

A Knowledge Based Decision Support System (KBDSS) for Indonesian Contractors to implement Business Continuity Management (BCM)

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Abstract

Throughout the business process, crises may give various consequences to an organization, whether financial, legal or operational impacts. Being in an industry that is complex with high uncertainties, contractors are likely to experience costly errors if they are unprepared when a crisis strikes. As firms located over a vast geographical area, Indonesian contractors have also experienced various crises that have significant impacts on their business activities. To become resilient and capable of providing an effective response to such threats, Indonesian contractors need to adopt a systematic management concept in their organizations. Business Continuity Management (BCM) provides this framework, where it is not only focusing on overcoming crises, but also conducting activities that are needed for keeping the business operations running during a period of displacement or interruption. The initial step in developing BCM for Indonesian contractors is to understand the BCM implementation through its principles and non-technical aspects which are the organizational culture and institutional forces. This phase can be conducted in the form of an implementation guideline that starts with assessing the firm's BCM level of preparedness, followed by relevant action plan recommendations. A Knowledge Based Decision Support System (KBDSS) can be used for developing this guideline where it is a computer-based system that supports decision making by aiding knowledge storage, retrieval, transfer and application by supporting knowledge access. This system provides quick access to all relevant information and the problem models that are evaluated in the system can be integrated into a logical framework. The objective of the study is to propose a framework for developing a BCM-KBDSS for Indonesian contractors. The study is based on an extensive literature review and benchmarking to BCM best practices. The result of this

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study is the proposed framework which is the foundation for developing the BCM-KBDSS which forms part of a larger, on-going study.

Keywords: Management, Business Continuity, KBDSS, Contractors, Indonesia

1. Introduction

The business world is currently experiencing an increasing level of uncertainty in its environment, where it can lead to adverse financial implications, damage to corporate reputation, viability and integrity (Marsh, 2007). Events like crises or emergencies can occur unexpectedly during the course of conducting business activities and these cannot be overlooked. A crisis may give various consequences to an organization, whether financial, legal, or operational consequences. It may disrupt the business process from a few minutes up to several months or years in extreme cases. These consequences can impact the business process, and hence may threaten the firm's sustainability.

In order to overcome a crisis and to continue business as usual, an organization or firm must first have systematic ways and approaches in place. Although some organizations survive such events due to perseverance, but continuity of a business is primarily due to planning and preparation. One of the concepts that can be used is Business Continuity Management (BCM), where it is not only focusing on overcoming any crises that occurred, but also considering thoroughly on how to sustain the business in order to obtain its goals and mission. BCM provides a method for managing any disruption to ensure continuity of service when there is a disruption of business. Moreover, business continuity means to conduct activities that are needed for keeping the business operations running during a period of displacement or interruption (Smith, 2003).

In managing a crisis, decision making is considered as an important part of the process. Critical decisions such as task assignment, resource allocation, guidelines to long-term decisions, training and the control capabilities of the organization are necessary for this situation (Yoon et al, 2008). As part of a decision making process in responding to crises or unexpected events, BCM can be designed into an effective model, which is using computer application for providing faster and reliable decision. Based on the development of advanced computer programming technology nowadays, BCM can be automated by using a Decision Support System (DSS) (Eom and Min, 1999). A DSS can also be developed into a system which utilizes knowledge as its based information, where a knowledge base consists of groups of knowledge from experts which provide any information related to the focused problems (Mockler, 1989). The latter description is called Knowledge Based Decision Support System (KBDSS). The broad benefits from this system are that it provides a quick access for the user to all relevant information, the process is direct and personalized and the problem models that are evaluated in the system can be integrated into a logical framework.

One of the industries that should implement BCM is the construction industry, where it has an important role in a country's economic growth and development. Considering its characteristics and complexities, overcoming crises and threats in order to continue business in this industry is necessary. As firms located over a vast geographical area, which

is known as the world's largest archipelago (Raftery, Chiang and Anson, 2004), Indonesian contractors have also experienced various threats or crises that have significant impacts on their business activities. Various crises have recently occurred in Indonesia, such as the financial crises in 1997 and 2008, natural disasters that occurred frequently (earthquakes, floods, tsunamis), the political and financial instability, terrorism issues, and other internal events. The crises stated above had resulted in various levels of impacts, where it can start from disruptions to business activities, loss of potential markets, loss of productivity and profitability, to the extreme case such as bankruptcy of a firm. From these cases, it seems that these firms have not developed their crisis responses into a holistic management approach in the organization, and there is a lack of detailed responses for their business stakeholders. To become resilient and capable of providing an effective response to such threats, Indonesian contractors should start to adopt a systematic management concept in their organizations. BCM provides this framework, where based on its definition, it builds resilience and the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand and value creating activities (Supriadi and Low, 2012).

