IMPROVE CONSTRUCTION KNOWLEDGE MANAGEMENT SYSTEM BY USING THE SOFT SYSTEM METHODOLOGY (SSM)

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ABSTRACT

The construction industry has a poor record in the management of its knowledge and results into huge wastage of resources and detrimental effect to quality. Research has shown that data and information management system plus knowledge management are a critical part of today’s project management practice for construction projects. Few people will deny that ‘quality information’ and ‘useful knowledge’ are extremely important to any decision-making. However, the current processes of handling information and knowledge in the construction industry are increasingly costly. One of the major reasons is the nature of this industry is not conducive to good knowledge management and the traditional data/information systems used in the industry has long been criticized. It is very common that information is often duplicated, inconsistent and not current. In turn, making knowledge becomes difficult to be managed properly. Project managers have in the past found it very difficult to source and analyse data in order to make sound decisions. This paper is part of a doctoral research project which summarizes three exploratory surveys; namely ERP system, Partnering strategy and Leadership impact of a knowledge management system in a construction company. Those findings are described by using the Soft Systems Methodology (SSM) which later becomes the basis for actions research. SSM is useful to reveal the complexities of the knowledge management situations that occur in construction industry. The first stage was to conduct interviews of the different practices in knowledge and reporting process. Then, the SSM rich picture was developed to present the problematic areas including difficulties in inputting data to enable the knowledge platform in place. The research then develops root definition and CATWOE, and a conceptual model was formed. Interviewees were conducted with structured questions to identify prioritized actions and activities that can be undertaken to improve and manage the knowledge platform.

Keywords: knowledge management, project management, soft-systems-methodology (SSM).

INTRODUCTION

Construction industry is segmented, fragmented and project-based and Tah (2001) concluded that it consistently suffers from poor performance due to lack of formalized risk management procedures and a knowledge-based approach to construction. Knowledge management (KM) is therefore becoming important in the construction industry. There have been proposal of re-engineering and re-valuing construction in the industry, and Kamara, Augenbrote et al. (2002) considered KM is recognized within the project based architecture, engineering and construction industry as very vital to the gaining of competitive advantage by innovation and improved performance.

Indeed, KM is now recognized as a major business concerned advantage. Walker (2005) said that KM strategy can develop to an organization’s knowledge advantage (K-Adv). Kamara, Augenbrote et al. (2002) added that KM in today’s organization is important and especially relevant to construction organization and point out that it is very vital to gain competitive advantage by innovation and improved performance.

Duyshart (1997) noted that much of the paper-based exchange during the construction phase involves duplication, continual translation and transcription from one medium or form to another, as well as the loss of information. However, implementing a successful KM system in construction organization is by no mean easy. Although Boisot and Griffiths (2001) stated that information technology (IT) greatly affects the flows of data within and across organizations, the choice of good
tools is still a concern. Because as Mark (2001), the current stage of using IT in cost control for construction projects has not been able to efficiently achieve results. Therefore, the attitude of decision makers (i.e. leadership) towards knowledge sharing, creation, and use, as well as the technology itself is important (Brindle 1999).

As part of the doctoral research, one of the authors undertakes a case study in a Hong Kong construction organization about how KM system can be managed by using ERP, Partnering and Leadership. Three exploratory surveys have been conducted between March 2006 and January 2007 to research the relationship of these three factors. However, it is difficult to visualize the impact on the KM system purely on the surveys and descriptive study is required which is presented by the Soft Systems Methodology (SSM). The purpose of this paper is thus related to describe how SSM helps to improve the construction KM system.

Barry and Fourie McIntosh (2001) recommended that SSM, which incorporates systems thinking and systems concepts, is an approach that provides the opportunity for incremental improvement that is needed to address messy and uncertain problems. SSM indeed provides an effective and efficient way to carry out a systems analysis of processes in which technological processes and human activities are interdependent.

Therefore, SMM is used as the research tool here and this paper is structured as follows. Having provided a brief introduction for the paper, literature review forming the theoretical basis addressed by the paper is discussed. The research approach regarding the need of descriptive study for exploratory surveys is then briefly described. Research result is followed including summarized collected data from surveys and descriptive study by using SSM to improve the construction KM system. Finally, limitation of the paper and conclusions are provided.

