Designing local evaluation models for IT investments

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ABSTRACT

In this paper a approach towards designing an evaluation model is described. Although many methods have been proposed to aid in the evaluation of IT investments, they fail to take into account local language and the many locally based conventions, priorities and strategical goals in organizations. In response to this an approach for 'local for local' design of evaluation models is presented. These models cannot be solely based on financial arguments but will also include non-financial arguments. To support this process a framework containing the most relevant criteria is presented.

DESIGNING LOCAL EVALUATION MODELS FOR IT INVESTMENTS

1 Introduction

Investments in information technology (IT) are large and increasing. They constitute up to 50 percent of the capital expenditures of large organizations (Earl, 1989; Davenport and Short, 1990; Keen, 1991). Information systems (IS) are not only used in administrative and decision making tasks but are changing the shape of production processes and enable the development of new products and services. Recent empirical studies show that organizations have several difficulties with the evaluation of IT investments (e.g. Hochstrasser and Griffiths, 1990; Bacon, 1992; Farbey et al., 1992; Yan Tam, 1992; Willcocks and Lester, 1993). A number of causes can be identified. Because information systems are often for a great extent integrated in the organization, it is difficult to establish the boundaries of the system. For instance, which user costs of a new electronic mail system should be considered in an investment proposal? Another possible cause is the ongoing dispute on the relevant decision criteria. How should for instance long term consequences of an IS investment be incorporated? An example of this is the contribution of a database management system to the realisation of data infrastructure in an organization.

Many methods and techniques have been proposed to assist in the evaluation of IT investments. Already in 1961 the International Federation of Information Processing devoted its first conference to evaluation issues (Frielink, 1961) and in 1968 Joslin wrote his book on computer selection (Joslin, 1968). However, the current methods all prescribe a standard and rigid set of evaluation criteria[1]. It is our contention that an evaluation model for IT investments should reflect local organizational circumstances and local language in use in an organization. The purpose of this paper is to present an approach for the design of locally based evaluation models. This approach is based on research in Eindhoven University of Technology on 'local for local' methods for professionals in the IS management field and the evaluation of IT investments.

The structure of the paper is as follows. First, Section 2 introduces and elucidates the main features of the 'local for local' design approach. Next, section 3 sketches a picture of the structure of an evaluation model for IT investments and gives an overview of the predominant criteria as suggested by current methods, while section 4 is devoted to ways in which a resulting evaluation model can be used. Finally, section 5 gives our concluding thoughts.

[1] The set of evaluation criteria is what we refer to as the evaluation model.

2 Design approach: 'local for local'

In this paper we advocate a local for local design approach. This section goes further into this notion. When introducing a method aimed at supporting IT management in an organisation it is important to take into account the specific local circumstances. Often the introduction of this type of method fails when a fit between method and organisation is missing. This can be explained by looking at the people, the processes and the product involved.

People:
More and more the people involved with IT-based systems can be typified as knowledge workers, or as professionals. Characteristics of this type of person are:

- they rely mainly on their own knowledge, experience, and education when carrying out their task,
- they often use a peculiar type of language, specific to their profession, and also to their organisation,
- they accept authority only if it is based on acknowledged experience and knowledge.

Another characteristic in this area is that we are not dealing with one single person, but that a (quit often large) number of people is involved who will each have their own responsibility, background and purposes.

Product:
An IT-based system is largely an invisible product. It is nearly impossible to describe these systems in an adequate manner. Any description will only cover one or a few of the many aspects that have to be covered in order to get a complete overview of the system.

Process:
The information system development process, as well as most processes involving the use of IT-based systems have in common that they rely on human performance as the main production factor. It is most of the time nearly impossible to obtain a proper insight in productivity, let alone that an objective evaluation of this productivity is possible.

Given these characteristics a number of key issues can be derived which have to be kept in mind when designing and introducing management support methods. Wholehearted support from professionals might be obtained by invoking authority. However, given the nature of the personnel involved an approach based on obtaining the *commitment* of all staff involved is bound to provide better results. Especially since the activities involved are so susceptible to subjective influences due to the immaterial nature of the product

involved and the intangible nature of the development process. Commitment is a many facetted notion and we will not lay claim to a recipe to induce it. However, it can be safely said that a necessary (but not sufficient) requisite for attaining commitment is taking people (especially professionals) seriously. Accept their evaluation of a given situation and work with realistic targets that are accepted by all. This in turn depends on locally defined and accepted methods and definitions.

