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An exploratory study investigating the perception that ICT capital projects are different

Evidence from the Czech Republic

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Abstract

Purpose – The purpose of this study/paper is evidence to suggest that information communication technology (ICT) capital projects are different from non-ICT projects and that as a result the appraisal of such projects is more difficult. This may suggest that organisations would use dissimilar financial and risk assessment models or place different importance levels on such models between the two types of investment. The purpose of this paper is to investigate this issue and present the results of research into the practices of organisations in Czech Republic that have recently undertaken an appraisal of both ICT and non-ICT capital projects.

Design/methodology/approach – A factual and attitudinal survey was developed and conducted during the end of 2011, addressed to organisations based in the Czech Republic. The object of the survey was the identification of current practices in respect of the appraisal of both ICT and non-ICT projects and the opinions of senior executives on a number of important issues regarding such practices. This paper focuses on the issues relating to ICT projects being "different" from non-ICT projects.

Findings – The empirical findings support the literature in that ICT projects are, in many respects, different from non-ICT projects. However, the evidence indicates that, in practice, there is no significant difference in the financial and risk assessment models used in their appraisal. This indicates that any perceived difficulties, which may infer that the projects are "different", are overcome (or ignored), to some extent, when it comes to the formal financial and risk assessment stage of project appraisal. There is also evidence to suggest that practitioners use assessment models that academics regard as unsophisticated. The findings also show that strategic issues are more important with respect of ICT projects than non-ICT projects. The research therefore supports the view that ICT projects are perceived to be different, but that the current conventional (financial and risk) appraisal models are adequate to appraise such capital projects, provided they are supported by a strategic assessment.

Research limitations/implications – As the findings are based on a survey of companies in the Czech Republic only, we accept that the research results may have some limitations in terms of drawing general conclusions. The concern over drawing general conclusions is also brought about by the relatively low response rate, although the rate is in line with previous published research.

Practical implications – ICT projects are different and as such these differences must be taken into account when appraising capital projects. The evidence supports the need for practitioners to review their appraisal of ICT capital projects, by adopting more sophisticated financial and risk models (as prescribed by academics) and linking their appraisal to corporate strategic goals. Future research should be aimed at identifying the formal and informal strategic approaches adopted by practitioners in the appraisal of ICT capital projects.

Originality/value – This is the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the Czech Republic. As such, it gives a valuable insight

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into the practices of Czech Republic organisations in their appraisal of ICT and non-ICT capital projects. The identification of the four main problem areas with respect to the appraisal of ICT projects will help to focus academic research in the future.

Keywords Information technology, ICT, Information systems, Risk, Capital investment, Financial appraisal

Paper type Research paper

Introduction

The importance of investing in information communication technology (ICT) cannot be over-emphasised (Heemstra and Kusters, 2004; Milis and Mereken, 2004; Oxford Economics, 2011a). ICT consists of all technical means to handle information and aid communication, including computer and network hardware and software (Oxford Economics, 2011a). Harris *et al.* (2009), in their recent research, emphasise the strategic importance of new technology or infrastructure, e.g. computer systems projects, with 70 per cent of their survey respondents having experience of the appraisal of such projects. Nah *et al.* (2001) state "Now, more than ever, effective business strategy centres on aggressive, efficient use of information technology". Expenditure on ICT projects has been growing at a rapid pace over the past two decades, while investment in non-ICT projects (other than commercial real estate) has, in comparison, been on decline. Despite the global downturn, ICT is the world's fastest growing international industry (International Telecommunications Union, 2011). The appraisal of ICT projects, however, continues to present a problem. ICT projects are multidimensional constructs requiring a multidimensional approach to their appraisal (Etezadi-Amoli and Farhoomand, 1996).

This paper reports on research into current ICT and non-ICT appraisal practices of trading organisations in the Czech Republic, looking specifically at the perception of ICT projects being "different" and the current financial and risk appraisal models used. If one accepts that ICT projects are no different from non-ICT projects, then it could be argued that the appraisal models should be the same. On the other hand, if ICT projects were very "different", then the conventional appraisal models may be inadequate, a view supported in the literature by Anandarajan and Wen (1999).

