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IT project management control and the Control Objectives for IT and related Technology (CobiT) framework

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Abstract

Motivated by scarce academic consideration of project management control frameworks, this article explores usage, value and structure of frameworks with a focus on the popular Control Objectives for IT and related Technology (CobiT) construct. We attempt to add to an empirically validated structure of internal control over IT project management by including CobiT's views on the intended domain of content. Results from the empirical survey indicate that the metrics suggested by CobiT are regarded as feasible and important by project management professionals, and are regularly used in controlling practice. Experience, regularity of significant projects and the size of the hosting organisations, however, seem to be stronger moderators of success rates than the use of a management control system with or without support of CobiT. CobiT's suggestions are of generic nature and in particular useful for programme performance management. The latent dimensions of project quality on process and activity levels were not validated and gaps to other project assessment models were identified.

Keywords: IT project management; IT project performance management; CobiT; Programme management; IT controlling

1. Introduction

As organisations worldwide constantly strive for competitive advantage, major tools in pursuing their objectives are well functioning projects and resulting project organisations (Lindkvist, 2008; van Donk & Molloy, 2008). Management control of project progress throughout their lifecycles is becoming increasingly recognised for its importance. Recent findings highlight that management control influences task completion competency and, thus, project management performance (Liu et al., 2010). Internal management control is seen as an attempt to optimise employee behaviour in a way that allows the achievement of organisational goals (Flamholtz et al., 1985). Henderson and Lee's (1992) study revealed a positive relationship between the adoption rates of management control and project management performance. In traditional project management, managers concentrate on monitoring project progress against schedules and budgets. More contemporary approaches embrace a variety of variables of control at different levels and stages of the project process, e.g., user contributions, project team task completion competency, and individual project team's performance (Liu et al., 2010). According to Bryde (2003), 65% of the subjects in his study utilise "methods for managing the meeting of specified project objectives". Business practice and a fast growing audit and consulting industry are already relying on extensive control frameworks to provide assurance that business objectives are being met and compliance issues tackled. These frameworks are often driven by IT governance objectives which play a prominent role in fostering IS project success (Bowen et al., 2007). One well established example is the Control Objectives for IT and related Technology (CobiT) framework (ISACA, 2008) which is extensively used to control IT related strategies and operations and to support legal compliance with regulative requirements such as those from the Sarbanes Oxley Act or Basel 2 (Hardy, 2006; Kordel, 2004). CobiT was developed by the Information Technology Governance Institute and its associated Information Systems Audit and Control

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Association. CobiT and other systems for management control refer to best practice guidelines. However, up to date they have received very limited empirical and theoretical support from academia despite their extensive use in organisations in particular for IT, operational and compliance audits (Ridley et al., 2008). The accounting and information systems domains seem to lack an empirically validated theory of internal control that identifies metrics that determine good control (Tuttle and Vandervelde, 2007). It can be reasoned that organisations adopt control frameworks without investing the considerable time and resources to question the validity of the constructs and dimensions for the subject task and taking into account the specific organisational needs and culture. For this article we chose to focus on two main goals: To explore use and success of control frameworks with a special consideration of the IT project management chapter of the mentioned CobiT framework (i); and to investigate use and implications of individual metrics following suggestions from CobiT (ii). We develop a critical position against the unconditional usage of generic frameworks which is supported by actual project success rates. The research objectives of this article will thus provide insights on success and validity of a popular IT project performance management construct and its metrics, which were cross referenced into other assessment structures and models. Results and insights should therefore also be of value to other related studies. The next section will give more theoretical background. This is followed by the research methodology and a section showing how the CobiT project management sub-structure relates to comparable models from literature. Consequently, findings from the empirical survey according to the given research objectives are presented. The last section concludes the article.

2. Theoretical background

2.1. Measuring project success

It is commonly agreed that projects have a definite start and end, consist of different lifecycle stages, develop progressively and pursue deliverables or objectives (Gray and Larson, 2008; Maylor, 2005; Project-Management-Institute-Inc., 2004). The time dependent nature of projects needs to be accounted for in assessing and controlling their status. In the context of project management the meaning and choice of metrics remain an active area of research, are difficult and no clear-cut definition of successful and failed projects is available (Agarwal and Rathod, 2006). The classic view of the project management literature defines three major success factors of IT projects: costs, time and quality. These interdependent factors are commonly known as the Iron Triangle and are regular subject to critics as projects could also be affected by other factors such as methodologies, tools, knowledge and skills as reflected in resource and capability based research (Teece et al., 1997; Zahra and George, 2002). In a quantitative survey of projects in construction, the Iron Triangle was extended with 55 performance attributes of which commitment, coordination, and competence were identified as the key factors for success (Jha and Iyer, 2007). Atkinson defines another extension of success criteria summarised in his Square Route (Atkinson, 1999). Additional factors cover an information systems view, and organisational and individual stakeholder benefits. Atkinson assumes that the wide application of the Iron Triangle as sole success criteria in project management has resulted in a biased measurement of project management success. He states that using the Iron Triangle of project management creates a type II error meaning that something is missing. His additions to the Iron Triangle would reduce the level of type II errors in measuring success rates. The importance of tying project success to stakeholder perceptions in particular referring to the customer is also highlighted by other scholars in the field. De Wit, for example, defines successful projects as those that "meet technical performance specification and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among key people in the parent organisation, key people in the project team and key users or clientele of the project effort" (DeWitt, 1998). Tukel and Rom (2001) define project quality as "…meeting customer's needs fully for the end product, reducing the reworking of non-conforming tasks, keeping customers informed of the progress of the project, and changing the course of work to meet the customer's emerging requirements." Criteria can be classified as success criteria, performance drivers and outcome measures. Some authors consider this taxonomy while others do not. Overall, research suggests that in order to measure project success a wider set of metrics needs be applied, which measure time, costs, quality and the diverse benefits for the delivering organisation and the stakeholders. While time, costs and quality are project characteristics or constraints which are normally predefined and known at the beginning of the projects, other criteria can emerge in the course of projects such as certain capabilities to the delivering organisation which can be utilised in future projects. As discussed above benefits vary across different stakeholders. An exact definition of metrics measuring the diverse benefits to the stakeholders remains elusive and ambiguous. We add to literature by providing new insights into the selection and use of project management metrics for controlling project success.

