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From Framework to Organization-Specific Process Model for IT Investment Justification and Evaluation: An Experience of Action Research

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Abstract

This paper presents the preliminary results of an action research project in a large Norwegian oil and petrochemical company. It focuses on the pilot phase of the project for testing the feasibility and practicality of the unified justification and evaluation framework (UJEF) developed by the authors based on extant IT investment justification and evaluation theories and frameworks. The UJEF framework emphasizes the alignment between corporate competitive strategies and the objectives of IT investments and the integration between project justification and its subsequent evaluation. It builds on the strength of the recent theoretical development on competitive strategies, resource based view of IT value, real options analysis, and the balanced scorecard management system. The experience of the research shows that when dealing with theoretically complex, yet practically significant, issues such as IT investment justification and evaluation, action research methods can be valuable alternatives to traditional positivist approaches. The researchers and practitioners have benefited greatly from each other in this collaborative effort and consequently both theoretical and practical knowledge of IT investment justification and evaluation have been advanced. Areas of potential improvement are identified and future activities on this project are outlined.

Key words: action research, IT investment evaluation, IT investment justification, balanced scorecard.

1. Introduction

As information technology (IT) continuously integrates and assimilates into all aspects of business and work processes, organizations are increasingly becoming dependent on IT for short term survival and long term prosperity. Thus, it is not surprising to see billions of dollars poured into IT and related products and services each year by organizations and that investments in IT now account for more than 50% of total capital spending of organizations across industries (Hu and Quan, 2002).

With such significant levels of investment, an increasing number of practitioners and academics have begun to ask an important question: how do we know that the money on IT has been well spent? In the IS literature, researchers have argued that IT investments contribute to the well being of organizations in at least four different dimensions: 1) IT investments as a strategic necessity for surviving in the highly competitive global economy

(Clemons and Row, 1991; Carr, 2003); 2) IT investments for competitive advantage (Porter and Millar, 1985; Bharadwaj, 2000; Applegate, et al., 2003); 3) IT investments for organizational agility (Weill et al., 2002; Sambamurthy et al., 2003); and 4) IT investments for digital options (Sambamurthy et al., 2003). Practitioners, on the other hand, still face tremendous challenges in evaluating the actual benefits and the real impact of IT investments at project and organizational levels, even thought numerous IT investment evaluation techniques and frameworks have been developed and published. It is still difficult to measure the true impact of IT investments, especially when the expected benefits from such investments are intangible and non-financial in nature. Many organizations rely on informal techniques and processes in the *ex-ante* justification and the *ex-post* evaluation of an IT investment. To make the matter even more complicated, human factors often play a significant role in the evaluation processes. A politically motivated analyst can understate the cost to gain acceptance from the management for a particular IT project, *or* project managers often deliberately overstate the cost and time to minimize the risk of delivering the project over the allocated time and budget (Willcocks, 1992).

The significance of IT investments in organizations and the challenges in assessing the benefits of such investments only intensify the desire to search for, and the determination to find, more reliable and robust IT investment justification and evaluation techniques and methodologies in both academic and practitioner communities. This paper describes our experience in working with a large international corporation for developing a theory-based IT investment justification and evaluation framework and then constructing a process model from this framework for use by the project managers in this organization. With this participatory action research, we have acquired some valuable knowledge and insight in working with project managers, and transformed our conceptual framework into a step-by-step process from the initial IT investment justification to the final project evaluation. Even though the research is ongoing and incomplete, we believe the results, so far, constitute a significant contribution to the knowledge of IT investment evaluation research.

2. Theoretical Foundations

2.1 The Action Research Strategy

Action research is a type of research methodology that "aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (Rapoport, 1970, p. 499). Baskerville and Wood-Harper (1996) argue that in the study of a new methodology or an improvement to an existing methodology, action research method may be the only relevant research method presently available. This assertion is based on the fact that alternative research methods often are not relevant to the real world. However, action research necessarily takes place within a multivariate real world environment, thus relevance is not a problem.

