12-4-2011

Developing a Situational Model of Information System Project Success

Dirk Basten

Dominik Joosten

Werner Mellis

Developing a Situational Model of Information System Project Success

Dirk Basten
University of Cologne
basten@wiso.uni-koeln.de

Dominik Joosten
University of Cologne
joosten@wiso.uni-koeln.de

Werner Mellis
University of Cologne
mellis@wiso.uni-koeln.de

ABSTRACT

Scholars have not found a common understanding of information system (IS) project success nor does a common measurement approach exist in empirical research. A plausible cause for the lack of such an agreed on definition is that a generally accepted definition of IS project success practically cannot be derived due to stakeholders' different perceptions of success. Therefore, we develop a situational model for the group of IS projects' contractors. We gathered data from 52 IS projects managers and apply PLS path modeling to determine the relevant success dimensions from their subjective perspectives. Our results show customer satisfaction, process efficiency, and functional requirements as the three most important dimensions for contractors. Scholars and practitioners should shift from measuring IS project success in terms of adherence to planning to an approach adapted to the specific terms of the project under consideration and the stakeholder group addressed.

Keywords

Information system project success, PLS path modeling, situational model, questionnaire.

INTRODUCTION

Scholars have been discussing the measurement of project success in general and of information system (IS) project success in particular for a long time. Nevertheless, there is still no satisfying solution for the problem of identifying the constituent dimensions of project success. Scholars have not found a common understanding of project success nor does a common measurement approach exist in empirical research (Baccarini, 1999; Ika, 2009). The same applies to IS projects and the measurement of their success (Aladwani, 2002; Thomas and Fernández, 2008).

The measurement of IS project success, that is, assessing the degree to which an IS project has to be considered holistically successful, is of high importance for research and practice. First, IS researchers often analyze different ways to design the software development process (e.g., using specific tools, technologies, or approaches) to optimize the process and its outcome (Deephouse, Mukhopadhyay, Goldenson and Kellner, 1996; Jiang, Klein and Shepherd, 2001; Na, Simpson, Li, Singh and Kim, 2007). In this context, researchers aim to identify IS projects' critical success factors. For these studies, it is essential to use an operationalization of IS project success as a dependent variable that is valid and generally accepted. The use of such a dependent variable assures the comparability of different studies and avoids misleading interpretations. Second, companies depend on a valid measurement of IS project success as well. Without such a measurement, a proper evaluation of a project's benefits is not feasible. As projects need to exhibit benefits to justify their cost, companies may draw misleading conclusions for future projects if benefits are evaluated a wrong way.

The consensual evaluation of IS projects requires project stakeholders to agree on a definition of the concept IS project success – at least for the project under consideration. Amongst others, a plausible cause for the lack of such an agreed on definition is that a generally accepted definition (i.e., a definition that is fully accepted by all project stakeholder groups) of IS project success practically cannot be derived due to stakeholders' different success perceptions (Cuellar, 2010; Dvir, Lipovetsky, Shenhar and Tishler, 1998; Shenhar, Dvir, Levy and Maltz, 2001) that rely on different interests and roles (Freeman and Beale, 1992; Stuckenbruck, 1986). Depending on the context, developers might for example evaluate IS project success in terms of substantial learning and reusable code instead of time and budget (Linberg, 1999).

As an alternative to a generally accepted definition, scholars suggest to develop situational models of IS project success (Dvir et al., 1998). Such models each correspond to a specific context, that is, they are adapted for instance to a specific type of project or product and/or to a specific stakeholder group. Our study is an exploratory approach to develop such models. Next to other potential distinctions like product type (e.g., application, system, or embedded software) and contract type (e.g., fixed-price vs. time-and-material), the one between different stakeholder groups is highly important for measuring success (e.g., Baker, Murphy and Fisher, 1988; Freeman and Beale, 1992). According to the differentiation between stakeholder groups, we empirically determine contractors' specific perceptions of the concept IS project success in order to develop a first situational model from the contractors' point of view. This stakeholder group denotes the management perspective of the contractor, that is, project managers and their supervisors (cf. section "IS Project Success from the Contractor's Point of View"). Our model specifically pertains to this stakeholder group and is general concerning other aspects like product type and contract type. The approach is based on the assumption that even the differentiation between stakeholder groups results in significantly different models. Our corresponding research question is:

Which dimensions constitute a model to measure IS project success for the group of IS project contractors?