Adopting a new concept like BCM is not a straightforward process. There are issues to consider before implementing the concept into the firm. Previous studies had shown that the immediate motivation for a firm in adopting a concept or system comes from institutional forces and organizational culture (Liu et al, 2010). Based on these considerations, before implementing BCM, the Indonesian contractor's organizational culture and institutional forces should be identified in order to determine whether these elements support or do not support BCM implementation.

Based on these problems, the objective of this study is to propose a framework for developing a BCM implementation guideline in the form of a KBDSS for Indonesian contractors. The study is based on an extensive literature review and benchmarking to BCM best practices. In developing the framework, a thorough literature review on BCM principles, organizational culture, institutional forces, Indonesian contractor's business characteristics and KBDSS is conducted. The review also highlighted the relationships between these elements that underpin the basis for the framework.

2. Literature Review

2.1 BCM Overview

The Business Continuity Institute (BCI, 2002) defines Business Continuity Management (BCM) as an act of anticipating incidents that will affect mission-critical functions and processes for the organization, and ensuring that it responds to any incident in a planned and rehearsed manner. Foster and Dye (2005) similarly viewed BCM as the process of developing advance arrangements and procedures that enable an organization to respond to an event in such a manner that critical business functions continue with planned levels of interruption or essential change. In this context, top management must take the lead in driving organizational BCM with a view to garnering the collective efforts of all individuals within the organization for this purpose (Low et al, 2008).

Historically, BCM was developed many years ago, where this concept is an evolution of a disaster recovery approach in a firm. Its roots lie in Information Systems (IS) protection although it is argued that it has grown a long way since then. Elliott et al (2010) developed on these theories in more details explaining that the evolution of BCM has progressed from a focused technical aspect to a broader strategic organizational requirement. BCM is a system that develops a framework of protocols and sets of procedures and instructions which give structure, order and stability to the particular function being managed. It is in line with the definition of a management system, stated by Griffith (2011) that sets out and describes, for a particular management function, the organization's policies, strategies, structures, resources and procedures used, within the firm to manage the processes that delivers its products or services.

The main aspects in BCM principles are described in Table 1 which shows the BCM concepts being grouped into six categories for BCM implementation.

Table 1: Main aspects of BCM principles

No	BCM Principles	Description
1	Risk analysis and review	<ul style="list-style-type: none"> Examine internal and external risk events and impacts (qualitative and quantitative) that can affect the critical operation's continuity. Using Risk Analysis (RA), Business Impact Analysis (BIA), and Cost benefit analysis (justification for initial treatments to prevent or reduce the effects of risks and potential losses).
2	Business Impact Analysis	<ul style="list-style-type: none"> Examine the impact to the organization (assesses the potential impact of loss from an internal perspective), qualitatively and quantitatively, due to a disruption of business operations and processes. BIA must be conducted on a periodic and systematic basis to assess the impact of losses if the corresponding business operations and processes are disrupted in view of proposed changes.
3	Strategy development	Examine the possible strategies for maintaining the operation of Critical Business Functions (CBFs). This should cover pre-incident preparedness, response and recovery.
4	BC Plan development	Examine the BC plan(s) which is an action plan that guides the response and recovery actions of the organization when disaster occurs. It includes an emergency response to stabilize the situation following a disaster, the set up and operation of an Emergency Operations Centre (EOC), and specifies CBFs to be recovered within their established Recovery Time Objectives (RTOs) and Recovery Point Objectives (RPOs) when a disaster occurs. RTO is the period of time in which functions must be recovered after a disruption has occurred, and RPO is the point in time at which systems and data must be recovered after a disruption has occurred.
5	Test and exercises for BC plan	<ul style="list-style-type: none"> Ensure that the BC plan drawn up and implemented by the organization is viable and workable. Tests are intended to verify the capability of the BC plan to attain specified objectives or established criteria. Exercises are intended to train and condition BC team members to improve their coordination and performance in executing the BC plan. Exercises also serve to highlight any weaknesses in the operation and effectiveness of the BC plan, with establishing generic corrective actions if the result falls below assessment criteria.
6	Program management	<ul style="list-style-type: none"> Examine the ongoing efforts and activities of the organization to maintain the effectiveness of its BCM. BCM involves firm commitment of organization's efforts and resources to safeguard the interests of its key stakeholders, reputation, brand and value-creating activities on a continuous basis. Assessment of an organization's BCM efforts should therefore be dynamic. The BC plan is operated by staff of the organizations. Staff in the organization should be familiar with the plan via appropriate awareness and training programs prior to any test/exercise of the plan. Periodic and systematic training and awareness programs should be conducted to