2.2. Management control over projects and CobiT

The area of management control has gained recent attention by new legal requirements, e.g., as imposed by the US Sarbanes–Oxley Act in 2002 (US-Congress, 2002) connected with the announcement of the Public Company Accounting Oversight Board's (PCAOB) Auditing Standard No. 5 (AS2) in 2007 (PCAOB, 2007) which forces organisations to implement internal control frameworks and provide evidence for their effectiveness for financial reporting. Local adaptations and derivations in other countries and regions are similar although in general lighter approaches to the same problem of tackling fraud in financial reporting. Accordingly responsibilities of the board of directors for IT Governance and overall supervision of an organisation's information management initiatives have amplified the need for management control systems (O'Donnell, 2004). The Control Objectives for IT and related Technology (CobiT) framework (ISACA, 2008) represents a widely recognised international control framework to address the current IT governance issues in particular related to project management (Boritz, 2005). It is used by auditors, IT managers and consultants to evaluate the state of internal control and to manage IT related risks in the enterprise. Those frameworks provide structure and metrics as an important part of the suggested performance measurement and control systems. Ideally, metrics are consistent with how the operation delivers value to its customers as stated in meaningful terms (Melnyk et al., 2004). Thereby metrics provide essential links between strategy, transformation, and creation of value. Conceptualisations in CobiT, however, have been questioned by emerging research, e.g., relating to definitions of information integrity (Boritz, 2005), while others suggest to use CobiT to address internal control related issues without drawing on empirical support (Flowerday et al., 2006).

CobiT appeals to business practice as it promises guidance for assessing project management success and performance. Project management according to CobiT refers to an IT process of the framework named "Manage Projects" (PO10), which is associated with its first domain of planning and organising IT (ISACA, 2008). As any other CobiT process, PO10 has to comply with business goals and is desired to be effective and efficient. Hence, if an organisation manages its projects efficiently and effectively, the projects are deemed successful. The projects are efficient and effective if they accomplish the following business goals, defined in the PO10:

> "… ensuring the delivery of project results within agreed-upon time frames, budget and quality by focusing on a defined programme and project management approach that is applied to IT projects and enables stakeholder participation in and monitoring of project risks and progress" (ISACA, 2008)

This definition firstly embraces a very classical view by focusing on the classical Iron Triangle (time, cost, and quality). It adds the risk component in projects, control and measurement aspects from the view of potentially different stakeholders. To measure the accomplishment of goals CobiT utilises a three level structure, thereby incorporating the concept of drivers and outcome measures. It consists of: goals; processes supporting the goals; and activities supporting the processes. Consequently, there are metrics for each of these three levels. Outcome measures often referred to as key goal indicators (KGIs) indicate if the goals at the top level have been met. These are lagging indicators as they measure goal achievement ex post after the accomplishment of tasks. The second group of measures are the performance metrics also known as key performance indicators (KPIs) which should measure the achievements in progress and are therefore leading indicators. The top level in the measurement framework depicts only one metric, which captures the percent of projects meeting stakeholders' expectations (on time, on budget and meeting requirements). This metric is an aggregated one and reflects "The Iron Triangle" from the viewpoint of stakeholder expectations. A segregation of this measure is seen on the second level, the process level, where the two metric focus on efficiency (time, budget) and effectiveness (stakeholder targets, expectations). To avoid redundancy we have focused on the process and activity level metrics, which are given in Table 1. The activity level includes another set of four metrics, which are supposed to facilitate or drive success on the process level. Research indicates that standardisation (A1) may improve project success (Milosevic and Patanakul, 2005). Post-implementation reviews (A2) are recognised tools to support organisational learning and increase the efficiency and effectiveness of future projects. Usage in project management practice is, however, not consistent (Anbari et al., 2008). Literature also confirms that education and training of project managers (A3) are important in influencing the timely delivery of construction projects (Brown et al., 2007). Stakeholder in particular user participation (A4) is increasingly recognised as an important facilitator for project management performance (Liu et al., in press). CobiT attaches information criteria to its metrics. For project management control the framework provides information on either effectiveness and/or on efficiency of management processes out of seven possible dimensions. According to CobiT, "effectiveness deals with information being relevant and pertinent to the business process as well as being delivered in a timely, correct, consistent and usable manner. Efficiency concerns the provision of information through the optimal (most productive and economical) use of resources" (ISACA, 2008).

Despite the recognised importance of IT governance practices (Bowen et al., 2007), empirical and theoretical research on internal management control over IT projects specifically relating to existing control frameworks such as CobiT is scarce and reported suggestions apart from traditional metrics for project management assessments and measurements are often inconsistent. This article attempts to add to an empirically validated concept of internal control for IT project management considering suggestions from CobiT through primary and secondary research as outlined in the next section.

3. Research methodology

3.1. Overview

To investigate our research objectives this study incorporates secondary data and models from current literature on project management control as well as primary data from an empirical survey. We investigated through comparisons with literature to which extent the Cobit construct reflects the specific intended domain of content. Hence, we questioned whether the metrics suggested by CobiT in its current version 4.1 (ISACA, 2008) sufficiently capture the scope of project management measures needed and if specific yet important aspects have been excluded. The gathered primary data augment this view by questioning the empirical feasibility and importance of the CobiT construct. We also assessed usefulness, general and CobiT specific benefits of

Table 1
Considered CobiT project management metrics and their level of measurement.

