



Design of an Instrument for Improving Project Management Efficiency through Projects' Knowledge-Based Evaluation

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ABSTRACT

Making knowledge and experience available to entry-level project managers is not a dream anymore. The knowledge (experience) transfer in the project management can contribute severely to improving its efficiency. Multinationals are not exceptions themselves, even if they had nurtured the learning organization and created the necessary flexible type of organization.

In this research, an instrument was designed for project management's based on knowledge management which includes four components: the project management's knowledge areas process diagrams, the knowledge base, the knowledge threshold matrix and the knowledge look up map. This instrument serves as a tool for entry-level project managers to know; the project management processes; the project management's knowledge areas; the desired level of knowledge in each knowledge area; and to define basis for evaluating project management. The evaluation output is the input to the knowledge base. They can capitalize on the previous experiences existing in this knowledge base to: support decision-making; improve risk management; improve the organizational performance and the efficiency of the project management, hence, enhancing the quality of service leading to better customer relation management. This evaluation can complement the financial evaluation currently used in the company to evaluate projects. In addition, of giving input to the knowledge base, the evaluation methodology, if supported by management commitment, can also be the mechanism that insures the sustainability of our knowledge initiative.

1 OVERVIEW

"Business firms are organizations that know how to do things", Economist Sidney Winter. "Knowledge is the new basis for competition in post-capitalist society", Peter Drucker. "An investment in knowledge pays the best interest", Benjamin Franklin. "Knowledge is power", Anonymous.

Those phrases can be interpreted as; knowledge should not be dispersed and should only be kept for personal use to take better decisions than others. However, the prominent authors never intended to convey that meaning, actually they meant the opposite. Information gives power to both the individual and the organization only when it is solid and tangible, only when it can be shared, and only when it can be processed.

Knowledge is power, but what is knowledge, do we mean the implicit or explicit knowledge. Do we mix it with data or with information? How we define the knowledge in organization? Many organizations have adopted different knowledge management initiatives and invested considerable costs, time and efforts for that purpose. The outcomes of these initiatives were doubtful in terms of its effectiveness. We believe that the failure of knowledge management initiatives was not

always the case. There were success stories here and there. To improve the success rate, the initiatives have to be narrowed to specific business application/function areas. The project management is the application area to focus on to guarantee: customer satisfaction, profitability and reasonable return on the investment. It is the kitchen of the organization where it cooks its work to produce a product according to a customer need. The organization knowledge and experience lays their dispersed in forms, processes, routines and personnel. The usage of this knowledge and experience is jeopardized by the diversity and hidden characteristics of knowledge.

The project management institute (2000) defines the project as a temporary endeavor undertaken to create a unique product or service. The project manager competes demands for: scope, time, cost, risk, and quality. Projects are usually divided into several phases to improve management control and provide for links to the ongoing operations of the performing organizations. The most important characteristic of projects is progressive elaboration. The project management institute literally defined Progressive elaboration characteristic as follows: progressive means 'proceeding in steps; continuing steadily by increments,' Elaboration means 'worked out with care and detail; developed thoroughly (Project management institute, 2000). It is that characteristic that provided us with the backbone of the system to track down the project through its road map. We conclude a project phase generally be reviewing of both key deliverables and project performance to date. We can also divide each project or project phase into many processes. A project processes is a series of actions bringing about a result. Process groups are Initiating, Planning, Executing, Controlling and Closing (Project management institute, 2000). The same analogy can be applied aiming at enriching the logic of the entry-level project managers (and even other project managers) and helping them to improve their decision-making. The project management body of knowledge represented the desired skills and knowledge within the project management context (Project management Institute, 2000).

2 PROBLEM DEFINITION AND RESEARCH OBJECTIVES

The most annoying issue was watching businesses going from one project to another, the knowledge and experience of these projects were kept with the project managers who executed the projects and was not transferred to other project managers. This simply led the company to repeat the same mistakes, pursue the same bad project while they should have learned that they should not. The transfer of such experience was limited only to verbal and weak communication. The documented knowledge (explicit) only represented a tiny amount of the available knowledge, even that documented part could not be benefited from, as it was not part of a comprehensive system. We define the research problem as

the loss of project management experts' knowledge due to not documenting the executed projects' experiences.