Action research expands scientific knowledge and enhances the competencies of the respective actors because of the collaboration in an instant situation where data feedback is used in a cyclical process with the aim to increase the understanding of change processes in social systems (Baskerville and Wood-Harper, 1996). Avison et al. (1999) consider action research to be a unique methodology because of the way it associates research and practice. In action research, a theory is tested using practitioners in real situations. Feedback from this experience can lead to modifications in both theory and practice. The research influences the practice and vice versa; thereby action research produces very relevant research findings (Baskerville and Wood-Harper, 1996).

Given the challenges of IT investment evaluation and the opportunity to collaborate with a large international organization, our decision to conduct action research was predominantly influenced by two factors. First, the idea of a unified IT investment justification and evaluation framework was already developed by the authors based on the extant literature on IT value and investment theory, but had not been tested in real world cases. The details of the framework were still evolving. Second, the management of the target organization had expressed strong interests in the framework and willingness to participate in the collaborative effort after an initial presentation by the researchers at the headquarters of the organization. Both the researchers and the practitioners believed that such collaboration would be mutually beneficial and thus a solid foundation for successful action research was constructed.

2.2 Developing a Unified IT Investment Justification and Evaluation Framework

Many studies have identified the difficulties and uncertainty associated with IT investment justification and evaluation (e.g., Wen et al., 1998; Farbey et al., 1992; Renkema and Berghout, 1997; Irani, 2002; Gunasekaran et al., 2001). In a study of 1000 UK companies, Ballantine et al. (1996) showed that the problems in the evaluating processes are widespread within the respondent organizations. Their study finds that identifying and quantifying relevant benefits and quantifying relevant opportunity costs are the most problematic issues. The study also shows that there are no correlations between these problem areas and the organizational size, budgets and project sizes. Smaller organizations experience the same problems as larger organizations; organizations with large IT budgets have the same problems as those with smaller IT budgets; and smaller projects appear to have the same problems as larger projects.

A study by Farbey et al. (1992) showed that among 16 IT projects which had just been implemented or were about to be implemented, only nine included a justification of the IT investments. The other seven projects were approved without any assessment of the expected benefits mainly because they were an important part of the corporate competitive strategies. Interestingly, in five of the latter IT projects, the organizations had formal evaluation methods, but they were bypassed because the projects did not fit with the methods.

There is, however, a consensus among researchers that traditional capital budgeting techniques such as cost benefit analysis (CBA) and discount cash flow (DCF) methods [e.g., return on investment (ROI), net present value (NPV), and internal rate of return (IRR)] are grossly inadequate for assessing the expected benefits of many types of strategic IT investments where the cash flows either cannot be estimated or are so interwoven with other business processes that the impact of the IT investments cannot be isolated. Hares and Royle (1994) suggest that other forms of measure for the non-financial benefits such as weightings and scorings are preferable. Further, they argue that it is essential to convert non-financial benefits into monetary values to avoid mixing financial benefits and non-financial benefits because that could lead to inconsistent information and insufficient decisions. However, attempts to convert non-financial benefits into monetary values at the project proposal stage are difficult and often unreliable.

Others, like Ward and Peppard (2002), suggest using multiple methodologies when justifying IT projects, particularly for large projects where a wide range of benefits are expected. According to Ward and Peppard (2002), there is little consensus on how to assess and justify IT investments. Many researchers argue for the importance of using a formal method or procedure when assessing and justifying IT investments (Hochstrasser, 1990). However, other studies show that few organizations use such methods or processes (Farbey et. al., 1992).

The challenge for any IT investment justification and evaluation framework or methodology is to outline concrete steps through which the immediate and future benefits of an IT investment can be identified and quantified based a solid theory of where, how, and why such an IT investment creates value to an organization. It is also critical that in any justification and evaluation framework the focus is on the work systems that an IT system is intended to support rather than the IT system itself (Alter, 2002). This calls for the organizational vision and business strategies to be at the center of such framework.

