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The role of knowledge management in post-disaster housing reconstruction

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Abstract: Purpose - A disaster is a serious disruption for the operation of a society, causing extensive life and property losses. Since construction activities are highly knowledge-intensive, knowledge management (KM) practices will encourage continuous improvement, distribute best practices, quick response to beneficiaries, share valuable tacit knowledge, reduce rework, improve competitiveness and innovations, and reduce complexities in post-disaster housing reconstruction. Therefore, this research aims to study and explore the degree to which KM is involved in post-disaster housing reconstruction and the effect that KM has on post-disaster housing reconstruction in the Sri Lankan context. Design/methodology/approach - The study was conducted by systematically reviewing the literature in Knowledge and KM to highlight the basic principles. Data collection mode for the study was close-end questionnaires and semi-structured interviews. Data were collected from donor and consultancy organisations which are involved in post-disaster housing reconstruction in Sri Lanka. Findings - The results show that most of the donors and consultancy organisations carry out permanent disaster housing reconstruction for tsunami devastation. Further, the study reveals that organisations use competences and repositories as the main sources of knowledge internal and external to the organisation. Project reviews, task teams, face-to-face interactions, and electronic mail systems were greatly used to support KM. Even though the performance of the work was improved through KM, lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organizing would be the main challenge faced by these organisations. Practical implications - It is evident that a more concerted and formal approach will improve disaster housing reconstruction. Since knowledge gatekeepers have extensive tacit and explicit knowledge, the organisations have to use it as a significant source. Even though the majority of the donors and consulting organisations used competencies and repositories as main sources of K, the identification and exploitation of a variety of appropriate sources are of central importance. Further, organisations have to focus more on a variety of IT tools in order to store Knowledge for future use. Since there were challenges for KM, the organisations have to identify proper solutions in order to move towards and achieve the benefits of KM. Finally, the organisations have to provide an appropriate rewards system to encourage their employees in participating in KM. Originality value - The disaster housing reconstruction will not end on a certain point and it will be a continuous process. Formal KM systems will help to improve the present state and further provide proper Knowledge in the future. There should be a standardised practice in order to improve the performance and give good value for beneficiaries. The study makes it quite evident that proper KM will improve the status of post-disaster housing reconstruction. [PUBLICATION ABSTRACT]

Full Text: Disaster management and the built environment Edited by Professor Dilanthi Amaratunga and Dr Richard Haigh 1. Background 1.1 An overview of disaster A disaster is a serious disruption of the functioning of a society, causing widespread human, material, or environmental losses, which exceed the ability of affected society to copy using only its own resources ([7] Disaster Management Centre of Sri Lanka (DMC), 2007). Disasters can be classified as sudden or slow (according to onset speed), or natural or man-made (according to cause). Disasters are often named by the hazards that cause them ([3] Abrahams, 2001). A disaster occurs when the hazards impact badly upon a community, which is susceptible to that hazard. There are several hazards like floods, tsunami, tropical storms, landslides, drought, high wind, rock falling, etc. affect Sri Lanka from time to time. Natural disasters attack the poor at three levels: they interrupt income, reduce personal assets, and destroy essential public infrastructure (World Bank, 2000a cited [13] Jha, 2005). The World Bank

estimates that losses due to natural disasters are 20 times greater (as a percentage of GDP) in developing countries than in the industrialized nations ([24] Ofori, 2002). According to National Construction Association of Sri Lanka ([22] National Construction Association of Sri Lanka, 2005), a joint study by donors in January 2005, damaged over a US$ 1 billion worth of infrastructure (about 4.5 percent of GDP), but the replacement costs were estimated to be between US$ 1.5 billion to US$ 1.6 billion (7.5 percent of GDP). Further, [24] Ofori (2002) states that disasters have a greater impact on the built environment of developing countries than industrialized ones. 1.2 Post-disaster housing reconstruction Reconstruction means the action of constructing new buildings to replace buildings, which have suffered damage, or repair of damaged buildings (UN, 2006 cited [20] Malalgoda, 2006). Reconstruction stage develops after the rehabilitation stage and aims to