LEVEL OF RISK MANAGEMENT PRACTICE IN MALAYSIA CONSTRUCTION INDUSTRY FROM A KNOWLEDGE-BASED PERSPECTIVE

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ABSTRACT
The construction industry is a competitive high-risk industry with unprecedented uncertainties in technology, budget, and development processes. The need then evolved to develop a framework for project performance in Malaysia construction company. This study investigated the associated problem in the management of risks in Malaysian construction projects using the knowledge-based approach. This perspective proposed a methodology based on a one-fold arrangement involving the application of risk management modelling function, evaluation of the comparative effectiveness and desired quality with the availability of a best practices model. The preliminary conclusion from these findings revealed that risk management in Malaysian construction projects is ineffective and still at a developmental stage. The applications of a knowledge-based framework, therefore, allow clients, contractors and consultants to develop a project's risk management function based on best practices. The implementation of knowledge management will, therefore, avoid the organization the cost of repeating the same mistakes. This will invariably lead to improvement in the performance of construction work in Malaysia when incorporated as part of the organizational strategic plan.

Keywords: Construction, Knowledge management, Risk management, Malaysia

INTRODUCTION
The management of risk is a crucial task that must be taken seriously by project managers at the beginning of any construction work for an effective project performance The effectiveness of any risk management process, therefore, involves a systematic methodology most importantly from experience and knowledge point of view. Previous research studies conducted on the Malaysia construction projects have shown that owners, contractors and consultant do not systematically apply risk management practices. This on a long-run result in negative penalties thereby affecting the performance of the project as supported by Shehu et al., (2014). The management of risks in many constructions works has myriads of limitations which impacts greatly on the overall performance of the project (Adeleke et al., 2015). For so many years, the management of risk has been limited only to a reductionist approach and these have produced poor results which

consequently reduce the quality of the project management. Take for an instance, in terms of money or time, the risk is handled through the application of contingencies that are not determined based on a complete risk analysis (Zang et al.,2013).

There are different classification of projects within the construction sector with inherent risk exposure, and this includes fragmented, temporary and complex (Banaitienė, et al., 2011). The decision makers, therefore, need access to information and knowledge in order to adequately handle construction risks in a more sufficient and systematic way Hence, the implementation of effective risk management in relation to management associated with project risk knowledge may facilitate successful construction project endeavours. The management of risk is an important role a project manager must therefore undertake. However, project manager duty becomes difficult and wasteful if good risk management is not properly handled from the beginning of the project work. An efficient and effective risk management approach, therefore, entails a proper and systematic methodology from the perspective of experience and knowledge as reported by Adeleke al., (2015). It is pertinent to note that construction projects are risky in nature and the existing theories and tools lack the ability to adequately capture the true picture of risk quantification (Farooq et al., 2018; Renn, 1998; Taroun, 2014).

Karim &Qusoiri (2013) reported that the owners, contractors, and consultants do not systematically apply risk management practices in Malaysian construction work and this consequently results in poor project performance... Previous studies revealed that the risk management in construction projects is full of limitations which include human errors, coupled with bad decisions from project designers and managers. This, in turn, affects the usefulness of the project management function and their corresponding output. Moreover, due to the prevalence of risk in construction work, its management has always been an integral process required for the success of any project. It is therefore essential to have a systematic methodology with a knowledge-based experience of various types of project that has been handled before. For example, knowledge of unforeseen circumstances that may occur during the project execution is required. The lack of an inadequate risk management function exhibits lots of undesirable consequences for different participants in a construction project. This partly happens when there is no plan against the risks and uncertainty that may

occur during the course of project execution. For an instance, the of measure in the prevention against the risk of defining the project scope environmental hazards, communication risks, poor site management, and slow decision making significantly increases the costs, contractual disputes and litigation among others as supported by Adeleke et al., (2015).