LITERATURE REVIEW

There is a Chinese proverb “温故可以知新” (wēn gù kě yǐ zhī xīn), means in order to gain new insights; people must always re-study through old materials because there are so many theories and researches built-up by other scholars. Reviewing the past can help people understand the present. This is also relevant for any researcher to review literatures which form the basis of the research, and the structure of this review section is organized as follows:

- What is KM in construction management?
- Why use “ERP” in KM?
- Why “partnering” is part of KM?
- How leadership affects KM?

What is KM in construction management?

Dent and Montague (2004) stated that the evolution of knowledge as one of the key factors in current economic activity which has led to businesses seeking to develop new practices (even in mature industries such as construction) by utilizing a greater breadth of internal and external sources to obtain, create and employ knowledge. Therefore, KM is now recognized as a core business concern and intellectual assets that play a vital role in gaining a competitive advantage. Sveiby (2006) also argued that collaboration and knowledge sharing have clear benefits for people and enhance business performance. According to (Walker 2004), an organization’s knowledge advantage is its capacity to liberate latent creativity and innovation potential through effective management of knowledge both from within its organizational boundaries and its external environment. Therefore, KM in today’s organization is important and especially relevant to construction organization (Kamara, Augenbroe et al. 2002).

As for KM in construction organizations, both Love, Li et al. (2000) and Kamara, Augenbroe et al. (2002) asserted that effective KM in the construction industry is likely to produce innovation, reduce project time, improve quality and customer satisfaction. In the project environment, KM will assist project managers to improve communications within teams. It will also provide informed knowledge to the project manager and project teams. KM can ensure better sharing of best practice documents, lessons learned, PM and system engineering methodologies, and review and document the rationale
for strategic decision-making (Liebowitz and Megbolugbe 2003).

Failure to capture and transfer project knowledge leads to an increased risk of “reinventing the wheel”, wasted activity, and impaired project performance. These potential benefits of KM are convincing enough for the construction organizations to venture into adopting the KM principles.

**Why use “ERP” in KM?**

It is widely understood that Information communication technology (ICT) tools that can assist project managers to improve information communication and facilitate KM. According to Walker (2005), KM support by an effective ICT infrastructure can facilitate competitive advantages in at least two ways – having a cost advantage or a differentiation advantage. Indeed, ICT can help to enhance communication and manage information construction processes (Bjork 1999) and also benefit the management of construction projects (Abudayyeh, Temel et al. 2001; Liaquant, Jon et al. 2002; Nah 2002).

Many organizations use ERP as their ICT backbone, because managing a project involves hundreds of thousands of documents that must be shared by project teams. A well-developed ERP can deliver great job efficiency. This system for a construction project will have high possibility for success, economically and efficiently. According to Nah (2002), ERP and KM promise organizations the benefits of enhancing competitiveness and continuous revitalization. Al-Mashari, Al-Mudimigh and Zait described ERP as customised standard integrated software applications that facilitate IT coordination in control aspects of management and other operational facets such as human resource management and logistics.

**Why “partnering” is part of KM?**

If ERP is adopted as a KM tool, it is worthwhile to consider synchronizing it with other business functions e.g. integration with the supply chain system. According to (Baker 1990), the world of contracting is challenged by many problems such as: poor communications, adversarial contractual language, cost overruns, continuity from project to project, extended schedules, poor-quality work, and change-order negotiations. In too many cases, the work is not performed in the most cost-effective manner. To strengthen the competitive position, construction companies must strive to improve the procedures, the working relationships, the cost effectiveness, and the performance. Contractors must change to respond to the needs of the marketplace by providing the environments for and capitalize on the synergies that will result from contractors, subcontractors and suppliers working together as partners. ERP then provides a common platform for the “partners”.

An ERP is useful to generate both upstream and downstream supply chain expectation and relational knowledge with a client and subcontractors / suppliers (Akkermans, Bogerd et al. 2003). Partnering is also the rising trend in the supply chain; it is therefore worthwhile to integrate it into the ERP/KM system.

**How leadership affects KM?**

Tsoukas and Mylonopoulos (2004) stated that adopting KM in organization is so invaluable; it links between organization learning and competitive advantage of an organization through the development of its distinct capabilities. By seeing organizational knowledge as a “project”, top management can investigate how knowledge is diffused properly within the organization. However, for it to succeed, KM should not be viewed as just “another project” or fad. The key to its success is KM must be seen as an important aspect of business strategy.