Based on the available literature about the understanding of how and where IT investments create value to organizations, and how and where these values should be expected and measured, we propose a unified justification and evaluation framework (UJEF) for IT investments, as shown in Figure 1. UJEF is developed from four fundamental pillars of organization strategy and management theory:

- *The resource-based view of firm* (Barney, 1991; Bharadwaj, 2000, Sambamurthy et al., 2003, Melville et al., 2004);

- *The theory of strategic alignment* (Henderson and Venkatraman, 1993; Sabherwal and Chan, 2001);

- *The framework of the balanced scorecard* (Kaplan and Norton, 1992, 1993, 1996);

- *The real options analysis of investments* (Kogut and Kulatilaka, 1994; Benaroch and Kauffman, 2000; Taudes et al., 2000).

As a result, it has the following four fundamental principles at its core:

- *The strategic alignment principle*. IT investments can create value to an organization if and only if the objectives of the investments and the resulting systems or applications are aligned with the overall strategic objectives and mission of the organization;
- *The digital option principle*. The value of IT investments must be assessed in terms of not only the immediate and direct impact on the processes of an organization, but also the long term capabilities and future potentials created as a result of such investments;
- *The measurability principle*. Any benefits created or expected from IT investments, tangible or intangible, must be measurable in quantitative and practical metrics. Anything that is not measurable cannot be managed effectively and thus should not be considered as objectives or benefits of the IT investments.
- *The accountability principle*. The post implementation evaluation must be based on the initial investment justification. It is irrelevant whether an investment in IT has resulted in increased usage from users or higher user satisfaction with the system if these are not the initial justification for the investment.

The fundamental philosophy of UJEF is that any IT investment should be aimed at either creating new or leveraging existing organizational strategic resources and capabilities that contribute to short-term or long-term organizational performance gains. For that reason, UJEF suggests that two sets of justifications be developed for IT investment projects: strategic justification based on the vision and strategies of the organization, and financial justifications based on the capital investment criteria of the organization. For evaluation and accountability purposes, the strategic justifications should be articulated in the form of a series of balanced scorecard measures (Kaplan and Norton, 1992, 1993, 1996) at different levels of the organization; and the financial justifications should be expressed in the forms of return on investments based on current and future cash flows and option values. Incorporating the idea of organizational learning and dynamics, UJEF recommends that the

ex-post evaluation process should also provide feedback to the *ex-ante* justification process in order to continuously refine the justification and evaluation methods and processes developed.
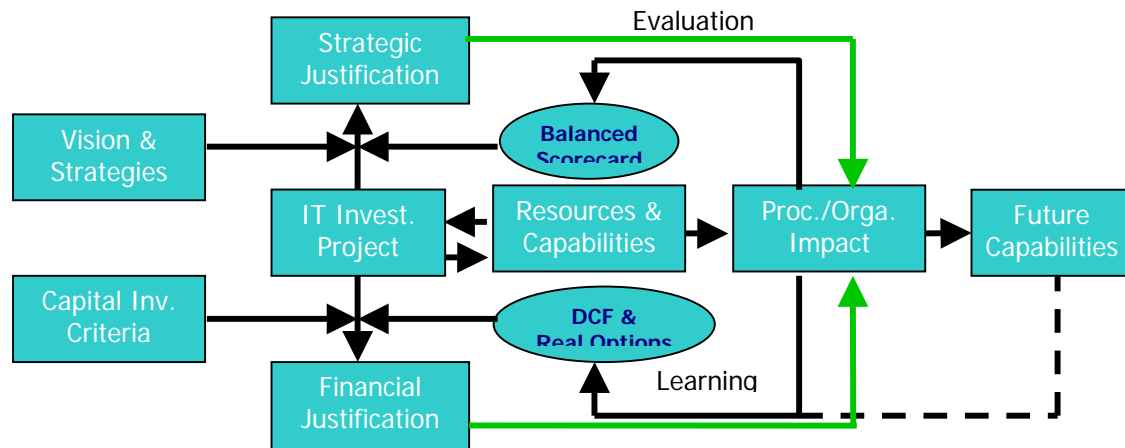