RESEARCH PROBLEM

In this study, the research question discussed include the following viz: i) What are the appropriate risk management practices currently applied in risk management on construction projects and how they compare with current practices in Malaysia? ii) How can risk management practices in construction projects be assessed?, iii) What knowledge is needed for an effective and efficient management of risk in construction projects?, and iv) How can needed risk management knowledge be obtained, organized and made available in a systematic and useful way?. The research methodology employed in this research was obtained through a comprehensive review of past literature from books, dissertations and published research papers.

LITERATURE REVIEW

The International Organization for Standardizations Risk management involves the application of the systemic and logical method in establishing the context, creating a communication, consultation mechanism, constructing risk management identification, analysis, evaluation, treatment, monitoring, and recording in a project. There have been reported cases of project failure in many Malaysia construction projects and this is unconnected with the failure of decision-makers in placing more emphasis on risks during construction work (Ijaola & Iyagba, 2012). Risk management is, therefore, one of the nine knowledge areas propagated by the Project Management Institute which include, scope management, integration management, cost management, time management, resource management, human management, procurement management, and risk management (Ibbs & Kwak, 2000).

Moreover, the management of risk in the construction project management context is a broad and systematic way involving the identification, analysis, and responding to risks for the purpose of achieving project goals. This involves the identification of potential risk that might affect the project and the documentation of their characteristics. This will invariably lead to the improvement of construction project management

processes with efficient and effective use of the resources. This identification could also stand as opportunities, but the fact that most of the risk usually has negative results has made most of the people to only think about the negative side alone (Adeleke[1] et al., 2015; Baloi & Price, 2003). The risk management as of today is an essential part of project management with difficulties in planning, identifying and how they should be grouped (Del Cano & de la Cruz, 2002; Olsson, 2007), This is an important process with most project managers knowing that risk management is vital for good project performance (Baloi & Price, 2003; Perera & Holsomback, 2005). These process comprises of the following main steps, namely; risk planning, risk identification, risk assessment (qualitative and quantitative), risk analysis, risk response, risk monitoring, and recording the risk management process (Baloi & Price, 2003; ISO, 2009).

MATURITY MODELS

The Project Risk Maturity Model (RMM) was first developed by HVR Consulting Services in 1999. It is a four-level capability structure derived directly from the structure developed by David Hillson (1997) who used it on establishing a generic Risk Maturity Model framework used in carrying out a comparative evaluation as illustrated in Figure 1.

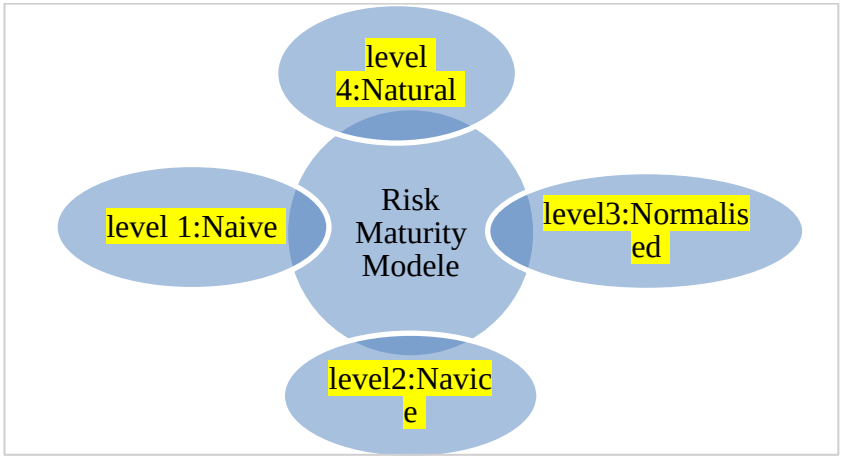


Fig.1: Risk maturity model levels**,** (David Hillson, 1997).