So, the purpose of this study was to develop a knowledge-based instrument to be used in the project management department in a manufacturing company in Egypt (SEE), resulting in: an efficient and effective project management through providing knowledge based decision support system and creating the methodology to evaluate (scale) the projects based on knowledge.

3STATE-OF-THE-ART

Senge, et al. (1994) Explored the learning organization, and sat the basics and rules of the game. Thanks to them, now, the disciplines that need to be mastered in order to put into practice the learning organization are understood. They are; personal mastery, mental models, shared vision, team learning and system thinking. Senge and his colleagues showed us the embedded essence of what we were trying to describe while we talked about different facets of it: to marry the individual development of every person in the organization with superior economic performance. This is the simplest, and most complicated in the same time, way to tell organization how to do it.

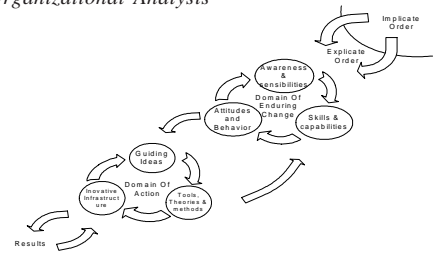
Organizations wants to establish its own learning organization: for superior performance, to improve quality, for customers, for competitive advantage, for an energized committed workforce, to manage change, for the truth, because time demands it, because we recognize our interdependence and because we want it (Senge, et al. 1994). The learning organization most importantly provides the environment that encourages synergy between the different outputs, applying the multiplier effect to boost organization economic performance. Figure 1, illustrates the generic organizational analysis model they reached. They designed the model to unfolding the implicate order by human beings (experts) into the explicate order. Going through the domain of enduring change, or deep learning cycles: where individuals who have capabilities to capture the knowledge and experience exist. Transferring to the domain of actions, or organizational architecture: which is responsible for bringing about results. We need to know which, when and how we should measure results. The evolution of the given model is; logical, represents the methodology that should be adopted when pursuing knowledge initiatives. Implicitly, the model tells what we need to have (do not have) to create the learning organization: the experts, the knowledge workers, the competent resources, the infrastructure, innovation, and the culture. We made use of that model in designing the instrument.

Michael H. Zack (1999) article on developing a knowledge strategy focuses on knowledge and learning. They tell how business organizations are coming to view knowledge as their most valuable and strategic resource, and bringing that knowledge to bear on problems and opportunities as their most important capability. Zack (1999) article was self-explanatory when he said that a knowledge-based competitive advantage is also sustainable because the more a firm already knows, the more it can learn. It can combine its learning experiences into a "critical learning mass" around particular strategic areas of knowledge. They can use this map to strategically guide their knowledge management efforts, bolstering their knowledge advantages and reducing their knowledge weaknesses.

Assessing an organization's knowledge position requires cataloguing its existing intellectual resources by creating the knowledge map. Zack (1999) classifies knowledge according to whether it is core, advanced or innovative. Knowledge generated within the firm is especially valuable because it tends to be unique, specific, and tacitly held. It is therefore more difficult for competitors to imitate, making it potentially strategically valuable.

Davenport & Prusak (1999) defined 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. They drew a scale as follows: data, information, knowledge, experience, ground truth, complexity, judgment, and beliefs. Davenport & Prusak (1999) quoted Sidney Winters knowledge codification as: tacit, not teachable, not articulated, not observable in use, rich, complex, and end up with undocumented. Though this codification is

Figure 1: Generic Organizational Analysis (Peter Senge, 1994)



not complete, but it has inspired me to where to focus my research area. What is the knowledge we target to capture and make use of it? We need to understand that explicit knowledge captured in documents and databases is different from implicit knowledge, which lays in minds of people. The second is the most valuable to organizations while it is very expensive and difficult to manage.

Capitalizing on their scale and codification, we chose to focus into managing the knowledge and experience. They identified one of the prime benefits of experience is that it provides a historical perspective from which to view and understand new situations and events. In addition, they provided dozens of business examples that lighted our way.

