

# Thinking about the processes used when organisations select and evaluate Software: Operationalising ICT Evaluation theory

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## Abstract

*This paper looks at the contemporary research and theory on ICT evaluation, as well as other areas of IS theory and aspects of ICT, which may also be relevant to the evaluation of ICT. The purpose of the research being proposed is to gain a deeper understanding of the processes which are used by organisations, when they are evaluating software. The current literature lists methods which are used when the processes have finished being ranked and a single number or a small series of ratings is given, but there seems to be little explaining the manner in which these numbers are reached. Another aspect where there also seems to be little work is contemporary research in testing the available literature on evaluation methods. Part of the argument being made is not that there is a problem with the methods, but that literature also is available which discusses the importance of ICT alignment, Governance, Security, Architecture, best practice frameworks, and existing ICT, which is not fully considered in the ICT evaluation literature. The purpose of looking at these areas of literature is that while these aspects of ICT theory have been developing and the areas of ICT evaluation have also been developing, to a large extent they seem to have been developing independently*

*The paper then looks at the gaps in knowledge of the evaluation of compromise, between the need to evaluate in a timely manner and due diligence, against a depth of looking into the evaluation process. The political and reactionary measures affecting ICT evaluation are also considered. Finally a research methodology is proposed for the research.*

## Introduction

Although many organisations evaluate various options before selecting a software environment there is little current literature, which details the processes followed by organisations when they are going to evaluate software environments. There is literature which lists methods which are used when the processes have finished being ranked and a single number or a small series of ratings is given [1] but there seems to be little explaining the manner in which these numbers are reached. Another aspect where there also seems to be little work is contemporary research in testing the available literature on evaluation methods. Part of the argument being made is not that there is a problem with the methods, but that there is literature which is also available which discusses the importance of ICT alignment [2], ICT Governance [3, 4], ICT Security, ICT Architecture [5], considerations in the adoption of ICT, just to name a few as well as newer best practice frameworks such as COBIT [6, 7] and ITIL [8], which give metrics and guidance in the acquisition and ongoing fit between ICT being considered and existing ICT. Literature also comments on the development of a strategic plan [9], and on the lack of a purposeful plan that is carried out from start to finish [10]. Drivers behind the decision or desire to achieve value have also been researched [11]. As well as further consideration that possibly needs to permeate the discussion in the processes of evaluation and selection, is the lack of time that is available for ICT attention by the Senior officials of an Organisation. If a Board will not discuss issues unless they involve greater than \$10 Million dollars or don't understand the impact and business risk, or how to drill down into an ICT decision then where is the direction, process and decision being made [12]?

The purpose of this paper is to describe part of the literature which is relevant and identify the issues involved in traditional ICT evaluation and the issues when considering alternatives to evaluation. Based on this analysis a method of enquiry is proposed for the investigation of which processes are used when organisations evaluate software and ICT.

## ICT Evaluation

There has certainly been work on the use of evaluation methods of ICT. [13] is an edited book on the subject, a PhD Thesis [1, pp 22, and 28], lists 82 methods of ICT evaluation techniques, with references, as well as a table which divides them into three categories, the Financial, Quantitative and Qualitative methods of IT evaluation techniques. Financial methods include Accounting Rate of Return, Net Present Value, Return on Investment and Time savings times salary. Quantitative methods include the balanced scorecard, Bayesian Analysis, Information Economics, Measure the Benefits of IT Innovation, and Value Analysis. Qualitative methods have as examples Bedell's method, Critical Success Factors, Functional Analysis of Office Requirements, Prototyping, Strategic Application Search, Value Chain Assessment and Ward's portfolio analysis. Although some of the techniques described come from papers published in 1999, many of the methods were developed in the 1980's or early 1990's.

Although not a complete list [1], it is a comprehensive list of the evaluation techniques available in the year 2000. These techniques also only produce an end result, each of them gives an indication either about how to rank completing projects or the financial result that the ICT, (generally) project will have on the Organisation. How the organisations derive the information is not dealt with in depth. This is similar to the comments made about Business Process Reengineering, [14] where the authors look into the literature on BPR and describe how the literature deals with the 'as-is' or pre BPR processes, and then gives the 'to-be' processes, but the literature does not present a detailed description of how the transformation is achieved. Literature specific to IT Evaluation, is given in a paper analysing eleven years of papers to the European Conference on IT Evaluation [15], which comments on the lack of detail in and of evaluation methods, except generally in the form of books, but the authors do comment that this could be due to the lack of space for publication in journals or conferences.

