DEVELOPING A FRAMEWORK FOR KNOWLEDGE MANAGEMENT SYSTEM

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Abstract

Knowledge has been increasingly valued in recent years, because it reflects best practice and therefore the success of an organisation or business. Organisations seek better methods of knowledge management (KM), to assist them in motivating their employees to capture, transfer and share knowledge. This research aims to develop a framework for KM systems (KMS), the objective being to capture and store the knowledge of the organisation expertise in databases and retrieve it when needed. The study will be focussing on private and public sectors of the construction industry in Saudi Arabia. The research consists of four phases, the first of which deals with enterprise project management, whereby project basic information, project related experiences and lessons learned are all captured through IT software. The second phase consists of the automatic capture and transfer of this knowledge to a multi-dimensional database. Phase three is the building of an E-library, where the knowledge is distributed within the database according to its characteristics. The fourth phase is the measurement of KMS performance, where baseline knowledge derived from earlier projects is used in planning the next ones. Hence, this phase is to measure the performance of teams who use the Knowledge System.

Keywords: Knowledge management (KM), knowledge management system (KMS), KM strategy, performance measurement.

1. Introduction

With improvement of business and implementing of projects become knowledge management sensible factor for organisations. When an organisation uses their knowledge in a suitable way and in the right time, it will get great results in their works (AL-Shahrani, 2003). Concept of knowledge is different in the value than other concepts; Bhatt (2001) stated that knowledge is not like information; knowledge is the interpretation of information, so that, knowledge is an organized combination of data, assimilated with a set of rules, procedures, and operations learnt through experience and practice.

Organisational knowledge has several dimensions; individual and group knowledge, internal and external knowledge, and tacit and explicit knowledge (Al-Ghassani et al., 2002). On the other hand source of organisational knowledge consists of these dimensions. Consequently knowledge is based on three sources: first experiences from the organisation; second experiences from other organisations; and third experiences from other external sources (Ozorhon et al., 2005).

2. Knowledge Management System (KMS)

In the present time many organisations are more focussed on the concept of knowledge and its management, because knowledge of the organisation will assist in increasing its output,

reduce the costs of the execution of projects, and in implementing of projects within the allocated time (Al-Shahrani, 2003).

There is still no one definition or consensus on what knowledge means. Davenport and Prusak (1998) define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information ". Dr Carla O'Dell, President of American Productivity and Quality Center, states that "Knowledge is information that has value" (Elliott, 1996).

The resources of knowledge of the organisation may come from three sources, the first resource is from own experiences of the organisation, the second resource is from the experiences of other organisations, and the third resource of the knowledge gathered from external sources (Ozorhon et al., 2005).

Knowledge management (KM) is an integrated, systematic approach to identify, manage, and share all of the organisation's information assets, including databases, documents, policies and procedures, as well as previously unarticulated expertise and experience resident in individual officers (Jones, 2003). KM creates a new working environment where knowledge and experience can easily be shared and also enables information and knowledge to emerge and flow to the right people at the right time so they can act more efficiently and effectively (Smith, 2001).

From the above concepts; the knowledge management (KM) refers to the developing body of methods, tools, techniques and values through which organisations can acquire, develop, measure, distribute and provide a return on their intellectual assets (Snowden, 1999).
KM needs the right methods, technologies, and tools for a successful implementation (Duffy, 2001; Gupta et al., 2001; Marwick, 2001). A knowledge management system (KMS) facilitates KM by ensuring knowledge flow from the person(s) who know(s) to the person(s) who need(s) to know throughout the organisation, while knowledge evolves and grows during the process. A variety of tools and technologies make up a KMS (Bontis et al., 1999).

3. Knowledge Management System Framework

Knowledge management, as a formal area of management activity, it seems to reflect a constellation of changes in the business environment. these include long-run shifts in advanced industrial economies which have led to the increasingly widespread perception of knowledge as an important organisation asset, the rise of occupations based on the creation and use of knowledge, the convergence of information and communication technologies and the advent of new tools such as Interanets and Groupware system, and theoretical developments which emphasize the importance of unique and inimitable assets such as tacit knowledge (Morris et al., 2003).

This study develops framework for knowledge management system (KMS), the objective being to capture and store the knowledge of the organisation expertise in databases and retrieve it when needed. The study will be focussing on private and public sectors of the construction industry in Saudi Arabia.

