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STAKEHOLDER PROCESS APPROACH TO INFORMATION SYSTEMS EVALUATION

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Abstract

Different views are held by different groups of people involved in evaluating information systems (IS) and information technology (IT) projects. If these different views are not understood in the beginning of the project, problems will most like arise when the project is completed because of the different evaluation criteria. The stakeholder approach to IS evaluation implies that the system developers among others involved in the system development project need to understand the various stakeholders' expectations from the system at every stage of the system development process. In this paper the stakeholder theory and process theory were reviewed and applied in conducting empirical studies in two organizations. One of the major results of the analysis is a process framework for evaluating IS/IT investments, using the stakeholder approach.

Keywords: Stakeholders, IT evaluation, IT project evaluation

Introduction

This paper investigates the applicability of stakeholder thinking to IT evaluation. According to stakeholder thinking, success in satisfying multiple interests - rather than meeting conventional economic and financial criteria - constitutes the ultimate test of corporate performance (Donaldson and Preston, 1994; Ruohonen, 1996). Nasi (1995), states "by stakeholder thinking we mean a way to see the company and its activities through stakeholder concepts and propositions. The idea is that 'holders' who have 'stakes' interact with the firm and thus make its operation possible" (p.19). Applying stakeholder thinking to IT evaluation implies that IS success in satisfying multiple IS stakeholders will constitute the ultimate test of IS success organizationally.

IS evaluation is increasing in importance because more organizations are applying IS/IT in strategic, tactical and operational issues (DeLone and McLean 1992). However, methods for assessing IS investments are not clear with the result that organizations are finding it difficult to justify IS investments. This paper proposes a different but complementing approach to the previous methods of IT evaluation. The new approach is called the stakeholder process approach to IT evaluation. This approach is based on two theoretical foundations, stakeholder theory (Carroll, 1989; Freeman, 1989; Nasi, 1995; Ruohonen, 1996 and Remenyi and Sherwood-Smith, 1996) and process theory (Van de Ven and Huber, 1990; Newman and Robey 1992; and Walsham, 1993). The main strength of this approach is the involvement of the different IS/IT stakeholders in the evaluation process at every phase of the system development or evolution. The two important issues in this approach are the *stakeholders' involvement* and the *process nature* of the IS/IT evaluation.

Previous Approaches to IS/IT Evaluation

IS evaluation has been addressed from many perspectives: consulting and negotiation (Avgerou, 1995); productivity, business performance and consumer value (Hitt and Brynjolfsson, 1994); virtual process measurement (Nissen, 1994); business value (McKeen, Smith and Parent, 1996) act-oriented approach (Nurminen and Torvinen, 1996); and post-modern approach (Remenyi and Sherwood-Smith, 1996). There are significant differences between the various approaches to IT/IS valuation, making it difficult to compare the results of IS evaluations see (Irani and Sharif and Love 2001). Symons (1991, p. 205) states that "despite its importance, there is no commonly accepted framework or methodology for information systems evaluation". This means many companies find it difficult to measure the contribution made by IT to business performance (Symons,

Avgerou (1995) notes that while the significance attributed to information systems is increasing, judgments on their value are usually ad hoc, rather than formal and systematic. Previous research has indicated that a formal evaluation is seldom done, and when it is done, it is usually incomplete, assessing only some of the effects that are expected from or related to the system evaluated.

Nissen (1994) explains that the predominant approaches to IS/IT evaluation can be classified into four major categories: (1) financial, (2) functional, (3) strategic, (4) subjective. Table 1 provides a summary of the key strengths and weaknesses of each approach. Financial measures can be effectively employed to quantify tangible costs and benefits associated with IT investments. The main limitation to the financial measures comes from the narrow focus on money and quantification. Many costs and benefits associated with IT investments are qualitative, intangible, and difficult or impossible to measure quantitatively. Business stakeholders often employ this approach. Remenyi and Sherwood-Smith (1996) note that fortunately there is a growing understanding that the financial figures alone cannot represent a convincing picture of the role which information systems plays in an organization.

The objective of functional measures is to estimate the complexity of a system during the development process and determine a cost per unit of complexity. It addresses cost associated with the software development process (see Pressman, 1994), examples include the function point analysis framework and the COCOMO model (Boehm, 1981). This measure focuses primarily on software engineering and therefore ignores the huge costs associated with hardware, training, and so on. Technical stakeholders often employ this method to evaluate system development projects. The functional approach also evaluates the technical performance of the system, using languages and technical jargons to determine the level of system performance. The results of these evaluations are often meaningless to management with respect to determining the impact of the system on the organization.