Background

As a result of the perceived deficiency in the conventional financial (e.g. net present value – NPV, internal rate of return – IRR and payback period – PB) and risk appraisal models to incorporate some important factors involved in the justification of new technology capital projects and the increasing complexity of such projects, a number of multi-attribute appraisal methodologies, incorporating weighting and multi-attribute utility theory have been developed to look at such projects in a more sophisticated way.

Gunasekaran *et al.* (2001) have developed an IT justification model which takes into account, strategic (e.g. support for corporate strategy), tactical (e.g. performance indicators), operational (e.g. systems integration) and tangibles (e.g. return on investment – ROI) considerations together with intangibles (e.g. risk of not investing in IT). Heemstra and Kusters (2004) suggest that any new multi-criteria ICT investment appraisal model should include not only the financial consequences of the investment but also the non-financial data and risk factors. They put forward an approach, which not only includes the financial data but also presents the risks according to a number of

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categories and give a score value to the non-financial criteria, presenting the data in an investment profile, similar to that proposed by Lefley and Morgan (1998). Lefley (2008) introduces an "IT Score" as the fourth dimension to the financial appraisal profile (FAP) model as a way of selecting the most appropriate supplier(s) of ICT software and hardware. Milis and Mereken (2004) recommend the use of the balanced scorecard, as developed by Kaplan and Norton (1992), for the evaluation of ICT projects. They argue that it is a simple task to adapt the balance scorecard framework to fit the need of ICT investment evaluation. The approach, which combines traditional financial appraisal approaches with new, non-financial evaluation methods, also assesses strategic alignment. And, as Milis and Mereken (2004) argue, it forces management to take a broader, more strategic, view of investment in ICT.

The option theory, which emanated from the financial/securities markets, is now seen as applicable not only to financial investments but also to investments in real assets (Benaroch, 2002; Fichman *et al.*, 2005). Three notable examples would be:

(1) the option to make follow-on investments (a growth option) if the immediate investment project succeeds;

(2) the option to abandon the project (an abandonment option) and sell the project's assets; and

(3) the option to wait and learn (a deferment option) before investing.

While option valuation models (Black and Scholes, 1973; Merton, 1973) have been developed for the financial/securities markets, they are not seen by all managers as directly applicable to ICT capital investments. And, as Stark (1990) points out, managers may not be able to use some options valuation models because of their mathematical complexity – even if the financial data required by such models were available. While Fichman *et al.* (2005), who put forward tools for quantifying some option values, argue that "it is a certain philosophy of project management – more so than precise quantification – that comprises the essence of options thinking".

Since Saaty (1980, 1982, 1986) developed the analytic hierarchy process (AHP) in the late 1970s, others have applied this concept to various management decision-making applications. Of particular relevance is the work of Mohanty (Mohanty, 1992; Mohanty and Venkataraman, 1993; Mohanty and Deshmukh, 1998) who applied the AHP to the project selection and justification problem. Although there is some criticism of the AHP, it is argued that the process is based on a sound theoretical foundation and is a viable, usable decision-making tool (Harker and Vargas, 1987).

However, there appears to be very little use of multi-attribute appraisal models by practitioners. In support of the conventional financial models, Anandarajan and Wen (1999) show, through a case study, how previously unquantifiable intangible benefits can be valued and included in the NPV calculations. They also show how cashflow uncertainty and risks can be included in the economic model through the use of the probability theory and sensitivity analysis.

The literature suggests that ICT investments differ, in many respects, from non-ICT capital investments and that, as a result, possibly their appraisal should be different. It is argued that information technology investment is different because information technology is different (Powell, 1992). Harris (2009) argues that IT projects (including systems development projects and enterprise resource planning systems) have a

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number of distinctive characteristics. Ford (1994) argues that conventional economic appraisal models are inappropriate because information technology projects are different from other, more traditional cost-saving projects. ICT investments are perceived to produce a greater contribution towards increased productivity than non-ICT capital investments (Ramesur, 2012). However, Fox (2013) argues that there is a lot of hype about ICT that can cloud the decision-making process.