No	Item	Level of measurement
P1	% of projects meeting stakeholder expectations	Process
P2	% of projects on time and budget	Process
A1	% of projects following project management standards and practices	Activity
A2	% of projects receiving post-implementation reviews	Activity
A3	% of certified or trained project managers	Activity
A4	% of stakeholders participating in projects (involvement index)	Activity

Based on version Cobit 4.1, Process PO10 "Manage Projects".

control systems. According to CobiT, the given measures in Table 1 determine latent quality against three levels in project management: Activity, process and IT. The latent construct on the topmost IT level is the ability to respond to business requirements with projects that are on time, on budget and meeting quality standards in line with governance and board directions. We also set out to question these latent construct theoretically and empirically.

3.2. Data collection procedure

A cross-sectional field and web based survey was conducted to collect data about success of IT projects, control systems and characteristics of CobiT metrics. We targeted project management professionals, information system auditors and IT consultants. In order to validate the questionnaire, firstly a pre-test was conducted. For this purpose an announcement in a niche forum from XING named "Standards, process models and methods in IT" was published inviting to participate and provide feedback. Based on the answers given and feedback received the questionnaire was modified mainly by removing questions, improving the wording and flow of questions. The questionnaire was compressed in order to focus on the main topic of this study, e.g., the idea of an empirical investigation of other non-CobiT related metrics was dropped. We directly extracted single item CobiT measures from the original CobiT documentation. Face validity of the items is not of concern as we used the wording from the original CobiT documentation. We ensured consistent coding across all questions. The main study forwarded the research instrument to eleven different e-communities with a focus relevant to this study. Appendix A shows the final flow of questions and Appendix B includes the survey instrument. The data can be requested from the authors.

3.3. Profile of respondents

Members of targeted e-communities amounted to a target group size of 72,641 persons based on a count conducted on the 27th of January 2009. We posted invitations to participate in all forums and did not invite target persons directly to limit potential response bias. The survey recorded 324 responses with 266 partial and 58 fully completed questionnaires. In terms of potential response bias, we analysed this high dropout rate with five different Chi^2 tests. Table 2 displays the results of the comparison on demographics (language, functional affiliation, size of organisation, respondents' tenure, and main project role) between partial respondents (35–266) and full respondents (58). The comparison revealed no statistically significant differences for either variable, thus providing no evidence of non-response bias.

Table 3 presents the results on key demographics for respondents for full respondents to this study. The sample dominantly includes experienced project managers working within large organisations, regularly engaged in IT projects of substantial size. As we were interested in IT projects, the majority of respondents are affiliated to technology intense business sections such as IT, consulting and financial services. Therefore, care must be exercised in generalizing the results to the entire population of firms.

Table 2
Results from full and partial response bias analysis (Pearson Chi-square (χ^2) tests).

Variable	Full respondents	Partial respondents	χ^2	*df*	Significance
Language	58	266	0.139	1	.710
Functional affiliation	58	35	13.232	13	.430
Size of organisation	58	35	2.707	2	.258
Respondents' tenure	58	35	2.100	3	.552
Main project role	58	35	3.946	5	.557

3.4. Data analysis

To support our data analysis we worked with SPSS v16 and applied descriptive, inferential, correlation and regression analysis. We used Chi^2 analysis and the non parametric Mann–Whitney *U* test for testing whether two independent samples of observations come from the same distribution. We worked with Spearman rank correlation analysis to see whether two variables have a relationship without making any other assumptions about its particular nature. Paired *t* tests were applied to test for different means of independent samples. Linear regression was applied to test for interaction effects to predict the outcome of project success rates. Cronbach's Alphas were used as internal consistency reliability coefficients.

Table 3
Sample demographics[a].

Items[a]		%	#
Size of hosting organisation	Small	20.7	12
	Medium	15.5	9
	Large	63.8	37
Respondents' tenure	<3 years	13.8	8
	3–8 years	22.4	13
	Over 8 years	63.8	37
Functional affiliation of respondent	Advertising/marketing/media	3.45	2
	Financial/banking	10.34	6
	Government/national/state/local	6.90	4
	Health care/medical/pharmaceutical	6.90	4
	Insurance	1.72	1
	Manufacturing/engineering	8.62	5
	Public accounting	1.72	1
	Technology services/consulting	37.93	22
	Telecommunications/communications	3.45	2
	Education/student	8.62	5
	Other	10.34	6
Main project role	Project assistant	1.70	1
	Project member	17.20	10
	Project manager	60.30	35
	Project controller	3.40	2
	Steering committee	8.60	5
	Other stakeholder	8.60	5
Participation in significant (IT) projects	Never	0	0
	Seldom	29.3	17
	Often	70.7	41

[a] All items based on 58 data sets.

4. A comparative view of CobiT

To explore how well the CobiT framework reflects the specific intended domain of content with respect to project management we firstly give a comparative view considering its metrics in a selection of project management performance studies (see Table 4). Our view is that in comparison to other studies CobiT is less specific and provides less guidance on how practitioners should measure project management performance. Its selection of metrics on the activity level is, however, not seen in most of the listed articles. It also becomes clear that CobiT's approach grounds on an IT governance point of view. Its metrics are on a higher level of assessment, which in general give an overview over the state of all projects in the organisation as needed in project programme management. While the studies in their own focus fields provide help on what and how exactly to design and measure metrics, CobiT confines to aggregated and abstracted measures to assess the state of project management. Next, we will shortly describe each study and its position with respect to CobiT.