Strategic measures take the position that a strategic IS is indispensable and hence must be developed. Therefore, they argue that the precise costs and benefits of a strategic IS are relatively unimportant. For example, the theory of strategic thrusts (Wiseman, 1985) outlines the IT-based means for achieving competitive advantage (e.g. through product differentiation, innovation, or competitive alliance). The disadvantage with this measure is that once a competitive advantage has been mitigated, a strategic IS can lose its status and importance. This measure is often employed by IS consultants and similar stakeholders.

Lastly, subjective measures emphasize the value added by IS, such as leanness, responsiveness and other qualitative concepts. These are the most difficult to measure and yet is the approach that most users adopt.

Each of these measure have a common limitation, a focus on just one aspect of IT evaluation. The stakeholder process approach is more comprehensive and more holistic than these approaches. The stakeholder process approach to IT evaluation builds on the previous IT evaluation methods and frameworks. It involves different stakeholders in evaluating the IT/IS at every phase of the IS development and use process. Kumar (1995, p.203) remarks that "post-implementation evaluations include evaluations performed just before installation, just after installation, and considerably after installation after the system has a chance to settle down." The stakeholder process approach builds on Kumar's (1995) post-implementation framework to include evaluation during the IS planning phase, during the development phase, and during the use phase.

Table 1. Key Strengths and Weaknesses in IS Valuation Measures (Adopted from: Nissen, 1994)

Measure	Strengths	Weaknesses
Financial	Quantify tangible costs and benefits	Poor at qualitative concepts
	Precise, accurate measures	Poor at addressing intangibles
	Supported by quantitative measures	Limited to financial variables
	E.g. Return on Investment (ROI), Internal Rate of Return (IRR) etc.	
Functional	Assess cost early in SDLC	Do not address benefits
	Facilitate software engineering	Limited to software engineering costs
Strategic	Focus upon competitive advantage	Competitive advantage not sustainable
	Align IS with business strategy	Do not address fundamental economics
Subjective	Focus upon lean, responsive process	How to measure?
	Focus upon managing risk	How to relate to IT investments?
	Focus upon value added	

Theoretical Foundations

Stakeholders' Theory

Freeman (1989) states that a stakeholder is any group or individual who can affect or is affected by the achievement of a corporation's purpose. A stakeholder, then, is an individual or group that ascertains to have one or more kinds of stakes in business. Just as actions, decisions, politics, or practices of the business firm may affect stakeholders, these stakeholders may also affect the organization's actions, decision, politics or practices. With stakeholders, therefore, there is a potential two-way interaction or exchange of influences (Carroll, 1989).

Stakeholder analysis aims at identification of stakeholder groups, revealing their interest and bases of power and describes relationships between stakeholders and the firm and among stakeholders themselves (Freeman, 1989). Ruohonen (1996) notes that there are differences among stakeholders with respect to the importance of their stake and their power in connection with managers. Ruohonen (1995) classifies the stakeholder group in an organization into two broad groups, internal and external. The concept of the stakeholder includes a broader set of groups or individuals, for example customers, suppliers, owners, employees and local, private and public actors in the business environment. See Figure 1 for illustration of the concept of the stakeholder.

Carroll (1989) comments that the stakeholder approach can be applied in a number of functional areas, such as marketing, production and finance. Niskala and Nasi (1994) applied stakeholder thinking in the accounting field, Ruohonen, (1991) applied stakeholder thinking to human resources management research. Pouloudi and Whitley, (1997) proposed the use of stakeholder theory in IS understanding and suggested its application to evaluating IS/IT.

Ruohonen (1995) notes that a number of stakeholders can be found at different phases of IS development. Ruohonen (1995) identified customers, suppliers, government, IS market players such as hard/software companies and consultants and in some cases even trade unions as external stakeholders. Earl (1989) also includes business users, manufactures, suppliers, consumers, competitors, and employees as IS stakeholders. The power and influence of these stakeholders is very much related to the scope and content of IS development project