By answering this research question, we expect the contribution of our study to be threefold. (1) The development of a first situational model will explore the importance of different success models and thus lead to new insights for future research on this topic. (2) The model will show whether the traditional measurement approach is adequate and sufficient for the group of IS project contractors and thus the necessity to distinguish different models for different stakeholder groups. (3) We provide new insights for practitioners that might help to evaluate the success of IS projects.

We derived potentially relevant success criteria, in the following called dimensions, of IS project success from literature and a previously conducted empirical study (Pankratz and Loebbecke, 2011). In case of the latter one, we did not use the success factors but the related laddering information (Joosten, Basten and Mellis, 2011). We apply partial least squares (PLS) path modeling to questionnaire data of project contractors' subjective perceptions of IS project success and its dimensions.

The remainder of this article is the following. The next section presents a short outline of the development of IS project success measurement. Then, we provide an overview of potentially relevant success dimensions and refer to those dimensions that we expect to be relevant for the contractor's perspective. Afterwards, we describe our study design and present our results. Finally, we discuss these as well as implications for the overall model and present implications for research and practice.

IS PROJECTS AND THE MEASUREMENT OF THEIR SUCCESS

Traditionally, the measurement of IS project success relies on the criteria of adherence to planning. Project success is measured using a project's adherence to budget and schedule as well as its conformance with specified functional and non-functional requirements (Agarwal and Rathod, 2006; Cuellar, 2010; Karlsen, Andersen, Birkely and Ødegård, 2005). Practitioners also refer to this approach as Iron Triangle (Atkinson, 1999) or Triple Constraint (Pinto, 2004). Although there are reasons to rely on additional criteria as well, companies nowadays still mainly apply this measurement approach (Collins and Baccarini, 2004; Thomas and Fernández, 2008). On the one hand, the use of adherence to planning is comprehensible due to its objective and straightforward nature. On the other hand, this approach has been shown to be insufficient and highly defective. Measuring IS project success using solely adherence to planning is insufficient as it does not account for the perspectives of all project stakeholders (Agarwal and Rathod, 2006). Empirical studies showing the deviation between adherence to planning and subjective success perceptions support this view (Furulund and Moløkken-Østvold, 2007). Additionally, a valid success measurement in terms of adherence to planning relies on correct effort estimates. As such estimates are often inaccurate (cf. the overview in Basten and Mellis, 2011), uncertain information are in many cases the basis for the assessment of IS project success.

Although many researchers (Aladwani, 2002; Saarinen, 1996; Yetton, Martin, Sharma and Johnston, 2000) agree that IS project success is a multidimensional concept, there is no agreement on the criteria that need to be regarded. Scholars often propose models that consist of the two main dimensions, process success (or synonymously project management success) and product success (Baccarini, 1999; Saarinen and Sääksjärvi, 1992). This approach corresponds to a differentiation between (process) efficiency and (product) effectiveness as project success' two key measures (Liu, Chen, Chen and Sheu, 2011). In this context, this differentiation is not without problems as several studies misleadingly equate efficiency with both effectiveness and/or adherence to planning (Ika, 2009). At least, most suggested measurement approaches consider the necessity to differentiate between a narrow concept of process success (project management success) and a wider concept of overall project success (e.g., Cooke-Davies, 2002). In contrast to previous approaches that consider only the implementation phase of IS projects, newer ones assess project success with regard to the overall life cycle of the developed information system (Judgev and Müller, 2005). For example, such newer success concepts consider the product's economic benefits as well. As a consequence, IS project success does no longer only refer to project management or implementation success but to the combined success of the process and its outcome.