Bryde (2003) published a project management performance assessment model based upon the EFQM business excellence model. He also provided an empirical test to show how and if the model can be applied to understand and explore project management performance. Another study validated its usefulness in an empirical survey (Qureshi et al., 2009). Bryde's work considered 16 different project management key performance indicators and noted that the most important KPI is the client/customer perception of the project. The comparison between CobiT's and Brydes' metrics supports the view that CobiT metrics have a more pronounced quantitative and programme management character. CobiT considers all projects in the organisation to assess its project management processes trying to find common attributes whereas Brydes' metrics focus on individual quality aspects of projects next to organisational ones. Especially key organisational benefits or threats that can be expected from projects such as responsiveness to change, level of disruptions, enabling capacity, degree of innovation are not explicitly taken into account by suggestions from the CobiT framework. These aspects can only be substituted into CobiT's category of achieving stakeholder's expectations, which is a very ambiguous connection.

Table 4
Selected studies of project success and performance control in comparison with CobiT.

Focus of study	Comparison with CobiT	Citation
Model development for project management performance assessments and empirical validation	Delivers a more extensive model in particular listing key performance indicators; Gives empirical insights on the importance of metrics; CobiT provides some additional parameters.	Bryde (2003); Qureshi et al. (2009)
Discusses and proposes a new framework that extends the Iron Triangle of Project Management	More clearly distinguishes performance attributes in terms of their level of measurement (individual and organisational); Mentions an IS perspective of success; CobiT provides some additional parameters.	Atkinson (1999)
Performance measurement system for construction project control	More extensive framework; Fully defines metrics; Includes information on technical implementation; Misses out on some specific CobiT suggestions.	Cheung et al. (2004)
Relationship-based factors that affect performance of general building projects in China	More specific help for practitioners to know when to focus on what to gain performance; Explicit emphasis on relational factors, therefore some gaps to CobiT.	Jin and Ling (2006)
Explorative study of software project success criteria	Focuses on outcome measures; Does not mention activity level metrics from CobiT.	Agarwal and Rathod (2006)
Identification of key success drivers for construction project management	Looks at drivers and barriers to project success; Considers mainly aspects from the project environment and individual stakeholder characteristics; More extensive but not inclusive of all CobiT suggestions.	Jha and Iyer (2007)

The components of the Atkinson's (1999) "Square Route" are also reflected in the CobiT framework. The post-implementation reviews suggested by CobiT are known to be essential for organisational learning, which is also a benefit criterion according to the Atkinson's "Square Route". The involvement index can be related to the Atkinson's benefits for the stakeholder community. CobiT suggests two further metrics which should help to control future project success by including the "percent of projects following project management standards and practices" and "percent of certified or trained project managers".

Another paper has developed and implemented a performance measurement system for construction project control using eight different categories of performance measures: People, Cost, Time, Quality, Safety and Health, Environment, Client Satisfaction, and Communication (Cheung et al., 2004). Each of which comprises a set of metrics, which in detail describe the indicator and how it is measured. In comparison to CobiT it therefore provides a much more detailed specification and specific guidance for potential adopters. The construction study naturally places a greater emphasis on the properties of construction projects such as the need to control for safety, health and environmental issues. The study, however, also misses to acknowledge central suggestions from CobiT such as post-implementation reviews for organisational learning (A2) or compliance with project management standards and practices (A1).

Another study explored success indicators as perceived by software professionals based on the characteristics internal to the project organisation (Agarwal and Rathod, 2006). It concluded that scope in comparison with time and costs is considered as the most important success criterion. Scope comprises functionality and quality, while the former is found to be more important for software projects. CobiT includes scope related aspects within the generic stakeholder expectations metric (P2). Customer satisfaction was also rated as important criterion among a few more parameters. CobiT adds additional metrics on the activity level.

Key relationship-based determinants of project performance were assessed in another performance study (Jin and Ling, 2006).

Through extensive regression analysis many significant relationship-based drivers were identified that drive performance such as staff empowerment. Again, in its field the paper provides more specific information on performance management than CobiT but has a number of gaps due to its focus on relational factors. Post-implementation reviews and adherence to standards and policies were not mentioned.

Another study promoting the extension of the Iron Triangle to assess project success focuses on construction projects and identifies 55 project performance attributes in a two-stage questionnaire survey (Jha and Iyer, 2007). The article concludes with suggesting commitment, coordination, and competence as the key factors for achievement of schedule, cost, and quality objectives respectively. This study therefore also complies with the view of using drivers and outcome measures to control performance. The study is more extensive than CobiT yet again misses out on learning and compliance related aspects such as post-implementation reviews.

5. View on control frameworks

Project control systems of any type are used by 63.8% of the respondents (see Table 5). This number shrinks to 19% when restricting the control systems to CobiT based instalments. These results compare with an adoption and usage rate of CobiT of around 30% published by the IT Global Status Report 2008 report, the institution that developed and promotes CobiT (ITGI, 2008).

The empirical data revealed a success rate of 70% relating to the last significant IT project that participating project managers had to close. Successful projects according to this survey are projects that were completed on time, in budget with all features and functionalities as agreed upon. This number is rather high when compared to the latest 2009 CHAOS report, where 32% of projects are successful, but 44% are “challenged” (i.e. either take longer or cost more) while 24% really fail (The-Standish-Group, 2009). When comparing these numbers to the previous years (2004, 2006), a slight negative trend of more failed projects can be observed.