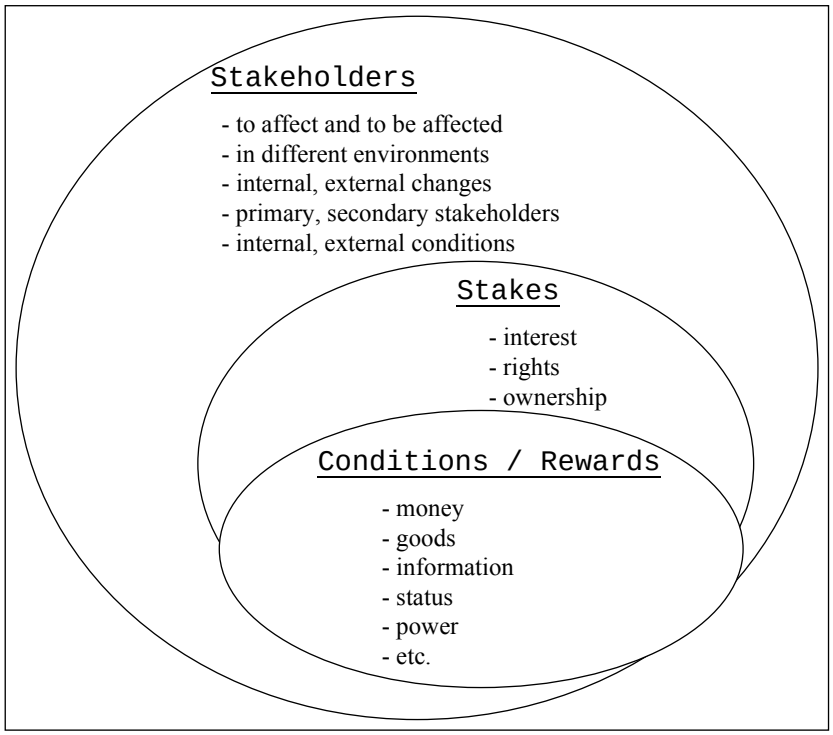

Figure 1. The Stakeholder Concept (Nasi, 1995).

Process Theory

Process theory according to Van de Ven and Huber (1990) focuses on the dynamics of social change, explaining how and why the results of development efforts are achieved. Process theory focuses on the story that explains the degree of association between predictors and outcomes. IS evolution or development is conceived as a sequence of events that occurs over time. Process models differ from factor models which attempt to explain the variation in a dependent variable by studying its associations with one or more independent variable (Mohr, 1982; and Robey and Newman, 1996). Applying the process approach, IS/IT evaluation is conceptualized as a sequence of events that occurs over time. While the factor approach might be able to establish that there is a positive or negative relationship between specific IS/IT factors and success (e.g. increase in sales) using statistical analysis, it might not be able to explain exactly how and why the factors and outcomes are related.

Research Approach: Case Studies

The multiple case study approach was used in this research following Yin (1989). Data was collected using, multiple interview, archives, observation and end-user surveys.

McBee

The McBee Company (not the real name) is a manufacturing company. The company operates three plant locations and several sales offices in about 12 countries in Europe. The company's success has been driven by a focus on high quality products. For example, the company has got the ISO 9001 and 9002 quality certificates to illustrate that it is the company's philosophy to produce high quality products.

In late 1990/1991 the IT department made a proposal to the executive board for the replacement of the order processing system. The reasons mentioned in the proposal were that the system was too old (over 10 years in 1990) and was written in the Cobol programming language, thus making the system hard to maintain due to poor documentation and difficulties in finding capable people. Moreover, the cost of maintaining the old system and the complexity of adding new functionality to the system was increasing exponentially with time. Project teams were formed to design the system. The project teams defined new business processes to be implemented by the system and requested vendor bids to develop the system.

After an extensive evaluation of eight vendor ERP application systems the project group selected the SC&D system (not the real name.) The final selection was based on three factors: cost, closeness of fit between the application and the newly defined business processes, and the amount of modification required before the system could be implemented. In January 1997 the vendor presented a compromise solution to McBee because SC&D was not capable of fully supporting the newly defined business processes. The compromise solution was reviewed, modified and finally accepted. An agreement was made that the compromise system should be delivered by January 1998. Modules to be included were: invoicing, sales statistics, inventory, EDI connection, order/delivery system, main planning (i.e. product planning on a weekly basis, capacity planning), and production planning (manufactory program on a daily basis).

The first prototype was available in October 1997 and tested in one of the plants. During prototype testing, the project group realized that they had developed a system that supported the new business process but that the end users had not yet been prepared for the new business process. There was extensive user resistance to the new processes and the new system interface. Additionally, the previous system could not be linked to the new system.