Furthermore, researchers consider project stakeholders' different subjective perceptions to be important for the measurement of the overall IS project success (Baker et al., 1988; Ika, 2009). The same applies to the consideration of different stakeholders' interests in general (Baccarini, 1999; Baker et al., 1988). These different interests and corresponding differences in the perceptions of success are two reasons for researchers doubting that it is actually possible and meaningful to define a concept of IS project success that is valid for all types of stakeholders (Liu and Walker, 1998). Accordingly it might be impossible to define success for all different types of projects and all types of products (Dvir et al., 1998; Karlsen et al., 2005; Shenhar et al., 2001). Therefore, scholars explicitly demand the development of situational models of IS project success (Dvir et al., 1998), which do not exist so far. Such models each correspond to a specific context, that is, they are adapted for instance to a specific type of project or product and/or to a specific group of stakeholders.

IS PROJECT SUCCESS FROM THE CONTRACTOR'S POINT OF VIEW

The contractor organization is one of four stakeholder groups that are typically mentioned in the context of contracted (IS) projects. The other ones are the customer organization, the users, and the project team (e.g., Baker et al., 1988). The contractor organization denotes the management perspective of the contractor, that is, project managers and their supervisors. Thereby, the contractor may be an external company as well as an internal department. Previously, researchers have already analyzed IS project success from the perspective of developers and users (Cho, Subramanyam, Lee and and Krishnan, 2007). To continue this research stream, we might analyze the customer as well the contractor organization. In this study, we concentrate on contractors' management representatives as this stakeholder group usually has the broadest overview on project management.

As a first step to develop a contractor-specific situational model of IS project success, it is necessary to identify potentially relevant success dimensions. For this, we use the consolidated list of potential success dimensions (cf. Table 1) that was derived from literature and qualitative interviews and that has been used before (Joosten et al., 2011).

We expect a situational model of IS project success for the contractor to contain a subset of these dimensions, that is, those that are relevant for this particular group of stakeholders. With regard to Table 1, we expect four of the potentially relevant success dimensions to be of high importance for contractors' project management. (1) To gain economic benefits, the project's economic success is important. Therefore, the contractor is supposed to aim at conducting the project efficiently in order to generate profit. (2) Apart from the direct financial effects, we assume that customer satisfaction is of high importance as decisions about follow-up projects are typically based on the contractor's reputation. (3) Project managers will aim to satisfy the contractor as an organization as job promotions may heavily depend on this index. (4) Although there are a number of reasons against the use of adherence to planning as success criterion (cf. section "IS Projects and the Measurement of their Success"), we might expect it to be considered relevant by the respondents due to long-time practice.

STUDY DESIGN

In this section, we describe our research approach, the way of data collection, and provide an overview of the characteristics of our sample.

Research Approach

We conducted an empirical questionnaire study with project managers and line managers in German companies to relate project contractors' perceptions of the different potential success dimensions (cf. Table 1) to the overall success of an IS project. In this context, we need to regard the distinction of success factors - that directly or indirectly influence project success - and success criteria or rather dimensions - that can be used to measure project success. Although the conceptual distinction between these concepts is considered important (Cooke-Davies, 2002; Dvir and Lechler, 2004), factors and dimensions are often congruent or a differentiation turns out to be challenging. Basically, in each case we have to conceptually decide whether a variable associated with IS project success has to be considered being a factor or a dimension.

Success Dimension	Definition
Adherence to Budget	Deviation between the actual and the planned cost of development.
Adherence to Schedule	Deviation between the actual and the planned time of development.
Conformance with Functional Requirements	Deviation between the specified functional requirements and their actual realization.
Conformance with Non-Functional Requirements	Deviation between the specified non-functional requirements and their actual realization.
Process Efficiency	Ratio of resources used (development effort) and outcomes achieved (project goals).
Project's Economic Success	The project is economically successful, i.e., it generates sufficient profits.
Product's Economic Success	The product is economically successful, i.e., it generates a positive return, e.g., market success or structural cost savings.
Customer Satisfaction	The customer organization is satisfied with the project's overall course of action and its outcome, i.e., the product.
User Satisfaction	The users are satisfied with the product in terms of functionality and usability.
Contractor Satisfaction	The contractor organization is satisfied with the project's overall course of action and its outcome, i.e., the product.
Project Team Satisfaction	The team members are satisfied with their job on the project.
Transparency of the Development Process	The project is transparent if all project stakeholders are able to get the information they need.
Product's Flexibility and Maintainability	Economically maintaining or adapting the product to new conditions.
Technical Innovativeness / Learning Effects	A project is innovative if the product is new and/or complex from a technological point of view and/or if the use of new and/or complex technology leads to learning effects.
Contribution to the Strategic Mission of the Enterprise	A project contributes to the strategic mission of an organization if the product leads to strategic advances in terms of added value that is not directly measurable.
Quality of Planning	Project plans are correct and contain sufficient information about resources, task dependencies, and task assignments based on the underlying effort estimates.
Quality of Estimation	Sufficient effort has been invested to estimate the development effort in terms of using analogies, systematic estimation techniques, and considering specific project characteristics. Estimates are also correct.
Freedom from Defects	A number of defects as low as possible after the product's rollout indicates high system quality.