Figure 1. The Unified Justification and Evaluation Framework

3. The action Research Process

3.1 Statoil and the e-Collaboration Initiative

Statoil ASA is the largest Norwegian integrated oil and gas company, having approximately 17,000 employees and business operations in 25 countries. The company is a leading retailer of petrol and oil products in greater parts of northern Europe. It is also a significant player in the international market in terms of oil reserves and production. In 2002, the company generated a net income of about $2.4 billion (Statoil, 2002). Statoil operates in the following five main areas:

- Exploration and production of oil and gas
- Supplying gas to the European market
- Trading with crude oil
- Delivering energy and products to the retailing market
- Processing of petroleum by refining, petrochemical activity and production of methanol

Statoil IT, the information technology division of Statoil, employs more than 700 professionals responsible for maintaining and developing the company's application portfolio. As such, Statoil IT is among the largest IT organizations in Norway. In January 2002, Statoil launched a comprehensive enterprise-wide initiative called "e-Collaboration" (Weiseth et al., 2002). The mission of this initiative was to create an integrated environment for collaboration and content management within Statoil and between it and its customers and partners. The target included a corporate "knowledge reservoir" that "provides global access to and the management of a common pool of digital assets used to collaborate, support work processes and share information between the company and their customers, employees and business partners" (Kleppe, 2002).

3.2 Objective of the Action Research

In the early phases of the e-Collaboration initiative, Statoil identified the sensible justification and evaluation of the related IT investments as an important and challenging issue to be

addressed (Munkvold et al., 2003). Initiatives related to electronic content management (ECM) were chosen as a research target challenging enough by mangement to develop an investment justification and evaluation procedure. In the fall of 2002, two faculty members and two students formed a research team to work in collaboration with the company to develop a step-by-step process through which project managers would be able to justify and evaluate IT investments in future initiatives within the business units of Statoil.

Initial and subsequent meetings between representatives of Statoil and the research team identified the Governing Document Management project as the target for the pilot analysis and testing of the proposed UJEF framework. The main objectives of this pilot study are as follows:

- To identify and determine the objectives and expected benefits of implementing ECM technology in the Governing Document Management business process using UJEF;
- To identify and determine a set of practical processes and metrics that can be used to measure the impact of the implementation of ECM in the target business process using UJEF;
- To refine the processes and metrics developed in the above steps so that they can be used to monitor and evaluate the realized benefits of the implementation of ECM in the target business process after the completion of the implementation phase;
- To refine the UJEF framework and the operational processes and the metrics so that they can be used in the justification and evaluation of IT investments in general in other Statoil business units and processes.

3.3 The Interactive and Iterative Research Process
This action research process started in the fall of 2002 when two faculty members of the research team visited the Statoil headquarters in Stavanger, Norway and made the initial presentation of the UJEF framework. It was followed by an agreement to continue the project with graduate students from Agder University College under the supervision of one of the faculty members. During the next six months the student team visited the offices of Statoil and held three workshops with the project managers and other Statoil personnel. Meanwhile, the faculty members of the research team maintained e-mail contacts with the some of the project managers and monitored the progress of the student team. Those action research cycles are described in Figure 2.

