

Towards a New Conceptualization of Information System Benefits Assessment

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Abstract: Different perspectives on benefit evaluation are presented in the information technology literature, from the perceptual assessment of benefits to the financial calculation of return on investment. This study aims to complement the literature by integrating the IT capital expense literature and Delone and McLean's (2003) information systems success model. A model was developed using a qualitative approach with respondents from three manufacturing organizations responsible for the information system evaluation process. The five-stage model is composed of project identification, proposal development, proposal selection, IS creation/use and organizational benefit evaluation. This conceptualization adds a new and enriched perspective to the literature by integrating financial and perceptual benefit assessment with an organizational assessment process. The analysis of the data collected confirmed the inefficiency of user perceptions for organizational success assessment but also revealed top management perceptions to be a critical factor in the evaluation process.

1 INTRODUCTION

In the last half-century, information systems (IS) have assumed an important role in the operational and administrative activities of organizations of all sizes. However, the progress of information systems is a paradox; although success stories exist, a number of significant failures have also taken place (Brynjolfsson, 1993). Top management in the information technology (IT) field has identified the inability to fully define the contribution made by IS as one of the main challenges (IT Governance Institute, 2004). Numerous research initiatives have focused on explaining the relationship between IS benefits and the improvement of IS implementation activities (Pan and all., 2008; Chen, and all., 2009). However, other factors such as IS selection, IS usage and investment assessment may also explain this phenomenon. Delone and McLean's (Delone and McLean, 2003) information systems success model is a prominent example of the use of IS selection and usage dimensions to evaluate success.

The other research stream analyzed in this study is based on investment assessment practices. It originates from the financial field, where IS investments are included in the capital expense evaluation process. This financial view of IS success

does not have a high profile in the IS benefit evaluation literature as very few articles have been published on this subject (Bajaj and Bradley, 2009).

Finance researchers have developed a repertoire of capital expense assessment practices (Bennouna, and all., 2010; Burns and Walker, 2009), but they are not applied in the IS success literature. However, this research stream richly documents IS investment evaluation through perceptual measures of benefits. These different assessment perspectives represent complementary approaches to explain IS's benefits. The combination of these two perspectives led us to ask the following research question:

How do organizations evaluate success when selecting and implementing an information system?

The objective of this research is to identify the stages that an organization should follow to adequately evaluate the success of its information systems, from the identification of the project to the post-implementation activities.

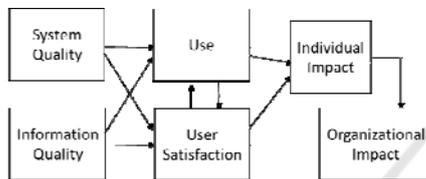
In the next section, the literature review presents IS evaluation models, which leads in section 3 to the development of a conceptual model for IT benefit evaluation. Methodological aspects are then covered before findings are exposed in section 5. The paper concludes with the contributions and limitations of this research initiative.

2 MEASURES TO EVALUATE IS BENEFITS

2.1 Delone and McLean's IS Success Model

Research using Delone and McLean's model focuses on the identification and comprehension of the elements that explain the success of IS. Their first model was developed in 1992 but it was revised in 2003 (Delone and McLean, 1992; Delone and McLean, 2003). This model (see figure 1) was selected due to its predominance in the literature but mostly because of its capacity to be transformed from its current state to a process model.

Initial model (1992)



Revised model (2003)

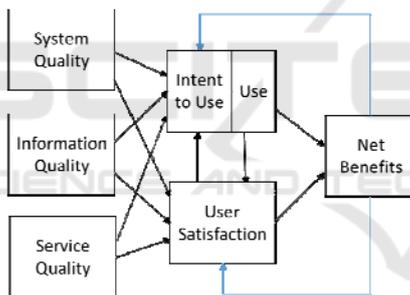


Figure 1: IS success models (source: Petter et al. 2008).

The new version of the model differs from the older one in three ways: (i) the incorporation of Intent to Use into the Use variable, (ii) the addition of Service Quality as an antecedent to user satisfaction and to use/intent to use, and (iii) the combination of Individual and Organizational Impact to form the Net Benefits variable.