A second PhD thesis, [16] investigated the employment (the term employment was used to avoid the word adoption, and was given as " 'initial uptake and continuous use' of an IT evaluation method" [16, p 25]). The purpose of the thesis being "to understand how the *process* of employment of IT evaluation methods occurs" [16, p 23]. In the literature review several evaluation methods were identified that have been created in the last decade, some for general application, some for specific application. Another issue raised in the literature review was the more prevalent use of the methods in *ex ante*, or before the implementation as opposed to the use as well of *ex post* methods, which would be after the implementation.

When looking at the appropriate methods of use in *ex-ante* IT/IS investment evaluation [17], argue that IS evaluation should move from traditional capital budgeting processes because this has created a basis of consumption in the evaluation, without looking beyond. The paper gives a frame of reference for different taxonomies in appraisal, showing the characteristics, the involvement of financial appraisal, and the limitations in the techniques. Six taxonomies for appraisal are given; Analytic Portfolio, Strategic, Economic Ratio, Integrated, Economic Discounting and Other Analytic. Each taxonomy, contains subdivisions, for a total of seventeen appraisal techniques, the majority referenced before 1995, with only two referenced after 2000. Although this is likely because the paper itself was published in 2002, however, there again seems to be a lack of literature describing techniques that are described or build explicitly to deal with the post internet time period, or literature which tests the adequacy of the past techniques. The paper also seeks to discuss the use of different types of the taxonomy to match to different organisational levels of IS

planning and evaluation, these being Strategic, Tactical and Operational. These levels match to different organisational aims and scope thereby better matching to different investment appraisal techniques.

## **Other Considerations in evaluation**

Although there is literature on the use of many methods in the evaluation process of ICT, there are also other theoretical areas including methods and frameworks developed by practitioners that present themselves as part of either the evaluation phase or that are considered to be de rigueur in achieving organisational value from the ICT. The purpose of looking at these areas of literature is that while these aspects of ICT theory have been developing and the area's of ICT evaluation have also been developing, to a large extent they seem to have been developing independently. Part of this maybe explained by the lack of depth which word limits place by the publications, and the need to specifically address the topic of the particular paper, and as well to avoid clouding or complicating the theory. However, some consideration needs to be given to the consolidation of the breadth, and place of each area in the synergy of the ICT evaluation process. [18], in an alternative view, discusses and describes theory and cases specifically aimed at the building of corporate information infrastructures, but which has relevance to other aspects of ICT evaluation. The focus is on the information system as a set of complex interrelations rather than a hierarchical and decomposable system.

## **Alignment**

The alignment of ICT to business is given as critical by many [2, 7, 8, 19-21], the general comment being that if the ICT is not aligned with the business strategy then the ICT is not fully serving the business. Alignment of the ICT to the business is not easy to manage, particularly because both business strategy and ICT can change constantly, as well as the inability of certain ICTs to evolve, rapidly change or that ICTs are expensive to modify. Such issues apply to many artefacts used by organisations in their business dealings, so it is not specific to ICT. In a review of key issues for IT executives, in 2005, Alignment was seen as the number one issue of management concern [22].

There is also the consideration when looking at alignment to consider the level in an organisation, from which perspective the alignment needs to occur. As previously discussed [23], presents different evaluation techniques for different levels of the organisation. Besides the consideration of specific ICT to match alignment, the IT portfolio of the ICT should consider issues such as management objective of the ICT which could be strategic, informational, transactional or infrastructural [4, 24].

## **IT Governance**

IT Governance is a key asset area in the Organisation [4]. There are differences in definitions of governance, but for many IT Governance is defined similarly to having a framework for decisions and accountability for desired behaviour in ICT usage [4]. Although similar to both management and to alignment, governance sits above them, in effect to say that the organisation needs to understand or have processes to ensure that issues such as Alignment and management of the ICT occur, and these steps should be followed, these people are responsible. Governance can exist at multiple levels, there is organisational governance, ICT Governance, Security [of ICT] governance. Besides internally developed governance documents, there is literature as well as official standards on governance such as the Australian Standard on ICT Governance [3], as well as Security governance standards [25].

A governance overview should if detailed give direction to the use of or the needs of an ICT evaluation technique. The purpose partially to assist the organisation in being able to

make decisions, but also to justify and create a transparent process which is understood by the organisation.

## **Architecture**

The term architecture, when applied to ICT, can be used at many levels of the organisation. There is the physical architecture of the ICT, both at the organisational level, and at the hardware level, this effects what specific other physical hardware can be used or integrated as well as the ongoing maintenance and lifecycle of the ICT. At a logical level, the architecture will determine the information that can be obtained, the interactions that can be made internally and externally as well as the agility and flexibility of the organisation.