The maturity model is of evolutionary in nature, which means, it consists of a number of stages with the level of complexity level increasing

from one stage to another during the process of searching for perfection as reported by Serna, (2012). In general, a risk maturity model is a tool designed to assess the risk management capability of an organization (Hopkinson, 2011). Moreover, in the area of project management maturity models, research has shown that any organization that improves their project management maturity are likely to experience an increased in schedule predictability, cost savings, and improved quality (Korbel and Benedict, 2007). Yeo and Ren, (2009) reported the proposition of several known risk management maturity models. One of such is the one proposed by Hillson (1997),

The study indicated that the maturity model is a good way for an organization to implement a formal approach to risk management and to also check the level practices being held by the industry. The model comprises of four maturity levels which include the naive, novice, normalized, and natural. These are measured with culture, process, experience and application as an attribute (Yeo and Ren, 2009). Group of researchers in 2002, expressed the Risk Management Maturity Model (RMMM) but the structure of the model did not change, with adhoc, initial, repeatable and managed as the four levels of evaluation. The author stretched the initial definitions of each level and completed the characteristics of the attributes to be evaluated which include culture, experience, application and process. Heijden (2006), modified the model proposed from the one proposed by Hillson and other researchers, without any changes to the structure of the four levels of evaluation. Instead, he added the fifth attribute named " structure", and this was based on the way the risk management is being applied within the organization with how the industry organize their processes and responsibilities (Heijden, 2006). Hence, they are the models tools which allow an organization to implement formal risk processes, and to also identify their priorities for process improvement, determine whether risk processes are suitable for the organization, and to create an action plan for in enhancing the organization risk management process maturity level (Hopkinson, 2011). According to Young &Williams (2002) Various risk management maturity models have been introduced to effectiveness improv the organization's risk management.

KNOWLEDGE MANAGEMENT

The knowledge management (KM) has been reported to be an important intellectual asset which play a vital role in gaining organizational competitive advantage (Kamara, et al., 2002). This has generally been accepted in many

competitive business environments and project- based industries where knowledge is a vital project resource with market leverage and which contributes an overall project success. In order to establish effective risk management, it is, therefore, require to have a systematic methodology coupled with various knowledge and experience. Knowledge management (KM) has received a great deal of attention in recent years (Kim et al.,2014). Scarborough, et al., (1999) describe KM as a ‘‘label’’ used to articulate the ways in which firms facing highly turbulent environments can mobilize their knowledge assets in order to ensure continuous innovation in projects. It has also been defined as ‘know-why, know-how, and know-who’, with an intangible economic resource from which future revenues will be derived (Rennie, 1999). However, it is referred to the process of knowledge creation, validation, presentation, distribution, and application.

It has, therefore, become a critical subject of discussion in the construction projects. Many organizations are still trying to implement knowledge management systems with the overall aim of improving their knowledge base with the hope of generating innovation (Adeleke, et al., 2016). Both business and academic communities believed that by leveraging knowledge, an organization can sustain its long-term competitive advantages. These five phases in knowledge management allow an organization to learn, reflect, unlearn and relearn, which is usually considered as essential for building, maintaining, and replenishing of core-competencies as presented in Figure 2.