provide proper permanent housing for the victims in a short period of time ([19] Limoncu and Çelebioglu, 2006). The stakeholders of post disaster projects are the government, donors, lending agencies, beneficiaries, contactor, and social, environment and religious groups. Whilst relying on routine processes proved adequate in many ways for these small-scale disasters, a higher level of coordination and management would be needed for programmes of reconstruction following a larger disaster ([27] Rotimi et al. , 2006). Further, [9] Gunasekera (2005) added that all the phases and activates of a project done under normal conditions have to be done when managing projects after a disaster and all phases and activities need to balance with the time factor. Most of the time, this is done at a cost, because there is a minimum quality level and scope requirement that each project has to achieve ([9] Gunasekera, 2005). As per [4] Barenstein and Pittet (2007), one of the most visible consequences of many disasters is the widespread devastation of houses. Quarantelli (1995 cited [15] Johnson et al. , 2006) proposed four stages of housing in the recovery process such as immediate relief (within hours), immediate shelter (within day or two), temporary housing (preferably within weeks), and permanent housing reconstruction (probably within few years). Post-disaster housing reconstruction is considered by many experts as one of the least successful sectors in terms of implementation ([4] Barenstein and Pittet, 2007). Further, a lack of effective information and knowledge dissemination can be identified as one of the major reasons behind the unsatisfactory performance levels of current disaster management practices ([10] Haigh et al. , 2006). According to Banerjee (2005) (cited [10] Haigh et al. , 2006), a lack of prior knowledge and proper point of reference have made most of the recovery plans guessing games, eventually failing without adding appropriate values to the recovery attempts. Therefore, applicable external knowledge support based on actual recovery processes can play a crucial role in promoting post disaster recovery ([12] International Recovery Platform (IRP), 2005). However, in case of the Sri Lankan construction industry, there has not yet been any appropriate research done in this area. Thus, little is known about how knowledge is managed in Sri Lankan post disaster reconstruction works. 2. Knowledge hierarchy 2.1 Data, information, knowledge A common theme in the KM literature is that data is combined to create information, and information is combined to create knowledge ([11] Hicks et al. , 2006). Information is data that has been interpreted, verbalized, translated, or transformed to reveal the underlying meaning and context ([16] King, 2005). For example, when a disaster occurs, different types of information might come from different sources, such as the disaster field, remote sensors, public information centres, and the World Wide Web ([28] Zhang et al. , 2002). Knowledge can be defined as a dynamic human process of justifying personal belief toward the "truth" (i.e. a justified true belief) (Nonaka and Takeuchi, 1995 cited [5] Carrillo et al. , 2000). According to Siemieniuch and Sinclair (1999) (cited [5] Carrillo et al. , 2000, various classification of knowledge include: formal (explicit) and tacit (expertise) knowledge; foreground and background knowledge; classifications with respect to the role of knowledge for business relevance (e.g. knowledge of business environments), or with respect to the functional roles within an organisation (e.g. knowledge for control activities). One of the most practical distinctions is that between tacit and explicit knowledge (Nonaka and Takeuchi, 1995 cited [25] Robinson et al. , 2004). As per [16] King (2005), tacit knowledge is the personal knowledge resident within the mind, behaviour and perceptions of individual members of the organization. On the other hand, explicit Knowledge is the formal, recorded, or systematic K

that can easily be accessed, transmitted, or stored in computer files or hard copy ([16] King, 2005). Knowledge sources, in this context, mean the "reservoirs of knowledge", which a knowledge-worker has to fall back on in fulfilling his/her responsibilities ([8] Egbu et al. , 2003). As per [8] Egbu et al. (2003) there are two main categories of knowledge sources, i.e. sources internal to the organisation (other individuals, team(s), routines, competences, and repositories) and sources external to the organisation (other individuals, communities of Practice, other networks, repositories, and knowledge gate-keepers) (see Figure 1 [Figure omitted. See Article Image.]). 