The research consists of four phases, the first of which deals with enterprise project management, whereby project basic information, project related experiences and lessons

learned are all captured through IT software. The second phase consists of the automated transfer of this knowledge to a multi-dimensional database. Phase three is the building of an E-library, where the knowledge is distributed within the database according to its characteristics. The fourth phase is the measurement of KMS performance, where baseline knowledge derived from earlier projects is used in planning the next ones.

The framework will be built using the Enterprise Project Management (EPM) solution, an integrated system consisting of Project Professional 2003, Project Server 2003, Project Web Access, SQL Server 2000 and Windows Share Point Services, as illustrated in Figure 1.

The development of the framework consists of two steps: (a) The first step will use Project Professional 2003, which capture project information regarding time control, cost control, quality control and contracts administration, to serve the KMS. (b) The second step will be to create a multi-dimensional database through SQL Server, to receive the knowledge extracted from the EPM database. The multi-dimensional database, which is recognised as an E-library, will include the required knowledge which will assist the organisation in managing future projects.

4. Justification for selecting the EPM software

The EPM software was chosen for many reasons, as follows:

i. Microsoft EPM is ideal for organisations that need strong coordination and standardisation between projects and project managers, centralised resource management, or higher-level reporting about projects and resources.
ii. It is widely used throughout the world.
iii. It consists of three main elements: Project Professional 2003, Project Server 2003 and SQL Server 2000. This environment assists in developing a multi-dimensional database within SQL Server, which can easily receive the knowledge created through the management of projects by professionals.
iv. It can handle multiple projects simultaneously.

Fig 1 Enterprise Project Management Architecture
(http://www.projectdirect.com)

5. Phase 1

The proposed framework will use EPM environment to deal with time control, cost control, quality control, contract administration, contractor database, bidding database and a database of standards and specifications for capturing and transferring knowledge. The KM team will handle some information related to KM; they will analyze this and the results of the analysis will be sent to certain fields which have been installed and added to the main data tables of the project. All information on projects which have been executed will be available in the database, which will represent an E-library, allowing the organisation to use the experiences accumulated from past projects for future projects (see Phase 3).