Zhang, Lee et al. (2005) completed qualitative research by case study of four Chinese organizations using the ERP system and concluded that “lack of top management support” is one of the factors affecting the success of an ERP. Therefore, effective KM by ERP can create a sharing environment but requires the endorsement by the leader.

It is very obvious that the strategies of “ERP” and “Partnering” require “Leadership”, and therefore viable to study the impact of leadership in the implementation of “ERP” and “Partnering” for
construction project management.

RESEARCH APPROACH

Sekaran (1992) said that descriptive research studied variable and possible models that may explain the phenomena being investigated, identifies overlapping areas, and constructs paradigms that offer a more complete theoretical picture. Since exploratory research may only describe the "what" of a situation, not “what caused it”. Therefore, descriptive research can be used to provide a systematic description which is much factual and accurate. It not only helps to set up and obtain information concerning the current status of the phenomenon but also describe what the situation of the problem for improvement more precisely. The results of the descriptive research thus provide deeper understanding about the extent being studied.

The primary objective of the three research surveys in the case study is to explore the problems. It focuses on employees within the organization who are currently working with ERP to explore the factors influencing ERP performance which affects the KM system subsequently. These surveys help to identify problems that the employees perceived, and allow researchers to understand the nature and extent of the supportive environment within the organization that could facilitate partnering. Once the problems are identified, a richer appreciation and understanding of the nature of the workplace environment inhibits ERP performance and affects the KM system. The focus of attention throughout the study is mapped out the interrelationship for performance improvement of ERP, partnering and leadership in the processes. The maps will then lead to actions that will be taken to improve the performance.

However, there was difficulty encountered in finding a suitable language and conceptual basis for understanding the subtle and contextual data that was vital for making sense out of highly confusing situations where tacit knowledge is such a vital asset. Fortunately, the SSM approach provides an ideal way to unearth the context of confusing knowledge situations through its use of rich pictures and model development to provide “thick” rather than “thin” knowledge (Walker, Finegan et al. 2003).

SSM has not only been used in various management improvement studies and different industries, for example knowledge management in construction industry (Green 1999; Maqsood 2006), but also has been applied widely as a methodology for scholarly research. According to Brown-Syed (1993), the publications that have resulted from SSM research undertakings include doctoral dissertations, master's theses, monographs, consultants' reports, and journal articles. There were about 30 graduate theses which involved SSM listed in Dissertation Abstracts International by 1994.

Although other systems approaches, such as ‘Critical Systems Thinking’ have incorporated many of its ideas, SSM remains the most widely used and practical application of systems thinking. Finegan (1994) stated that the complex systems associated with human activity are often poorly defined but SSM provides an effective and efficient way to carry out a systems analysis of processes in which technological processes and human activities are interdependent. As the ERP is an ICT tool adopted as a KM tool and a partnering procurement method was associated with the leadership style for implementing the ERP system, this does involve human activity and support using SSM tool for the research.

This methodology developed by Checkland (1981) uses a 7-stage research process where complex and rich contextual issues are exposed and studied. One of the key elements of SSM is developing rich pictures that are developed jointly between the researchers and subjects to better understand complex situations. These lead to developing an ideal situation and gap analysis to identify actions that can be taken to improve a current situation to move it towards the idealized situation. The use of SSM thus provides a third part of the triangulation required for a rigorous study and the action part of the outcome from the SSM resulted in a series of recommendations for the action learning approach.