Table 1. Potentially Relevant Success Dimensions and their Definitions (Joosten et al., 2011)

We base our study on the set of potentially relevant dimensions that were previously identified (cf. Table 1). In this study, we analyze if they are relevant for the specific model for the contractor perspective (cf. Figure 1).

According to the assumption above, we apply PLS path modeling to empirically develop our model of IS project success from the contractor's point of view. For this analysis, we use reflective constructs and apply SmartPLS (Ringle, Wende and Will, 2005).

In IS research, PLS is widely used (Evermann and Tate, 2010). PLS emphasizes the measurement in the absence of a certain theory (Lohmöller, 1989). As we seek to identify a model with a high explanation of the observed variance in the endogenous latent variables, PLS is the best choice (Gefen, Straub and Boudreau, 2000). Additionally, for studies with a large number of constructs, PLS is more suitable compared to the covariance-based approaches of structural equation modeling (Chin and Newsted, 1999; Fornell, 1987).

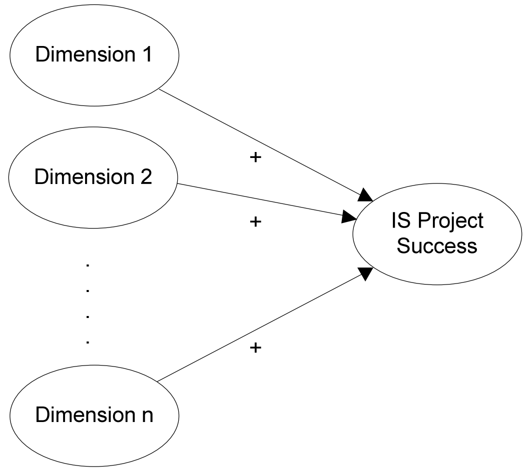

Figure 1. Potential Success Dimensions and their Influence on the Overall IS Project Success

Data Collection and Instrument

For the potentially relevant success dimensions (cf. Table 1 and Figure 1), we initially developed the corresponding items on the basis of the results of a literature review and information from interviews with project managers (cf. section "IS Project Success from the Contractor's Point of View"). Afterwards, three external researchers and four software experts successively approved or adapted these twice. Researchers secured the items' clearness. We chose the software experts, who mainly judged the items' relevance, due to their long-term experience in managing IS projects. In the questionnaire, each dimension contained between 3 and 6 items. All items were measured on a 7 point Likert scale (1 – total disagreement; 7 – total agreement).

The data was gathered through a questionnaire survey with software experts from Germany (the questionnaire containing the items is only available in German and can be retrieved by contacting the authors; translated sample items for the most important dimensions are included in Appendix A). We used a call for participation by the GPM, the German chapter of the International Project Management Association (IPMA) and personal contacts to software companies to gain participants. Overall, 52 software professionals from project management on behalf of the contractor participated in our survey to report on their own experience on a project conducted as part of the project contractor stakeholder group.

Participants' and Projects' Characteristics

All participants are experienced in the field of IT business with many years of professional experience (17 mean; 16 median). They gathered their experience on about 20 IT projects on average (31 mean) and in 17 (9 median) in their current position. Almost 80% hold a university degree.