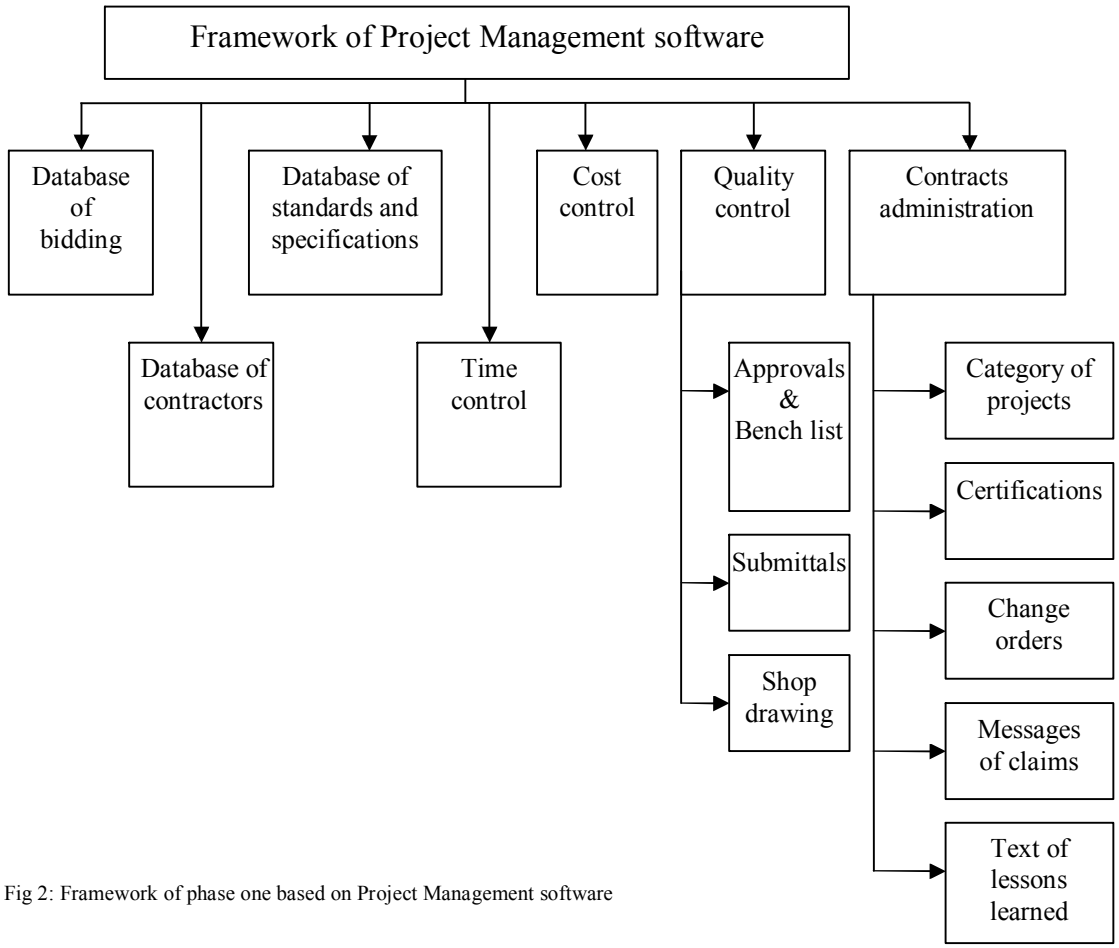

Fig 2: Framework of phase one based on Project Management software

6. Phase 2

The aim of the second phase is capturing the knowledge and transferring it to the multi-dimensional database. In order to build this database, Online Analysis Processing (OLAP), data mining and a relational database engine will be used. The project will create the database through SQL Server. The capture and transfer of knowledge will be automatic and will fall into five sub-phases as follows:

The first sub-phase starts before the implementation of the project and deals with the bidding process, contractors, and standards and specifications databases. The bidding database

contains the conditions and regulations of bid inspection, standard reports on bid analysis and the opinions of the committee which has inspected the bids concerning the behaviour of the contractors in tendering and pricing. The database of contractors will be used in two stages: the first begins at the end of the procurement stage, once the owner awards the contract to the contractor or contractors, when all detailed information on the contractor or contractors will move to the database; the second stage comes after completion of the project and handover to the owner, when opinions of the project manager and the team about the execution by the contractor or contractors of the project will move to the database. The third database contains the standards and specifications for all projects; changing and updating it will be time-consuming. The framework of this sub-phase will be as shown in Figure 3.

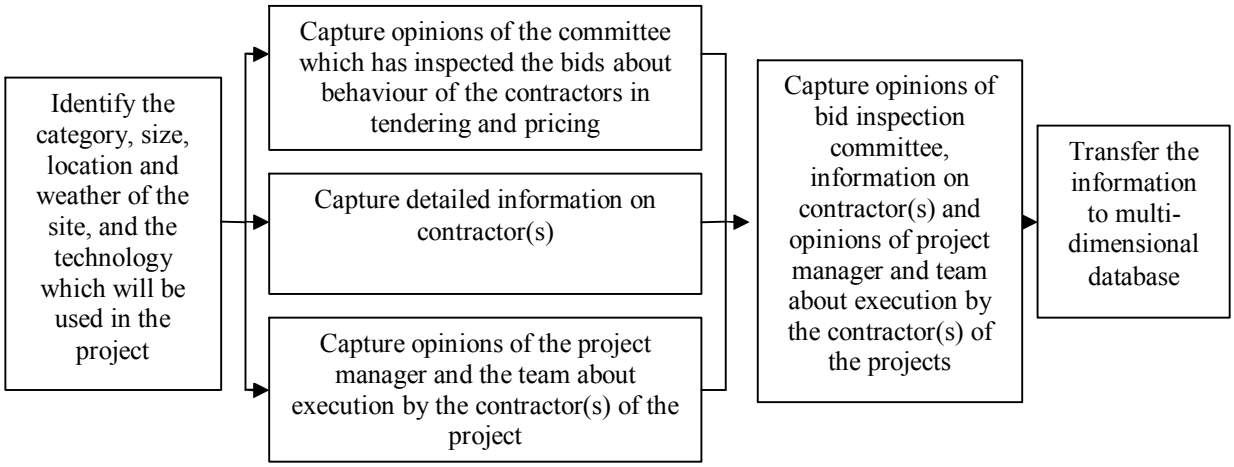

Fig 3: Framework for capturing and transferring knowledge regarding bidding process

With respect to time control and cost control, the framework of manipulation of information found in the EPM database will capture actual information about duration or cost of the execution of the activity, group of activities, or certain project, it will do it through analysis and compare initial and actual durations or costs of the execution of the activity, group of activities, or certain project, then transfer the actual information to multi dimensional database.

Dealing with quality control is different from time and cost control, because the latter do not require employees to interpret information on the time or cost of the project, while quality control does depend on their interpretation of information in submittals and shop drawings. The framework for the manipulation of quality control information found in the EPM database will capture the approved submittals and shop drawings of the activity, group of activities, or certain project, then transfer the information to multi dimensional database.