Delone and McLean (2003) grouped the model's variables into three categories: System creation, System use and Consequences of system use. The first category, System creation, measures two types of IS-related activities. The System quality and Information quality variables measure the characteristics of the information system, while Service quality measures the IS user support. The second category, System use, comprises the User satisfaction and Intent to use/Use variables. The latter variable involves measuring how and how

much users apply the system's functionalities. User satisfaction is concerned with users' appreciation of the reports, websites and support provided by the IS. It is important to note the duality of measures to distinguish real use from appreciation of use, as intense IS use does not guarantee user satisfaction. The third category includes only the Net benefits variable, which is the system's contribution to the success of individuals, groups, organizations, and industrial sectors. For the sake of parsimony, this variable was simplified, although, for some studies, finer granularity may be appropriate (Delone and McLean, 2003).

2.2 Evaluation of Capital Expenses

The second research field identified centers on the evaluation of capital expenses, which is mainly addressed in the accounting and finance literature. As this paper examines the evaluation of IS benefits, our analysis will be limited to capital expense practices. In this stream of research, the literature focuses not on IS investments alone but on capital expenses in general. Hence, researchers analyze the activities and tools used by practitioners in their capital expense management processes. Burns and Walker (2009) provide a sound synthesis of the available documentation on the subject by classifying 19 articles on capital expense management practices in American organizations between 1984 and 2008. In their classification, Burns and Walker (2009) identified the four stages presented in table 1: (i) Identification, (ii) Development, (iii) Selection, and (iv) Control.

Table 1: Burns and Walker's (2009) capital expense management stages.

Phase	Definition
Identification (stage 1)	<ul style="list-style-type: none"> ▪ Initiation of capital expense projects, in a continuous process and for ad hoc needs ▪ Hierarchical level of idea generation ▪ Identification and understanding of a formal idea submission process ▪ Identification of incentives associated with the generation of relevant ideas.
Development (stage 2)	<ul style="list-style-type: none"> ▪ Project proposal selection and transformation of ideas into proposals ▪ Data collection to justify projects
Selection (stage 3)	<ul style="list-style-type: none"> ▪ Workforce and practices to prioritize proposals ▪ Project approval
Control (stage 4)	<ul style="list-style-type: none"> ▪ Post-implementation project evaluation ▪ Identification of incentives associated with post-implementation evaluation

3 CONCEPTUALIZATION OF AN IS BENEFIT ASSESSMENT MODEL

3.1 Developing the Model

To initiate the conceptualization of the model, the literature on Delone and McLean's (2003) model was used. It should first be mentioned that Delone and McLean's is a variance model but the objective of our conceptualization is to obtain a process. Thus, we needed to return to the model descriptions in order to transform the variables into sequential components. Hence, our analysis grouped the variables of the model into three sequential components: Information system implementation, IS use and Net benefits. For the model conceptualization, the Net benefits component was divided into two to reflect Delone and McLean's 1992 model (Delone and McLean, 1992), which distinguishes between individual and organizational benefits. The decision to return to the previous format of benefits measurement was based on the fact that researchers have only succeeded in validating the link between the model's different variables and the individual benefits variable. Moreover, the financial literature used in our model does not measure individual benefits.

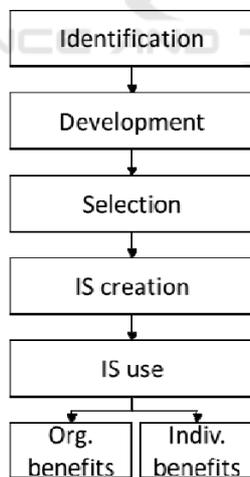


Figure 2: New conceptualization of IS benefits assessment.

Our analysis of the capital expense assessment literature led us to adopt Burns and Walker's (2009) four stages as presented above. The definitions of these four phases were then compared to the three components (adapted from Delone and McLean), leading to the discovery that three of the four stages

(Identification, Development and Selection) were not covered in Delone and McLean's models. In fact, their models are based on measures that characterize the information system once it has been implemented. Burns and Walker's last stage, Control, was integrated into organizational benefits, as their definitions were similar (Burns and Walker, 2009; Petter, Delone and McLean., 2008). Figure 2 presents the sequential model that integrates both perspectives.