2.2 Knowledge Management (KM) Knowledge Management: the systematic strategy to collect; store; and retrieve knowledge, and then help distribute the information and knowledge to those who need it in a timely manner ([16] King, 2005). However, the KM has not only limited to human centered asset but also extended to intellectual assert. While some definitions specify the management of intellectual assets, it also spells out the benefits of KM. However, the parameters to be managed, has been fairly addressed by some academics like Huber (1991) (cited [18] Kululanga and McCaffer, 2001), [16] King (2005), and [26] Robinson et al. (2005). Organizations who are successful in leveraging knowledge, normally witness increased efficiencies in operations, higher rates of successful innovations, increased levels of customer service, and an ability to have foresight on trends and patterns emerging in the marketplace [6] Desouza and Awazu, 2006). The lack of common knowledge has been known to impede the flow of knowledge, resulting in failures to stimulate innovation and creativity in the organization (Simonin, 1999; Szulanski 1997 cited [6] Desouza and Awazu, 2006). 2.3 Knowledge Management (KM) sub-processes The KM sub-process has been identified as locating and accessing, capturing and storing, representing, sharing, and creating ([8] Egbu et al. , 2003). Knowledge acquisition is the process that involves imbibing information including making meaning of situations and other stimuli from the internal and external business environment [18] Kululanga and McCaffer, 2001). Nonaka and Takeuchi defined knowledge production as a continuous, social process, which is a never-ending spiral of tacit and explicit knowledge through knowledge conversion, socialization, externalisation, combination and internalization (SECI) (Sverlinger, 2000 cited [8] Egbu et al. , 2003). This is quite true when it comes to post disaster housing reconstruction, where the participants have to act according to the situation, which will have the above triggers and leads to knowledge production. According to [18] Kululanga and McCaffer (2001), knowledge sharing encompasses thinking, speaking and perceiving and is not merely "transferring" knowledge and such a process is called "creative sharing". National Disaster Management Division ([23] National Disaster Management Division, 2005) suggests that 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 and moreover people. Storage of knowledge involves the keeping of intellectual assets in a form that promotes its preservation, retrieval and- utilization (Walsh and Ungson, 1991; Miyashiro, 1996 cited [18] Kululanga and McCaffer, 2001). Knowledge transfer can be defined as a sub-process of KM that occurs when two or more individuals exchange information, in order to move towards each other (or apart) in the meaning they ascribe to certain events ([1] Argote and Ingram, 2000). 2.4 Knowledge management tools [2] Anumba et al. (2005) distinguishes between KM tools, the terms "KM techniques" and "KM technologies" are used to represent "non-IT tools" and "IT tools" respectively (Table I [Figure omitted. See Article Image.]). 2.5 Knowledge management in post-disaster housing reconstruction KM initiative has been thoughtfully envisaged as a tool to store, retrieve, disseminate and manage information related to disaster management ([23] National Disaster Management Division (2005). Furthermore, [14] Johnson et al. (2004) states that organisations, such as governments in continuously disaster prone countries needs the ability to act as learning organisations and channels of information as well; however they do not seem to take advantage of this opportunity. The value of KM is that it provides senior management with a rationale to support the creation and maintenance of repositories of project histories ([21] Maqsood et al. , 2006). In order to improve housing reconstruction projects we need to look back at past experiences, which the processes that created them. The demand for efficient KM to help the agencies make post disaster housing widely recognized. 3. Research methodology Since the most of the objectives of

this study was to identify and explore several parameters related to KM, "what" type of question was more suitable for the study and therefore, the structured questionnaire survey was carried out. A total of 75 randomly selected sample of 45 donors and 30 consultancy firms were used for questionnaire survey. Semi-structured interviews were done to identify the KM sub processes involved in post disaster housing reconstruction. In total, 12 semi-structured interviews, six from donors and six from consultancy organisations, were done to achieve the above objective. While the relative importance index (RII) was being used as an analysis technique for questionnaire survey, the semi-structured interviews were analysed using data matrix. 4. Research findings The total number of targeted respondents for the research was 75 organisations consisting of 45 donor organisations and 30 consultancy organisations. The total response rate was around 74.67 per cent. The largest respondents were from donor organisation constituting 53.57 per cent of the total respondents, whereas the other 46.43 per cent of the respondents were from the consultancy organisations. Post-disaster housing reconstructions were done in Sri Lanka for several disasters such as draught, rock falls, tropical storms, fires, landslides, high wind, floods and tsunami. However, according to survey, it was found that in Sri Lanka, most of the post disaster housings were done for the tsunami (Figure 2 [Figure omitted. See Article Image.]) through donors and construction consultancy organisations. According to Figure 3 [Figure omitted. See Article Image.], majority of the respondents (100 per