The projects under investigation were almost equally internally and externally contracted. There were also as many fixed-price as time-and-material contracts. The majority of projects (92%) were conducted to develop new or extend existing application software. Table 2 provides an overview of the projects' business sectors. Indices of project size and duration are given in Table 3.

Threats to Validity

Our study only covers a limited number of IS projects in Germany. Thus, further studies are needed to corroborate our findings with regard to external validity. Furthermore, the selection of participants might bias our results as we expect members of such a professional organization not to be representative for IS practitioners in general.

As we did not contact single persons, but organizations, we did not receive any information how many respondents actually received our call. Thus, our sampling approach does not allow any insights into the response rate and a potentially non-response bias. Nevertheless, we believe this to be an appropriate approach as we otherwise might have received even fewer responses due to the length of our questionnaire (3 to 6 items for each the overall success and the 18 potentially dimensions).

Industry	Share
Financial Services	46%
Telecommunication	15%
Transport	12%
Other	5%
Retail	4%
Chemistry	4%
Manufacture	4%
Supply	2%
Research and Development	2%
Public Services	2%
Defense	2%
Media / Print	2%

Table 2. Projects' Distribution over Industries

	Median	Mean
Project Cost in €	500,000	3,009,282
Project Duration in Months	12	17
Number of Team Members	10	19

Table 3. Projects' Cost, Durations, and Number of Team Members

DATA ANALYSIS AND RESULTS

First, we applied confirmatory factor analyses to confirm the dimensions uni-dimensionality. We removed items that showed no distinct coherence to a single factor.

As our sample is not sufficient to estimate path coefficients for all 18 potential success dimensions at the same time, we chose to first estimate the path coefficients between the single success dimensions and the overall success. The results (Path Weighting Scheme, Mean 0, Var 1, Maximum Iterations 300) show that only eight out of the 18 potential success dimensions have a significant correlation with the overall subjectively perceived success of IS projects. Figure 2 illustrates the path model for the combination of the eight significant dimensions. We also used SmartPLS' bootstrapping (Ringle et al., 2005) to calculate the t-values (no sign changes, 5000 samples). For a dimension to be significant, the according t-value needs to exceed 1.65 at a confidence level of .9.

Although our approach is single-sided, method biases seem to be less serious in IS research than in other disciplines (Malhotra, Kim and Patil, 2006). Nevertheless, we applied the marker variable technique (Malhotra et al., 2006) to check for the correlation between theoretical uncorrelated dimensions. As the second lowest one amounts 0.06, we do not assume common method variance to be a problem for our analysis.

Measurement Model

In the following, we refer to the four validity and reliability criteria that are relevant for measurement models containing only reflective indicators.

First, the internal consistency of all constructs fulfills the required levels of cronbach's alpha (each construct exceeds 0.76) (Nunnally, 1978) and construct reliability (each construct exceeds 0.86) (Werts, Linn and Jöreskog, 1974).

Second, an indicator is meant to be reliable when the related construct explains more than 50% of the indicator's variance (Henseler, Ringle and Sinkovics, 2009). As a consequence of data's standardization, this criterion can be evaluated in terms of the squared factor loadings. As the reliability of the factor with the lowest loading amounts 0.55, our model fulfills this criterion.