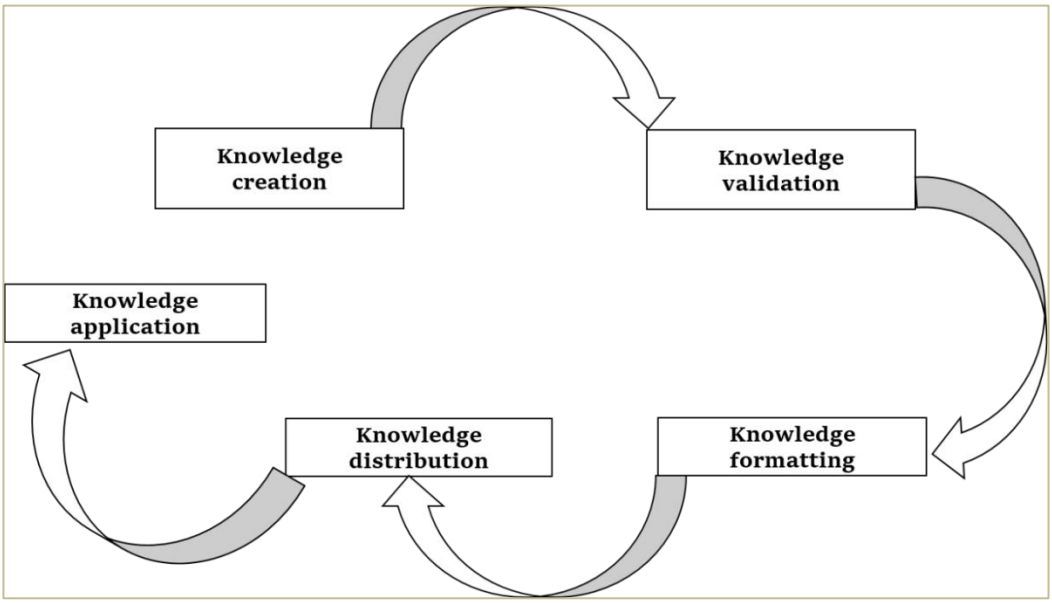


Fig.2: Knowledge Management Process
Source: Baloi&Prince (2003)

The knowledge- based perspective in construction risk management is ontologically grounded in the systems or contingency theory of management where an organization is viewed as a system of interdependent part (Kim, Lee, et al., 2014). The knowledge-based view (KBV), is derived from the resource-based view (RBV) and focuses on the value of intangible assets which indicated that knowledge is critical to a company's long-term success (Grant, 1996; Håkanson, 2010; Kim et al., 2014). Increasing turbulence in the global marketplace has suggested that the tacit knowledge of individual employees is of strategic importance for many organization (Quinn, 1992). Tacit knowledge of individual employees is both difficult to transfer and necessitates knowledge management. The primary task of the management is to integrate the specialized knowledge of multiple individuals and units within and across the company (Grant, 1996). The knowledge integration is, therefore, one of the leading source of organizational success and not the knowledge itself. When embracing the knowledge-based view KBV, the expectation is that knowledge interdependence as an element of organizational design and subject to managerial choice (Hart & Banbury, 1994).

Due to the unique nature of construction work, it is regarded as one of the the most hazardous and dangerous industries in which fatal and non-fatal occupational injuries occur most frequently (Sacks, Rozenfeld, & Rosenfeld, 2009). It has been reported that over 157 bridges collapsed between 1989 and 2000 in United State of America (Wardhana & Hadipriono, 2003), and more than 26,000 workers lost their lives on construction sites during the past two decades (Zhang, et al., 2013). Within the project-based architecture, engineering and construction (AEC) Industry, knowledge management has been recognized as a vehicle through which the industry can address its need for innovation and improved business performance (Egan, 1998; Egbu, 1999). The failure to capture and transfer project knowledge, especially within the context of temporary virtual organizations, could, therefore, leads to the increased risk of ' reinventing the wheel,' wasted activity, and impaired project performance (Jung, 2017; Siemieniuch & Sinclair, 1999).

The construction industry is a project-based one, which utilizes a variety of separate firms to produce investment goods such as buildings, roads, bridges, factories. These are custom built to unique specifications (Al-Zayyat, Al-Khaldi, Tadros, & Al-Edwan, 2010). The management of project knowledge involves knowledge management across the temporary 'virtual' project organization. The characteristic of these that the knowledge management changes in content and context over its lifecycle. For example, in the design stage, there is much more dynamism in facilitating the development of innovative design solutions to the client's problem. However, in the construction stage, the project organization is much more mechanistic, as it involves a planned construction programme, which is to be thoroughly followed by contractors (Kim et al., 2014). Knowledge management improves the capacity of an industry as a methodological method in organizing, assembling and improving the knowledge when it comes to decision-making ability and business strategy process (Adeleke[1] et al., 2015; Hsu & Shen, 2005; Ooi, 2009). Its definitions show that they are coined out from three segments, which include the knowledge acquisition, knowledge dissemination and knowledge responsiveness.