There are two main modes within SSM, real world activities and systems thinking about the real world. Initial work involves undertaking interviews and meetings to gain an understanding of the problem situation which is represented by the use of rich pictures. SSM works within a seven-step framework. However, it may not always treat taking sequential steps as being necessary. Generally, the first four steps are undertaken with a number of iterations and overlaps. The 7-steps process is described.
Table 1 as follows.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Finding out about the problem situation. This is the basic research to</td>
</tr>
<tr>
<td></td>
<td>locate WHO is the key players and how does the process work now.</td>
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<tr>
<td>Step 2</td>
<td>Expressing the problem situation through Rich Pictures. As with any type</td>
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<tr>
<td></td>
<td>of diagram, more knowledge can be communicated visually.</td>
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<tr>
<td>Step 3</td>
<td>Selecting how to view the situation and producing Root definition. This</td>
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<tr>
<td></td>
<td>definition is then tested against a group of elements known by the mnemonic</td>
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<tr>
<td></td>
<td>CATWOE and the different perspectives of a situation must be considered:</td>
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<tr>
<td></td>
<td>C Customers - the victims or beneficiaries of a transformation</td>
</tr>
<tr>
<td></td>
<td>A Actors - those who would do the transformation</td>
</tr>
<tr>
<td></td>
<td>T Transformation process - the conversion of input to output</td>
</tr>
<tr>
<td></td>
<td>W Weltanschauung - the world view which makes the transformation</td>
</tr>
<tr>
<td></td>
<td>meaningful in this context</td>
</tr>
<tr>
<td></td>
<td>O Owner(s) - those who could stop the transformation</td>
</tr>
<tr>
<td></td>
<td>E Environmental constraints - elements outside the system which takes</td>
</tr>
<tr>
<td></td>
<td>as given</td>
</tr>
<tr>
<td>Step 4</td>
<td>Building conceptual models of the system for improvements</td>
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<tr>
<td>Step 5</td>
<td>Comparing of the conceptual models with the real world to see where they</td>
</tr>
<tr>
<td></td>
<td>differ and are similar.</td>
</tr>
<tr>
<td>Step 6</td>
<td>Identifying feasible and desirable changes to improve the situation.</td>
</tr>
<tr>
<td>Step 7</td>
<td>Proposing actions to improve the problem situation.</td>
</tr>
</tbody>
</table>

PRESENTATION OF RESEARCH: DESCRIPTIVE STUDY - SSM

In the following context, the results of three exploratory surveys are summarized and then descriptive study is presented by using SSM.

Summary of Surveys’ Results
From the exploratory surveys, the following results are summarized:

- Survey 1: ERP system is under-utilized and the cost reporting function should be enhanced to improve management reporting and is presented in Figure 4.
- Survey 2: Partnering strategy is an important new trend in the supply chain and will be integrated into ERP system to share knowledge and can improve management reporting and is presented in Figure 5.
- Survey 3: Leadership is the essence to implement strategy: ERP system and Partnering strategy to improve management reporting. The essence of proper leadership style includes power, cultural impact, and empowerment and is presented in Figure 6.

For more details of the surveys, please refer to the attached
Appendix A for Surveys Summary.

Figure 4 – Survey 1 (ERP System) Mapping

Figure 5 – Survey 2 (Partnering) Mapping

Figure 6 – Survey 3 (Leadership) Mapping

ERP system is the “heart” of KM process of the studied organization, and the ultimate “product” of the ERP system/KM process is the “Management Reporting” which consolidated data, information and knowledge of various projects and departments within the organization. These management reports form the basis for business decision-making. All the findings are pointed to an enhanced management reporting for better business decisions.

Descriptive research helps to see the “as-is situation” which can be undertaken with many kinds of tools. Mapping is one common tool to map the relationships of the phenomena of ERP, partnering and leadership together which is shown in Figure 7. A system map or a pictorial and text description is created of what was observed from interviews. Descriptive research is therefore conducted by using SSM in conjunction with series of interviews.
Descriptive Study - Using Soft Systems Methodology (SSM)

Management Reporting is undoubtedly important for KM system and its process is indeed critical for the business decision-making. However, the selection and inclusion of data, information and knowledge relies heavily on the experience of the people involved despite the use of ERP system, especially if partnering strategy will be implemented. It was at present not well structured and was a complex informal process. Improvement is required to enable and lead the studied organization making various important business decisions. For instance, when the organization is deciding the tender margin for a project, this management report is strategically and operationally important for the profitability and sustainability of the organization. Any improvement in deployment of knowledge in this process may make a significant difference in winning tenders at acceptable profit margins. It also could conserve management energy to concentrate on the most “profitable” or strategic projects thus enabling the organization to make the most of its opportunity cost of its skilled staff engaged in this business process.

The management reporting format is documented in an explicit structure. However the content, data, information and knowledge feeding into the report depends on the team how to gather sufficient data and information about the projects. It is a process that is embedded in the organization’s customary routine.

The typical process flow for the management reporting is illustrated in Figure 8, and the 7 stages of using SSM to improve management reporting will be adopted.
Figure 8 – Process Flow of Management Reporting

Deployment of the 7 stages SSM on the process of improving management reporting includes: conducting unstructured interviews, developing rich picture, developing root definition and CATWOE, developing conceptual model, comparing model and reality, developing of list of actions and leading to action learning.