As was mentioned, the processes we are discussing involve people with different areas of knowledge, different goals and different backgrounds. They have to work together in an effective and efficient team. Essential for this is that a suitable form of *cooperation* is brought into existence. This makes *communication* a key factor. Communication relies on the willingness of people to participate (see commitment), and on a consistent and general accepted usage of language. Given the diversity of people involved and the specific circumstances that reign in each organisation this indicates a heavy emphasis on a locally defined set of definitions that is known and accepted by all involved people.

This leads us to a first aspect of the 'local for local' design approach. When adopting an evaluation model a requirement is that the language used in the model is not only communicated to all people involved, but also is accepted and used by all. Introducing new terminology is a possible, but very risky approach. It is less risky to adapt the usage of language in the model to the local definitions and jargon that are currently in use in the organisation. Adoption will therefore always be equal with adaption. It will not suffice to carry out this exercise once. Circumstances change, people leave the organisation and new staff is hired. This means that continuous attention will have to be paid to keeping the fit between actual local usage of language and the terminology used in methods and tools intact.

Adoption of local language is one, but not the only result of the 'local for local' approach. Any evaluation model will contain a number of criteria which guide the final decision. Cost as well as benefits can partly be expressed in monetary terms. This criterion (money) will always play a major part in the decision making process. However, given the often indirect in which information systems can benefit or disrupt an organisation the sole use of money will often not paint a sufficient correct picture. Therefore, most of the models that are found in literature provide several other criteria that together with monetary costs and benefits provide a more complete picture.

If we look at these models we notice that many different criteria are presented. There is obviously no agreement as to which criteria should be used. This dovetails with the local for local notion we embrace. It is our contention that the lack of agreement as to which criteria should be used is not the result of insufficient theoretical insight into factors influencing an IT investment decision. It is more likely the result of the different

circumstances in which different organisations find themselves which dictate that other arguments have to be used to underpin an investment decision.

Take for instance an organization that operates on a highly competitive market. Arguments that a system will help to attain a (temporary) competitive advantage or to redress the success of efforts by the competitors will be very relevant. An unthreatened market leader will have other priorities. So will a non-profit organisation. They might be more interested in better management support, or in improving working conditions of their employees. A public sector organisation will have to consider the possibility of political pressure as a major criterion when deciding the acceptance of a project.

Listing all these criteria and using them in all situation is not a feasible option. An evaluation model that takes into account different criteria that are measured on different dimensions cannot use a large number of criteria. The evaluation of IT investment proposals and the setting of priorities between proposals is, in the end, a management responsibility. They will have to weigh the proposals on the criteria used. Too large a number of criteria will obscure the issues and. Such a model cannot therefore use more than a few criteria.

This in its turn means that each organisation will have to decide which criteria will be used in the evaluation process. This choice, once taken, is not carved in granite. Circumstances may change. It is therefore wise to re-evaluate this choice every few years to see if it still fits in well with the situation in which the organisation finds it self.

A final consequence of the local for local approach is the way the results are presented. As was mentioned above, in the end it is senior management that will have to take the decision. The way in which the results of the model are displayed can influence this decision and will therefore have to be handled with care. It can be taken for granted that the way the results of the model are presented have to be adjusted to the personal preferences of the people working with the model. Many models found in literature do not take this aspect into account and rigidly prescribe a single presentation method. Needless to say, we do not agree to this single minded approach.

The following might serve to illustrate the notions described above. A typical example of an evaluation model is de one developed by Parker, Benson, and Trainor (1988). This widely known model provides a number of possible methods of expressing costs and benefits in monetary terms. Also several non-monetary criteria and risks are presented. We have in our direct environment encountered three implementations of the model. They involved a government department, a large insurance company, and a large manufacturing firm. In each case it was found to be necessary to adapt the model to the specific circumstances in which the organisations found themselves. These changes were made in

the usage of language, in the method of presentation as well as in the criteria used. Others have experienced the same (Oosterhaven, 1992; Wiseman, 1992).

3 The structure of evaluation models for IT investments

Different authorities have given an overview of evaluation methods (see e.g. Powell, 1992; Farbey et al., 1993; Renkema and Berghout, 1994). The purpose of any evaluation method is to establish some sort measure of value of an investment. At the heart of an evaluation method lies a set of evaluation criteria. This set of evaluation criteria is what we refer to as the evaluation model. At the feasibility stage of an IT project the evaluation model aims to support the decision whether to go ahead with the proposed investment by means of an assessment of the expected value. Later on, the evaluation criteria can be used to control and manage the value of the investment.