No	BCM Principles	Description
		familiarize employees to the operation of the BC plan.

Adapted from SPRING (2008)

2.2 Organizational Culture (OC) and Institutional Forces (IF)

Organizational culture had been defined as the way things are done and operated within the internal environment of the workplace. The features in organizational culture are common beliefs; pattern of behavior, norms; values and rules that are exercised among members of the organization. They viewed that the closer the values and beliefs among members of the organization are, the stronger the culture will be (Kotler and Heskett 1992).

The importance of organizational culture towards adopting a concept or system in the organization can be seen from studies which increasingly push organizational culture as the guide for organizational strategies. It is suggested that organizational culture can impact manager's ability to process information, rationalize and exercise discretion in their decision-making processes (Hofstede and Hofstede, 2005). Liu et al (2010) found that identifying organizational culture helps its members to understand organizational functioning. It affects how the firm responds to external events and makes strategic choices. Moreover, organizational culture is a key to many change initiatives, where success in implementing a concept depends on the organizational culture.

Institutions are considered as multifaceted, durable social structures made up of symbolic elements, social activities, and material resources. Institutions are inhabited by people and their interactions. Rules, norms and meanings arise in interaction, and they are preserved and modified by human behavior. The essence of the institutional perspective in general resides in the three pillars – the regulative, normative, and cultural-cognitive – which provide meaning and stability for social behavior. The regulative pillar is distinguished by the prominence given to explicit regulative processes; rule-setting, monitoring and sanctioning activities. In the normative pillar, the emphasis is on values and norms which introduce a prescriptive, evaluative and obligatory dimension into social life. The cultural-cognitive elements include widely held beliefs and taken-for-granted assumptions, the rules that constitute the nature of reality and the frames through which meaning is created (Scott, 2008).

2.3 Indonesian Contractors

In delivering a project, a contractor needs to manage the materials, people, and equipment in a project site and assembling the materials in the proper sequence to construct a project that meets the customer's requirements. In meeting these requirements, the contractor also has to consider their stakeholders, which can vary from the customers, suppliers, creditors, investors, employees, subcontractors, governments and the public, to existing and new competitors. Schaufelberger (2009) also mentioned that each type of construction projects has its unique set of technical challenges, but the following business responsibilities for contractors are similar, which are acquisition of the work, performance of the work, and management of the financial, capital, and human resources of the firm.

The existing conditions of the Indonesian contractors have been analyzed. Suraji (2003) had completed an analysis showing the strengths, weaknesses, opportunities, and threats in general. Based on these findings, the Indonesian contractors have the strengths of delivering more projects due to their many labour resources and the current needs of infrastructures in many cities in Indonesia. There are many opportunities for collaboration with other foreign contractors arising from their recent businesses in Indonesian construction projects. Thus, this can enhance the capability of Indonesian contractors in delivering better projects through technology and knowledge transfer. Some weaknesses identified are the lack of funds and technologies, lack of skilled workers, the high level of competition in the national construction industry, and management inefficiencies. Factors such as the competencies of human resources, research and development, certification and support from other sectors may threaten the firm's growth and sustainability in the future if not considered comprehensively. Moreover, low skill index and experience of construction workers make the business face difficulties in undertaking new concepts and technologies.