Stage 1: Conducting Unstructured Interviews
The first stage SSM requires conducting unstructured interviews, which took place between January 2007 and June 2007, with people involved in the management reporting process. There were two group interviews conducted, one with a team in a major civil engineering project (HK$2.2 billion) comprising eight participants. The other team is engaged with a mega building project (HK$2.1 billion) comprising also eight participants. Those interviewees include participants that were involved in the three surveys and the main reason to hold two interviews is to conclude and consolidate the different practices in management reporting process. These interviewees on one hand can maintain consistency to the research programme, they can also inject fresh ideas on the other hand.

The interviews for the SSM conducted are in semi-structured in format, and there are open-ended questions with no limitations on how the participant responded. In essence, the interview procedure is intended to be directed somewhat by the flow of responses rather than by specific items set by the research context.

The interviewees were asked about their involvement in the reporting process based upon their experience and expectations. They were asked to talk about their role and the important tasks that
they have performed in the past. It was observed that some participants found it difficult to focus on the answers. This difficulty is normal and can occur when people try to present their tacit thoughts verbally. Therefore an important task of the interviewer was to keep the discussion within the topic and context of the study.
Table 2 summarizes the role of interviewees, the current process and procedure, belief, expectation and perception as well as the value and goal in the management reporting.
Table 2 – Role, Process & Procedure, Belief, Expectation & Perception, and Value & Goal in Management Reporting

<table>
<thead>
<tr>
<th>Role:</th>
<th>Input data as front-line users. Ensure fulfilling system requirement and company procedures. Review accuracy and consistency of data. Ensure timely data input.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Process &amp; Procedure:</td>
<td>Report in manual and or system format to present the status. Work with many different types of report. Work in detail outside system for all cost data into different cost code and categories. Consolidate data using ERP system. Generate ERP reports for review and analysis. Correct and/or adjust, if error found or required. Re-generate the consolidated reports. Review and analysis by exception. Feedback to management the findings and result. Implements various measures as monitored by top management. Control versus budget. Form a basis for forecast. Consolidate status report. Produce management report.</td>
</tr>
<tr>
<td>Value &amp; Goal:</td>
<td>Serve as common tool for performance review and management decision. Identify problem for earliest correction and resolution. Become a database for daily work, like search similar items for assessment/reference, check subcontractor’s information, working status with company, check approval status, etc. Provide a reliable base for relevant parties to get access to required information. In other words, it provides uniform, organized information. Enable top management using it as a base to monitor performance. Reduce running cost of costing system and maintenance.</td>
</tr>
</tbody>
</table>

Stage 2: Developing Rich Picture
Developing rich picture gives a structure to the problematic situation learning about the structures, processes, perceptions and beliefs associated with the studied situation of management reporting. Iterations are very common in the development of a rich picture, where the rich picture is drawn and reviewed it with the participants for amendments. This is iterated until consensus of the participants is achieved on the true representation of the situation portrayed in the rich picture. The notes based on role of interviewees, the current process and procedure, belief, expectation and perception as well as the value and goal in the management reporting as shown in the
Table 2. This categorization helps the development of the rich picture. The purpose of the rich picture is to portray all the key players involved in the process and present a structured view by putting the factors affecting the process into context.

After both soft and hard data were collected, the former by direct observation and informal interviews and the latter by the examination of written records in Stage 1. The findings are then summarized in the form of rich picture which was developed using MS drawing clipart. Drawing rich pictures is a creative skill that comprises a narration of a story as told by interviewed participants from their perspective and worldview. This is a cartoon-style representation of the problem situation which includes a collection of vivid symbols. Flows of dialogue, expectation and perception, as obtained from the interview notes, are also represented with key issues highlighted, in this case is management reporting. Relationships between key elements and perceived sub-systems are also indicated together with arrow-links. This rich picture therefore allows for the representation of myths and meanings in addition to facts.

After the initial version of the rich picture was developed; it was then presented and reviewed with the participants. Their opinions were obtained on the accuracy of the situation depicted in the rich picture and another version was then developed after taking into account all feedback is sought. The iteration process was done totally four times until all participants reached the final amendment with consensus. The rich picture was eventually developed using to serve as a basis for the further study.

Participants involved in the study highly regarded the use of rich pictures as these allowed them to make sense through use of this explicit knowledge about the process where previously only tacit knowledge existed in their heads. This demonstrates the power of rich pictures in making implicit knowledge explicit and codifying and socializing it. The rich picture is shown in Figure 9.