Davenport & Prusak (1999) said: "The perception and the reality of a new global competitiveness, rapid change, increasing competition for the dollars of increasingly sophisticated consumers have led companies to seek sustainable advantage that distinguish them in their business environment". Among diminishing physical assets, knowledge is a sustainable and an everlasting asset. Ford never recorded the reason of success of Taurus experience. International harvester, No one was there after 20 years of building the truck factory in Russia to benefit from the first experience.

Davenport & Prusak (1999) quoted Arthur Hugh Clough saying: 'Grace is given of God, but knowledge is bought in the market.' They also presented the knowledge market theory that taught us new vocabulary and terminology of the market as: buyers, sellers, brokers, and price system mechanism. The theory drew our attention to observe the organization from a different cross-sectional view, the knowledge cross-sectional view. The awareness of the existence of such cross-sectional view derives people to think differently. They are pushed to find themselves a suitable positioning in the organization structure according to that view.

Many critics reroute the failure of knowledge projects to the huge size of knowledge that were flooding from the information systems and knowledge management initiatives. We believe that there are many reasons why we need to reconsider knowledge initiatives as: The escalating rate in the growth and the diversity of knowledge and information, The fractionation of the disciplines into narrow specialty fields, augmenting a trend toward depth rather than breadth, An increase in professional mobility, leading to a discontinuity of focus and experience within an individual's career, and ultimately fewer real experts, Increasing demand for the secularization of knowledge to enable democratic processes, and presumably, more appropriate application of knowledge, The lack of any formal framework which explicitly represents the collective knowledge base and problem solving processes, in order to enable meaningful dialogue and action, irrespective of expertise.

Somehow, if it was possible to map out the collective knowledge base, then it may be possible to manage Trans-disciplinary problems (projects) without being overwhelmed by complexity. Human experts do this implicitly, much to the consternation of their protégées. This ability to synthesize and apply essential knowledge is what makes experts valuable. Experts report that the ability to handle knowledge increases significantly once this plateau of essential knowledge is reached, but there is something which lay people find highly undemocratic about expertise, namely that the means by which the expert draws conclusions is not explicit and universally accessible. Knowledge mapping therefore represents an opportunity not only to solve wicked problems, but also to democratize the understanding of Trans-disciplinary processes.

What would induce individuals to volunteer the recording of personal knowledge mapping processes for storage and access in a public domain environment, or even within their particular private enterprise? Some form of tagging, analogous to genetic coding, is needed allowing for the tracing of knowledge to its source(s).

Knowledge is the sixth dimension in the company balance scorecards system along with the other five dimensions: financial; customer; employee; growth; and internal business processes. Knowledge management is the dream of every promising organization. Many books and studies have been trying through the last decade to tell organizations how to do it. Unfortunately, most of the efforts were theoretical frameworks or discrete examples from different types of organizations. The way we see, we can help people and organizations to apply it and get the benefits is to narrow the talk to certain application areas.

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements (Project management institute, 2000). The project management institute has identified nine modules that together combine the project management activity. These modules are project integration management, project scope management, project time management, project cost management, project quality management, project human resources management, project communication management, project risk management and project procurement management (Project management institute, 2000). Furthermore, for each of these modules they recognized certain knowledge areas. They defined those knowledge areas and demonstrated them by the tools and techniques applied in them. We capitalized on that model, but we adopted it to match the company's (under study) project management activity and processes. Following the breakdown and the given subsets of the project management's knowledge areas done by the project management institute we found it detailed to the right level where we could still catch and feel the knowledge areas. Allowing us to study each area and measure our performance and our evolution in these areas. Our feedback was crossed checked with other industry visionaries inside the company who agreed that the knowledge and practices are applicable to company projects; and that there is great consensus on their value and usefulness.