The final system implementation worked like the old system due to the strong user resistance. Modifying the new system to work like the old system cost the organization over $100,000 but that was the only solution because the old system was already on its way out. Training of the end users had started and the business "profit season" was about to start. This was important due to this being a seasonal organization.

Powerco

Powerco (not its real name) is an electric generating facility. Periodically the facility shuts down and performs routine maintenance and refueling. One activity performed during these outages is inspection and repair of high-energy steam lines. This

activity must be performed in a compressed time period. Three groups are involved and require coordination: engineering assesses inspection results and determines repair requirements, quality control inspects the steam lines, and maintenance prepares the lines for inspection, performs the repairs, and restores the lines to service. Additionally, the Information Systems, IS, group maintains the information infrastructure for the facility and develops systems for the users. In 1998 engineering determined that the activity would be performed more effectively if a database application was developed to support scheduling and coordinating activities. Engineering approached IS with a request for the system. IS was not able to develop the system on engineering's schedule so engineering contracted with an outside provider for the system development.

Engineering worked with the vendor to develop the application to engineering's perceptions of the requirements. Potential process improvements were not considered. IS, Quality Control, and Maintenance were not included in the project team. The product was delivered in 1999. It was implemented for use during the 1999 outage, however, it failed to meet the needs of the Quality Control and Maintenance and was abandoned after only a few days of use. In 2000 Engineering requested IS take a look at the application and attempt to make it work.

IS formed a small project team to re-work the application. Requirements for the application were gathered through a series of meetings that included Engineering, Quality Control, and Maintenance. The application was re-worked in accordance with the gathered requirements. The project started approximately three months prior to the outage with the commitment that the application would be ready for the outage. The reworked application was verified to meet the requirements of all users through a simulated outage test. A few additional items were identified as needing work but the application was verified, accepted, and implemented two weeks prior to the outage. The application was used successfully throughout the outage. Management was satisfied with the activity as the application facilitated management reporting and assisted in reducing the activity time by 33%.

A post outage review was held with all activity participants with enhancements being identified and approved by all four organizations. A one month window was identified for the work to be completed prior to the next outage scheduled for the other unit at the beginning of 2001. The activity was performed with even more success during the second outage. A post outage review was also held after the 2001 outage and a maintenance plan prepared for maintaining and enhancing the application.

Management was extremely pleased with the final application. Approximately $500,000.00 was spent preparing the initial application and there was a great deal of management dissatisfaction when the initial application failed. Re-work of the application was done at a cost of $40,000.00 with IS estimating that the application could have been built by IS for approximately $200,000.00.

Analysis

Stakeholder Perceptions

McBee shows that the different stakeholders were using different criteria to evaluate the IS/IT implemented in the organization. Top managements focused on the cost and value of the implemented system. At the project closing the top managements were highly unhappy because about 10 million Finnish marks was wasted altogether. Top management had a difficult time evaluating the IS because the objective of the IS was not resolved. Some perceived the project objective as replacing the old system, others perceived the objective as reengineering the business processes.

A decision was made at the project conclusion to scrap the compromise system and develop a new system from scratch. The main reason for this was the comprise system failed to correct the maintenance issues from the previous system. Although SC&D project management accepted that the system might be difficult to maintain they were satisfied with the outcome of their initial evaluation of the compromise system.

Users evaluated the system based on their concerns with the usability of the system and the fit between the system and their tasks. Several users expressed a negative feeling about the system in the beginning. Some older employees were really threatened by the system, believing that the only way they could keep their job was to know how to work with the new system, even though they knew the system was not adequate. According to Goodhue (1995) task-technology-fit focuses on the degree to which system characteristics match user task needs. Goodhue (1995) explains that technologies are viewed as tools used by individuals in carrying out their tasks. Tasks are more broadly defined as the actions carried out by individuals in turning inputs into outputs. Task-technology fit perspective (Figure 2) suggests that a better fit between technology functionalities, task requirements, and individual abilities will lead to better performance (i.e. faster or more effective task accomplishment).

Goodhue and Thompson (1995) assert that for information technology to have a positive impact on individual performance the technology must be utilized and a good fit with the tasks it supports. This is very much in line with Juran's definition of quality – fit for use.

Powerco shows that lack of stakeholder participation leads to a lack of ownership of the application and a willingness to let the application fail. Management assessed the success of the application through cost and savings. Quality Control and Maintenance assessed success by how well the application supported their work activities. Engineering assessed success by how well the application facilitated activity management and reporting. IS assessed success by how well the application worked within the organizational infrastructure and user satisfaction. Engineering worked with the vendor to design an application that met their needs, other groups' needs were secondary and not well understood, including management's. When implemented the application was allowed to fail by the other stakeholders.