2.4 Knowledge Based Decision Support System (KBDSS)

As a computer-based system that supports decision making by aiding knowledge storage, retrieval, transfer and application by supporting knowledge access, KBDSS provides benefits for the management process. Most scholars viewed the major benefit for the management process is improvement in managerial productivity. Managerial productivity is considered as a function of the time spent in retrieving information, generating value added information and finding problems in the intelligence phase, and developing alternative solutions in the design phase of decision making. A good KBDSS may reduce the time required in this process and thereby improves managerial productivity (Raman and Phoon, 1990). Nonetheless, before using KBDSS for the management process, it is necessary to understand that KBDSS is not designed to make decisions for users, but rather it provides relevant information in an efficient and easy-to-access format that allows users to make more informed decisions (Arain and Low, 2006).

In the construction industry, there are several KBDSSs that have been developed for various functions such as for material and procurement planning in construction projects (Mockler, 1989), integration of AUTOCAD and construction scheduling (Wang, 2001), resource allocation, risk management process and project success forecasting (Mohan, 1990). It can be seen that a DSS or KBDSS is quite applicable in the construction industry, and there could be other processes or concepts that can be applied into this tool.

Yoon et al (2008) also found that KBDSS have been developed for emergency response and management. A KBDSS for emergency response was developed to assess the state of preparation of an agency to respond to emergencies, enable the development of new SOPs, and to better train and empower employees in the decision making process. It is utilized to reduce the time to make critical decisions such as task assignment and resource allocation and to guide long-term decisions, training and the control capabilities of the organization. Considering the function and benefit of this tool, developing a KBDSS can be proposed in order to improve the effectiveness and efficiency of the decision making process in BCM.

3. Results

Based on literature reviews, a framework for developing a BCM implementation guideline in the form of a KBDSS for Indonesian contractors is proposed. The framework consists of aspects which are the Organizational culture (OC) dimensions, Institutional forces (IF) attributes, BCM for Indonesian contractors and KBDSS for BCM. Section 3.1, 3.2 and 3.3 describe the aspects that are part of the conceptual framework, followed by section 3.4 which shows the whole framework proposed for the study.

3.1 Determining Drivers and Hindrances of Implementing BCM through OC and IF

Based on the previous discussion, it appears that institutional forces and organizational culture may work together and interact with each other to affect concept or system adoption. Studies also had suggested that the immediate motivation for concept or system adoption comes from institutional forces. Furthermore, organizational culture, as a stable element of the organization, moderates the effects of institutional forces (Liu, et al., 2010). Based on this understanding, IF and OC attributes can be synthesized with BCM principles in developing a framework for determining the drivers and hindrances of implementing BCM by Indonesian contractors. Figure 1 illustrates the framework for this purpose.

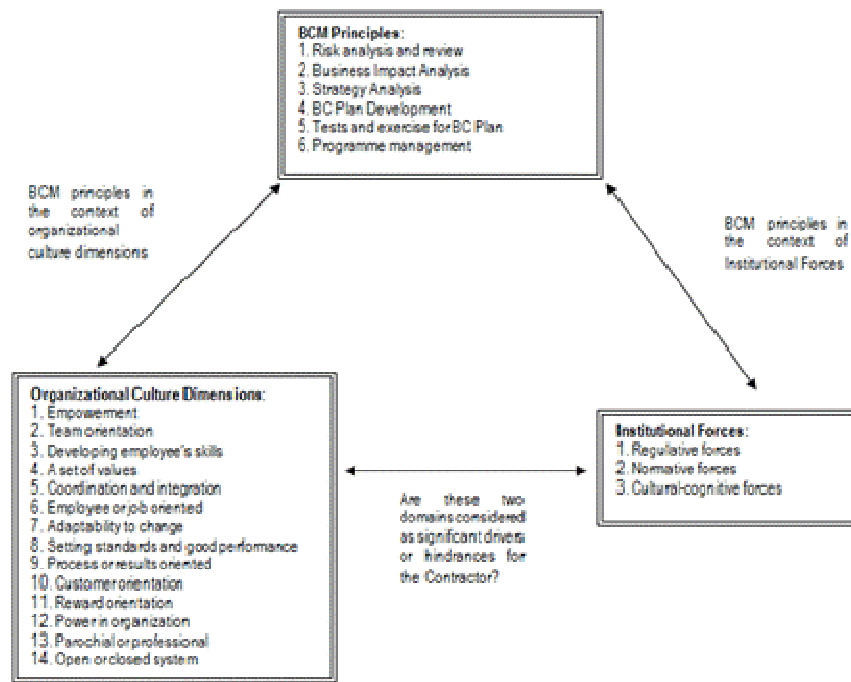


Figure 1: Framework of IF – BCM – OC relationships

There are two relationships that can be described within this framework. Firstly, the relationship between institutional forces and BCM principles is primarily about the contractor's perspective on BCM principles in the context of the institutional framework. It describes whether the contractor views the BCM principles as regulative, normative or cultural-cognitive forces towards implementation. This relationship can be considered as the