4 THEORETICAL FRAMEWORK AND RESEARCH DESIGN

The virtual border shown in figure 2 is splitting the explicit knowledge space from the implicit knowledge space. We divided the implicit knowledge space into: the skills & talents and the illusion. Again we divided the skills and talent space into: The shadow space that represents the experts experience which mates with them as long as they stay in the organization; The trace space that represents the experience kept in the organization after they leave. Knowledge is the universal space to a normal person. That person (organization) claims that he knows his solar system (explicit knowledge space), what he knows really is his earth (documented knowledge), he can understand that there are other planets (not documented explicit knowledge spaces) exists inside his solar system but he can not see. If the sky is clear (learning organization), they can find ways to see those other planets (either easily document that knowledge or hardly document it with some efforts). What he can hear writers (scientist) talk about is the rest of his galaxy (implicit knowledge space) but he can never see it with his bare eyes. We

will focus our study to try to help that person (organization) to see and benefit from the other planets (not documented explicit knowledge spaces) in that person

Figure 2: Knowledge Space Map (Authors)

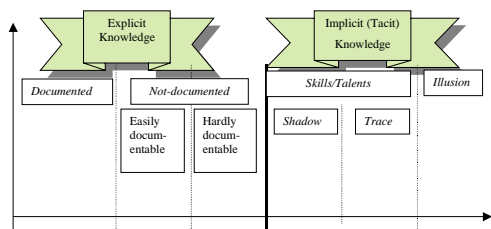
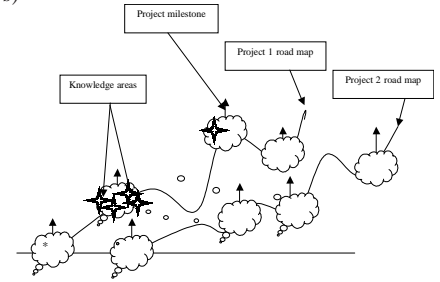


Figure 3: The project road map showing milestones and knowledge areas (Authors)



solar system. The scope has enlarged to cross the virtual boundary to deal with part of the universal space (implicit knowledge space).

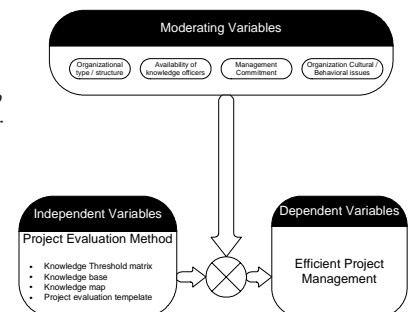
If we can imagine the projects' road maps given in Figure 3, each project has a specific road map. We can divide the project management activity into several phases or milestones all of them are located on the road map. Each milestone has its own knowledge areas (knowledge cloud). If we can understand and declare the knowledge areas inside each cloud then we can capture, store and make use of the knowledge concentrated in these areas. By declaring these knowledge areas we can light the way for the entry level project managers to insure that they; do not loose the way go on their own most of the way. By completing the map: we were able to; evaluate our knowledge position in each knowledge area, guide the entry-level project managers where they can find the knowledge and experience related to each knowledge area.

We illustrated in figure 4 the main relationship among the study variables and the components of the project management's knowledge management instrument. We believe that targeting efficient project management would lead to many positive results for the individual/organization as: better usage of company resources; improving customer relation management; minimizing risks; increasing profitability. In addition, the learning organization climate that surrounds the organization under study encouraged us to pursue that knowledge initiative. The management commitment, cultural / behavioral issues, organization type / structure and availability of knowledge officers represented the moderating variables of the relation understudy. The research provided answers to questions as: How can we evaluate projects based on knowledge? What are the specific knowledge areas in project management for SEE? What is project specific level of knowledge comparing to the minimum level of knowledge required in specific knowledge area? What is the project management's knowledge look up map? What is the effect of organization type on knowledge sharing (dissemination)? What is the role of management commitment on knowledge (willingness of experts) leveraging? What is the role of availability of knowledge workers in the success of implementing the instrument?

The instrument were designed to achieve the objective of four components: the project management's knowledge areas processes diagrams, the knowledge base, the knowledge threshold matrix and the knowledge look up map.

The first component is the project management's process flow diagrams. The process diagram of the project management's activity

Figure 4: the Relationship between the variables under study



knowledge areas were defined through the different process groups comprising the project management activity. That component guided the entry-level project managers; through identifying the project management related knowledge modules (integration, scope, time, cost, quality, human resources, communication, risk, and procurement) and the knowledge areas existing in each module. In addition, it elaborated the progressive elaboration of the project through the knowledge modules, their interrelation and how to follow it in executing projects.