As was mentioned above, the different models do not all use the same criteria and often give different interpretations to common criteria. It is however possible to provide a picture of the structure of an evaluation model by means of the type of criteria taken into account. This structure can be used as a starting point when designing the local model. This picture is summarized in the following table:

Criteria	**Positive**	**Negative**	**Uncertainties**
Financial	Earnings: - unique - recurring	Expenditures: - internal - external	
Non-financial	Positive contribution	Negative contribution	Risks

Table 1: The structure of an evaluation model

A distinction is made between *financial* and *non-financial* criteria. Financial criteria are the consequences of the investment that can be expressed in monetary terms. Non-financial consequences can not be expressed in monetary terms. For the latter we use the notion *contribution.*

Earnings refer to positive, incoming cash flows. A further distinction can be made between earnings that occur once only and earnings that re-occur on a regular basis. An example of the first type is a lower stock level made possible by a new stock control information system. The reduction in stocks frees an amount of money on a once only

basis. The same time this can generate an recurring earning if the money released is invested profitably.

Expenditures are the negative, outgoing cash flows. In accordance with the capital budgeting literature (see e.g. Brealy and Myers, 1988; Fox et al.; 1990) we contend that a sound financial evaluation of a proposed investment should be based upon an analysis of the cash flows arising from the investment. Another negative financial criterion is formed by the effort that is spent within the organisation. If several of the organisations fixed complement work full time on an information system development project maybe no direct outgoing cash-flows are generated, but certainly 'costs' are incurred. Both types of criteria should be included in the evaluation process, however often in such an evaluation these 'internal' costs will weigh less than the better visible external costs.

The assessment of the consequences of an IT initiative can be seen as sort of estimation. One can however never be sure that these expectations are actually realised. The uncertainties regarding the expectations are expressed in measures of *risk* surrounding the investment.

Finally there are the negative and positive *contributions,* a very diverse group of criteria which form the distinguishing characteristic of most evaluation models found in literature. That these non-financial criteria are added to the model does not mean that they are totally unrelated to financial gains or losses. However the link, although undoubtedly present, is too tenuous to express in monetary terms. Examples are 'increased customer service' and 'competitive advantage'. These will in the long run have a positive effect on the financial health of the organisation, but expressing that impact in dollars and cents will yield very uncertain results that will obscure the evaluation process. Therefore this type of criterion is added as a separate factor into the evaluation model.

We now have outlined the main building blocks of an evaluation model. All of the methods that have been proposed for the evaluation of IT investments are in some way or another composed along this lines. These models differ with respect to the type of criteria taken into account (see Table 1) and the number of criteria that are covered by a type of criterion. In our view, a local evaluation model should reflect the local language and local circumstances.

Building upon this structure of an evaluation model of the previous section it is possible to design an evaluation model that fits the actual priorities in a particular organisation.

A local evaluation model should at least account for the financial consequences of the proposed investment. Table 2 presents an example of a framework to support this financial analysis. In it on the expenditure side a distinction is made between the type of

expenditure (internal versus external), the main activities that have to be accounted for, and the main cost factors that in the end explain the expenditure.

On the positive side, a distinction is made between unique and recurring earnings. Recurring earnings will have to be discounted in some way that ties in with the accounting practices of the organisation. To further assist the elicitation of earnings a number of areas and factors is presented in table 2. The balance of earnings and expenditures is input to the calculation of the financial return of the investment.

Financial criteria: expenditures		
Type of expenditure:	Activities:	Cost factors:
• Internal • External	• Development • Training • Implementation • Operations • Maintenance • Security • Phasing out	• Staffing • Hardware • Software • Consultancy • Travel • Printing • .....
Financial criteria: earnings		
Type of earnings:	Area of earning:	Earning factors:
• Unique • Recurring	• Efficiency • Effectiveness • Organisational transformation	• Cost savings • Time savings • Increased output

Table 2: overview of financial criteria

Non-financial criteria: contributions		
Type:	Category:	Examples:
• Positive • Negative	• Effectiveness	- product/service quality enhancement - increased customer service - increased market share - management information and decision making - improved communications - competitive necessity - competitive advantage
	• Transformation	- new markets and products/services - influencing the value chain - redesigning the business processes
	• Technology	- technological necessity - technological flexibility - infrastructure availability - integration and standardization
	• Compliance to external necessities	- political pressure - legal necessity
	• Wider human and organizational impacts:	- new work contents - organizational learning - political and cultural impacts - organizational structure

Non-financial criteria: risk	
Main risk area:	Examples of risk factors:
• Development risks	- commitment of stakeholders - application risk - technological risk - development staff - external suppliers
• Implementation risks	- resistance to change - lack of application knowledge - conversion
• External risk	- competitive risk - structural economic risk

Table 3: overview of non-financial criteria

Next to the evaluation of the financial consequences, we have to take into account non-financial criteria. The contributions account for the non-financial consequences, while risks provide a measure of the uncertainties surrounding the investment. The contribution of the investment can be valued both positively and negatively, depending on the goals and strategy of the investing organization. A selection of relevant non-financial criteria will have to be selected. The local priorities of the organisation will have to guide this selection process. The number of criteria that is added to the model will have to be limited otherwise the evaluation of the proposed investment will be nearly impossible. In table 3 an overview of non-financial criteria is presented. Its is based on the predominant criteria that have been proposed by the current methods[2] that have been described in the literature.