Contract administration is different from time, cost and quality control, because it requires employees to analyze and interpret information and to discuss it among them; such discussion will result in the right decision about this information and enable it to be sorted into separate issues. The KM strategy in this case is different from the previous cases; it concentrates on two issues: the messages and claims between the contractors and the client, and texts of lessons learned from project management team. The framework for the manipulation of information with respect to contract administration found in the EPM database will capture the analysis of messages of claims and texts of lessons learned concerning the activity, group of activities, or certain project, once obtain details of claims and lessons learned from the

activity, group of activities, milestone, or certain project; it transfer the information to multi dimension database.

Phase 2 concentrates on capturing and transferring knowledge; this section will discuss debriefing, which according to Schindler and Eppler (2003), consists of two steps:

i. The integration of learning and knowledge goals into the project phase model, and
ii. The integration of learning and knowledge goals into the overall project goals and metrics.

This section will consider the first of these. The demand for the integration of learning and knowledge goals into project phase models to anchor learning into the enterprise processes is based on the need to add knowledge goals to every project step in order to foster systematic reflection about every milestone in a project. Examples of such knowledge goals are the production of a team glossary and team rules on communication and working, a milestone plan or the documentation of a stakeholder analysis at the beginning of a project to adjust the project goals to the stakeholders' expectations. Such documentation can be achieved by the extension of so-called gates that work as decision points in the course of a project. A gate serves as a point of decision to examine predefined time, cost and/or output targets.

7. Phase 3

This phase represents the final database containing the useful information on the lifecycle of the project. For the purposes of this study, the database can be divided into sections according to the processes of implementation within the project. Each process has variables which depend on the project. These variables are often different from place to another, so the engineering organisation in Saudi Arabia deals with the popular variables such as type and size of project, nature of the project site, weather at the site, availability of infrastructure and the required technology. The final shape of the database is the same as the E-library. The framework for receiving information into the multi-dimensional database is illustrated in Figure 4.

With respect to time control and cost control, results of the comparative analysis of the initial and actual information will yield the final information for anything in the lifecycle of the project. This information will be transferred to a multi-dimensional database called the E-library. The framework for dealing with this information will receive the actual information about duration and cost of the execution of the activity, group of activities, or certain project, treating with this information depends on six variables; they are type of project, size of project, nature of the project site, weather at the project site, availability of infrastructure at project site, and the required technology, the result will be the required knowledge.

With respect to quality control, the main objectives are approval of submittals, shop drawings, etc. Each contractor submits shop drawings and samples of material or products (submittals) to the owner organisation and awaits their approval in order to complete its work in the project. The owner organisation will review these and approve them if they are reasonable. The second step is for the owner organisation to store the shop drawings and information concerning submittals in the project database, to assist future contractors on repeat projects in selecting the required shop drawings or submittals. Dealing with approved submittals and shop drawings is simple, as the information is transferred to the multi-

dimensional E-library, where they are available for reuse by any engineer or contractor on repeat projects, in order to reduce the cost of preparing shop drawings and the time spent in seeking approval for submittals. The framework for dealing with this information will receive the approved submittals and shop drawing for the activity, group of activities, or project, manipulating this information depends on six variables as same as the previous variables, the result will be the required knowledge.