A question with regard to this papers' research aim is whether the use of a control framework has an effect on project success rates. The data showed that success rates within the group of managers that not worked with control systems is considerably lower (63.2%) than compared to those with control systems (74.2%). This rate increases to 88.9% when considering CobiT based control systems only. These numbers indicate a positive impact, which, however, could not be confirmed with inference analysis. The difference is not substantial based on the relatively low number of observations. Another aspect that was considered relates to the experience of project members. Those who are rarely facing significant IT projects achieve in the mean a much lower success rate of 46.2%. This large difference to the expected rate (70%) is statistically significant despite the low N (Chi^2 test, $p = .03$). Experience also positively correlates with success rates as shown by a Spearman correlation coefficient of .39 ($p = .004$). Experience seems to be a stronger moderator of success rates than the use of control systems. Another moderator of success in IT projects is the size of the hosting organisations. Larger organisations seem to be more successful as confirmed by a Spearman rank correlation coefficient of .31 ($p = .026$).

To identify how and if the set of considered variables relate as sets to project success rates variable, stepwise regression analysis was performed. It was therefore implicitly hypothesised that a multivariate model can be found, that significantly predicts success rates as the dependent criterion. The results of the stepwise analyses are reported in Table 6. Two steps were calculated. Due to the stepwise approach, the remaining factors significantly contribute to the model and therefore explain project success. Respondents' tenure was the first measure to be included in the stepwise calculation, followed by the frequency of important IT projects. Specifically, 22% of the variance in project success rates is explained by the only two factors in the final model ($p < .01$). As can be seen control frameworks did not significantly add to the regression model. No interaction effects with control systems were observed.

6. View on individual metrics

Firstly, the survey questioned the feasibility of CobiT metrics for assessing efficiency and effectiveness of project management processes. Table 7 shows the resulting ratings of the assessed CobiT metrics in respect of both views. The metrics seem valid to different degrees for measuring either effectiveness or efficiency of project management. Paired samples *t*-Test revealed that all means are significantly different for each pair of assessments apart from “% of projects following project management standards and practices”.

Table 8 shows the usage rates of CobiT metrics in project management control. It can be seen that the most used measure relates to the control of budget and time, which is used by 81% of the respondents. Costs and time are known as the hard facts while quality aspects are more elusive and difficult to quantify. The second ranked criterion considers stakeholders expectations. Both metrics can be seen as central aspects for project success relating to the previous literature review. Statistical tests do not indicate that the use of individual metrics promotes or hinders IT project success.

Table 5
Utilisation of control frameworks and project success rates.

Item	% of all	Item	% of all	Item	% of all
Project control system in use	63.8	CobiT control system in use	19.0	Success of the last significant IT project [a]	70.0

[a] Projects that were completed on time, in budget with all features and functionalities as agreed upon.

Table 6
Results of stepwise regression analysis of project success rates.

Step	Variable	B	R^2	corr. R^2	Δr^2
1	Respondents' tenure **	.29	.18	.16	–
2	Respondents' tenure **	.27	.25	.22	.06
	Realization of significant (IT) project *	.29			

The regression constant was excluded from the table for every step.
* $p < .05$.
** $p < .01$.

Table 7
Mean feasibility ratings of CobiT metrics.

No	Item	Feasibility as effectiveness measure (mean)	Feasibility as efficiency measure (mean)	Significance (paired sample test)
P1	% of projects meeting stakeholder expectations	33%	60%	.010
P2	% of projects on time and budget	62%	41%	.034
A1	% of projects following project management standards and practices	48%	60%	–
A2	% of projects receiving post-implementation reviews	26%	52%	.008
A3	% of certified or trained project managers	34%	57%	.018
A4	% of stakeholders participating in projects (involvement index)	19%	60%	.000

There is a gap between the feasibility of metrics either in terms of efficiency or effectiveness and their utilisation. For each metric Table 8 also shows the corresponding feasibility value which is the maximum mean accross both, the efficiency and effectiveness, views. Apart from the metric, percentage of projects on time and budget", which has a larger degree of utilisation compared to its maximum feasibility, all other metrics seem to be underutilised. Paired sample *t* tests revealed that in terms of all activity related metrics (A1 to A4), the underutilisation is statistically significant.

As feasibility outscores usage of metrics, the next questions are concerned with their actual practical importance and associated costs to measure the underlying construct. If metrics are feasible or valid to measure PO10 information criteria they not necessarily need to be perceived as important to the individual project stakeholder or hosting organisation. Hence, the difference between feasibility and usage of a metric could be potentially related to its low perceived importance. After assessing the feasibility of PO10 metrics to measure either effectiveness or efficiency the respondents had to estimate the importance of PO10 metrics according to both the information criteria using a scale between 1 (unimportant)

Table 8
Utilisation rates of metrics and their feasibility in comparison.

No	Item	Usage (mean)	Paired feasibility (mean)	Significance (paired sample test)
P1	% of projects meeting stakeholder expectations	64%	74% [a]	–
P2	% of projects on time and budget	81%	77% [b]	–
A1	% of projects following project management standards and practices	55%	74% [a]	.048
A2	% of projects receiving post-implementation reviews	41%	77% [a]	.003
A3	% of certified or trained project managers	33%	79% [a]	.000
A4	% of stakeholders participating in projects (involvement index)	41%	85% [a]	.000

[a] Feasibility as effectiveness measure.
[b] Feasibility as efficiency measure.

and 5 (very important). Table 9 shows the mean normalised importance rates for each metric again in comparison with the mean usage values. The data showed that all metrics were rated above the middle threshold of 50%, which confirms their importance. The study confirmed the multiple attributive character of project control as all questioned items being important, which is in conformance with Bryde (2003) assessed range of task and psycho-social outcomes, which were also rated as important (with one exception out of 16 criteria). Results shows that more quantifiable facts relating to time and costs rank first closely followed by stakeholder perceptions. Client/customer perceptions were ranked first in the mentioned Bryde's study. The results confirm and add to the results from the feasibility view. Important and feasible metrics in the activity view of CobiT seem to be underutilised in practice. In terms of project success rates, respondents who think that controlling for post-implementation reviews (A2) is important have greater success rates (Spearman rank correlation coefficient of .345; $p=.04$). Respondents who regularly take part in significant IT projects pay greater attention to stakeholder expectations (P1; Spearman rank correlation coefficient of .343; $p=.02$).