3.2 Defining the Model'S Stages

This section will define each of the stages identified in the previous section. The definitions of the first three components outlined by Burns and Walker (2009) were retained. Hence, as table 2 shows, Identification comprises activities associated with the initiation and submission of projects by different stakeholders in an organization for planned or ad hoc capital expenses. Development covers the selection of ideas for projects and the transformation of these ideas into concrete proposals requiring elements of justification to feed the next stage (Selection). The third stage, Selection, includes the analysis of the different quantitative and qualitative justification elements and the project approvals to be conducted by the organization.

As mentioned previously, the next three stages of the model originate from Delone and McLean's (2003) work. The definition of the IS implementation stage is the same as Delone and McLean's, which includes System quality, Information quality, and Service support quality. The IS use stage groups two of Delone and McLean's variables: Use of IS and User satisfaction.

Finally, the approaches to establish the benefits are different. At the individual level, the user's absolute appreciation of the system is measured, whereas at the organizational level, an improvement is required compared to the initial situation (old or no IS in place). Furthermore, Delone and McLean's original 1992 configuration directly relates the Organizational benefits variable to Individual benefits (Delone and McLean, 1992). A distinction is therefore essential as the Individual benefits component is important but insufficient to explain the Organizational benefits. Optimal use of a system is possible without making a significant contribution at the organizational level.

The Individual benefits component was therefore defined based on Delone and McLean's (1992, 2003) most commonly used validation measures (Perception of usefulness, Perception of success,

Processing speed/delay, Improved decision making, Quality/ accuracy of the output). For the Organizational benefits component, only the elements associated with capital expenses were used, as the literature arising from Delone and McLean's model did not demonstrate a significant relationship with this variable.

Table 2: Definition of the stages of the IS benefit assessment model.

Stages	Elements of definition	Source
Identification	<ul style="list-style-type: none"> • Project initiation • Project submissions 	Burns and Walker (2009)
Development	<ul style="list-style-type: none"> • Selection of ideas • Project justification 	Burns and Walker (2009)
Selection	<ul style="list-style-type: none"> • Quantitative and qualitative analyses • Project approval 	Burns and Walker (2009)
Information systems creation	<ul style="list-style-type: none"> • System quality • Information quality • Service support quality 	Delone and McLean (2003)
IS use	<ul style="list-style-type: none"> • System use • User satisfaction 	Delone and McLean (2003)
Individual benefits	<ul style="list-style-type: none"> • Perception of usefulness • Perception of success • Processing speed/delay • Improved decision making • Quality/accuracy of output 	Delone and McLean (2003)
Organizational benefits	<ul style="list-style-type: none"> • Quantitative analysis • Qualitative analysis 	Burns and Walker (2009)

4 RESEARCH METHODOLOGY

The use of a new conceptualization, combined with the limited literature on IT capital expense practices and the unclear distinction between the phenomenon and the context, justifies the case study approach (Yin, 1994). This methodological approach enables researchers to retain the holistic, meaningful characteristics of real-life events (Yin, 1994). The unit of analysis in this study is the process, which also makes the case study approach appropriate to collect data.

A five-step methodology was followed in this research initiative. Organizations and respondents were selected and sampling was done at both levels. Selection criteria were defined to ensure adequate

information quality and to validate the subsequent research results (Patton, 2002). Data collection was then conducted via semi-structured interviews and document analysis to guarantee triangulation of the data (Yin, 1994). All interviews were recorded and transcribed.

In the third step, data analysis, narrative and graphical representations of the process were created. An example of a process (organization B) is presented in Appendix 1. A mixed interpretation strategy was used at this step to analyze each case individually (Langley, 1999). To identify similarities and differences in the process and develop a process model, a cross-case data analysis was then conducted so we could understand and validate the process applied by the organizations (Eisenhardt, 1989). Finally, to validate and understand the results of the research, interviews were conducted with the respondents from each company involved (Eisenhardt, 1989).

