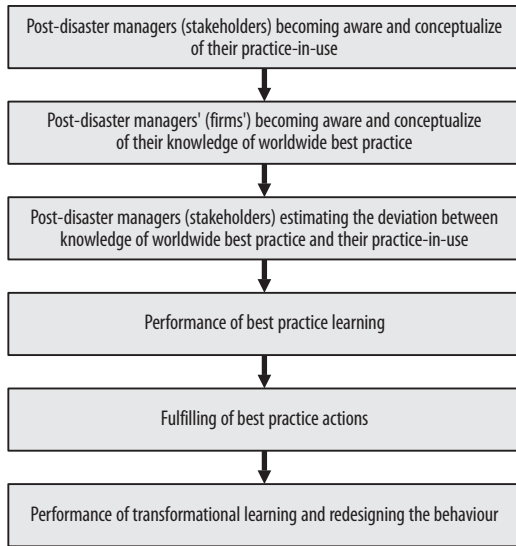
Figure 2. Performance of transformational learning and redesigning the manager' mental and practical behaviour

If post-disaster manager' activities produce an unsatisfactory result, he change activities to amend the result. However, if it is unable to observe the typical situations that led to the not rational result occurring, it is likely that problems will continue to appear. The aim of best practice activities is to redesign post-disaster managers' core patterns of thought and behaviour according to their knowledge of worldwide best practice. This is achieved if, after performing the best practice learning process and correcting post-disaster managers' mistakes, managers go one step further and ask what the recurring demands and objectives that caused their initial mental and practical behaviour are. In redesigning the way managers think that he can become less protective, more open, and gradually more aware. This is the point where individual mental and practical behaviour change occurs.

There are quite close relationship between best practice activities and post-disaster managers' learning abilities. Post-disaster managers who shifted from best practice learning to best practice activities are able to take on more responsibility, and better respond to micro and macro environment around them. The managers are able to test potential ideas, solutions, and develop possible alternatives to deal with likely results. Post-disaster managers became more confident in their interpersonal skills and more inspired in problem-solving.

Also is possible to apply the best practice actions process to firms. For organisations to perform better, mistakes that occur should not simply be corrected, as occurs in best practice learning process. Rather, the underlying framework in the firm that led to the error occurring should be analysed. In this way, organisations can improve their goals, strategies, plans, technologies, values or beliefs, to improve their overall functionality.

Yeo (2006) examined a Singaporean higher learning institute that was being gradually transformed into a learning organization through the use of reflective-action learning groups. Reflective-action learning groups were intended to provide a specific forum for staff (the members of the firm) to analyse teaching and learning effectiveness in order to improve their skills in these areas.

Blackman and Henderson (2001) compare an organisation's knowledge system with a washing machine: In order for clothes to be really clean (which represents attaining new knowledge), all previous dirt (which represents experiences) must be removed. This means that, before a cleansing rinse commences, the dirty water has to be totally drained away. If even a small amount of the previous dirty water remains (representing the ingrained, limiting systems of learning), it will spread through and taint the entire rinse (making it impossible for fresh learning to occur) (Blackman and Henderson, 2001).

Transformational learning investigates the context and nature of the learning process itself, and by extension, putting post-disaster manager under the microscope. Transforma-

tional learning involves considering why managers think and act in the manner managers do, and exploring underlying hidden patterns of thinking and acting. Just as best practice actions goes one step further than best practice learning by asking post-disaster managers to examine the internal processes that led to the erroneous behaviour occurring, transformational learning goes one step further again, asking post-disaster managers to consider why those particular internal processes even exist, and whether there are other factors operating on a subconscious level to affect post-disaster managers behaviour. In a firm context, transformational learning also involves examining core principles on which the organisation is set, and testing its mission, vision, market position, technology and culture.

Utilising transformational learning techniques increases post-disaster managers' awareness, helping post-disaster managers gain more control over the factors that affect their behaviour, which ultimately helps post-disaster managers to achieve required goals. By observing post-disaster managers language, premises, opinions, responses, and mental models that influence the way managers interact, managers enhance ability to create genuinely new manners of technological, social, ethical, etc. behaviour, habits of learning, and improve understanding of how to interact with micro and macro environment. This helps post-disaster managers and organisation achieve goals more effectively, as managers become able to identify and remove barriers to goals. Transformational learning can be defined as creation of a setting where conscious collective mindfulness can be maintained. By using transformational learning techniques, individuals can learn to think and act together ways that will benefit the firm.