Moreover, Lee et al. (2001), reported that knowledge management is made up of which include knowledge dissemination and knowledge acquisition. Out of these points of view, the knowledge management comprises of knowledge creation, knowledge retrieval, knowledge sharing

and knowledge application (Nonaka and Takeuchi, 1995). According to the above statement, its behaviours include acquirement of the knowledge, dissemination and also the application part. However, all the knowledge areas are not complete without knowledge development, because it is the baseline that will add more experience to the knowledge. They are the major concepts of KM which are derived from the three constructs of knowledge, but each concept of KM is dependent on other components. The construction industry is a knowledge-based industry and this is because the implementation of construction activities needs the knowledge of specialized experts and their problem-solving expertise (Al-Ghassani et al., 2005, Egbu et al., 2004; Carrillo et al., 2004)). As a result of this, the execution of knowledge management is mainly interesting for the construction industry (Carrillo and Chinowsky, 2006), and its implementation will innovate and improve the performance of the industry (Kamara et al., 2002) (Egbu et al., 2004), and to better their behaviour.

RESEARCH METHODOLOGY

To achieve the research objectives, a systematic review was performed to provide evidence for the synthesis. The overall systematic review process suggested by Adeleke et al., (2015), is already operationalized as presented in Figure 2. In starting a systematic review, the research questions need to be addressed unambiguously and specified order in step 1, the framing of questions for a review (Khan, et al., 2003) Search keywords are required to be set in order to meet the requirements of study (Ke et al.,2009). To assure the search range of the review, plural forms of search keywords are advisable (Lu & Liu, 2014). In step 2, the selection of data sources, comprehensive and extensive search from the relevant database and journals is required (Khan et al., 2003). Therefore, to capture as many relevant citations, journals, the appropriate domain of study need to be identified and selected (Lu & Liu, 2014). Moreover, in step 3, The performance of a preliminary search involves the use of search keywords within the defined specific domain of titles, keywords, and abstract. These search keywords are inserted and entered into the identified and then selected from the journal databases (Ke et al., 2009; Lu et al., 2014). The search needs to be rigorous, without any language restrictions, and subject to flow from the research questions as priori (Khan et al., 2003). Lu & Liu, (2014) and Ke et al., (2009) suggested that in this stage a confined parameter search should be employed to ensure consistency. Moreover, step 4 involves assessing the quality of studies in order to ensure academic rigour (Khan et al., 2003). This implies that the articles acquired

for analysis and synthesize should be subjected to a set of qualities for proper assessment. The qualities of these articles from the preliminary search need to be filtered. Understandably, the preliminary search conducted in step 3 would yield a broad spectrum of themes and mainstreams of articles. Hence, a visual inspection of the article content is essential. Furthermore, step 5 involves summarizing the evidence. Here a detailed review will be conducted to analyze and synthesize the remaining filtered articles, focusing on the articles which are only related to topics of interests. This calls for extraction of articles which aligned with research scope and background (Lu et al., 2014). Normally, the data are summarized and synthesized in the form of tabulation by study characteristics, quality and effects of study. The statistical method may appropriately use as supported by Khan et al., (2003). To achieve this, the synthesis of outcomes was adopted by Lu et al., (2014).

In this study, the generic research trends were discussed in the form of available mainstreams (themes), overall time span, overall journal shares. This was preceded separately by the research methods, distribution across countries and citation influences as related to the topic of interest. Finally, step 6 involves interpreting the findings. Here the data are synthesized and interpreted from the tabulation of the studies. Recommendations are made based on evidence of strength and weaknesses (Khan et al., 2003). The characteristics of these factors were examined and clustered into shared dimensions. The weaknesses and shortcomings identified in the systematic review, therefore, offer an opportunity to identify and address the potential research gaps.

Table 1: : Approach for the assessment of the risk management and desired quality function of an organization and comparison with the risk management benchmark.