cent) stated that they were involved in permanent housing reconstruction. However, these figures were only relevant to the donor organisations and construction consultancy organisations, who were involved in post disaster housing reconstruction. In this study, the sources of knowledge were categorised as internal to the organisation and external to the organisation. The list below indicates the list of sources of knowledge internal to the organisation in descending order of "usefulness" as perceived by the respondents. Knowledge sources - internal to the organisation in descending order of use: - competences; - lessons learned; - repositories; - team(s); - other individuals; and - routines. Further, Figure 4 [Figure omitted. See Article Image.] illustrates the repositories used internal to the organisation. Majority of the respondents responded that they have used project-monitoring documents (87.50 per cent) more often than other repositories. Reports (82.14 per cent) were the second mostly used repositories. Further, the list below suggests that the most significant external source of knowledge related to post disaster housing reconstruction in Sri Lanka was repositories. Moreover, the knowledge gatekeepers were the least significant external knowledge source. Knowledge sources - external to the organisation in descending order of use: - repositories; - communities of practice; - other individuals; - other networks; and - knowledge gate-keepers. The list below stipulates that the e-mail system was the high-useful KM technology used in post-disaster housing reconstruction by donors and consultants. Next significant tool was the costing and cost management system. KM technologies : IT-based tools in descending order of usage: E-mail system. Costing and cost management system. Document management system. The central project file. Intranet. Knowledge bases. On-line project management. Data and text mining. Skills Yellow Page. Groupware. Technical call centre. Web-based application. Taxonomy/ontology. Online procurement system. Extranet. Online KM system. According to the list below, the face-to-face interactions, task teams, and project reviews were the most significant non-IT based tools in post disaster housing reconstruction. KM techniques : non-IT-based tools in descending order of usage: Project reviews. Task teams. Face-to-face interactions. Formal meetings. Brainstorming. Site liaison initiative. Quality circle. Recruitment. Seminars. Training. Communities of practice. Focused group sessions. Knowledge gatekeepers. Apprenticeship. Share fair. While lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organizing was the most significant challenge, conflicting priorities between KM and other business functions was the least significant challenge to KM in post disaster housing reconstruction (see list below). Challenges to KM : challenges to KM in descending order: Lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organizing. Lack of systematic collection of standardized data. Lack of documentation of knowledge and application of lessons learned and best practices for decision-making. No validation mechanism. Lack of measure to value the performance of

knowledge assets. Unstructured KM approach. Overload of information in the form of reporting. Changing people's behaviour. What knowledge should be managed. Organisational culture. The difficulties associated with communicating the benefits of KM. Poor IT infrastructure. Bureaucracy associated with KM. People's fears. Conflicting priorities between KM and other business functions. Change management. Employee resistance. Lack of top management support. Improved performance was the key benefit that the respondents got through KM and the other benefits like effective monitoring of initiatives, efficiently and effectively use available resources were some of the highly rated benefits among respondents (see list below). Benefits of KM : benefits of KM in descending order: 1. Improved performance. 2. Effective monitoring of initiatives. 3. Efficiently and effectively use available resources. 4. Improved decision-making. 5. Improved reconstruction project delivery. 6. Improve effective acquisition, sharing and usage of information within organisations. 7. Reliable, useful, up-to-date and timely knowledge can be created and shared. 8. Can avoid repeating past mistakes. 9. Better valuation of Resources and services. 10. Respond very quickly to client's needs and external factors. Innovation. Organisation can retain tacit knowledge. Dissemination of best practice. Increased intellectual capital. Risk minimization. Lower cost in managing the projects. Promoting fair practices among the disaster management community. Creates competitive advantage. Increase profit, market share, market size and reduce cost. Most of the KM sub-processes were practiced by the donors and consultancy organisations, but in an informal way. The respondents believed that the knowledge capturing is important to function effectively, work quicker, plan better, reduce cost, give good out put to beneficiaries, get more resources (attract new donors), carry out future disaster reconstruction, give good solution, learn from, and have a win-win situation. Further, the importance of knowledge creation or production was to improve performance, motivate staff, increase organisational asset, etc. While knowledge sharing was vital in order to grow knowledge; get best decisions; avoid duplication; save time and energy; share correct and timely knowledge; improve relationships, the knowledge storing was essential to get accurate information future; reduce cost; justify and accountable to donors and communities; and to show transparency. Moreover, the significance of knowledge transferring was to learn more, increase effectiveness and efficiency of the work force, reduce cost, change the quality of construction, capacity building for local technical people, get timely advice, and disseminate knowledge. 