The appraisal of ICT (as well as information system(s) (IS)/IT) projects is not without its problems; costs and benefits are difficult to identify and quantify in financial terms, and non-tangible benefits may be significant (Ballantine and Stray, 1998; Gunasekaran *et al.*, 2001; Irani and Love, 2001; Milis and Mereken, 2004; Dunk, 2007). Anandarajan *et al.* (1997) argue that there are hidden costs with IT projects that are underestimated or left out of the evaluation altogether. Love *et al.* (2006) argue that ICT projects have hidden costs and intangible benefits that are not captured by the conventional financial appraisal models. Such investments are said to present operational difficulties, which are not present in the more traditional capital projects (Symons, 1991). Anandarajan and Wen (1999) argue that two significant differences of IT investments are:

(1) "IT involves a wide range of strategic benefits that are hard to quantify"; and

(2) "circumstances surrounding IT investment criteria are subject to increasing rapid change".

IT projects are said to present a different risk profile (Anandarajan and Wen, 1999; Milis and Mereken, 2004; Lefley, 2008; Harris, 2009; Wong and Dow, 2011). Lefley (2008), from a case study research, identifies the following risk factors as being important to a professional organisation when evaluating an ICT capital project: failure of system to function as planned, losing or corrupting data during conversion, delay of system coming on line, misunderstanding of bespoke programming requirements between the professional body and its suppliers and possible conflict over user acceptance of new IT skill requirements. Harris (2009), from a cross-industry survey, confirms important ICT risk characteristics as: misunderstanding of system specification between technology experts and non-technical users, availability of required skills, planning timescale, demands of customer, information quality, project complexity and quality of supplier. While some of the risk factors are similar to those that would be incurred with non-ICT projects, there are clearly those that are specific to ICT projects.

There is also the suggestion that the strategic nature of IT projects offers such benefits as improved productivity and performance, competitive advantages, assist in the development of new businesses, improvement in organising and managing firms and to develop new business (Earl, 1989). IT projects are perceived to be "distinctive" in that they are an enabler to the creation of new ventures and support for business change (Apostolopoulos and Pramataris, 1997). In fact, Earl (1992) argues that the benefits from ICT are more to do with business change than the technology itself. Further support of ICT projects offering a competitive advantage in a global economy is given by Ives and Jarvenpaa (1991), Earl (1993), Sethi and King (1994), Powell and Dent-Micallef (1997) and Lefley (2008). ICT has more of a global perspective than some non-ICT projects, and even in (if not, as a result of) the current global recession, there is acceleration in the transition to a global digital marketplace (Oxford Economics, 2011b).

The literature therefore supports the view that ICT capital projects are different in four main respects:

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(1) cashflow ascertainment;
(2) project specific risk;
(3) strategic relevance; and
(4) appraisal difficulties.

In both theory and practice, the term "ICT evaluation" has a multitude of meanings. In this paper, we use the term "appraisal" to refer to the initial process of project justification (the procedure prior to the investment decision), whereas the term "evaluation" relates to an ongoing post-investment exercise, a post-implementation review of achieved benefits (Farbey *et al.*, 1999). Appraisals are necessary to assists practitioners in determining which projects are appropriate (and should therefore be accepted) and which projects are inappropriate and should be rejected (King and McAulay, 1997).

In this paper, we look specifically at whether there are perceived differences between ICT and non-ICT projects as the literature suggests and at the appraisal methods currently used by Czech Republic organisations in project selection, with the aim of determining if these differences (if any) have an influence on the models used. We therefore focus, in this paper, on two research questions:

(1) "Is there a perceived difference between ICT and non-ICT projects?" – looking at four of the issues raised in the literature, strategic relevance, appraisal difficulties, project specific risk and cashflow ascertainment.

(2) "Are the appraisal models, and their levels of importance, used in both ICT and non-ICT project appraisals the same?" – looking specifically at the financial models and the assessment of project specific risk.