Three iterations of this cycle were eventually completed by the time of this writing, resulting in major updates to the original framework developed by the researchers. In each of the iterations, data were collected with a variety of methods. As a theory-guided empirical research methodology, the evidence collected is typically qualitative and interpretive. Thus, evidence should be collected from a variety of sources to get a more complete picture of the situation. Journaling is commonly used by action researchers to record and reflect on events as they occur. Baskerville and Wood-Harper (1996) suggested some reliable data collection techniques to use in action research, such as observations, interviews, action experiments and discussions. The data collection methods we used are showed in table 1. Tape-recording during the meetings and group-interviews were not used because of privacy concerns of some group members, but extensive notes were taken during these meetings. Without being taped, the groups were able to discuss the issues more freely. Based on these notes, meeting minutes were written and the notes and minutes were later analyzed to capture relevant information for the research project.

Data Collection Method	Venue	Evidence Collected
Meetings	Workshops held at Statoil	**Notes and minutes of meetings**
Document Analysis	Documents provided by Statoil	**Project documentation** **Existing project evaluation methods** **Email communications with participants**
Interviews	Group interview with project managers followed by emails for validation and clarification	**Interview notes** **Follow-up emails**
Journaling	**Journal entries by researchers detailing the activities**	**Records of activities** **Reflections of the researchers**

Table 1. Data Collection Methods Used in the Research

4. Results and Analyses

The most important outcome of the interactive and iterative process with the project managers of Statoil was the transformation or operationalization of the UJEF framework into a step-by-step action-oriented process model, as shown in Figure 3.

The initial steps define the boundaries of the justification project, the idea of the scenarios to be considered, visions and strategy, critical success factors, stakeholders involved, and data collection methods to be used. The steps for risk and cost analyses are conducted in parallel with estimated strategic and financial justification arguments and measuring. For IT projects of infrastructural nature, such as ECM, real option analysis of the future prospects made possible by the current project are considered. Finally, the total project evaluation draws the analyses together and makes recommendations for the actions to be taken. The steps can be conducted iteratively until the total project evaluation phase – the logical order shows the likely sequence to start the particular tasks considered useful in Statoil. Every step, shown as boxes in Figure 3, involves at least one set of concrete techniques and questions to be asked to facilitate the process (Egenes and Holte, 2003).

Table 2 shows an example of a work template developed for finding out measures and target values for expected benefits in Step 9 in the phase of Strategic Justification (Figure 3) from the "Internal Business Process Perspective" (one of the perspectives in the Balanced Scorecard framework). Naturally, similar templates are created to cover all of the perspectives in the Balanced Scorecard as necessary. The use of this template is illustrated with an example concerning the Governing Documents Process.

Internal Business Process Perspective		
Expected Benefits	**Measures**	Target
Conform to rules and regulations regarding revision and documentation	% of non-conforming governing documents published each year	**50% reduction, or less than 5%**
User friendly and streamlined content publication process	**User satisfaction score on the question in yearly survey**	**90% or higher**