The second component is the knowledge base. The knowledge-based evaluation provided input to the knowledge base. To carry out the evaluation, we had a committee to evaluate the company projects in the closing meeting, which takes place at closing the project. The knowledge base provided the project managers with: projects database that can be searched according to scope, market sector, complexity and others; knowledge areas minimum desired level of knowledge; projects good/bad experience; and projects risk management good/bad experience. The knowledge-based evaluation acts as the mechanism to sustain the enrichment of the knowledge base with new projects' experience.

The third component is the knowledge threshold matrix. For each of these nine knowledge modules combining the project management activity, the related knowledge areas were defined. Reviewing the design suggested by the project management institute and mapping it to the company understudy reached the matrix design. Discussing them with industry visionaries with project management experience refined the design and the scale. The matrix provided a method to classify the knowledge position; whether it is basic, likely favorable or differentiating position; required in each knowledge area. Such classification unveiled the strengths and weaknesses in each knowledge position for each knowledge area. The organization, knowing its weaknesses and strengths made use of such analysis. The entry-level project managers compared their knowledge to the required one. The result of the comparison tells them where they need to consult the knowledge map to find out where about they can find the required knowledge.

The fourth component is the knowledge map. The knowledge look up map guides the person looking for knowledge, information and data to where he can find what he is looking for through multi-medias as documents, reports, company forms, databases and human beings (experts). The map tells that person the name of the source of knowledge and the location of the source of the knowledge.

The instrument was designed to be a multimedia tool with two interfaces. The first interface will be through the process diagrams screens. The second interface will be through selecting a project from the project database according to different criteria's as scope, duration, market sector, client, consultant and others mentioned in the project evaluation template. Through the multimedia tool, the users will be able to move interactively between the two interfaces.

The research followed the triangulation (Hybrid) classification. The classification of the research is qualitative in the knowledge management area and quantitative in the business application area (project management). This is mainly due to two dimensions of the research topic: knowledge management and project management.

The questionnaire was designed for identifying the desired level of knowledge in each knowledge area in each module. The selected sample evaluated the minimum desired level of knowledge in each of the project management's knowledge areas. The collected data were analyzed statistically to determine the knowledge threshold required in each knowledge area.

The population of this research is of two categories: the project managers and industry visionaries in the company under study (or in the industry). The expert project managers, as the users of the instrument, could understand and gave valuable opinion on it. The industry visionaries with previous experience in project management have insight and strategic contribution that added value to the research.

The sample was selected so it can provide valuable input (data) in both parts of the research, the static and dynamic part, from the overall two-dimensional population. By valuable input, we meant that the sample can understand professionally the nature and the importance of the knowledge project, they can decode the terminology of the questionnaire they can relate their answers to match the research requirement,

and they can contribute and add value to the project. For identifying the desired level of knowledge in each knowledge area, we used the questionnaire to collect the necessary primary data. The sample for the questionnaire was composed of two categories: seven experts project managers out of twenty-one project manager in the company; and six industry visionaries from the company with good experience in project management.