We also look at the reasons for not carrying out a formal appraisal of all ICT and non-ICT projects. This research should help to determine if the current conventional appraisal models are adequate to appraise ICT capital projects.

Research methodology

A factual and attitudinal postal survey was conducted during the end of 2011, involving 625 organisations based in the Czech Republic. Eighty-one valid responses were received, giving a response rate of 13 per cent. This response rate, although low, is in line with earlier surveys of this kind (Cotton and Schinski, 1999 – 16 per cent; Sandahl and Sjo¨gren, 2003 – group "B" 16.5 per cent; Lefley *et al.*, 2004 – 19 per cent; and Harris *et al.*, 2009 – 16 per cent). The respondents comprised 46 chief financial officers, 12 chief executive officers, 13 IT/administration managers and 8 other managers from a range of areas of responsibility (2 respondents did not state their area of responsibility). The respondents had worked an average of 12 years with their current employer.

The object of the survey was the identification of current practices in respect of the appraisal of both ICT and non-ICT projects and the opinions of senior executives on a number of important issues regarding such practices. This paper focuses on the issues relating to ICT projects being "different" from non-ICT projects and is part of a much wider research study.

This is the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the Czech Republic. By addressing the questionnaire

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to a single individual, and asking questions relating to both ICT and non-ICT projects, we hope to reduce any errors, which may be present if two or more individuals from an organisation are asked to comment on the same issues.

The advantages and disadvantages of this type of survey are well known, but it still provides a useful data collection tool (Frankfort-Nachmias and Nachmias, 1996). Murphy (2006) and Love and Irani (2004) give support for the use of a questionnaire methodology.

The questionnaire was divided into four parts together with a brief introduction by the researcher and the prominent display of the participating university's logo. The prominent display of university affiliation was made to highlight the academic importance of the research as distinct from a "commercial/trade" survey.

Part 1 of the survey consisted of questions aimed at identifying important characteristics of the respondents and their organisations. It was also aimed at identifying the type of ICT investments made in the past 10 years and the investment appraisal policies of each organisation with regard to ICT and non-ICT projects.

Part 2 of the questionnaire consisted of questions concerning the most recent ICT project appraised by the organisation. This part of the survey was aimed at identifying the size of project, team involvement, assessment of financial costs and benefits, project specific risk and strategic aspects of the project.

Part 3 of the questionnaire consisted of questions concerning the most recent non-ICT project appraised by the organisation of which the respondent was familiar.

Part 4 of the questionnaire consisted of a number of statements on a wide range of topics relating to the appraisal of ICT projects and investment appraisals in general. The respondents were asked to agree or disagree with each statement based on their own experience and in so far as it may reflect their organisation's investment policies. A Likert-type scale of 1 to 4 was used. The possible responses offered were "strongly agree" and "agree" for a positive response and "disagree" and "strongly disagree" reflecting a negative response. It was decided to use a 4-point scale to avoid the possible tendency for some respondents to take a middle-line approach. Support for an "even" (without a centre point) scale is given in the literature (Lefley and Sarkis, 1997; Ho and Pike, 1998).

Research results and discussion

This research first looks at the perceived differences between ICT and non-ICT projects. We then examine the various economic and risk models used in their appraisal, together with strategic assessment, to determine if such differences affect the investment appraisal models used or their levels of importance.

The perceived differences between ICT and non-ICT capital projects

In this part of the paper, we look at the perceived differences between ICT and non-ICT capital projects as revealed by the respondents' answers to four of the statements posed in the survey document. Respondents completed this part of the questionnaire based "on their own experience and in so far as it may reflect their organisation's investment policies". A Likert-type scale of 1 to 4 was used.