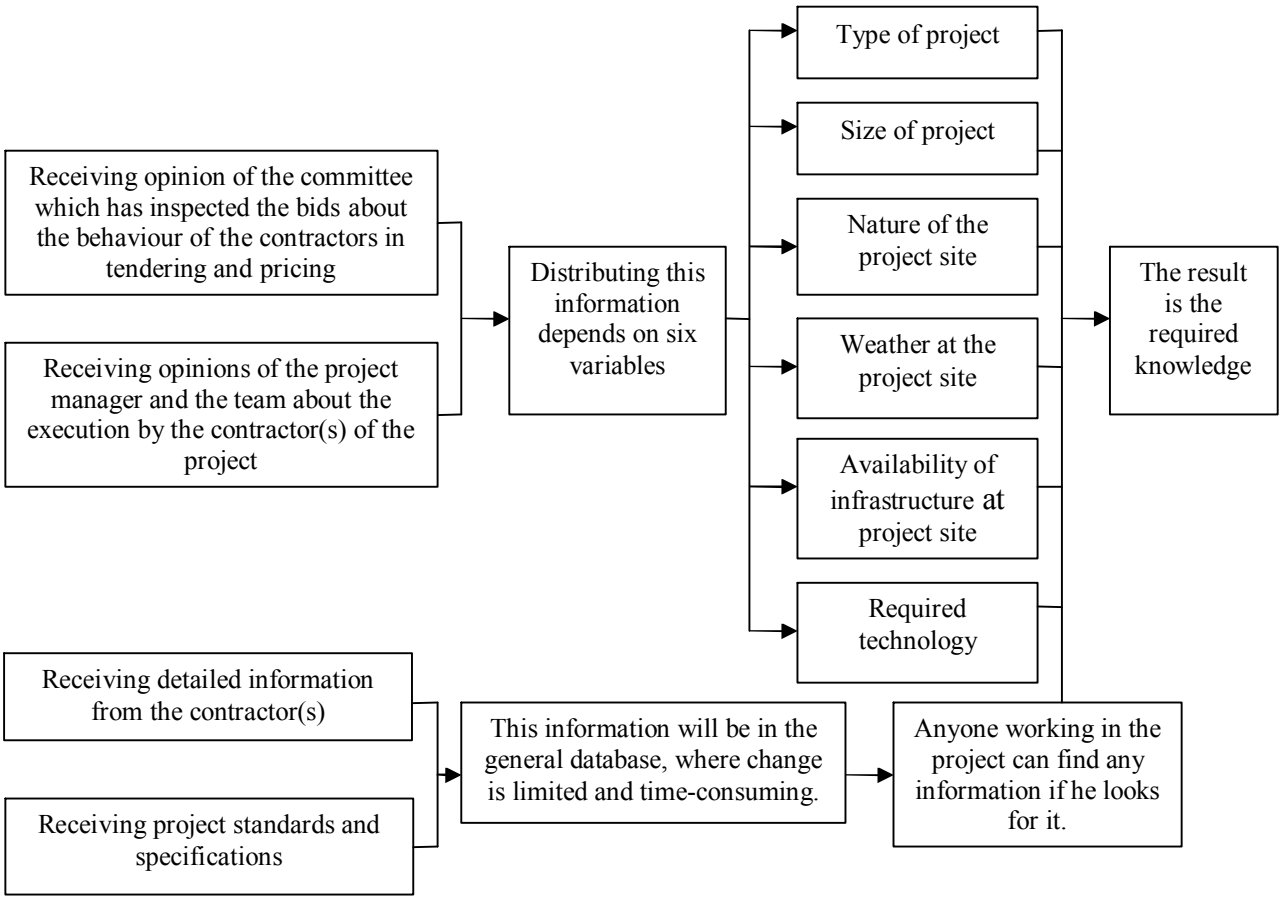

Fig 4: Framework for receiving knowledge regarding bidding process

With respect to contract administration, phase 3 will deal with the analysis of claims messages between the contractors and the owner, the answers of the owner to the contractors, and determination of the location of claims and disputes concerning the projects in order to avoid such claims in future projects. Phase 3 also deals with the text of lessons learned during the project. This again depends on the same variables. Work of framework will receive the analysis of claims messages and the texts of lessons learned during the activity, group of activities, milestone, or project treating this information depends on six variables as same as the previous variables, the result will be the required knowledge.

8. Phase 4

The knowledge management system will be complete if it includes a system of performance measurement. Phase 4 focuses on measuring the performance and impact of KMS on the

management of projects and process which takes the knowledge in the E-library and uses it in future projects as initial information; when the project is complete, the system receives the actual information and compares it with the initial information used as a baseline, thus providing new knowledge from the new projects, which is then stored in the database for use in later projects. The system will be able to distinguish between items of information via the name and date of the project. The framework of phase 4 is given in Figure 5.

9. Methods of Measuring KMS Performance

Phase 4, concerning the measurement of KMS performance, assists in achieving three popular methods used by organisations for measuring the performance of KM strategies. Bose (2004) presents these methods as balanced scorecard (BSC), economic value added (EVA) and Skandia Navigator.