Table 2. Example of Templates Developed for Balanced Scorecard Measurement

During the iterative process of operationalizing the UJEF framework into an actionable process model, the project managers injected significant amounts of input based on their
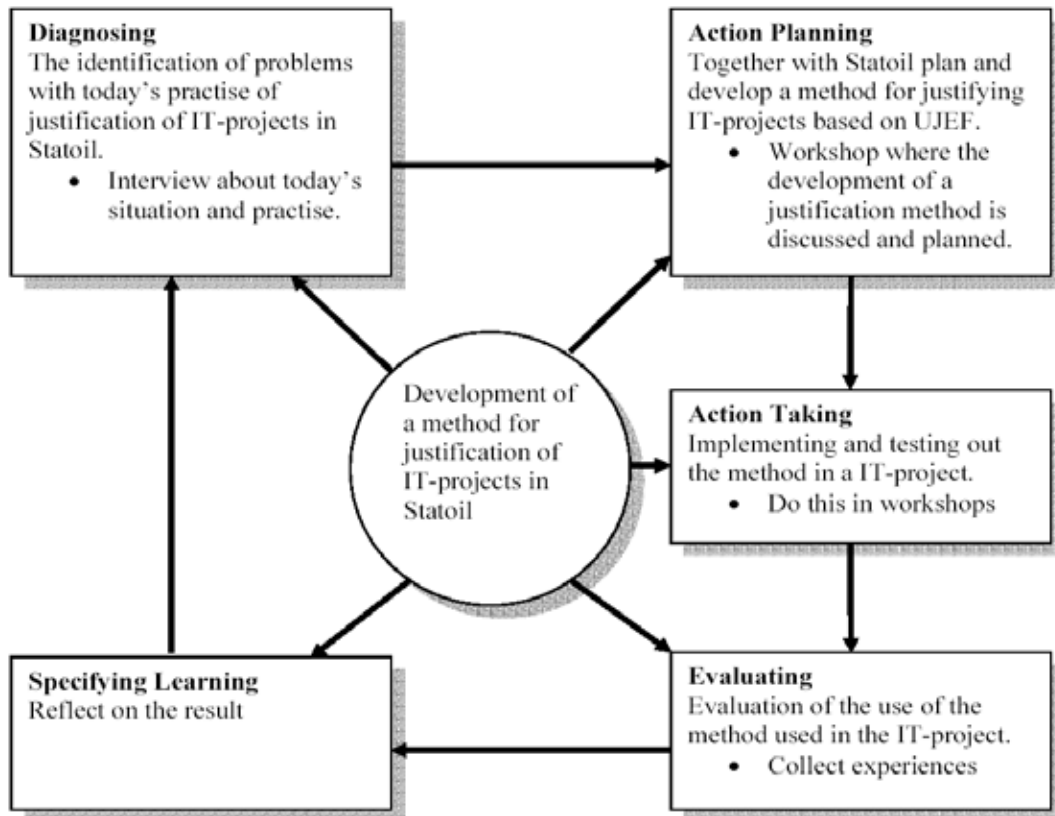

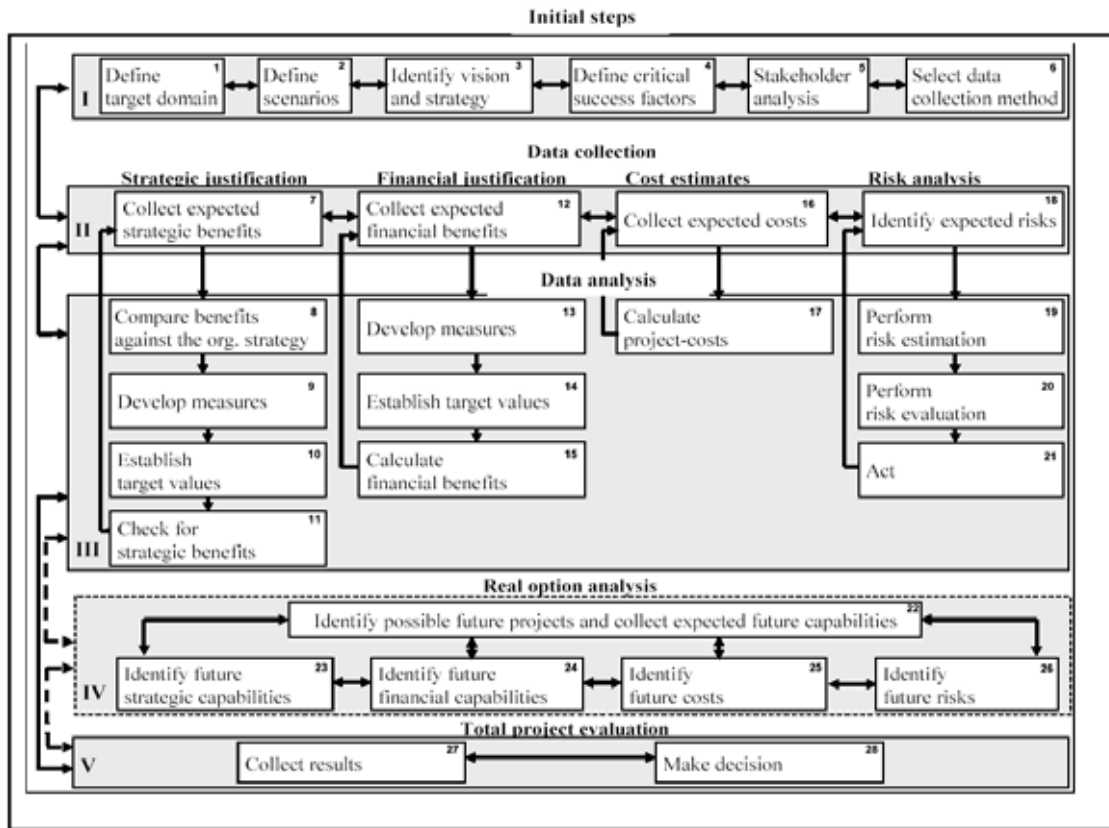*Figure 2. The Action Research Process at Statoil*