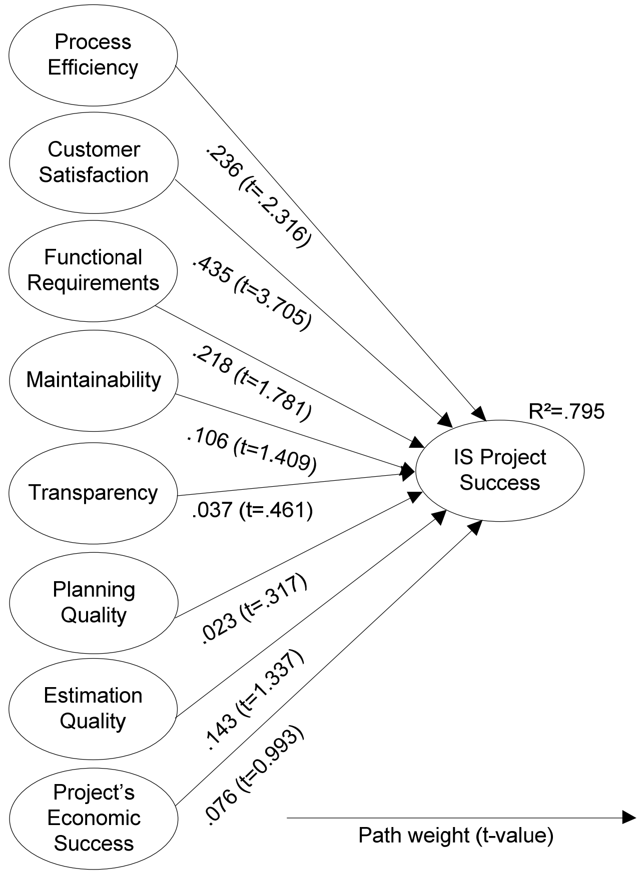

Figure 2. Model of IS Project Success from the Contractor's Point of View

Third, to fulfill the criterion of convergent validity, each dimension's average variance extracted (AVE) needs to amount at least 0.5 (Fornell and Larcker, 1981). As Table 4 illustrates, all constructs exceed this threshold.

Fourth, to confirm discriminant validity, a latent variable needs to explain its indicators' variances to a higher degree than the variances of other latent variables (Fornell and Larcker, 1981). Accordingly, the square root of each construct's AVE needs to exceed the construct's correlation with all other constructs (cf. Table 4). Our model's crossloadings confirm this finding. All indicators' factor loadings are higher for the related constructs compared to other constructs' loadings (Chin, 1998)

	1	2	3	4	5	6	7	8	9
IS Project Success	**.89**								
Customer Satisfaction	.74	**.92**							
Estimation Quality	.52	.24	**.82**						
Product's Economic Success	.43	.23	.57	**.86**					
Maintainability	.33	.22	.21	.00	**.90**				
Functional Requirements	.62	.41	.35	.31	.03	**.82**			
Process Efficiency	.70	.49	.46	.38	.34	.47	**.89**		
Planning Quality	.43	.18	.69	.40	.16	.41	.27	**.87**	
Transparency	.52	.39	.25	.18	.13	.70	.43	.35	**.93**

Table 4. Measurement Model's Discriminant Validity (Construct Correlations and Square Roots of Average Variance Extracted (Bold Values))

Path Model

Following the critical analysis of the many criteria to evaluate structural models in PLS modeling (Evermann and Tate, 2010), the suitability of these criteria highly and in a complex way depends on various aspects (e.g., specification, sample size, number of indicators). Due to a lack of noncritical criteria, we analyze the explained variance, the goodness of fit (GoF) index, the predictive relevance, and power analysis as global fit measures.

The overall model's explained variance (R^2) amounts 79.5%. Compared to the thresholds (Chin, 1998), this result is substantial. Figure 2 shows the path model of IS project success according to our results.

The goodness of fit (GoF) index can be used to assess the global validity of PLS based models (Tenenhaus, Vinzi, Chatelin and Lauro, 2005). For our model, this index amounts .80 and thus extends the threshold of .36 for large effects (Cohen, 1988).

Using blindfolding, we calculated the model's predictive relevance Q2. This value represents in how far the underlying empirical data can be rebuilt using the model and PLS parameters (Fornell and Cha, 1994). For our model, we obtained a value of .612 (omission distance = 7; cross validated redundancy) which represents a highly predictive model (Chin, 2010).

We also conducted a post hoc power analysis (error probability .10) using G*Power (Faul, Erdfelder, Buchner and Lang, 2009) to evaluate the possibility that despite the influences' significance, insignificant results are produced (Faul, Erdfelder, Lang and Buchner, 2007). Thereby, we only refer to the three influences that are significant. The power for the effects of customer satisfaction and process efficiency reach or rather exceed the recommended level of .80. Due to our rather small sample size, the power in case of the fulfillment of functional requirements amounts only .66. Thus, this influence has to be considered carefully.