Stage 3: Developing Root Definition and CATWOE
Root Definition is the ideal view of what management reporting should do. The third stage of SSM is going to build on the broad understanding established previously by developing the definition. The ideal solution to the problem of management reporting under study is formulated and expressed in statements, which clearly defined the purpose of the management reporting by establishing a precise wording for the system as the Root Definition. High perceptive skills were called upon to take the rich picture and offered a more systemic and formulaic summary. It is a transformation process: input > transformation > output. The third element of the CATWOE mnemonic relating to the need to define the “Transformation” includes the essential logic of management reporting. The fourth element “Weltanschauung” makes the Root Definition of management reporting meaningful. Therefore, a well formulated Root Definition should make explicit reference to and is then tested against each of the six elements CATWOE (Customer, Actors, Transformation, Weltanschauung, Owner, and Environment).
Figure 9 – Rich Picture of Management Reporting

Stage 4: Developing Conceptual Model
In this stage, the conceptual model is proposed to illustrate the activity model and eclectic approach.
When the Root Definition is complete, precise and concise, the understanding gained from the definition of the situation in this form is used to build the conceptual model that details an ideal situation. A well-constructed model incorporates all the activities which are necessary to fulfill the requirements of the Root Definition.

By comparing what is perceived to be the way things happen including subtext and the full picture with the conceptual model – it can then be revealed in next step. Figure 10 illustrates the Root Definition, CATWOE and Conceptual Model.

**CONCEPTUAL MODEL - Management Reporting**

<table>
<thead>
<tr>
<th>ROOT DEFINITION - Management Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATWOE -</td>
</tr>
<tr>
<td>Customer: Directors, Contracts Manager</td>
</tr>
<tr>
<td>Actors: Project Manager, O.S. Manager, Project Engineer, Site Q.S., Cost Clerk and IMS staff</td>
</tr>
<tr>
<td>Transformation: Project cost and status information and data are input into ERP system and convert to useful knowledge by consolidating together with details in the form of management reporting which helps to make business decision.</td>
</tr>
<tr>
<td>Weltanschauung: Project information and knowledge are useful for future tender bidding and project claims direction - affect the profitability and sustainability of the organisation.</td>
</tr>
<tr>
<td>Owner: Project Costing Team</td>
</tr>
<tr>
<td>Environment: To meet quality, cost and time requirement, cope with project budget and corporate goals</td>
</tr>
</tbody>
</table>

Figure 10 – Root Definition, CATWOE and Conceptual Model of Management Reporting

Stage 5: Comparing “Conceptual Model” and “Rich Pictures”

The purpose of this stage is to stimulate debate by comparing the conceptual models of Stage 4 to perceived reality in Stage 2. This comparison provides the framework for a structured debate about improving a problem situation. Interviewees were asked with the structured questions that have emerged from the key actions and activities described in the conceptual model in Figure 10 against the rich picture in Figure 9. This step provides not only the reality check but also throws forth a challenge to the owners of the situation, to rethink and re-analyze underlying assumptions in order that a more creative and fulfilling outcome can be reached.

The comparison started initially at the level of the root definition which acts to highlight important
differences in perceptions amongst the interviewees. Particular attention was then given to any obvious differences between the conceptual model and the rich picture for management reporting; thereby allowing a direct comparison with the relevant part of the conceptual model. The expected result is to represent important areas where changes can be made to improve performance of management reporting.

In addition to simply posting model/real world differences, in the structured-interview setting, specific stimulating questions were also asked all interviewees, and responses were restricted to the range imposed by the researcher, often with the opportunity to qualify responses.

Interviewees were asked the following questions for each action and activities highlighted in the conceptual model:

- What actions and activities can be undertaken in management reporting?
- How are these actions accomplished?
- How to measure the performance undertaking these actions and activities.
- Are there any improvements that could be made to the way the corresponding activities are undertaken.
- How are these actions and activities likely to undertake in the future?
- What is the priority of those important actions and activities?

The result of the discussion that was generated in this stage forms the basis for further actions.