Table 1: the Raw Data Table

		Raw Data													
		Category one: Industry							Category Two: Expert Project						
		Sample Category		Subcategory					Management		Subcategory				
		Knowledge Area	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7
Integrat ion	Plan Development Plan Execution Integration Change Control	B	2	2	2	1	3	3	2	2	2	2	2	2	2
		E	1	5	0	0	5	2	1	4	1	0	5	2	0
		D	1	1	2	3	2	0	0	1	2	3	2	0	0
Scope	Initiation Scope Planning Scope Definition Scope Verification Scope Change Control	B	1	2	3	2	2	3	2	2	2	2	2	2	2
		E	1	2	3	2	2	3	2	2	2	2	2	2	
		D	0	4	2	0	5	2	0	4	2	0	5	2	
Time	Activity Definition Activity Sequencing Activity Duration Estimation Schedule Development Schedule Control	B	1	3	2	2	3	2	2	2	2	2	2	2	2
		E	2	2	2	2	2	3	2	2	2	2	2	3	
		D	2	3	1	1	6	0	1	4	1	0	7	0	
Cost	Resource Planning Cost Estimation Cost Budgeting Cost Control	B	0	3	3	1	5	1	2	0	4	1	5	1	1
		E	1	3	2	2	3	2	2	1	4	1	3	2	
		D	1	4	1	0	5	2	0	4	2	2	5	0	
Quality	Quality Planning Quality Assurance Quality Control	B	3	3	0	1	5	1	0	4	2	0	4	1	0
		E	2	1	3	3	3	1	2	1	3	3	3	1	
		D	1	2	3	4	3	0	2	3	4	3	0		
Human Resources	Organizational Planning Staff Acquisition Team Development	B	2	4	0	1	6	0	0	3	3	2	2	3	3
		E	2	4	0	1	6	0	0	3	3	2	2	3	
		D	0	3	3	2	2	3	2	2	2	0	3	4	
Commitment	Communication Planning Information Distribution Performance Reporting Administrative Closure	B	2	2	2	0	3	4	2	2	4	2	1	2	3
		E	1	2	3	1	3	3	3	3	3	1	3	3	
		D	0	5	1	3	3	1	1	3	3	1	1	1	
Risk	Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning Risk Monitoring And Control	B	2	1	3	2	3	2	2	1	5	1	4	2	2
		E	2	1	3	2	3	2	2	2	2	4	1	2	
		D	0	4	2	3	4	0	0	4	2	3	4	0	
Procurement	Procurement Planning Solicitation Source Selection Contract Administration Contract Close Out	B	1	5	0	1	4	2	3	2	1	2	4	1	1
		E	4	2	0	3	3	1	4	2	2	0	4	3	
		D	2	2	2	2	2	4	1	1	2	2	2	4	

We will collect the data for the research through two types of sources: primary, where we collected it through running a questionnaire to two categories of people working inside the organization; and secondary, where we gathered data through the books, specialized magazines, articles and internet papers together with the researcher practical experience. In addition, ran unstructured interviews with the industry visionaries to review the adequacy of the instrument. The interviewers complemented and enriched the instrument by their insights and contributions. We adopt their comments into the instrument to make it more solid and comprehensive.

5 ANALYSIS AND DISCUSSION

Each person on each category of the sample selected one of the three levels of knowledge as the minimum required level of knowledge in each knowledge area. We define the three levels of knowledge as follows: Basic knowledge: the essential knowledge required in performing the task; it is what we call the must be knowledge. Likely favorable knowledge: the knowledge that if not acquired it is likely that the person will not perform the task; it is what we call the-should-be knowledge. Differentiating Knowledge: the innovative knowledge that if existing can help people to perform tasks differently: it is what we call the could be knowledge.

In the first stage of the data analysis, the data collected of each of the two categories was analyzed separately. The result for each category was the scale with the highest number of persons. At that stage, a desired minimum level of knowledge for each knowledge area for each category was reached. When the two categories desired level of knowledge was

the same, the result was considered as the minimum desired level of knowledge for that knowledge area. In case the two categories desired level of knowledge was different; the result was considered as the one of the first category as the minimum desired level of knowledge.

According to the qualitative nature of the data collected and analyzed in our research, most of our findings were of qualitative nature. As a byproduct, we deduced quantitative analysis for the research data.