Next we examine the costs of implementing metrics as a possible reason for not using them. For this purpose we used the actual costs perceived by the adopters and estimated costs from non-adopters and again compared these ratings to utilisation rates. The cost related items were assessed on a scale between 1 (low) and 5 (very high) and then normalised for comparison purposes. Table 10 shows the mean normalised costs for each metric in comparison with the mean usage values. Surprisingly, the gap between metric utilisation and implementation costs is not as pronounced in comparison with either feasibility or importance rates. Individuals who perceive high efforts and costs with implementing metrics to control the projects in terms of time and budget (P2) seem to experience lower project success rates (Spearman rank correlation coefficient of −.393; $p=.02$).

Finally, we assessed the degree to which sets of metrics measure two latent constructs (process and activity quality) as proposed by the CobiT framework (see Table 1). We therefore considered the empirical feasibility views for measuring efficiency and effectiveness of project management, and the importance ratings of metrics for individual project contexts. Table 11 provides results of the Cronbach Alpha tests. A lenient cut-off of .6 is normally considered as adequate for exploratory empirical studies (Nunnally, 1978). Only one out of the six possible views has an alpha greater than the minimum threshold, attesting that the items seem not to fit well into the latent quality constructs suggested by CobiT.

7. Summary and conclusions

Considerable potential exists for academic research to evaluate IT project management control systems and their effectiveness to determine value for organisations. In this paper we set out to see whether such control systems are used and if control variables are valid, important and used in project management controlling practice. The set-up of this research was guided by critically questioning suggestions from the Control Objectives for IT and related Technology (CobiT) framework, a popular framework used worldwide for IT controlling purposes. In terms of CobiT's project

Table 9
Utilisation rates of metrics and their importance in comparison.

No	Item	Usage (mean)	Importance [a] (mean)	Significance (paired sample test)
P1	% of projects meeting stakeholder expectations	64%	76%	–
P2	% of projects on time and budget	81%	78%	–
A1	% of projects following project management standards and practices	55%	72%	.023
A2	% of projects receiving post-implementation reviews	41%	67%	.001
A3	% of certified or trained project managers	33%	62%	.000
A4	% of stakeholders participating in projects (involvement index)	41%	62%	.016

[a] Importance ratings were normalised and averaged across their effectiveness and efficiency ratings.

management coverage our research verdict is two-sided. While CobiT's coverage of project management control assessment factors is underdeveloped and too abstract for specific applications, a few important aspects promoted by CobiT such as controlling for post-implementation reviews seem to be regularly missing in other studies. In overall, CobiT metrics seem to have a stronger relation to programme management rather than to the view of individual projects. They reflect aggregated views of project management within organisations and thereby fail to appreciate the many individual, relational, and contextual factors that were found to be significant moderators of project management success. It is therefore not surprising that according to our data the use of control frameworks alone regardless of a reference to CobiT does not significantly promote success of projects. We found that other aspects such as individual experience, the frequency of large projects and the size of organisations all positively correlate with success rates. Regression analysis showed that the former two factors together predict success rates with experience as the most significant aspect. According to this study the overall adoption rate of CobiT for Project Management control frameworks (19%) was significantly lower than other reports suggest. Individual metrics are seen as very important and seem to be confirming the multiple attributive character of project management performance management. Especially costs, time and stakeholder expectations (e.g. scope and quality) showed the highest relevance ratings. Stakeholder expectations are higher valued by project members who regularly participate in projects. The importance of post-implementation reviews is rated higher by successful project members. However, control over these activities through the use of according metrics rated as feasible and important seems underdeveloped. Costs for implementation are high, which is a possible explanation for underutilised metrics expecially of metrics outside the classical time, cost and quality triangle. The suggested latent multi-level classification of metrics into leading and lagging indicators on process and activity levels was not validated by the data.

Table 10
Utilisation rates of metrics and their costs in comparison.

No	Item	Usage (mean)	Implementation costs [a] (mean)	Significance (paired sample test)
P1	% of projects meeting stakeholder expectations	64%	62%	–
P2	% of projects on time and budget	81%	60%	.005
A1	% of projects following project management standards and practices	55%	65%	–
A2	% of projects receiving post-implementation reviews	41%	58%	–
A3	% of certified or trained project managers	33%	60%	–
A4	% of stakeholders participating in projects (involvement index)	41%	67%	–

[a] Based on reported or estimated implementation costs for adopters and non-adopters respectively.

Table 11
Reliability tests of CobiT's latent constructs (Cronbach alpha).