The resulting model provides a structured method to describe the financial and non-financial implications of IT-investment proposals in such a way that comparison is possible. The final section will look at the ways in which such a model can be used.

4 Use of the model

The model as finally designed can be used for obtaining insight in a specific project proposal. It also can be used by top management to evaluate and rank a number of projects in a consistent way. Each possibility will now be considered.

Evaluation of a single project
When evaluating a single project proposal use of the model will help to bring about a structured discussion between users and developers in an early stage of development. Such a discussion will give insight into the expectations that exist among the people involved and might get rid of some faulty assumptions. Often problems during development and introduction of a system are caused by the fact that developers and users do not agree on goals and starting points (Genuchten and Koolen, 1991). Early detection of these differences in opinion will prevent problems later on.

The idea behind this type of model is that several parties are involved in making the analysis. Together they have to come to an agreement as to the costs and benefits that they are likely to incur. The final analysis will have to be based on a consensus. Not only will this increase the mutual understanding, it also will raise the commitment towards to project.

[2] Different Dutch researchers in the universities of Delft, Eindhoven and Amsterdam identified over sixty methods, that all aim to be of help in the evaluation of IT investments (Swinkels and Irsel, 1992; Berghout and Renkema, 1994).

The model analysis also can be used as a basis for project control. It is an explicit statement of the goals that are to be attained. It also puts down in writing some of the assumptions that underlying the project. If any of these assumption change this will most of the time mean that either the required quality cannot be achieved or that the budget will be exceeded. With the analysis as a guideline it is now again possible to enter a structured discussion in which the pro's and cons of any proposed solution can be weighted.

Finally the results of the analysis can be incorporated into an experience database where the data will be available for the analysis of future projects.

Comparing and prioritising project proposals

The second application area of this type of model is the consistent evaluation and ranking of project proposals by top management. They will have to indicate in which phase of system development they want to evaluate a project. On the one hand they will want to carry out this evaluation as early as possible to prevent money and resources being spent on a project proposal that might never be carried out. On the other hand one has to take into account that a proper evaluation is possible only after sufficient data have been gathered and consequently a sound judgement has been made possible. Furthermore, the moment of evaluation also will vary with the size of the system. For a large proposed project more time and effort will have to be spent if one is to obtain sufficient information to base a decision on. It is advisable to evaluate a large project several times, for instance after the preliminary analysis and after functional design. Organisation related factors will have to decide when to perform this evaluation.

Given a set of proposals it is now the task of top management to rank the proposals on the basis of expected costs, benefits and risks. The main problem here is assessing the relative importance of the various non financial criteria. The explicit assignment of weights to these factors might be a useful method. Other possibilities are the use of ratio's, and the use of (graphical) portfolio presentations. Final judgement on a project will have to be made by balancing expected benefits on the one hand versus costs and associated risks on the other hand. Final ranking of the projects can never be a mechanical process but will remain a management decision, based on incomplete information. The advantage of using this type of model is that uncertainty is reduced as much as possible and that all proposals are described in a consistent uniform way.

5 Conclusions

In this paper an approach towards designing an evaluation model was described. These models cannot be solely based on financial arguments but also will include non-financial arguments. To support this process a framework containing the most relevant criteria was presented.

We started with the observation that although many methods have been proposed to aid in the evaluation of IT investments, they fail to take into account local language and the many locally based conventions, priorities and strategic goals in organizations. In response to this an approach for 'local for local' design of evaluation models has been presented. We argue that such an approach offers a new and challenging way to commit stakeholders in the evaluation process, to improve communication between them and to assure their cooperation. This in turn is a prerequisite for effective and successful evaluation of the impacts and implications of new IT initiatives.

That such a model has been developed and tested in a particular organisation does not mean that it is then finished. It is to be expected that during use in practice changes will occur. Within the organisation responsibility will have to be assigned for the maintenance of the model. By not fixing the model but by keeping the options for change explicitly open it is hoped that it will evolve together with the organisation and that a future mismatch may be avoided.

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