Stage 6: Developing List of Actions for Improvement

The discussions in Stage 5 provide the starting point to this sixth stage for the development of list of actions for the improvement of management reporting. This may trigger changes to existing systems, procedures and organizational culture. Therefore, the purpose of Stage 6 is to confirm which actions are both systemically and culturally viable and desirable, it implies that communication strategies for the need for change should be an important part of any set of recommendations. Interviewees’ opinions on the first set of actions list were obtained and reviewed against the existing management reporting process. Revised actions list were developed and aimed at reducing anxiety for a change. The iteration process was done totally four times until all interviewees satisfied with the recommendations.

The course of proposed actions and required activities compiled below (Table 3) are considered as appropriate and being promising to improve the management reporting process when acted upon.

Table 3 – Actions and Activities to Improve Management Reporting
<table>
<thead>
<tr>
<th>Proposed Actions</th>
<th>Corresponding Required Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Implement good leadership to ensure the correct data is</td>
<td>1. Empower frontline staff: delegation of authority</td>
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<tr>
<td>inputted for those report</td>
<td></td>
</tr>
<tr>
<td>2. Work closely with other stakeholder</td>
<td>2. Improve work flow procedure: multi inputting method</td>
</tr>
<tr>
<td>3. Share experience with other colleagues</td>
<td>3. Encourage experience sharing: lesson learning portal</td>
</tr>
<tr>
<td>4. Participate in the enhancement and development of the ERP system.</td>
<td>4. Integrate different system: 3D modeling</td>
</tr>
<tr>
<td>5. Streamline data input method</td>
<td>5. Streamline and improve reports: crystal report function</td>
</tr>
<tr>
<td>7. Train up data input staff</td>
<td>7. Involve top management: league table</td>
</tr>
<tr>
<td>8. Improve system user-friendliness</td>
<td>8. Upgrade system: resources requirement planning</td>
</tr>
<tr>
<td>10. Use bar coding system and universal coding system</td>
<td>10. Promote creativity: innovation competition</td>
</tr>
<tr>
<td>11. Set different security levels (internal users and external parties)</td>
<td></td>
</tr>
<tr>
<td>12. Make subcontractors to use our system</td>
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<tr>
<td>13. Allow user define report</td>
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<tr>
<td>14. Provide on-line interactive help context</td>
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</tr>
<tr>
<td>15. Report printing flexibility</td>
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<tr>
<td>16. Upgrade software and hardware</td>
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</tr>
<tr>
<td>17. Select suitable partners: ERP knowledge, affordability of ERP system</td>
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</tr>
<tr>
<td>18. Take the viewpoints from the frontline users</td>
<td></td>
</tr>
<tr>
<td>19. Integrate with other system/software</td>
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<td>20. Reduce double-handling</td>
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**Stage 7: Leading to Action Learning**

The final stage of SMM concerns actions to be taken to improve the process of management reporting which are considered to be desirable and feasible. Particular attention is on how effectiveness of the leadership will positively affect the course of proposed actions and required activities.

**LIMITATION**

The scope of this paper is limited to the descriptive phase of the overall research and has some limitations that need to be acknowledged. Firstly, the data is collected from those respondents are known to the researcher. Thus, the results may have an exclusive bias. However, all respondents are report-users who make the surveys fruitful.

Secondly, it was naturally not feasible to interview all employees within the organizations and so the choice mainly depended upon availability and willingness to participate in the study. Every effort was made to ensure that representative groups and individuals were chosen.

One of the major limitations of this descriptive research using SSM is that it may not be very useful to make inferences about the opinion and viewpoint of those staff that are not included in the interview sample, though every endeavor was tried to make it comprehensive. The continuation of this descriptive study has to be noted for the more accurate interpretation and utilization of the actions proposed by the SSM. The outcomes hereby can provide some fascinating insights, and although only descriptive in nature, that can spark the curiosity for more in-depth research. Therefore, action learning will be designed as the next phase of the overall research.

**CONCLUSIONS**

In order to facilitate the broader doctoral research project, descriptive research is required to provide a clear picture of the surveys, because this type of research is more rigid than exploratory research and seeks to define the problem of ERP, Partnering strategy and Leadership. It transforms the findings.
into a descriptive statement that forms the basis for action learning and such descriptive work is carried out based upon the SSM.