Blackman and Henderson (2001) claimed that once firms are set in a particular routine, it is very difficult to implement change. The routines tend to perpetuate themselves,

making it difficult for employees to extend beyond the ideas and processes already in place. Walsh and Ungson (1991) argue that it is very difficult to erase firmal memory because it is a result of a repeated action (whether appropriate/effective or not), and once the result has been associated with the action, it is defined and fixed as a process within the firm. Blackman and Henderson (2001) note the self-referential nature of learning processes as a barrier to learning: the organization will decide what it considers it needs to know, predetermining the knowledge that employees will then seek, meaning that all knowledge entering the organization is filtered.

Because the routines, filters and self-referential systems are so deeply implanted in the post-disaster management firm, best practice actions cannot operate rationally. Because post-disaster managers have become so deep-rooted within the routines and self-referential systems of learning embedded in the firm, post-disaster managers are unable to achieve the higher level of the best practice actions to meaningfully analyse the micro and macro environment that led to an error occurring.

The research was conducted in a British public sector organization with 2,800 employees, with a sample of 12 trainees. An initial internal attitude survey showed employees were willing to be involved in a change process in order to enhance their service and working performances. All participants indicated that they were not able to challenge existing assumptions in their workplace. If they did attempt to do so, they felt their position in their workplace was weakened. Juniors questioning traditional procedures were frightened and marked by managers as trouble makers. This enabled management to keep control over the way things were performed and minimise the opportunities for change (Turner et al., 2006).

Possibly the hardest matter for post-disaster managers is to change their mental and practical behaviour. As Blackman and Hend-

erson (2001) state it is almost impossible to remove our natural defense mechanisms and embrace new practices and systems of learning, whether individually or in a organisational context. This does not mean change is impossible. Research has identified major factors blocking change, which include managers being afraid of challenges to their authority (Turner et al., 2006) and employees being afraid of losing their position as a result of sharing information (Sun and Scott, 2005).

Finally we can draw a conclusion, that the most important obstacle to knowledge transfer is managers' behaviour and awareness about future consequences. Managers seek to preserve the comfort zone they have already created. Transformational learning (acquiring new manners of technological, social, ethical, etc. behaviour, get better understanding of how to interact with micro and macro environment) and redesigning the behaviour can be understand as change of relative perception about the micro and macro environment they operate in, which could reduce economic and ethical managers being, social status and psychological comfort zone. To prevent this shake-up from happening, post-disaster managers try to prevent information and knowledge transferring from managers to the firm.

A comfort zone denotes that limited set of behaviours that a person will engage in without becoming anxious. A comfort zone is a type of mental conditioning that causes a person to create and operate mental boundaries that are not always real. Such boundaries create an unfounded sense of insecurity. For example, inertia is when a person who has established a comfort zone in a particular axis of his/her life, tends to stay within that zone without stepping outside of it. To step outside a person's comfort zone, he/she must experiment with new and different behaviours, and then experience the new and different responses that then occur within his/her environment. The boundaries of a comfort zone can result in an internally

rigid state of mind. A comfort zone may alternatively be described by such terms as rigidity, limits or boundaries, or a habit, or even as stigmatized behaviour (Bardwick, 1995).

5. CONCLUSIONS

Although there has been important research on post-disaster management' life cycle, stakeholders, micro and macro environment, there has not been a model defined that can link the above. This while the need to integrate post-disaster management' life cycle, stakeholders, micro and macro environment both theory and practice. The Model for Post-disaster Management, described in this paper, consists of six stages. The purpose of this study also is to examine micro and macro environment impact on efficiency of post-disaster management and performance, based on the proposed Model. We conclude that the proposed Model offers a promising research toward improving post-disaster management efficiency through giving post-disaster managers method for enhancing a post-disaster's efficient micro and macro environment.

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SANTRAUKA

VADYBAI PO STICHINIŲ NELAIMIŲ SKIRTAS ŽINIŲ MODELIS

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Pagrindinis šio darbo tikslas – padėti asmenims, kurie vadovauja darbams likviduojant stichinių nelaimių padarinius, rasti racionaliausius sprendimus, naudojant pažangias žinias ir sukurtą modelį. Vadyba po stichinių nelaimių – tai bendra, tikslinga veikla, grindžiama priemonių ir bendro tikslų supratimo bei interpretavimo kūrimu. Suinteresuotos grupės priima asmeninius ir grupinius sprendimus, kurie prisideda prie vadybos po stichinių nelaimių sėkmės. Šiame straipsnyje aprašoma, kaip buvo sukurtas vadybos po stichinių nelaimių žinių modelis (vykdant EurAsia projektą), pagrįstas daugiakriterinio sprendimų priėmimo teorija. Sukurtą modelį sudaro šešios dalys, padedančios nustatyti racionalias vadybos po stichinių nelaimių alternatyvas, įvertinant vadybos po stichinių nelaimių gyvavimo ciklą, suinteresuotas grupes, mikro- ir makroaplinką.