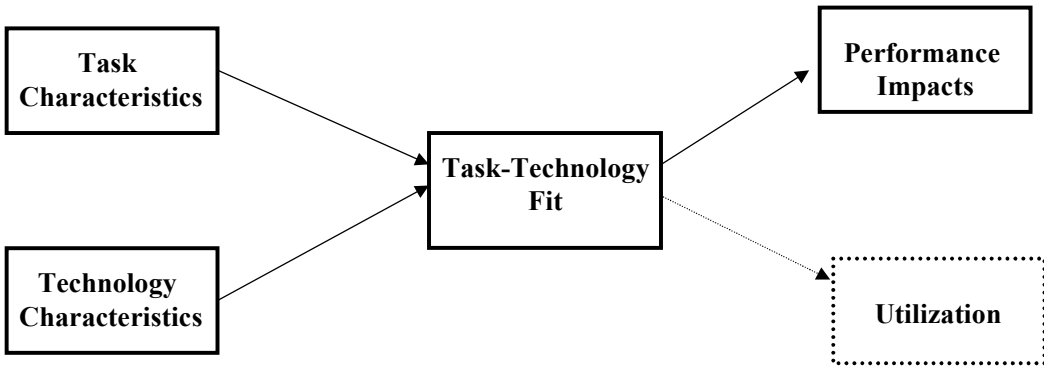

Figure 2. Task-Technology Fit (Goodhue and Thompson, 1995)

Incorporation of stakeholder requirements led to a application that was considered successful by all stakeholder organizations. At the time many organizations had a perception of IS as a organization that did not care about meeting user needs or supporting smaller applications. This project changed many of those perceptions as well supporting the stakeholder process approach to IT evaluation. Performance of post outage reviews and the generation of application maintenance plans following each outage illustrate the process aspect of this approach.

Stakeholder and Process Thinking in IS/IT Evaluation

According to stakeholder thinking, success in satisfying multiple interests, rather than meeting conventional economic and financial criteria, would constitute the ultimate test of corporate performance (Donaldson and Preston, 1994; Ruohonen, 1996). Both projects would have been more successful if all the various stakeholder interests were considered at each stage of system development. Remenyi and Sherwood-Smith (1996) observe that the dissatisfaction with information systems management can be substantially alleviated by the application of a number of initiatives based on post-mortem thinking. These initiatives include (1) identification of correct primary stakeholders and effective co-evolution of information systems solutions and (2) a meaningful evaluation of the IS/IT and their benefits, and a clear understanding of those benefits by all stakeholders.

Figure 3 illustrates how the various stakeholders should have been involved in the evaluation process. The first stage of the stakeholder process approach to IS/IT evaluation starts during the planning phase. At this phase the business stakeholders should define the business expectations from the system or technology. The challenge at this phase is the ability to identify the expected business benefits from the IS/IT. Several researchers have pointed out that senior managers' active involvement is of high importance (Lederer and Salmela, 1996; Lederer and Mendelow, 1987). The assumption here is that IS business and organizational stakeholders should know how the IS/IT fits into the organization's goals, mission, vision and strategy, and provide the business expectations that form the basis for business evaluation when the system is delivered. According to Premkumar and King (1991) and DeLone and McLean (1992), the ultimate measure of system success is reflected in organizational performance. This can only be measured against the expected business and organizational benefits. McBee failed to conduct this evaluation

and it ultimately lead to the failure of the project. The Engineering organization of Powerco also failed to conduct this evaluation with it leading to the initial failure of the application.