first domain. Secondly, the relationship between organizational culture dimensions and BCM principles (the second domain) is generally to determine whether the BCM principles are part of the contractor's organizational culture. In answering this, the 14 OC dimensions are used. The relationship between the two domains is to analyze how the contractor views the BCM principle (in the context of institutional forces and organizational culture dimensions) regarding its level of influence (significant drivers) and level of hindrances for the firm. From this relationship, it can further be determined whether BCM principles are supported or not supported by the contractor.

3.2 Developing BCM for Indonesian contractors

In developing the BCM implementation guideline for Indonesian contractors, the main steps that will be involved are based on BCM's main principles, which are risk analysis, business impact analysis (BIA), strategy development, BC plan development, tests and exercises and programme management. Moreover, BCI (2002) had provided some criteria for understanding the preparedness of the firm towards BCM. These criteria can be used as a benchmark in line with the BCM principles. In this study, some of these criteria will be observed in order to identify the preparedness of Indonesian contractors. Table 2 shows the variables to be used as the benchmark to better understand aspects for BCM preparedness.

Table 2: BCM preparedness criteria

<i>Variables to be used as a benchmark – BCM good practice criteria</i>	
• BCM vision and policy statement	• BCM training budget
• Communicating vision and policy throughout the organization	• Defined BC Plan
• BCM committee from senior management	• Awareness of the significance and importance of legal privilege in all communication and documentation regarding a crisis or BCM event
• Senior and middle management support and strong commitment	• Awareness of the communication and call-out tree
• Monitoring and evaluating BCM implementation and maintenance	• Employing BCM professionals
• Defined BCM roles and responsibilities at all levels within job descriptions	• Attending external BCM seminars and courses
• Integration with organization's reward and recognition system	• Provide formal training and professional development plans for BCM personnel
• Integration with organization's performance management and appraisal system	• Promoting BCM as an issue for continuous professional development for its staffs
• Defined BCM roles and responsibilities at all levels within personal annual performance contracts	• Defined BCM exercising, maintenance and audit programme
• Defined KPI for BCM	• Using BCM standards as a process for embedding a BCM culture
• Integral part of organization's project management process	• BCM awareness and training programme

Source: BCI, 2002

3.3 The Application of KBDSS for BCM

For this study, KBDSS will be proposed as a supporting tool for the management team in developing a BCM. According to Crabb (2011), there are parts in BCM that need consistency

of approach, consistency of information and structure and also consistency of process. This type of phase can be supported by a KBDSS. The content for the proposed KBDSS is to develop a BCM preparedness assessment and recommendation (in the form of action plans). It will provide technical guideline or steps to implement each BCM principle. The non-technical attributes that consist of the organizational culture (OC) and institutional forces (IF) that relate with BCM principles will also be included in the system. The answers from the user (the firm) will be assessed to determine the level of its BCM preparedness, and will be followed by recommendations on that specific level. In the proposed system, the level of BCM preparedness is grouped into four levels, which starts from an undeveloped BCM, beginner level, moderate level and comprehensive level. These levels are adapted from various BCM level of preparedness studies (Smit, 2005). Furthermore, all of the knowledge obtained from the BCM implementation guideline will be placed in the KBDSS for developing the assessment process.

Automating this process will provide the BCM information and knowledge in one place that allows the management to take a more rounded view of issues, resources and situations. This allows organizations to develop a much more strategic-based approach for planning its business resilience. Its content is not in providing the exact solution, but supports the decision maker (the user) with information for obtaining the proper solution in that phase. Knowledge will be provided for the decision maker in assisting him to select the decision for developing BCM through the recommended action plans. Figure 2 illustrates the general process in the proposed KBDSS.