4.1 Description of the Cases

Three organizations in different sectors with annual capital expenses between \$5 million and \$50 million were selected to conduct this research.

Organization A, which employs more than 6,000 people in the aeronautic sector, with service points and manufacturing sites in America, Europe and Asia, has a \$25-million to \$50-million IT capital expense budget. Respondent A, director of global infrastructures, supervises the IT capital expense evaluation process, from the initiation of IT projects to their completion. The physical infrastructure and applications to support activities are the main elements of the IT capital expenses.

Organization B is a manufacturing company that employs 3,000 people at six sites in Canada. It has an IT capital budget of \$25 million to \$50 million and is controlled by an American conglomerate that has establishments in 30 countries. The role of Respondent B, vice-president of IT, is to supervise the entire IT capital expense evaluation process and to ensure the respect of corporate IT policies for all worldwide IT projects. IT capital expenses in Organization B are centered on physical infrastructure and applications to support transactional, administrative and logistic activities at the different manufacturing sites.

Organization C, a large manufacturing firm with 30,000 employees worldwide (North and Central America, Europe and Asia), has an IT capital budget of between \$5 million and \$10 million. Respondent C, vice-president of information technology/business

applications, is responsible for the activities related to the implementation of new applications and transformation of existing applications. IT capital expenses concentrate on infrastructure investments, network technologies and applications to support administrative and transactional activities worldwide.

5 FINDINGS AND MAIN RESULTS

In this section, the IS benefit assessment model presented previously (figure 2 and table 2) is compared with the processes followed in the three organizations and particularly with the common routines of the different organizations' processes. The result of this analysis is a five-stage process presented in table 3 and described in the following sections.

Table 3: Comparison of the stages of the IT capital expenses process.

	Activities		
	Organiza- tion A	Organiza- tion B	Organiza- tion C
1.Project identification	Identification of initiatives	Project identification	Project identification
2.Proposal development	(included in next stage)	Project analysis	Development of project summaries
3.Proposal selection	Proposal selection	Proposal selection	Proposal selection
4.IS creation /use	Project implementation	Project implementation	Project implementation
5. Individual benefits	-	-	-
6.Organizational benefits	Project closure	Ad hoc analysis (top management perception)	Ad hoc analysis (top management perception)

5.1 Project Identification

When comparing the three organizations' assessment processes, the first element involved the project identification plan; all organizations had activities leading up to the identification of IT projects. There are few such activities and all are included in this first stage of the IT capital expense evaluation process.

5.2 Proposal Development

This stage, which is defined as the activities that establish the nature and impact of IT projects, is also found in all three organizations. A specific proposal development stage exists in Organizations B and C. In Organization A, proposal development is included in the selection stage.

The results for this stage were categorized in three parts: descriptive project information, impact analyses and stakeholders concerned by the proposal development processes.

All three organizations document project-specific information during the IT capital expense process. The elements used to describe IT proposals are very similar in all three. A total of eight elements were found for this specific part of the stage: brief project description, client identification, link with corporate strategy, internal resource evaluation, external cost evaluation, operational cost assessment, relationship with other projects, and calendar.

Two kinds of impact analyses are carried out: qualitative analysis and quantitative analysis. All three organizations conduct qualitative analyses on proposals by listing the potential benefits for the organization. The three organizations use different quantitative return on investment tools. However, the respondents indicated that these quantitative analyses faced major hurdles linked to specific benefit assessment in a project portfolio context and also to the evaluation of the opportunity cost related to technology upgrades. For instance, Respondent B mentioned:

There is a project analysis that is done in terms of cost and benefits. [...] Establishing a cost for a project at a global level and establishing the benefits as well – it is not always obvious.

Along with the IT group, operational and administrative groups are generally involved in the proposal development stage. Proposals that originate from operational and/or administrative groups are generally business-oriented but require support from IT. Proposals from the IT group are usually related to the improvement and maintenance of the IT infrastructure.