No	Item	Feasibility as efficiency measure	Feasibility as effectiveness measure	Importance
P	*Process level control*	.483	.402	.014
P1	% of projects meeting stakeholder expectations			
P2	% of projects on time and budget			
A	*Activity level control*	.515	.595	.636
A1	% of projects following project management standards and practices			
A2	% of projects receiving post-implementation reviews			
A3	% of certified or trained project managers			
A4	% of stakeholders participating			

To conclude, the CobiT framework seems to be a viable yet very generic construct to measure project management performance with gaps to studies in particular to those with a focus on specific project settings. Its metrics are seen as feasible and important for project management control and are used in practice but only by a minority of assessed project stakeholders. Industry practice will however find it difficult to implement an effective project performance management system based on CobiT alone due to its very generic nature and focus on programme management relevant for IT governance. Future CobiT related studies that examine IT project management control frameworks may target the gap that was identified in its coverage and develop a more specific, empirically tested multiple attributive model for IT project management control. We also need to know more on how these multiple attributes can be aggregated into consistent dimensions as the suggestions by CobiT were not supported in this study. The analytical hierarchy process for example could be introduced into such frameworks to help practitioners reduce the dimensionality of their models. A further key question to solve remains the identification of mediators of success that can be effectively incorporated into control frameworks to foster their impact on actual project success rates. Contextual elements should be part of frameworks and guide model development to better support the diversity of project management settings. We assume that a focus on project transparency for the benefit of auditors is not sufficient to generate value from IT project performance management systems.

Appendix A. Survey flowchart

The following figure shows the logical structure and flow of questions for the survey.

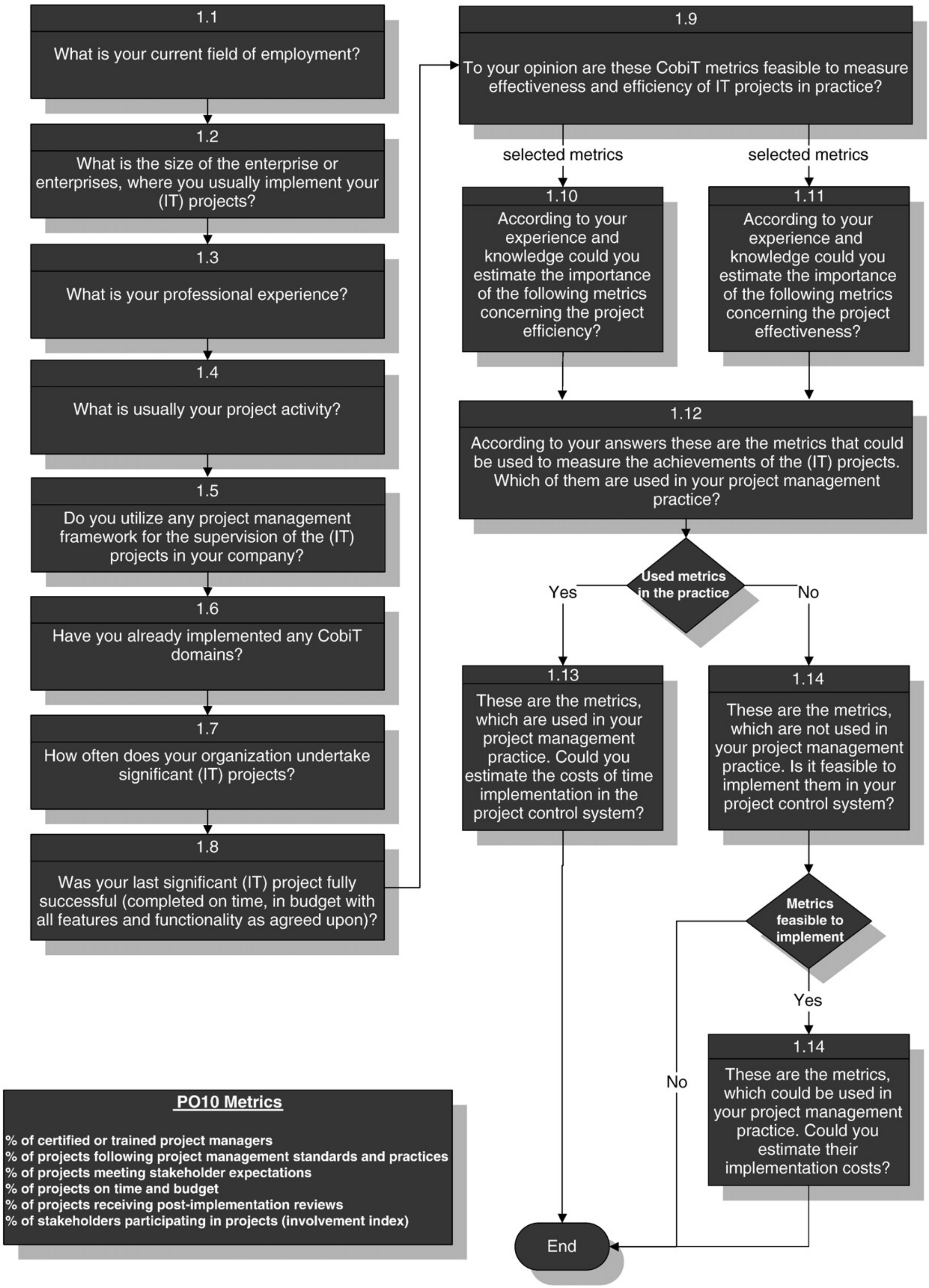

Fig. 1. The structure and questions used in the research instrument.

Appendix B. Survey instrument

Table 12
Survey instrument.