Farbey *et al.* (1992) argue that IT projects are accepted because they are an essential part of corporate strategy. The literature also points to the view that the strategic importance of ICT, for some organisations, is low (Cumps *et al.*, 2010). From our

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research, the strategic importance of investing in ICT projects is, however, not in dispute, as 60 (85 per cent) of those respondents who expressed an opinion stated that their organisation either formally or informally assessed the strategic aspects of such investments. It is whether such projects are deemed more strategically important than some non-ICT projects that may be an issue. As shown in Table I, the respondents' opinions (mean 2.8442) to the statement "Investing in ICT project has more of a strategic bias than some other capital projects" suggests that there is agreement to this statement. Fifty-three (69 per cent) respondents agreed with this statement; 12 (16 per cent) "strongly agreed", while no respondent actually "strongly disagreed". In addition, from a question on strategic evaluation, we discovered that a larger number of organisations assessed the strategic implications from investing in ICT projects (85 per cent of respondents) than non-ICT projects (76 per cent of respondents). On this basis, it could be argued that ICT projects are seen to be more strategically important than some non-ICT projects and as a result perceived to be "different".

The argument that ICT capital investments are perceived to be different and pose unique appraisal problems is supported by the positive agreement (mean 2.9079) to the statement "Evaluating investments in ICT projects poses a number of problems that investing in 'other' assets does not present" (see Table I). Of the respondents, 59 (78 per cent) (who expressed an opinion) agreed with this statement, 8 (14 per cent) "strongly agreed", while only 1 respondent "strongly disagreed". Although a large number of respondents agree with the assumption that ICT projects pose a number of unique problems, it is not clear how significant these "problems" are, but the perception of a "difference" between ICT and non-ICT projects is clearly indicated. According to Apostolopoulos and Pramataris (1997, p. 289), these "problems" stem from the fact that ICT investments have outcomes which are usually difficult to foresee, more difficult to estimate and even harder to express in quantifiable terms.

Support (although at a low level) is also shown with regard to the perception of project risk in respect of ICT projects in that a positive response (mean 2.5974) was given to the statement "Investing in ICT projects presents a higher level of risk than investments in more traditional capital projects" (see Table I). The results show that 39

Statement:	a	b	c	d	Mean
Investing in ICT projects has more of a strategic bias than some other capital projects	12	41	24	0	2.8442
Evaluating investments in ICT projects poses a number of problems that investing in 'other' assets does not present	11	48	16	1	2.9079
Investing in ICT projects presents a higher level of risk them investments in more traditional capital projects	8	31	37	1	2.5974
Projected cashflows from ICT projects are more difficult to determine than those in respect of investments in non-ICT capital projects	14	44	15	4	2.8831

Table I.
Opinion statements

Notes: Level of agreement with each statement: a = "strongly agree"; b = "agree"; c = "disagree"; and d = "strongly disagree"

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(51 per cent) positive responses were received, with 8 (10 per cent) strongly agreeing to the statement, while only 1 respondent "strongly disagreed". This supports the view that IT projects incorporate many different types of risks, which are difficult to identify at the appraisal stage (Anandarajan and Wen, 1999), again indicating that ICT projects are perceived to be different.

The belief that the identification of cashflows from ICT projects are difficult to determine is evidenced by the positive (mean 2.8831) reply to the statement "Projected cashflows from ICT projects are more difficult to determine than those in respect of investments in non-ICT capital projects"(see Table I). Of the respondents, 58 (75 per cent) agreed with this statement of which 14 (18 per cent) "strongly agreed", with only 4 respondents strongly disagreeing. Ward *et al.* (1996) concluded that it was not possible to anticipate all potential IT/IS benefits at the appraisal stage. This view is supported by Anandarajan and Wen (1999, p. 336), who conclude from their research "As technology becomes more sophisticated we can safely say that we may never have a total understanding of the full range of costs and benefits of information technology". Earl (1992) argues that some benefits from investing in IT are more associated with business change than the technology itself.

Whether the perceived difficulty in cashflow identification from ICT projects supports the view that ICT projects are "different" is debatable, as other non-ICT projects [for example, investments in advanced manufacturing technology (AMT)] present similar cashflow identification problems (Lefley *et al.*, 2004). It may be, however, that advanced technology (AT) projects in general are significantly different to non-AT projects. However, the fact that ICT projects are seen as "change enablers" may suggest that ICT projects are different. AMT projects are usually plant specific, while ICT projects have a much wider organisational (and global) spread. With respect to ICT supply-chain projects, these, in some cases, link a number of organisations together. On this basis, we would argue that ICT projects are perceived to be different.