5.3 Proposal Selection

All three processes include a proposal selection stage. In this stage, the selection process identifies the proposals that justify the annual IT capital expense budget, as indicated by Respondent B:

We have preliminary evaluations of different projects for costs and for benefits. All of these projects are then moved into a group of projects that are IT and non-IT. A committee looks at them, categorizes the most important things and approves an annual list of projects.

Two specific elements stood out from the analysis of the different interviews – proposal prioritization and IT capital budget allocation – which are described below.

Proposal Prioritization

The group responsible for proposal development in Organization A also has the responsibility to conduct the prioritization exercise, which is then validated by top management. In Organizations B and C, prioritization is the job of top management. To better understand the logic behind this choice, Organizations B and C were analyzed in detail.

In Organization B, the set of proposals for the organization is selected, as the respondent explained:

The vice-presidents will for sure look at the big projects, and all of the other small projects ahead of them may be decided by individuals as well. Therefore, the VPs might decide on the ten biggest projects, and in Canada, there are not only IT projects. There are several types of projects in our company. And IT, it's just one component among others [...] So, at a certain time, all these projects will collide. We created a committee that tries to manage the ten largest global and local projects.

These comments from Respondent B also show that top management prioritizes the most important projects; less important projects are prioritized in the organization's departments. Respondent C mentioned that the prioritization process is more a question of maturity than a prioritization strategy choice:

We don't have measures that move forward from one project to another. Right now, we use the measures that we are able to obtain. I mean that, for one project, there are certain things that we are able to measure, and for other projects, we measure something else. Then yes, when comes the time to prioritize, sometimes it is a bit difficult because we're comparing apples to oranges, but I can see that there may be a tendency emerging for which, with the new management team, we will try to set more global criteria. We recently talked about

standardizing projects so that we could have a more common base to evaluate projects more easily when we compare them.

Considering these two perspectives, the selection of a prioritization strategy seems to be based on the scale and coverage of the prioritization process along with the level of maturity of selection activities.

IT Capital Budget Allocation

As described above, Organization B allocates its IT capital budget during a global capital allocation exercise. For the other two organizations, a preliminary global capital budget is allocated before the selection process since targets are defined specifically for IT capital expenses. Respondent A explained how the activity is carried out in that organization:

Usually, the firm will try to keep a standard level because, for most companies, the IT side is an overhead cost. So, everything is charged back to the production groups, and we see if there is an increase directly linked to the manufactured product. Then, we try to have something more stable for that.

5.4 IS Creation/Use

It was no surprise to find that all three organizations consider project implementation to be a crucial stage in their IT project assessment process. However, the organizations do not distinguish between creation and use in their evaluation process since project implementation practices always involve activities associated with system use. As this research initiative did not have the objective of exhaustively analyzing implementation practices, these activities were not studied in depth.

During the discussions of IT project implementation, all the respondents mentioned the existence of a Project Management Office (PMO) in their organization to control their projects. According to the data collected, a PMO is necessary for IT project management, as Respondents B and C stated:

We have the concepts of business partner, project link and project manager. We have a structure that is not deployed in the rest of the organization, but I think that we won't have a choice about adhering to a specific methodology, because projects are becoming more and more complex and because there are more and more functions. Plus, the

stakeholders are both internal and external because we outsourced certain functions. It's the coordination of these stakeholders that makes the PMO inevitable in my view. I was very skeptical myself when we created the PMO. (Respondent B)

There is another position that we created three years ago, Head of the PMO. Under this person, project managers operate in a matrix, but they really made a difference at the execution level. Before, we didn't have these things, but now we develop project budgeting management practices. We put project schedules in place based on effort. We also put performance measures in place for these projects at a performance index level and a cost level.. (Respondent C).

5.5 Individual Benefit Evaluation

After we analyzed the data, it was clear that user benefits and individual evaluation were not mentioned by any of the respondents. This fact was confirmed during the validation interviews, as the respondents did not consider user perspectives appropriate for evaluating IS benefits at the organizational level. The respondents justified this approach by the negative reaction of individuals to change. Users react more strongly to the impact of the technology on their own tasks than to the impact on the organization. The respondents presumed that top managers have a better feel for the overall situation, which enables them to identify the advantages after the adaptation period. This stage is therefore not included in the model.