Section	Question	Scale	Scale format	Code
Demographic	What is your current field of employment?	Nominal	Advertising/marketing/media Financial/banking Government/national/state/local Health care/medical/pharmaceutical Insurance Legal/law/real estate Manufacturing/engineering Public accounting Technology services/consulting Telecommunications/communications Transportation Education/student Other	A0_03 3
	What is the size of the enterprise, where you usually implement your (IT) projects?	Ordinal	Small: less than 50 employee Medium: 50–250 employee Large: over 250 employee	A0_05
	What is your professional experience?	Ordinal	Less than 3 year 3–8 years Over 8 years	A0_06 6
	What is usually your project activity?	Nominal	Project assistant Project member Project manager Project controller Client Steering committee Other stakeholder *	A0_07
Project environment	Do you utilise any project management framework for the supervision of (IT) projects?	Binary	Yes[a] / no	A0_08
	Have you already implemented any CobiT domains?	Binary	Yes[a] / no	A0_09
	How often does your organisation undertake significant (IT) projects?	Ordinal	Never Seldom Often	A0_10
	Was your last significant (IT) project fully *successful* (completed on time, in budget with all features and functionality as agreed upon)?	Binary	Yes / no	A0_13
CobiT PO10	CobiT evaluates IT projects according their *effectiveness* and *efficiency*. The metrics for this purpose are listed below. Are these metrics feasible to measure *effectiveness* of IT projects in practice?			A2_01
	% of certified or trained project managers	Binary	Yes / no	_01
	% of projects following project management standards and practices	Binary	Yes / no	_02
	% of projects meeting stakeholder expectations	Binary	Yes / no	_03
	% of projects on time and budget	Binary	Yes / no	_04
	% of projects receiving post-implementation reviews	Binary	Yes / no	_05
	% of stakeholders participating in projects (involvement index)	Binary	Yes / no	_06
	Are these metrics feasible to measure *efficiency* of IT projects in practice?			A2_02
	% of certified or trained project managers	Binary	Yes / no	_01
	% of projects following project management standards and practices	Binary	Yes / no	_02
	% of projects meeting stakeholder expectations	Binary	Yes / no	_03
	% of projects on time and budget	Binary	Yes / no	_04
	% of projects receiving post-implementation reviews	Binary	Yes / no	_05
	% of stakeholders participating in projects (involvement index)	Binary	Yes / no	_06
	According to your experience and knowledge could you estimate the importance of the following metrics concerning project *effectiveness*?			A2_03
	% of certified or trained project managers	Interval	1 = "not important" to 5 = "very important"	_01
	% of projects following project management standards and practices	Interval	1 = "not important" to 5 = "very important"	_02

Appendix B (*continued*)

Section	Question	Scale	Scale format	Code
CobiT PO10	According to your experience and knowledge could you estimate the importance of the following metrics concerning project *effectiveness*?			_03
	% of projects meeting stakeholder expectations	Interval	1 = "not important" to 5 = "very important"	
	% of projects on time and budget	Interval	1 = "not important" to 5 = "very important"	_04
	% of projects receiving post-implementation reviews	Interval	1 = "not important" to 5 = "very important"	_05
	% of stakeholders participating in projects (involvement index)	Interval	1 = "not important" to 5 = "very important"	_06
	According to your experience and knowledge could you estimate the importance of the following metrics concerning project *efficiency*?			A2_05
	% of certified or trained project managers	Interval	1 = "not important" to 5 = "very important"	_01
	% of projects following project management standards and practices	Interval	1 = "not important" to 5 = "very important"	_02
	% of projects meeting stakeholder expectations	Interval	1 = "not important" to 5 = "very important"	_03
	% of projects on time and budget	Interval	1 = "not important" to 5 = "very important"	_04
	% of projects receiving post-implementation reviews	Interval	1 = "not important" to 5 = "very important"	_05
	% of stakeholders participating in projects (involvement index)	Interval	1 = "not important" to 5 = "very important"	_06
	According to your answers these are the metrics that could be used to measure achievements of (IT) projects. Which of them are *used* in your project management practice?[b]			A2_06
	% of certified or trained project managers	Binary	Yes / no	_01
	% of projects following project management standards and practices	Binary	Yes / no	_02
	% of projects meeting stakeholder expectations	Binary	Yes / no	_03
	% of projects on time and budget	Binary	Yes / no	_04
	% of projects receiving post-implementation reviews	Binary	Yes / no	_05
	% of stakeholders participating in projects (involvement index)	Binary	Yes / no	_06
	These are the metrics, which *are used* in your project management practice. Could you estimate the *costs* of their implementation in the project control system?[b]			A2_09
	% of certified or trained project managers	Interval	1 = "low" to 5 = "high"	_01
	% of projects following project management standards and practices	Interval	1 = "low" to 5 = "high"	_02
	% of projects meeting stakeholder expectations	Interval	1 = "low" to 5 = "high"	_03
	% of projects on time and budget	Interval	1 = "low" to 5 = "high"	_04
	% of projects receiving post-implementation reviews	Interval	1 = "low" to 5 = "high"	_05
	% of stakeholders participating in projects (involvement index)	Interval	1 = "low" to 5 = "high"	_06
	These are the metrics, which *could be used* in your project management practice. Could you estimate the *costs* of their implementation in the project control system?[b]			A2_11
	% of certified or trained project managers	Interval	1 = "low" to 5 = "high"	_01
	% of projects following project management standards and practices	Interval	1 = "low" to 5 = "high"	_02
	% of projects meeting stakeholder expectations	Interval	1 = "low" to 5 = "high"	_03
	% of projects on time and budget	Interval	1 = "low" to 5 = "high"	_04
	% of projects receiving post-implementation reviews	Interval	1 = "low" to 5 = "high"	_05
	% of stakeholders participating in projects (involvement index)	Interval	1 = "low" to 5 = "high"	_06
	These are the metrics, which are *not used* in your project management practice. Is it feasible to implement them in your project control system?[b]			A2_10
	% of certified or trained project managers	Binary	Yes / no	_01
	% of projects following project management standards and practices	Binary	Yes / no	_02
	% of projects meeting stakeholder expectations	Binary	Yes / no	_03
	% of projects on time and budget	Binary	Yes / no	_04
	% of projects receiving post-implementation reviews	Binary	Yes / no	_05
	% of stakeholders participating in projects (involvement index)	Binary	Yes / no	_06

[a] A further question was presented asking about the context.

[b] The given metrics depend on previous answer.

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