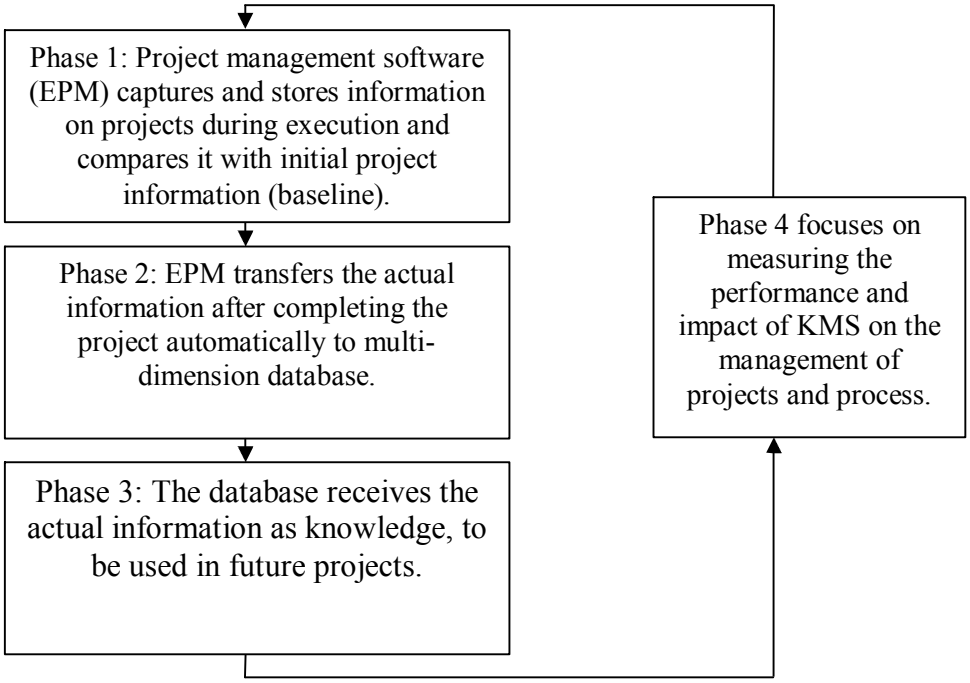

Fig 5: Framework for evaluation of system performance

9.1 The balanced scorecard (BSC)

BSC focuses on linking an organisation's strategy and objectives to measures from four key perspectives:

i. Financial ("How can we add value to our shareholders?" e.g. profitability and cash flow);
ii. Customers ("What do our customers value from us? Are we meeting their needs and expectations?" e.g. customer satisfaction and market share);
iii. Internal processes ("What do we need to do well in order to succeed? What are the critical processes that have the greatest impact on our customers and our financial objectives?" e.g. tender success rate and safety incidents); and

iv. Learning and growth ("Orientation to future success, how can we continue to add value?" e.g. unit costs and new products launched).

The BSC methodology, therefore, is an analysis technique designed to translate an organisation's mission statement and overall business strategy into specific, quantifiable goals and to monitor the performance in terms of achieving these goals.

9.2 Economic value added

EVA focuses on maximizing the wealth of shareholders (i.e. the shareholder value); it calculates a company's true economic profit and helps managers to create value for shareholders (Ray, 2001). Studies suggest that EVA is an effective measure of the quality of managerial decisions as well as a reliable indicator of a company's value growth in the future. EVA is always expressed as a dollar amount. The EVA methodology for performance measure in a company is carried out in five broad steps: 1: review the company's financial data; 2: identify its capital; 3: determine its capital cost rate; 4: calculate its net operating profit after tax; 5: calculate the economic value added by subtracting capital charge from net operating profit after tax. If the EVA is positive, the company has created value for its owners; if it is negative, the owners' wealth has been reduced (Bose, 2004).

9.3 Skandia Navigator

Navigator is a tool for evaluating the soft assets of an organisation, as well as a management reporting system that helps managers visualize and develop measures that reflect intangible assets, and guide them into the future (Malone, 1997). It measures intellectual capital (IC) covering five focus areas: financial, customer, process, renewal and development, and human. IC, according to this scheme, is composed of two elements: human capital and structural capital. The former is the accumulated value of investments in employee training, competence and future. It might also be described as the employees' competence, relationship ability and values. Structural capital is the value of what is left when the employees – the human capital – have gone home. Examples include databases, customer lists, manuals, trademarks and organizational structures.

10 Conclusions

The aim of this research is developing a framework for KMS, building a comprehensive KM strategy and establishing a measurement system for KMS performance. The proposed framework of KMS consists of four phases; phase one: uses EPM environment and captures information on projects during execution and compares it with initial project information (baseline). Phase two: The EPM environment transfers the project experiences and knowledge (captured in phase 1) automatically to multi-dimension database. Phase three: The development of the database with the projects knowledge and experiences to be used in future projects. Phase four focuses on measuring the performance and impact of KMS on the management of projects and process.

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