Unless, there is going to be a root and branch renewal of the ICT any new ICT will have to fit with or at least integrate with legacy ICT. Considerations such as the reach and range required of the software are also relevant [26]. The ICT might fit into the architecture at several levels, that of a single computer, a business process, business unit, or organisation wide. Best practice frameworks, which have been specifically written to address architecture exist, built by industry practitioners [5].

## **Best Practice Frameworks**

In the practitioner literature, there have been several frameworks created and published, which have been written by practitioners based on experience, knowledge and negotiated peer review based upon best practice. Some of them have become *de facto* standards, being used in industry. Each of them has a specific focus area, which can lead to organisations using two or more of them for different purposes. They all are presented as Frameworks, and although they give guidance, specifically state that each organisation must and should determine their own implementations, using the frameworks as a guide. The architectural framework TOGAF [5] has already been referred to in the previous section.

ITIL or Information Technology Infrastructure library was created by the British Government for the management of ICT, primarily on ICT service management[27, 28], but the series of ITIL books discuss business alignment [8], Application, Asset and Infrastructure management [29-31]. ITIL focuses on describing ICT in terms of business outcomes and in the application of best practices for ICT processes to support the business.

CoBIT is a framework created by the IT Governance Institute, formed from the IS Auditors and Control Association. The current version of CoBIT is 4.0 which builds upon the 3<sup>rd</sup> edition [6, 7, 32]. Focusing on creating of metrics to measure and meet, CoBIT develops measures and best practices for the governance and auditing of ICT. It is very detailed in its prescription of areas, but still leaves much up to the organisation to decide on the exact requirements to choose and their details.

CMM [33], and CMMI [34, 35] created by the Software Engineering Institute for the management of large software projects, it is a prescription for how organisations can continuously incrementally improve and understand their processes. Describing several areas of importance in the ability to Engineer software. The Maturity Models, which CMMI is based upon have also expanded into other areas such as Project Management, Acquisition, giving detailed guidance on specialising in best practice.

## **Maturity**

Each of the best practice frameworks explicitly addresses the issue of maturity of the process and the organisation. They emphasise that an immature organisation cannot fulfil certain tasks, either because they do not have the processes to support the task, or because they do not have the information. The purpose of considering the maturity is to make the

organisation deal with both achievable outcomes as well as map out a path to achieving a more mature set of processes.

### **Metrics**

The best practice frameworks, especially ITIL and CoBIT explicitly refer to the use of the Balanced Scorecard [36], as a measure so that it is not just financial metrics which are achieved, but also other organisational aims. They also wish organisations to consider what metrics to measure and why, so to align the organisational business aims to that of the ICT installation. Being able to set metrics for the ICT to achieve, that are relevant to that ICT also serves the purpose of *ex post* measurement and evaluation of the ICT, and gives information for the measurement of the organisation.

A further issue in Metrics has been the issue of what *ex ante* measures will be used. Particularly now, as different business models for providing software are being proposed for usage, which has highlighted issues where the previous methods of evaluation are inadequate or inflexible and were written for the current ICT provision models. An example of this is the modelling of Open Source Software against more traditional proprietary vendor software, where the metrics show that the cost of software is zero, but that the implementation is more expensive than the implementation of the proprietary software, even if the total cost is less the metric analysis is not able to deal with the different valuation of the software [37].

### **Compliance**

When considering compliance, in terms of both evaluation and being able to operationalise the ICT, there are multiple levels that require consideration. Some levels of compliance fit into easily into architecture, such as where new ICT must comply to communicate, logically and physically with the existing ICT.

There are other requirements for compliance, such as the CLERP 9 regulations in Australia, and the Sarbanes Oxley Act in the US, which along with other regulatory compliance is increasing in their impact on running of organisations [38]. Although some of these regulations could be considered extensions of governance, rather than being optional, they are mandatory, and in some cases extremely prescriptive in their directions. An Organisation may have membership to other bodies, such as the stock exchange, which require compliance to certain issues, or be required to fulfil obligations to authorities such as environmental or financial regulators. In some industries there are self regulatory compliance issues, where the industry has agreed to self regulate themselves rather than to have the government create regulation for the industry. These are all considerations in the evaluation of ICT.

Similar to the issues of Architecture, there is also in an international world the issue of different requirements in different jurisdictions. This includes issues such as different reporting requirements, but can also include different legal frameworks. Increasingly there is a overflow of regulation in one jurisdiction where companies even if primarily based in another jurisdiction must comply with the law or regulations of the other [39], the US Sarbanes-Oxley act being one example. Another example of complex issues of compliance is that a program which is used in one jurisdiction may not be allowed in another due to export controls, or may infringe patents either disallowing use or requiring a different licensing scheme, such as in the RIM blackberry patent dispute in the US. Accounting standards are different all over the world, and although some are similar there are always some differences [40], taxation issues also differ.