5.6 Organizational Benefit Evaluation

The literature on capital expense assessment practices mentions that few capital investment projects undergo post-project analyses. Our results demonstrated the absence of systematic post-project validation of pre-implementation evaluations in all three organizations. However, evaluation mechanisms are present in two of the three organizations, which are based on top management perception, the nature of the IT projects and other success criteria. These elements are presented in the following paragraphs.

First, the evaluation and control activities identified in Organization B are executed only if top management has doubts about the success of a project. Respondent B highlighted this particular finding:

When political questions emerge for certain deliverables, analyses are carried out.

We therefore presume that, in these organizations, IT projects are a success if top management seems satisfied with the solution implemented. Perception of IT performance seems to be the most important IT success factor, as Respondent C stated:

If you did it and it works, OK, nobody says anything [...] but if it does not work, then you'll hear about it.

Organization A decided to set up IT success evaluation mechanisms by identifying success criteria other than the ones identified during the pre-implementation analyses. Hence, Organization A identified a set of tangible success criteria in order to take the nature of projects into account. Respondent A mentioned:

I have a goal, but what are my success criteria? What will tell me that I succeeded in that, and that I was successful with my project? Do you know that I delivered 1,500 telephones, that I updated everybody to PCs that are less than four years old? What are my success criteria?

Pre-implementation evaluations do not seem to be aligned with the post-implementation evaluations. During our validation interviews, we questioned the respondents on the reasons for this incoherence between the measures used before and after the projects. Overall, we noticed that the executives' lack of motivation and willingness to measure the success of IS mainly explains this incoherence.

6 CONTRIBUTIONS AND FUTURE RESEARCH

6.1 Contributions

The process model developed during this study contributes to the evolution of the IT benefit evaluation field by combining the literature capital expense and IT benefits. The model, which displays how organizations evaluate success when selecting and implementing an information system, also has practical implications as it identifies the best IT/IS assessment practices that management of organizations can use to better assess their information systems.

The model also explains the validation problem

identified by Petter, Delone and McLean (2008) by confirming that end users do not accurately perceive the impact of IS use on an organization, which suggests that management's perception should be used instead to capture this impact.

6.2 Research Limitations

The first limitation on our research is a result of the qualitative approach we used, which we chose due to the richly detailed information it provides. This choice led to a sampling strategy using just a few organizations. The conclusions of this research might be different with a larger number of organizations, but our methodological approach and the importance of the identified routines allowed us to achieve the desired semantic and theoretical saturation.

During the data analysis, the two data analysis strategies we used to reach our research objective also involved the limitations identified by Langley (Langley, 1999). With the narrative strategy, the richness of the data presented prevents the development of a simple or generalized theory. This explains why we combined a narrative strategy with a graphical visualization strategy, which simplifies the interview data in order to generate a sequential model. This combined strategy makes it impossible to identify factors that influence the process's activities or to predict the presence (or absence) of certain activities.

6.3 Future Research Avenues

A first avenue of research may be the development of a theoretical model, as we limited our literature review to Delone and McLean's (2003) model and to IT capital expense evaluation practices. It would be relevant to explore the literature in other related fields such as IT productivity or project management.

Hence, the conceptualization of the proposed model could be improved by increasing our understanding of the stages of the model or by identifying new ones.

A quantitative validation of the model also represents a natural research avenue since the qualitative approach limits the generalizability of the results. A quantitative approach could quantify the importance of the different components of the model, which we were not able to do in this study.

Finally, our analysis of the organizational benefit evaluation component demonstrates the absence of validation of ex-ante assessments after IT use. This

situation also seems to give rise to new initiatives to measure IT project success after implementation. A study to identify the obstacles to post-project evaluation could be developed to understand the reasons for the lack of evaluations, but also to identify obstacles and measures used by the few organizations that do carry out post-project evaluations.

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