According to the indices above, our path model fulfills the necessary conditions to provide a good model.

SUMMARY AND DISCUSSION

In this study, we aimed to empirically determine the dimensions that are important for contractors to evaluate IS project success. Therefore, we analyzed survey data from 52 project managers on behalf of the contractor from IS projects in Germany. The study is based on the two following assumptions: (1) Success evaluations are highly subjective perceptions. (2) Success evaluations additionally depend on further situational variables like project type, product type, and the focused stakeholder group. Based on these assumptions, we argued for the development of situational models of IS project success. Such models are valid for specific parameter combinations, e.g., product type, contract type, and focused stakeholder group. This approach was proposed to revive the discussion on the objective and valid assessment of IS project success. Our study is a first step to develop situational models as we provide a model for IS project success from the perspective of the contractor organization, one of the four typical stakeholder groups (contractor organization, client organization, the users, and the project team) of contracted IS projects.

As a result of our analyses, we supported three of the potentially relevant success dimensions (cf. Table 1) to be significant for contractors. According to their path coefficient and effect sizes, these are in downward order the satisfaction of the customer organization, the efficiency of the development process, and the fulfillment of functional requirements. Figure 3 illustrates these influences in our final model of contractor's IS project success. In addition to path coefficients, the arrows show the dimensions' effect sizes (Cohen, 1988). The effect sizes confirm the strength of the path coefficients. Although these results partially meet our expectations, there are some findings that are surprising compared to our conceptual considerations. In the following, we discuss these findings.

Traditionally, customer satisfaction is of high importance in all business fields. Focusing on customer relations has been seen as the key to success for several years. Therefore, it is not surprising that this is also true for contractor organizations in German IS projects. Furthermore, contractors' success in IS projects heavily depends on the fulfillment of customer demands. Fulfilling these demands leads to satisfaction of the customer and follow-up contracts for the contractor. The high path coefficient (.451) and effect size (.585) for the overall success as subjectively perceived by project managers show the internalization of customers' interests by the contractors. Accordingly, project managers will align their action to satisfy the customer.

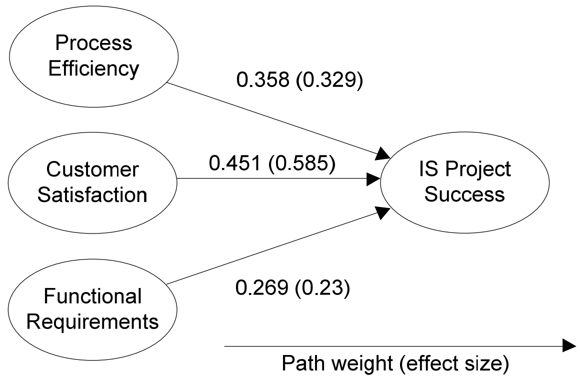

Figure 3. Final Model of IS Project Success from the Contractor's Point of View

In this context, the high importance of process efficiency is also coherent with regard to the business perspective. Assuming that customer orientation and customer satisfaction are necessary conditions for business success, process efficiency is the sufficient one. Efficient use of resources during project implementation in combination with satisfied customers enables market success and sustainable profitability. Functional requirements represent a project's essential goals. Without their fulfillment, it might only seldom be possible to reach overall project success.

Non-functional requirements do not seem to be important from the perspective of contractors. As these requirements can be seen as essential project goals, we find this result surprising. From our experience, it can be argued that software professionals in many cases do not distinguish between functional and non-functional requirements. As a consequence, the respondents might undervalue non-functional requirements compared to functional requirements.

Other dimensions did not show a significant path coefficient in the overall model of IS project success from contractors' point of view. We especially expected two of the traditional criteria of adherence to planning (time and budget) to be of high importance for project managers. Their lack is surprising in the light of the fact that practitioners typically use these criteria to measure IS project success. Consequently, we assume that success measurement in terms of adherence to planning is applied due to lack of alternatives. This assumption is shared by other researchers as well (e.g., Dvir and Lechler, 2004; Pinto and Slevin, 1988). It is comprehensible that companies apply their measurement based on indices that can be easily derived from project control's instruments whereas other potentially more suitable criteria can only be assessed through higher effort.