Table 2: the Semi-analyzed Data Table

		Semi-Analyzed Data													
		Sample Category		Category one: Industry					Category Two: Expert						
		Knowledge Area	B	E	D	B	E	D	B	E	D	B	E	D	
Integrat ion	Plan Development Plan Execution Integration Change Control	B	2	2	2	1	3	3	2	2	2	2	2	2	
		E	1	5	0	0	5	2	1	4	1	0	5	2	
		D	1	1	2	3	2	0	0	1	2	3	2	0	0
Scope	Initiation Scope Planning Scope Definition Scope Verification Scope Change Control	B	1	2	3	2	2	3	2	2	2	2	2	2	
		E	1	2	3	2	2	3	2	2	2	2	2	2	
		D	0	4	2	0	5	2	0	4	2	0	5	2	
Time	Activity Definition Activity Sequencing Activity Duration Estimation Schedule Development Schedule Control	B	1	3	2	2	3	2	2	2	2	2	2	2	
		E	2	2	2	2	2	3	2	2	2	2	2	3	
		D	2	3	1	1	6	0	1	4	1	0	7	0	
Cost	Resource Planning Cost Estimation Cost Budgeting Cost Control	B	0	3	3	1	5	1	2	0	4	1	5	1	
		E	1	3	2	2	3	2	2	1	4	1	3	2	
		D	1	4	1	0	5	2	0	4	2	2	5	0	
Quality	Quality Planning Quality Assurance Quality Control	B	3	3	0	1	5	1	0	4	2	0	4	1	
		E	2	1	3	3	3	1	2	1	3	3	3	1	
		D	1	2	3	4	3	0	2	3	4	3	0		
Human Resources	Organizational Planning Staff Acquisition Team Development	B	2	4	0	1	6	0	0	3	3	2	2	3	
		E	2	4	0	1	6	0	0	3	3	2	2	3	
		D	0	3	3	2	2	3	2	2	2	0	3	4	
Commitment	Communication Planning Information Distribution Performance Reporting Administrative Closure	B	2	2	2	0	3	4	2	2	4	2	1	2	
		E	1	2	3	1	3	3	3	3	3	1	3	3	
		D	0	5	1	3	3	1	1	3	3	1	1	1	
Risk	Risk Identification Qualitative Risk Analysis Quantitative Risk Analysis Risk Response Planning Risk Monitoring And Control	B	2	1	3	2	3	2	2	1	5	1	4	2	
		E	2	1	3	2	3	2	2	2	2	4	1	2	
		D	0	4	2	3	4	0	0	4	2	3	4	0	
Procurement	Procurement Planning Solicitation Source Selection Contract Administration Contract Close Out	B	1	5	0	1	4	2	3	2	1	2	4	1	
		E	4	2	0	3	3	1	4	2	2	0	4	3	
		D	2	2	2	2	2	4	1	1	2	2	2	4	

The multi-media tool has two interfaces. Through these screens, the users could identify: The name of the knowledge area, the interrelation between the knowledge areas inside the process group, the interrelation between the different process groups combining the project. The desired minimum level of knowledge in each knowledge area (refer to table

Table 3: The Results Table

Scope	Initiation	D	E	? (D)
	Scope Planning	D	D	D
	Scope Definition	B	B	B
	Scope Verification	B	B	B
Time	Scope Change Control	E	E	E
	Activity Definition	E	E	E
	Activity Sequencing	D	D	D
	Activity Duration Estimation	E	E	E
Cost	Schedule Development	E	E	E
	Schedule Control	E	E	E
	Resource Planning	D	D	? (D)
	Cost Estimation	E	E	E
Quality	Cost Budgeting	E	B	? (E)
	Cost Control	E	E	E
	Quality Planning	B	B	? (B)
	Quality Assurance	D	B	? (E)
Human Resources	Quality Control	D	B	? (D)
	Organizational Planning	D	B	? (D)
	Staff Acquisition	E	E	E
	Team Development	E	D	? (E)
Communication	Communication Planning	D	D	D
	Information Distribution	D	D	D
	Performance Reporting	D	E	? (D)
	Administrative Closure	E	B	? (E)
Risk	Risk Management Planning	B	B	? (B)
	Risk Identification	D	E	? (D)
	Qualitative Risk Analysis	E	E	E
	Quantitative Risk Analysis	D	E	E
Procurement	Risk Response Planning	D	D	D
	Risk Monitoring And Control	D	E	? (D)
	Procurement Planning	E	E	E
	Solicitation Planning	B	B	? (B)
	Solicitation	B	B	B
	Source Selection	E	E	E
	Contract Administration	E	E	E
	Contract Close Out	B	D	? (B)

3 for the final results of the research), the source of knowledge name and its location, the good/bad experience history in the specific knowledge area.