Financial, risk and strategic assessment of ICT and non-ICT projects

In this part of the paper, we look at the various models and approaches, used by the responding organisations to our research, in the appraisal of both ICT and non-ICT projects, with the aim of identifying any significant variations that would support the view that ICT projects are different.

From a question on formal guidelines, our research shows that a larger number of organisations are shown to have formal guidelines for non-ICT projects ($n = 55$) than ICT projects ($n = 46$). Forty-six organisations (i.e. all those who had formal guidelines for ICT projects) had formal guidelines for *both* IT and non-ICT projects. Eleven (24 per cent) stated that these guidelines were not the same for both types of projects. This indicates a difference between ICT and non-ICT projects.

A larger number of organisations conducted a formal appraisal of *all* non-ICT projects (62 per cent) than *all* ICT projects (60 per cent). The reasons given for not appraising *all* projects are shown in Table II. The two main reasons given are:

(1) project value and size, 67.9 per cent ICT projects and 68.2 per cent non-ICT projects); and

(2) operational urgency, 57.1 per cent ICT projects and 54.5 per cent non-ICT projects.

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Table II.
Reasons given for not carrying out a formal appraisal of all ICT and non-ICT projects

Reason	ICT projects ($n = 28$) (n)	ICT projects ($n = 28$) (%)	Non-ICT projects ($n = 22$) (n)	Non-ICT projects ($n = 22$) (%)
Project value and size	19	67.9	15	68.2
Operational urgency	16	57.1	12	54.5
Insufficient time and choice	9	32.1	5	22.7
Mandatory projects	7	25.0	4	18.2
Replacement projects	2	7.1	4	18.2
Other (no further details given)	2	7.1	0	0

Notes: Thirty-one respondent' did not carry out a formal appraisal of all ICT projects; three respondents' did not give any reason why; twenty-seven respondent' did not carry out a formal appraisal of all non-ICT projects; five respondents' did not give any reason why

Insufficient time and choice is seen to be higher with respect to ICT projects at 32.1 per cent compared with 22.7 per cent for non-ICT projects; this difference is not significant. (The z-score is 0.7361. The p-value is 0.4593. The result is *not* significant at $p < 0.05$). Mandatory projects and replacement projects are low down on the scale of reasons for not appraising *all* ICT or non-ICT projects. From Table II, it can be clearly seen that there is no significant difference between the reasons given for either ICT or non-ICT projects.

The importance of the financial appraisal of information technology projects is well stated in the IT, information management and financial literature (Gunasekaran *et al.*, 2001). While each financial model aims at assessing the "acceptability" of a project, each looks at "acceptability" from a different perspective and consequently some models are not merely substitutes for others. Acceptability can be viewed from a "value" perspective, in which case the NPV is the most appropriate model to use. Both the IRR and accounting rate of return (ARR) are more a measure of performance and reward criteria, while the PB aims to measure project liquidity. The perceived weaknesses of some of these models have resulted in the development of "modified" models, such as the modified internal rate of return (MIRR), the profitability index (PI) and the discounted payback period (DPB). While some of the models used (i.e. NPV) are supported by academics, other more pragmatic models (i.e. PB) are more favoured by practitioners.

The payback (PB) model of investment appraisal continues to be the one most favoured by organisations (see, Table III). This supports the earlier findings of Lefley *et al.* (2004) who reported that the PB was the most frequently used model of investment appraisal in respect of new technology projects in the UK, the USA and Czech Republic. DPB plus PB ranked first (3.4921) with respect to ICT projects and first (3.5968) with respect to non-ICT projects. In agreement with many academics, the net present value (NPV) was ranked above the internal rate of return (IRR). The NPV was ranked second with regard to both types of projects (ICT rank value 1.4127, non-ICT rank value 1.2097). There is no significant difference (using non-parametric ranking analysis) between the various financial models used with respect to ICT or non-ICT projects, although the ROI/ARR has a slightly higher ranking of fourth (1.1587) with respect to ICT projects than sixth (0.8710) for non-ICT projects. This difference is not significant (The z-score is 1.0632. The p-value is 0.28914. The result is *not* significant at $p < 0.05$). This would indicate that as far as the financial evaluation is concerned, there is no significant