In an increasing world of standards, there might be the requirement to comply with standards such as the ISO9000 or the security standards such as ISO 27000. There are also compliance issues with industry frameworks being used, such as CoBIT and ITIL, or perhaps

industry standards, such as EDI or XML Industry Schema [41]. As also previously mentioned the accounting standards might also have an impact on the use of or requirements needed from the ICT.

Besides the compliance with regulation, standards and legal environment, an organisation also is required to comply with the conditions of contracts which it forms, with other organisations. This could be in the form of its business operations, including supply chain agreements but can also be the conditions of ICT or other infrastructure which the organisation uses and has agreed to operate or comply to a series of terms in a contract or license. The compliance issues such as licensing conditions of the existing ICT would also be included as a compliance issue.

### **Portfolio management**

The use of portfolio management has been put forward as a technique to better manage a firms use of their IT and to better manage the overall process in particular the evaluation of where new projects need to fit and what metrics are can be supplied and asked [4, 24, 42-45]. Portfolio management should become a more important area of consideration in the usage of ICT, especially as organisations need to prioritise their usage and fit of new ICT. Being able to articulate the position of ICT in the organisation's portfolio should also allow for direction changes to be addressed more easily.

### **Risk**

In any organisational decision, there is risk, and the evaluation of risk is a critical step in any decision [46]. ICT shares the general risks of any project, or organisational acquisition, plus issues such as technology risk [4], and IT definitional uncertainty, strategy risk, service delivery risk, technical and implementation risk [47].

The reason to include risk as a separate consideration is to see what and how risk is judged. Risk may also have an upside, if the definition of risk is taken as a deviation from the expected norm, rather than just as a failure, then a project or ICT may deliver more than what is expected, rather than just being a failure. There is also risk in that if an organisation does not put some resources into some projects they risk losing out on areas that may later become profitable.

### **Further examining the evaluation and selection process.**

In looking at the literature on the evaluation and selection process, there seems to be little on the issue of dealing with another two aspects which would be important in the process of evaluation and selection. These aspects are compromises needed after evaluation and politics and reactionary measures that are organisation-specific. These are not *per se* areas of theory or aspects of physical linkages between the contenders for the solution and the organisationally explicit desired outcomes. These areas effect the dynamics of the governance of the process?

### **Compromise**

With all of the considerations in the evaluation of ICT, this raises an issue of the evaluation process, if done to a full, meticulous and exhaustive degree then the business need for the ICT will more than likely have changed or disappeared. Therefore in the evaluation of ICT compromises are required, one question which this raises is if the process is understood, do the organisations understand the implications of what has not been considered.

### **Politics and Reactionary measures**

In the evaluation of ICT, [15] specifically raises the issue of lack of research into the internal politics of organisations in the evaluation process. Therefore although an aspect which influences the process, there is little guidance on inclusion of this into the theory of evaluation. Anecdotal evidence has also brought out that the process of evaluation depends more on personalities and personal networks, gut feel and influences other than strict adherence to transparent evaluation policies.

A separate but closely aligned aspect of politics is that either an ICT project or a ICT evaluation can be changed if certain reactionary measures are flagged. The best example of this as a concept is that of reactionary response to the a companies stock price, perhaps in a government department a Ministers directive, or a response to bad publicity where changes are implemented or projects dropped in reaction to an event.

Sometimes this can occur due to responding to a disaster or to an event which is longer term. Examples of this might be the disruptive nature of the Internet for the organisational processes, or perhaps in the implementation of Enterprise Systems.

### **Research questions**

Given these aspects may be important in the selection and evaluation process, a useful research question, with the unit of analysis being the selection and evaluation process, could be framed as:

How do organisations evaluate and select software environments?

This broad question is broken down into several sub questions:

Who is involved in the decision?

What are the triggers for the decision? Are these at the strategic, tactical or operational levels?

What processes are used / followed in making the decisions?

What is the organisation seeking to find through these processes?

What is the organisation seeking to deliver (i.e. reports to internal / external bodies)?

How are the processes, learnt, developed, feedback and allowed to evolve>

## **Looking ICT Selection and Evaluation**

### **Methodology**

Based on the research questions, posed above, there is a need to use techniques that research in depth, rather than possibly in breadth. To look at understanding the process there will be a need to look at the process in a double sense of epistemology; a social-scientific enquiry as well as a philosophical enquiry; to look at how the evaluations are used, and as a meta theoretical enquiry to look at the question of what they know, and how they may attain a complex form of understanding [48].