Figure 3. Overview of the Process Model of UJEF Framework for Statoil

experience and knowledge of the IT projects in the organizational context of Statoil. The most notable components in the process model that are added or modified as a result of such inputs are stakeholder analysis, cost analysis, risk analysis, as well as making the real options analysis optional for certain types of projects. Brief descriptions of these changes are summarized in Table 3.

Comparing the current process model (Figure 3) with the original UJEF-framework (Figure 1) shows that all the components from the original framework were considered useful and necessary by the practitioners and that they were able to operationalize and contextualize the framework in Statoil in three interactive rounds. During their last evaluation of the process model, the experienced project managers gave the following kinds of comments regarding the current process model (Figure 3) and the descriptions of each of the steps (Egenes and Holte 2003):

> *"All elements included in the method are necessary and all elements cover the requirements for a justification method... There is not one single question that is not needed or [is] not relevant."*

The participants also saw a great need to put this new step-by-step process into use and believed it would improve the current, partially scattered, guidelines to justify the feasibility of IT projects and thus enhance the quality of the future justifications to give a basis for *ex-post* project evaluations: "*It is hard to see the connection between different parts in PromIT [Note: PromIT was one of the evaluation tools used in Statoil].... Other [previous] projects would have had much better basis for and quality [if using this new justification and evaluation process].*" (Egenes and Holte 2003)

New Components or Modifications to UJEF	Description
Stakeholder Analysis	**Required by the internal project management standard of Statoil, with a focus on identifying and clarifying responsibilities and accountabilities of the parties involved in a given development project.**
Cost Analysis	**Required by the internal project management standard of Statoil, including estimates of direct and indirect costs of a proposed project, such as hardware, software, maintenance, training, integration, audit and verification, etc.**
Risk Analysis	**Required by the internal project management standard of Statoil, including the analysis of physical and managerial risks related to the proposed project, such as vulnerability of hardware and software, probability of failure in generating the expected benefits, schedule slippage and budget overruns, and incompatibility with existing systems, etc.**
Real Options Analysis	**Project managers in Statoil requested that the ROA analysis of the UJEF framework be made optional since for certain types of projects ROA may not apply or too complex to be practical**