Management reporting in the KM system has been determined to be the critical for decision-making that must be improved. SSM, as the descriptive tool, is used to unearth the difficult situations. In the descriptive study, the paper introduces the normal existing process of the management reporting and details the seven stages of SSM improving the management reporting. The first stage was to conduct interviews with two target groups and conclude and consolidate the different practices in the management reporting process. Then, rich picture is developed to present the problematic areas including difficulties in inputting data and report producing. It follows by developing root definition and CATWOE, and conceptual model. By comparing the model with reality, interviewees were asked with the structured questions to identify 20 actions and 10 activities that can be undertaken to improve KM system.

In summary SSM helps:
- To achieve the systems and holistic view of the situation under consideration
- To obtain the overviews of various participants involved in the situation
- To address the span of control over the situation
- To know the problematic areas within the system
- To understand the inhibitor against improvement
- To involve those participants whom are looking for the solution to the problems
- To brainstorm actions for improvement
- To invite all participants in the action learning cycle
- To reinstate the existing system into a proper system

REFERENCE

Appendix A – Surveys Summary

In the Survey 1, it was concluded that an ERP tool that is effectively deployed provides not only valuable information processing capability to better control costs but it can also help identify ways to be more effective in dealing with its supply chain partners as well as improve its internal cost management reporting and decision making. In order to deploy the ERP system, this innovation must be effectively diffused. This ICT diffusion process at the ERP implementation stage itself involves a KM process. Adequate resources and feedback; on-line help; help desk and user support and training have been provided by the organization. In addition, the organization believes that the ERP is capable of managing cost data and identify efficiency is their most critical factor to increase organization’s competitiveness. However, the capability of ERP seems to be under-utilized. The survey also indicates that participants would prefer to operate at a high level. It is nevertheless useful to provide valuable insights into the messy and complex people’s personal experience trying to make use of this ERP system effectively. As the main theme of the ERP is to improve the management reporting, these insights will involve a SSM study to unearth paradoxes and hidden problems and to identify how the KM process of diffusion can be better deployed.

In Survey 2, it was concluded that partnering is sensible in the construction industry and the studied organization. When it is done well, it will offer a win-win solution with measurable and considerable benefits to all involved parties. It is a far more dynamic, effective and enjoyable process than the traditional procurement methods. Partnering has been successfully implemented between clients and main contractors (Baker 1990) and (Lenard, Bowen-James et al. 1996). However, it has not been successfully implemented between main contractors and subcontractors/suppliers. The survey opens the way for the argument of the implementation of partnering in lower tier of the supply chain. It does require the involvement of parties capable of embracing a comprehensive partnering culture by information and knowledge sharing and diffusion. If the involved parties seek to protect by mountains of procedural documentation, partnering will remain to be a “never”. These insights will help to involve a SSM study to reveal undefined and buried parts of the problems and to integrate the partnering into the ERP systems to improve the management reporting.

In Survey 3, the main objective is to assess the impact of leadership and power in the formulation and implementation of strategies i.e. ERP and partnering. The cultural impact on leadership and power in decision-making was also studied. A leader’s decision is always a determinant. From the survey, respondents recognized, in making decisions, what power can
positively bring into an organization when used properly. Findings also revealed that employees perceived leadership and power as important factors in formulating strategies as well as implementing them. A majority of the respondents preferred democracy as a leadership style over bureaucracy which is practiced in the organization. They prefer a leader who treats his/her subordinates equally and respects their opinion. Moreover, respondents identified control of decision process, formal authority, and ability to cope with uncertainty, and interpersonal alliances and networks as the most important sources of power for a leader. It is also concluded that cultural values are a concern and affect leaders’ practices. People believed that culture has an impact on how leaders make decisions. Different leaders from different national cultures have their own ways of addressing issues, oftentimes influenced by their own beliefs. Among the national cultures, staff are stimulated and aware of different races providing different powers to their leaders for generating sound decisions. This is significant. Today, leaders live with the increasing pressures of globalization and should therefore strive to build an organization that accommodates cross-cultural management practices. Moreover, considering the subtle influence of culture on management behavior, organizations should significantly increase the level of inter-cultural management training, including positive use of power and empowerment given to both local and expatriate staff.

Empowerment is not a zero-sum-game but a way of giving others the capacity to do things for themselves. Aside from leadership and power, empowerment was also seen as valuable in the organization. Leaders and subordinates have to be empowered to develop new passions for excellence in their craft. It would also make the entire organization unified, equipped, and successful. Therefore, how leadership affects ERP system and partnering in terms management reporting which will involve a SSM study to expose the proper leadership style including power, cultural impact, and empowerment.