5. Conclusions This research has investigated the concept of KM in the post disaster housing reconstruction in Sri Lanka. Mostly, the construction industry is relied on expertise of key members of staff. KM can be used as a tool to store, retrieve, disseminate, and manage information related to post disaster-housing reconstruction. It can be concluded that the most of the donors and consultancy firms, who do housing reconstruction, have got involved in tsunami housing reconstruction work compared to other disasters. Further, the respondents were mostly determined on permanent housing reconstruction rather than other types of disaster housings. While competence was the most significant internal knowledge source to the organisation, repositories were the most significant external knowledge source to the organisation. Analysis of the sample revealed that project-monitoring document was the highly used repository internal to the organisation. While the e-mail system was used predominantly as IT based tool for KM, the project reviews; task teams; and face-to-face interactions were the most significant non-IT based tool for KM. This was further supported by the semi-structured interviews. The findings suggest that lack of compiling and synthesizing the accumulated data, information and knowledge, storing and organizing was the major challenge in managing the knowledge faced by the donors and consultants who do post disaster housing. This may be due to the sense of urgency shown by the parties. The improved performance was viewed as the key benefit of KM in post disaster housing reconstruction. The KM sub-processes are important in order to avoid duplication of knowledge creation, store knowledge on local technical people, carry out future disaster reconstruction, change the quality of construction, disseminate knowledge, grow knowledge, get best decisions, get more resources (e.g. attract new donors), give good output to beneficiaries, improve performance, improve relationships, increase organisation asset, plan better, reduce cost by avoiding repetitive tasks, save time and energy etc. Even though the study presents most of the

elements of KM, most of the organisations have not implemented KM formally into post disaster housing reconstruction. Although, it can be concluded that the awareness of KM is there in the industry to implement KM in post disaster housing reconstruction to improve the performance. During the course of research, the researcher came across some interesting research opportunities. They are, study the same research question with additional unit of analysis, i.e. with donor, owner, consulting, and contracting organisations, study the each KM sub processes individually to deeper scope with regard to disaster reconstruction, study the role of KM in disaster management, and studying the procurement arrangement in post disaster housing reconstruction. About Disasters Knowledge Production Resources and Capabilities in the Construction Industry - Work Package 1 - Final Report Development of a Cross-Disaster Knowledge Management Kit to Support Better Recovery Learning from Good Practices and Lessons Multi-donor Trust Fund for Mainstreaming Disaster-Reduction for Sustainable Poverty Reduction Knowledge Management in Disaster Risk Reduction: The Indian Approach Construction Industry Development for Disaster Prevention and Response 3rd International Conference on Post-Disaster Reconstruction: Meeting Stakeholder Interests, Florence, Italy, May 2006 A Knowledge Management Framework for the Support of Decision Making in Humanitarian Assistance/Disaster Relief References 1. Argote, L. and Ingram, P. (2000), "Knowledge transfer: a basis for competitive advantage in firms", Organisational Behaviour and Human Decision Processes, Vol. 82 No. 1, pp. 150-67.
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Appendix Corresponding author Thanurjan Rajendram can be contacted at: thanurjan83@gmail.com AuthorAffiliation Rajendram Thanurjan, Department of Building Economics, University of Moratuwa, Moratuwa, Sri Lanka L.D. Indunil P. Seneviratne, Department of Building Economics, University of Moratuwa, Moratuwa, Sri Lanka Illustration Figure 1: The relationship for data, information, knowledge and wisdom Figure 2: Post-disaster-housing reconstruction Figure 3: Types of post-disaster-housing reconstruction Figure 4: Repositories - internal to the organisation Table I: A comparison between KM techniques and technologies

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