	F1	F2	F3	F4	F5	..	Fn
RM Tasks							
Risk management planning							

Risk management identification							
Risk analysis							
Risk response planning							
Risk monitoring and control							

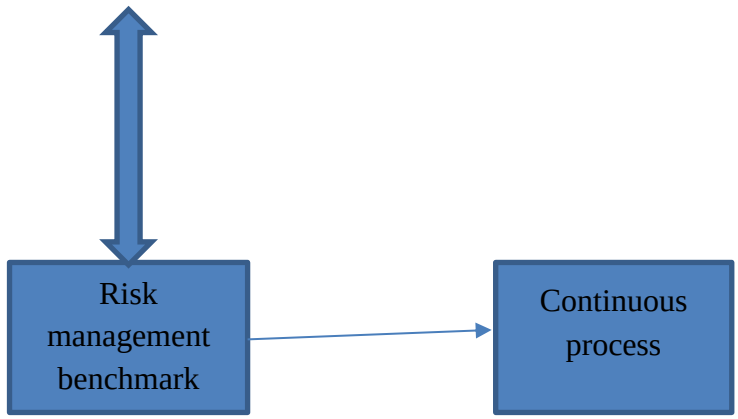


Fig.3: Evaluation of the key factor “f1” in the task “Risk management

The application of the tool is employed in proposing a set of best practices in filling out the major gaps found in the risk management function of each industry as shown in figure 3.

Table 2: : Diagram to assign the best practices based on gaps identified

	g 1	g 2	g 3	g 4	g 5	……	g n
Best Practices							
BP1							
BP2							
BP3							
BP4							
BP5							
……							
BPn							

Best practices n°1 (BP1) for overcome Gap n°1 (g1)

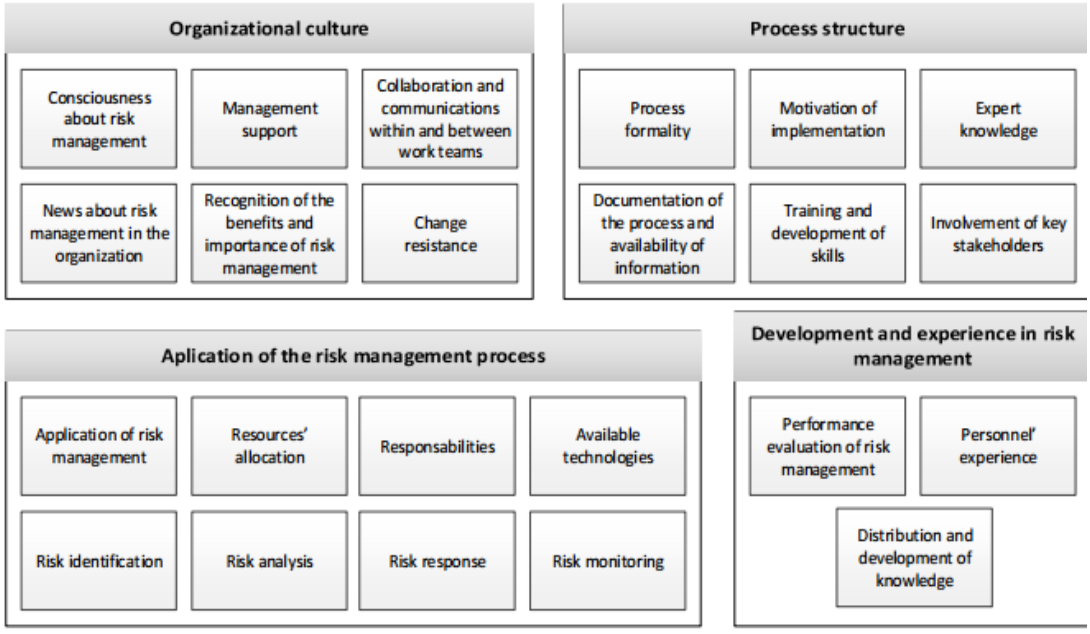
The experts thereafter validated the bes practice discovered and a prototype of the risk management support system was developed and applied to industries. This will allow for i) the storage of historical information, ii) serve as a guide to develop the project risk management function in owner, contractor and consultant industries, according to the established standard, iii) helps in conducting the assessment and monitoring of the maturity of the risk management function in the industries, iv) have lessons that will be able to educate about risk management depending on the hierarchical level and responsibility of employees, v) have a storage and backup system using case-based cognitive, vi) establish the administrative structure for the system and