In developing a methodology, there has been successful use of Actor Network Theory by [16], which was found to be more useful than diffusion theory which was initially used. In their paper, [15], discuss that the most commonly used technique is Case study research, but point out that perhaps Action Research may be more useful and that there possibly needs to be more employment of critical theory, since corporate politics and power relationships are well known but under researched. The use of action research will also allow the researcher to look at the process over a longer time, as the process might be longitudinal, incremental, iterative or tempered.

It is also proposed that there is use of a grounded theory approach. The purpose of a grounded theory approach is to test if the existing literature of evaluation methods is still valid, without interfering with the context by taking a specific theoretical lens. Also it is possible that there needs to be a new ICT evaluation framework created, that considers the dependence of organisational ICT much more on external factors, or on the need to create independent business units within an organisation for management, flexibility and spin off creations, as the greater Organisational strategy changes.

The exploration of the understanding of the political and considerations of constraints, especially as the proposal is for there to be depth rather than breadth, would involve descriptive research on a limited number of participants. However, it is also the intent to give guidance to others on the aspects of evaluation processes, which may include the additional aspects of compromises and considerations of politics and reactionary issues. In the MISQ paper on the nature of IS theory [49], these aims match to theory for Analysis, (type I theory) and theory for Explaining and Predicting (Type IV Theory) in [49]. In type I theory the research might not make a prediction about the applicability of the research, but seeks to analyse and describe. With type IV theory for explaining and predicting the researcher is trying to provide predictions, with testable propositions and causal explanations. Both of these types of theory include as one of the appropriate methods for that theory type the use of Grounded Theory [49, pg 623 and 628].

There is a two fold motivation in proposing the use of Action Research and Grounded Theory. One, especially in the use of Grounded Theory, it allows for a new and fresh perspective, without the constraints of existing theories. The existing theories also do not match with an in-depth exploration, where multifaceted issues are trying to be observed; therefore it is probably best to allow the observations to be made in-situ before application of an existing theory. The second reason is to also attempt to get a new perspective on the issue of evaluation, to see how and what the issues and techniques are, since the proposal is to describe the process rather than to predict, the use of a more open methodology is better suited. It may be revealed that the existing theories are valid and useful, but such a finding would have more value if this was not the initial premise of the research.

The methodology proposed here will be used to gather empirical data from large organisations, about how they prepare for, and conduct evaluations of software before deciding on an appropriate software choice for that business decision. The research is not necessarily interested in how the software originally becomes an option for consideration, for this could vary greatly, but once some software is considered, then what processes are used in making the decision to operationalise the software. The empirical research will explicitly explore both formal and informal approaches and develop a process model that will assist practitioners and management of organisations to optimise their approaches to the evaluation and selection processes.

The viewpoint taken in the research will be that of the Business case, from the CEO / Board view i.e. the value proposition to the organisation. The study will begin by looking at what triggers such processes, and after that, what processes, stakeholders and artefacts are compiled, used, consulted in the process where discards are made, and concludes when the final choice (including the choice to not do anything) is made. The implementation is outside of the scope of the research question, although previous implementations may play a role in the evaluation process.

The unit of analysis is to be the selection and evaluation process, itself, since this is the aspect which is being looked at, the process as a unit of analysis comes from the research question [50, p23].

## Conclusion

This paper has proposed a research project for investigating how organisations go about preparing for and evaluating various options available for organisational software environments. The study is based on an analysis of the literature on ICT evaluation and the specific issues that arise from a consideration of alternatives to traditional ICT evaluation. The empirical research will be based on a methodology which will specifically explore the current gap in the literature regarding identifying and understanding the actual processes, both formal and informal, that are currently being used in organisations and by consulting practitioners. With issues of compromise, political and reactionary amendments being specifically sort.

The research wishes to focus on three linked but separate issues., The first, and foundation issue of the processes that are used by organisations in their selection and evaluation of ICT. There is a contribution to both theory and practice in the analysis and guidance of a process of evaluation for organisations. The second issue is that of the understanding of compromise in the evaluation of ICT, simply what is our understanding and reliance on the practical issues of not being able to consider everything, and what does this mean in both practice and theory. The third and last issue is that of the political and reactionary aspects of ICT evaluation and what affect this has on the process, this is the most exploratory aspect of the research and therefore may be more likely to be a description rather than a predictive outcome. As either a part of a whole or individually each will contribute to the theory and likely the practice of ICT use and evaluation in organisations.

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