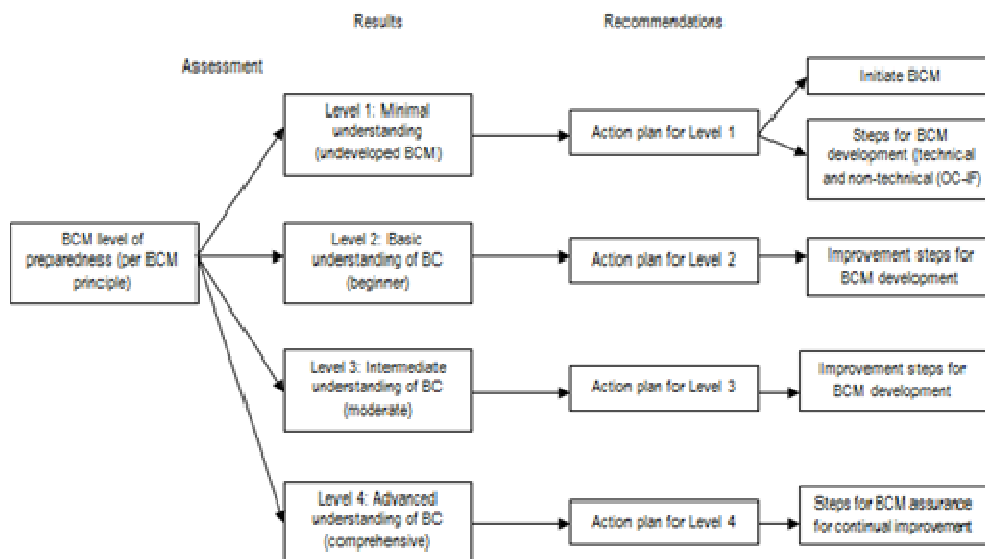


Figure 2: KBDSS process: BCM level of preparedness assessment

In developing the proposed KBDSS, all aspects from the previous phases of the study will be needed, where the data will be compiled and synthesized. Furthermore, the data will be processed as the knowledge base for the system (Mockler, 1989; Turban, 1995). For further illustration, Figure 3 shows the proposed BCM - KBDSS components. KBDSS comprises components such as DSS shell, knowledge base, inference engine, and database. All of the

data from the database will be analyzed to acquire the relevant knowledge needed in the system. Inference engine will be used to develop the knowledge base that will assess inputs from the user and provide the outputs. DSS shell will be the component that structures these processes into a user-friendly interface with the user.