the necessary feedback, and vii) develop supporting and operation procedures for the prototype to be able to handle the industries operations.

PRELIMINARY RESULTS

The first preliminary maturity model was defined at this stage. This model was based on two main elements, namely: i) the factors that can evaluate and comprises of a set of dimensions for each of them as shown in figure 5, and 4) dimension and level of risk management evaluation factors as shown in Figure 5 below.

Table 3: The key evaluation factors and their dimensions (Adeleke et al., 2015).



The information used at the evaluation levels was gathered from the review of past literature. The maturity model and the evaluation levels was tested by means of pilot studies that carried out by one owner, one contractor and one consultant industries. For each organization, the questionnaire was share to a group of professionals in the area of risk management based on the measured important factors and dimensions. To, therefore, create a web-

based prototype that can be accessed by industries the management of industries will be able to answer the questionnaire and find out the level of maturity their organization belongs to. More so, data from previous evaluations will be provided so that the management will be able to compare their current performance with historical performance. This will help the implementation for improved best practices. As Figure 5 implies, knowledge and experience will be combined together by showing the improvement or best practices that were related to the type of detected gaps during the questionnaire evaluation. Finally, the knowledge base is therefore expected to serve as new experiences learnt from the project.

CONCLUSION

This study provided a brief description of research inputs in the management of risk in construction projects using the knowledge-based approach. It is worthy of note that based on previous research, there is a limited application of risk management practices in Malaysia construction projects. Also, not all construction companies established their own risk management department as reported by Hamza et al., (2015). There is, therefore, an urgent need to introduce the knowledge-based approach in order to improve the client, contractors and consultants' performance. This will help them to make use of their own knowledge and experience for a more systematic and formal approach to risk management. The outcome of this research will help clients, contractors and consultants make use of their own knowledge and experience as well as worldwide best practices. Also, it will help them have a more systematic and formal approach to risk management.

Moreover, the classifications and definition of each level of risk management used for this research evaluation are as follows; the level 1, are those organizations that are not aware of risk management and lack a structured approach to face risk and uncertainty. The success of this kind of organization depends on their individual characteristics and mostly the organizations are weak in terms of project management knowledge. More so, the organization reacts to problems after it occurs without any actions. The organizations never care to develop any mitigation plans to identify project risk or learn from the previous mistake made from the project to prepare for

any uncertainty. While level 2 are those organizations that are conscious to some extent about the advantages of risk management but never implement it effectively in most of their project. These organizations know they can identify their mistakes from the past but the knowledge to apply this are limited and there is no way to share their experience of what they have learnt from the organization project. In line with that, level 3 is the organization that already developed and used a formal RM system.

The use of previous experiences on the project, especially for risk identification and experience of the previous project can be used for further project. They also employ people with needed risk management skills and adequate resources to develop a project. Level 4 shows that the organizations understand the advantages of risk management in every level and follows a standard process comprising of a proactive approach on the project. Level 5, which is the last level depicts that organization are able to adapt itself, empower teams and organize according to the protocols of the industry thereby reducing the system risks and initial risks. The continuous improvement which is also known as the optimized process is found in this level. However, it was used to evaluate the information gained through benchmarking and then decides whether or not the information will enhance the new methodology. The organization aim to use both qualitative and quantitative measurements in establishing an integrated risk management plan. Based on the classifications above and the levels of risk management, organisations can, therefore, improve their risk management using a knowledge-based approach in terms of client, contractors and consultants.

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