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Model	ICT projects (*n*)	Ranking	Model	Non-ICT projects (*n*)	Ranking
DPB + PB[a]	66	3.4921	DPB + PB[a]	65	3.5968
PB	48	2.5397	PB	46	2.5645
NPV	29	1.4127	NPV	25	1.2097
ROI/ARR	24	1.1587	DPB	19	1.0323
DPB	18	0.9524	IRR + MIRR[a]	20	0.8710
IRR	14	0.5397	ROI/ARR	18	0.8710
IRR + MIRR[a]	14	0.5397	IRR	17	0.7419
Other	5	0.2222	Other	5	0.2581
PI	5	0.1746	PI	5	0.1935
MIRR	0	0	MIRR	3	0.1290

Notes: [a]The description refers to a combination of related models; two respondents' did not give a ranking to the models they used; seven (ICT) and six (non-ICT) respondents' used both the PB and DPB

Table III.
Financial models used in appraising both ICT and non-ICT project

difference between ICT and non-ICT projects. This is contrary to earlier reports in the literature (Ballantine and Stray, 1999) which suggests that there is a difference in the financial models used in ICT and non-ICT project appraisals. These earlier findings show that more sophisticated models (such as NPV and IRR) are being used in respect of non-ICT projects and less sophisticated models (such as PB) being used for ICT projects.

The literature points to the fact that risk assessment with respect to ICT projects is possibly more important than the financial justification (Gunasekaran *et al.*, 2001). The financial theory argues that the most appropriate measure of investment risk is obtained by measuring the variance in earnings. This may be appropriate for measuring equity risk, but in practice, with respect to capital investments, models that are more pragmatic are used such as the payback period (PB) and sensitivity analysis. Several models are used in industry to identify and assess the level of perceived project risk. Some aim to *identify* risk (primarily from a financial perspective); others aim to *allow for risk*, while others aim to *achieve both functions*. Among the more well known are the PB, sensitivity analysis, probability analysis (e.g. decision trees), adjustment of the hurdle rate, discount rate or required payback period, certainty equivalent value, capital asset pricing model (CAPM) and the option theory.

Our research shows that the most popular method by far of assessing project risk is shown to be PB, used by 30 (94 per cent of those that assessed risk in respect of ICT projects) organisations with respect to ICT projects and 34 (97 per cent of those that assessed risk in respect of non-ICT projects) for non-ICT projects (see Table IV). PB, as a pragmatic model for assessing risk, only measures time risk (Lefley, 1996a). Other models, such as sensitivity analysis, probability analysis and option theory are shown to have very limited use. The three most popular methods for taking risk into account were:

(1) adjusting the discount rate used for the NPV;

(2) adjusting the hurdle rate with respect to the IRR; or

(3) adjusting the required payback period.

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Method	ICT (*n*)	Non-ICT (*n*)
Risk assessment: (ICT 32 organisations; non-ICT 35 organisations)		
Sensitivity analysis	1	6
Payback	30	34
Probability analysis (i.e. decision trees)	2	1
Option theory	0	0
Taking risk into account: (ICT 16 organisations; non-ICT 20 organisations)		
Adjust hurdle rate (IRR)	8	8
Adjust discount rate used	10	11
Adjust required payback period	3	6
Capital asset pricing model	0	0
Certainty – Equivalent Approach	0	0
Other	4	3
Do not adjust for risk and/or treat risk as a separate issue (ICT 25 organisations; non-ICT 17 organisations)		
Do not adjust for risk	9	5
Treat risk as a separate issue	16	12

Notes: It appears that a greater number of organisations formally assess risk (ICT = 32; non-ICT n = 35) than those that take project risk into account (ICT n = 16; non-ICT n = 20)