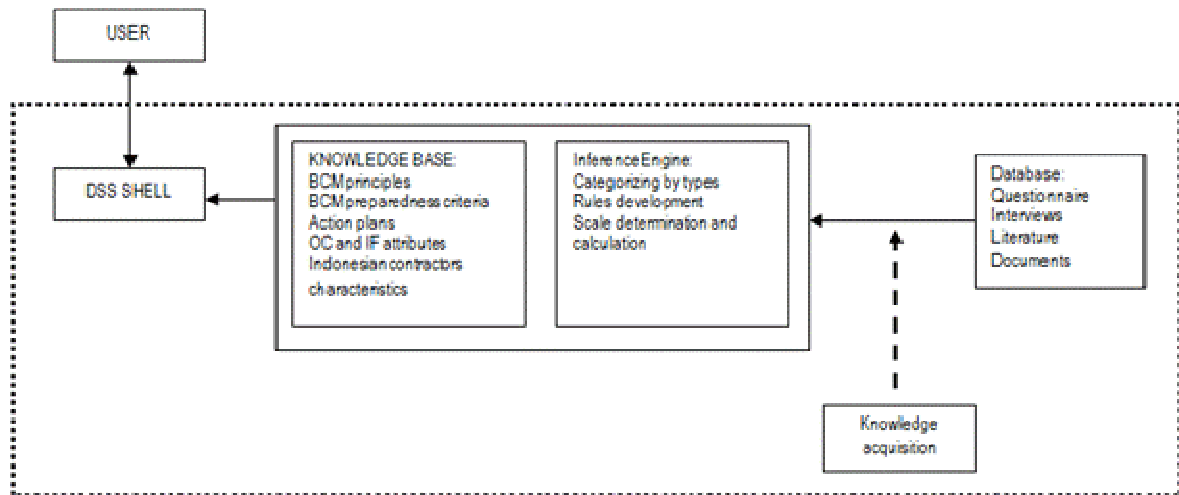


Figure 3: BCM - KBDSS components

3.4 Conceptual Framework

The main conceptual framework for this study is shown in Figure 4. The framework has synthesized the BCM-OC-IF relationships, BCM implementation guideline, and BCM-KBDSS aspects. The constructs needed to understand the Indonesian contractor’s knowledge of BCM are developed, followed by defining the relationships between BCM, OC, and IF. These relationships are considered as the outer layer of the framework. Furthermore, in developing BCM for Indonesian contractors, various constructs are identified that will be developed into a guideline for BCM implementation. BCM principles, BCM preparedness criteria and characteristics of Indonesian contractors are the aspects that will be used in this phase. The role of KBDSS as the automated BCM implementation guideline is the inner layer of the framework that consists of the KBDSS process (BCM level of preparedness assessment and action plans) and components.

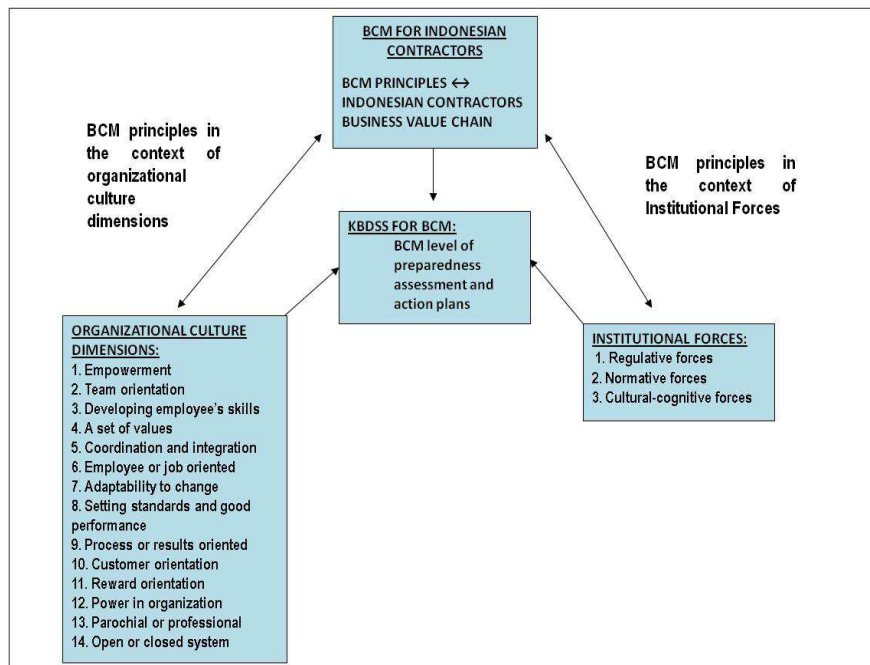


Figure 4: Conceptual Framework

4. Conclusion and Expected Contributions

4.1 Conclusion

Due to its vulnerability to various threats and crises, BCM should be adopted by Indonesian contractors. Furthermore, the roles of organizational culture and institutional forces were found to be important in adopting a concept such as BCM.

This research aims to study BCM implementation by Indonesian contractors, which identifies the significant drivers and hindrances for implementing BCM by Indonesian contractors that are related to their organizational culture and institutional forces. Moreover, in order to reach efficient decisions in the process, BCM will be developed as an implementation guideline model that will be automated into a KBDSS.

The conceptual framework for this study incorporates the constructs relating to the Indonesian contractor's knowledge of BCM; the relationships between BCM, organizational culture (OC) and institutional forces (IF); and aspects that will be used in developing the BCM implementation guideline model such as its principles, its preparedness criteria and the business characteristics of Indonesian contractors.

4.2 Expected Contributions

The BCM implementation guideline model can assist the firms to develop better coordination with their stakeholders that may lead to a competitive advantage and marketing value for the firms. If this model is applied by all the Indonesian contractors for them to become more resilient, the firms may have the ability to absorb, respond and recover from disruptions that will eventually contribute to higher corporate performance. Thus, this may support the role of the Indonesian construction industry in the economic growth plans of the country.

From the academic perspective, along with further understanding about BCM implementation in the construction sector, this study will provide further knowledge on cultural and institutional studies in construction organizations. Last but not least, the development of an automated system (KBDSS) in this study will also contribute to further IT implementation in the construction industry.

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