Table 3. New Components or Modifications to the UJEF Framework

As a result of these interactions and iterations, the research team also modified the original UJEF framework into the following updated version, reflecting the additions and changes suggested by the practitioners, considered to be valuable to the overall framework by the researchers. The modified UJEF framework is shown in Figure 4.
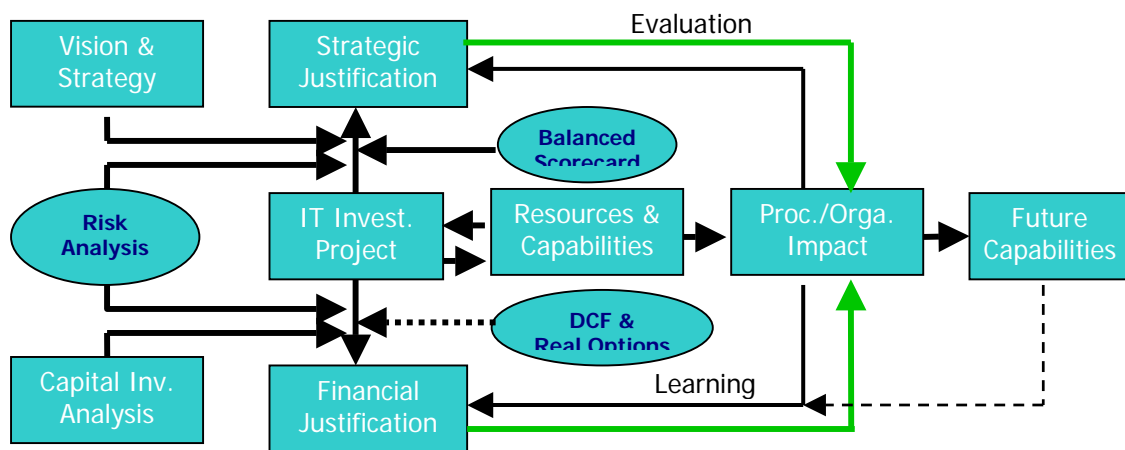

Figure 4. The Modified UJEF Framework

5. Discussions and Conclusions

This paper describes the development process of an IT investment justification and evaluation framework through an interactive and iterative action research process. In this process we have, together with the practitioners, refined and operationalized the framework into an actionable IT investment justification and evaluation method in the organizational context of

Statoil. At the time of this writing, this method has not been fully tested so we can not claim that we have accomplished the objectives of the action research project. To do that, the justification and evaluation method must be used for the *ex-ante* justification of a new IT project and the *ex-post* evaluations of the impact of this project. This will be the next step in our research agenda. However, we believe that our research has contributed to the literature of IT investment justification and evaluation in at least three significant ways. First, a comprehensive framework based on the theories of IT value is developed. This framework contributes to the understanding of how IT investments can be justified and evaluated in the context of competitive strategies and future capabilities and options. The operationalized process model from this framework provides a step-by-step guidance map to project managers who want to implement this framework in their perspective organizational context.

Second, we have shown the value of action research in developing theories and frameworks for highly practical issues such as IT investment justification and evaluation. During the entire research process, the practitioner participants were well informed on the subject of IT investment justification and evaluation. The participants and researchers contributed to all of the phases in the action research. During the diagnostic phase of the research, the participants were the ones that described the problems in the target organization while the researchers drew parallels to the existing literature. During the action planning phase, the practitioners came up with ideas and requirements and examples from earlier justification and evaluation methods, while the researchers investigated the literature and developed the initial framework for IT investment justification and evaluation. Both the practitioners and the researchers contributed to the operationalization of the framework with their practical and theoretical knowledge respectively. Consequently, a strong and mutually beneficial relationship between the practitioners and the researchers emerged.

Finally, compared to other generic, theory based IT justification and evaluation models and methods, such as the ones summarized in Wen and Sylla's (1999) literature review, this research contributes to the knowledge and practice of IT investment evaluation and justification by showing how these rather generic and abstract techniques must be contextualized and operationalized in greater detail in order to result in comprehensive multi-step process models. These models would describe what the organizations should actually do and in what order for project managers in the field. This might require a considerable effort from both the researchers and the practitioners, as illustrated in this action research project. Moreover, a detailed process model showing concrete steps with practical tools, templates, and techniques could function as a knowledge base of organizational learning about IT investment justification and evaluation that facilitates the continuing refinement of the processes and tools in the dynamic and constantly changing enterprise IT environment.

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