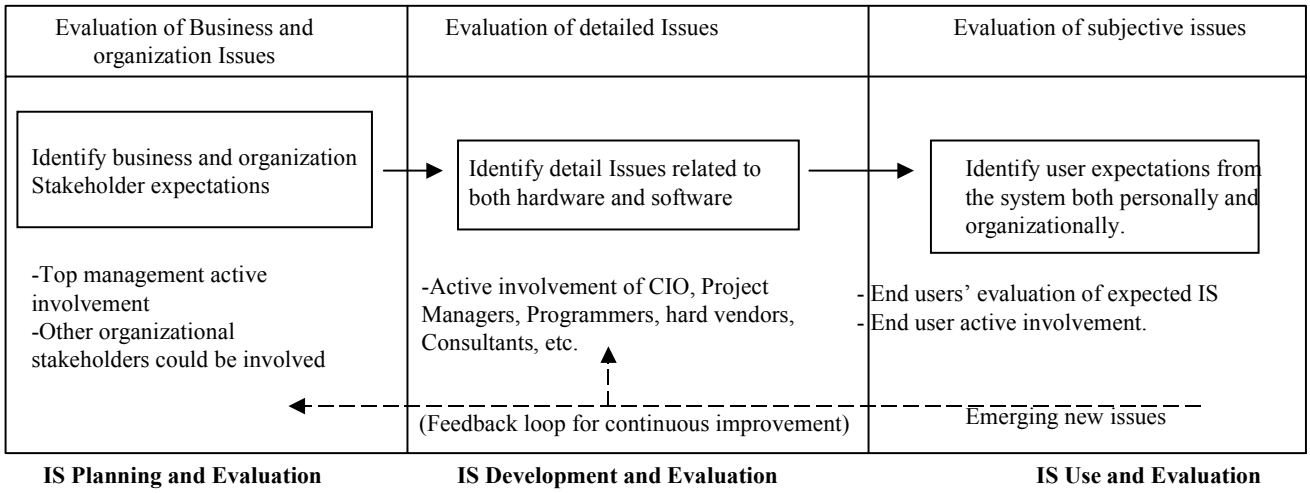

Figure 3. Stakeholder Approach to IS Evaluation

McBee assessed IS using technical issues and did not involve top management. The proposed framework assumes top management involvement during the planning phase. Top management drives IS projects through their evaluation focused on the business benefits of the IS/IT project to the organization. Powerco management as expected assessed success through organizational performance. What was problematic was Engineering and management failing to recognize how success would be assessed during the initial development phase.

The second stage of the stakeholder approach to IS/IT evaluation is during the development phase. The challenge here is identifying the hardware and software requirements, conforming to the specifications and meeting stated or implied standards. The most important stakeholders at this stage are the IS professionals. IS professionals are those associated with technical analysis, programming, design and testing. The software and hardware requirements and standards will form the basis of evaluation when the system is delivered. The evaluation process checks to ensure that organizational standards and requirements are followed and are aligned with the organizational objectives. Both McBee and Powerco performed technical evaluation at this phase. The technical evaluation view was emphasized by SC&D project manager that agues that the McBee system implementation was not a failure because "during the last year 9 months that the system has been running we had managed ... 27,000 orders and 177,000 order lines … the system is working 24 hours a day… How can you [say] that the system doesn't work?"

The third stage of the stakeholder approach to IS/IT evaluation is concerned with the users subjective opinion about the IS/IT. The challenge here is the ability of the user stakeholders to express their expectation accurately and honestly. User evaluation is often used as measure for IS success (DeLone and McLean, 1992; Seddon, 1997). User stakeholders are able to evaluate the appropriate balance between the technology and contextual social utility of the technology.

The stakeholder process approach is a continuous process. While it starts with the planning phase it does not have a clear end because the outcome of each evaluation becomes input to the next stage. For example, if one outcome of business stakeholder expectations is that the new IS/IT will introduce new hardware standards to improve back office processes, this output becomes input into the development phase. Which will imply that the new system cannot be designed around the present technology but must use new and better hardware. This will then serve as input to the user who should expect to get a more improved system that allows them to do tasks more effectively. This also implies that management will be aware of the users need for new skills and will start preparing them for the new system as well as motivating and informing them about the changes to the business processes.

This model highlights the focus point of various stakeholders in evaluating there IS/IT. Moreover, it gives the possibility to combine different evaluation methods at various phases of the system development.

Conclusion

In this paper we have shown that IS/IT evaluation should involve all stakeholders. It should be a continuous process that has the outcome of one phase serving as input into the next phase. McBee should have identified the business expectations and got the end users to develop their expectation in line with the business expectations. The hardware and software requirements should also be designed in line with the business expectations. This way the evolving output of one phase could serve as input into the other phases. If this is not followed there is a good chance that the different stakeholders evaluation will not be positive.

Powerco should have included all stakeholders from project inception. Leaving out key stakeholders during development prevented their evaluation criteria from being considered with the result of the application being allowed to fail during its initial implementation. Once this mistake was corrected, the application was developed to meet the different evaluation criteria at a minimal cost with the result of a highly successful application as evaluated by all stakeholders.

Future research will further test the stakeholders' approach framework to IS evaluation using multiple research approach.

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