Table IV.
Methods used to assess and/or take account of risk: ICT and non-ICT projects

No use was made of either the CAPM or the certainty-equivalent approach. Sixteen organisations treated risk as a separate issue with respect to ICT projects, whereas the figure was 12 for non-ICT projects; this difference is not significant (The z-score is −0.4446. The p-value is 0.65994. The result is *not* significant at $p < 0.05$). Nine organisations did not adjust for risk with respect to ICT projects, whereas the figure was five for non-ICT projects; this difference is not significant (the z-score is 0.4446. The p-value is 0.65994. The result is *not* significant at $p < 0.05$). The figures show that there is no significant difference in the treatment of risk between ICT and non-ICT projects.

The strategic importance of investing in new technology projects cannot be over-emphasised (Lefley, 1996b). ICT investment offers the potential to gain a competitive advantage (Ives and Jarvenpaa, 1991; Earl, 1993; Gunasekaran *et al.*, 2001; Lefley, 2008). As highlighted earlier in the paper, a larger number of organisations assessed the strategic implications from investing in ICT projects (85 per cent) than non-ICT projects (76 per cent). This is an interesting finding in that as we have seen no significant difference in respect of the financial and risk models used in the appraisal of ICT and non-ICT projects; this strategic "difference" is important, as it may suggest that strategic aspects override the more conventional appraisal models. Anandarajan and Wen (1999) argue that strategic "value" must be included in the appraisal process of information technology projects. Our research suggests that ICT projects may be more strategically important than some non-ICT projects, indicating a difference between the two types of projects.

Conclusion

The importance of ICT investments cannot be over-emphasised. The appraisal and justification of such projects is, however, presenting great difficulties, as a result of cashflow

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uncertainties, high project-specific risk and strategic influences. One of the frequent claims postulated in the literature is that ICT projects are "different" and as such should be appraised differently to non-ICT projects. This research set out to test this claim. ICT investments are seen by some to be different in that ICT *per se* is different.

This is the only survey to simultaneously address the appraisal issues concerning both ICT and non-ICT projects in the Czech Republic. Our research, based on this unique survey, gives support to the view that ICT projects are different, especially in the following areas identified in the literature:

- the cashflows from ICT projects are more difficult to determine than some non-ICT projects;
- ICT projects have a higher level of risk than more traditional capital investments;
- the appraisal of ICT projects presents greater uncertainties and difficulties; and
- ICT projects are seen to be more strategically important than non-ICT projects.

As our findings are based on a survey of companies in the Czech Republic only, we accept that the research results may have some limitations in terms of drawing general conclusions. The concern over drawing general conclusions is also brought about by the relatively low response rate, although the rate is in line with previous published research.

From our empirical evidence, we conclude that ICT projects are, in many respects, perceived to be different from non-ICT projects, confirming the general view in the literature. But the evidence indicates that, in practice, there is no significant difference in the financial and risk assessment models used in their appraisal. This indicates that any perceived difficulties, which may infer that the projects are "different", are overcome, to some extent, when it comes to the formal financial and risk assessment stage of project appraisal. On the other hand, this may suggest that organisations are satisfied with their evaluation methods or that they are unaware of alternatives or lack confidence in them (Gunasekaran *et al.*, 2001). It may also suggest that organisations are being complacent with regard to ICT appraisals and lack the willingness to adopt a more rigorous or analytical approach, supporting the view of Ballantine and Stray (1999).

The importance of the strategic implications and strategic assessment of ICT projects should not be underestimated. While we report no difference in the financial and risk models used between ICT and non-ICT appraisals, there does appear to be a difference when it comes to strategic issues. This difference may suggest that strategic aspects override the more conventional appraisal models – this is an area for future research.

We therefore support the view that ICT projects are perceived to be different and that the current conventional (financial and risk) appraisal models are adequate to appraise such capital projects, provided they are supported by a strategic assessment. The identification (supporting, to some extent, the earlier literature) of four main problem areas with respect to the appraisal of ICT projects will help to focus academic research in the future.

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