The second interface will be through selecting a project from the project database according to different criteria's as scope, duration, market sector, client, consultant and others mentioned in the project evaluation template. For the selected projects, the user can find out the evaluation given to the project in each knowledge area and the most important good/bad experience in the project.

We limited the evaluation to give only two good/bad experiences only for the whole project to avoid gathering repeated knowledge and to avoid a famous pitfall of the knowledge/information projects that they gather huge amounts of knowledge that makes it difficult for users to find the required information. The users could move interactively between the two interfaces looking for knowledge.

In addition, as a byproduct to the findings mentioned in this section, we can deduced some quantitative analysis. (See table 4 below)

Table 4 gives us a comparison about the relation between both categories' answers. The difference between the two categories indicates that we have one of the following cases: First, the first category, the industry visionaries, is away from the present project managers and they do not understand exactly the requirement of the position at least nowadays. Second, the second category, the expert project managers, is missing some basics of the position requirement and they need to have adequate training.

Authentication and confidentiality issues of the designed system are not different from any other information system and knowledge systems. A special attention would be given to our system, as it contains the know how of the company. The system includes the good experience that can invite the competition to a short way to catch up with the company. The system includes the bad experience that can give a lead to the competition to the pitfalls of the company to make the necessary propaganda. In addition, the instrument can point clearly to the knowledge sources of the company and soon making them vulnerable. The paradox of the knowledge system as usual, we need to make knowledge accessible and available but in the same time, we need to design tough security system. We need to solve that dilemma, do we share knowledge or we keep it confidential. A trade off has to take place here, meaning,

we should seek to reach that critical balance. The royalties and credit rights are very important issues that need to be looked after to guarantee the success of the system.

Table 4: Category A & B comparison

Second Category	Basic Knowledge		Likely favorable knowledge		Differentiating knowledge	
	Number	%	Number	%	Number	%
Basic Knowledge	3	12.5%	2	8%	2	8%
Likely favorable knowledge	3	12.5%	16	67%	5	20%
Differentiating knowledge	1	4%	1	4%	3	20%

6 CONCLUSION

Project management is not only one of the departments of an electrical distribution equipment manufacturing (tailored product) company. Project management is: the connecting ring between the upstream sales activity and the final production activity; the pot where sales and marketing, procurement, planning, production, quality and after sales services departments' work is melted; the key administrator of the customer relation management; and the responsible for the project/company profitability. We designed the project management's knowledge management instrument to serve as the pool that entry level (sometimes even expert project managers as well) can seek support through navigating into the project management knowledge areas and experiences. It will prevent or at least minimize the loss of the project management experts knowledge and keeps it stored in the knowledge base.

The project managers can capitalize on the previous experiences existing in this knowledge base to: support decision-making; improve the organizational performance and the efficiency of the project management, hence, enhancing the quality of service leading to better customer relation management. Creating the knowledge base was not the only product of the research; the more important output was establishing the mechanism, which guarantees the continuity of our knowledge project. The mechanism established here is the knowledge-based project management's evaluation methodology. The knowledge-based evaluation methodology can complement the financial evaluation currently used in the company to evaluate projects. In addition, of giving input to the knowledge base, the evaluation methodology, if supported by management commitment, can also be the mechanism that insures the sustainability of our knowledge project. In addition, while the company is moving to a new management through process ISO procedure, the research provides a framework that will support implementing the new procedure.

The success of such instrument will depend mainly on the management commitment. The management commitment can have a positive/negative impact on even other factors that affects the success. This commitment must be tangible through seen solid actions as: encouraging the knowledge workers, establishing incentive and crediting systems, inspiring the people to change their culture and behavior and basically creating the learning organization climate.

The knowledge map helps the company and company's management to trace the knowledge to its generating source and allow giving credits and royalty rights to those who shared their knowledge.

The system has the essence of its continuity embedded in it; as the evaluation methodology (the mechanism), the knowledge map (the royalty), the management commitment (incentives and reward systems), and the return. However, a special care should be given to the authentication issue of the knowledge system as the system incorporates the company know how, the most precious competitive advantage. The paradox should be solved via trade off between knowledge sharing and confidentiality.

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