In addition, it is generally possible that dimensions are interrelated. For example, fulfillment of requirements might be a mediator for customer satisfaction. Consequently, we analyzed our path model for mediating and moderating effects, but did not find any significant ones.

Overall, our findings suggest that the measurement of IS project success does not account for a highest possible number of criteria, but focuses on few important ones. With regard to our analyses, many of the potentially relevant criteria (cf. Table 1) have been shown to be of minor importance, e.g., contributions to the strategic mission of the enterprise, other stakeholders' satisfaction, and the project's economic success. Process efficiency is supposed to be a determinant of the latter one.

As we used project managers' perceptions of the overall IS project success as dependent variable, we are also able to derive a statement about the success rate of IS projects according to this measure. Although we used four different items for the reflective measurement, we only refer to one of these items at this point: "All in all, the reflected project was successful". Table 5 shows the percentage of participants stating their agreement with regard to the 7 point Likert scale.

As can be seen, 64% of the respondents stated at least agreement with their project's success. Compared to other success studies, like the CHAOS report (32% successful projects; The Standish Group International, 2009), this finding shows a way better picture of today's software development. Although it might be assumed that this result can be ascribed to the low sample size and a potential non-response bias, the interviews in a previous study concerning the perception of IS project success confirm this view (Joosten et al., 2011).

Degree of Agreement	Percentage
Strong Agreement	25%
Agreement	39%
Weak Agreement	16%
Neutral	8%
Weak Disagreement	2%
Disagreement	8%
Strong Disagreement	2%

Table 5. Project Managers' Assessments of the Overall IS Project Success
"All in all, the reflected project was successful"

Regarding our results for the general improvement of measuring IS project success, we state the following. As only few dimensions are significant from contractors' point of view, it seems self-evident that trying to develop an objective measurement approach relying on many different criteria is not conducive. One might expect a differentiated view on IS project success when continuing this stream of research with further stakeholder groups. Finally, this might lead to a set of situational models for IS project success. Nevertheless, this foils the goals of objectivity and comparability of IS project success measurement approaches only at first glance. Typical conflicting perceptions of IS project success are a consequence of not explicitly regarding projects' different stakeholders. The knowledge of the difference might help to overcome these conflicts due to (contractual) compromises. This problem also applies to empirical research. A study focusing on critical success factors based on a single situational model of IS project success is not suitable to derive general implications based on hypotheses tests. Nevertheless, this corresponds to findings that success factors are more or less critical in different contexts and from different perspectives. The lower level of generalizability corresponds with a higher level of validity. We believe this to be a positive effect.

CONCLUSIONS

The most important dimensions for IS project success from contractors' point of view are customer satisfaction, process efficiency (which does not equal adherence to planning), and fulfillment of specified functional requirements.

Implications for Researchers

Our study is a first approach to develop a set of situational models for IS project success. As it can be seen as success and further on as success promising, we encourage continuing this research stream. This denotes to develop further situational models of IS project success by applying our approach to other stakeholder groups (client organization, the users, and the project team). Furthermore, research is in need of additional situational variables. The suitability of characteristics like product and contract type needs to be evaluated as potential situational variables. As mentioned above, apart from the positive effect of higher validity, the use of situational models comes along with a restriction of research findings' generalizability (e.g., critical success factors derived in specific contexts).

Implications for Practitioners

Even for contractor organizations, adherence to planning in its narrower sense of keeping time and budget is not suitable as a criterion to measure IS project success. Despite its importance for project control, the sole use of this criterion is not conducive. Companies should spend the necessary effort to measure other criteria that are perceived to be relevant for IS project success. Customer satisfaction can be assessed right after project completion and later on. Few companies already measure this index. Companies should measure process efficiency in terms of utilization rates and comparisons with competitors. We suggest that the necessary effort for these assessments can be equalized or even surpassed through the advanced measurement of IS project success and related approaches to optimize fundamental processes.

REFERENCES

Agarwal, N., and Rathod, U. (2006) Defining 'success' for software projects: An exploratory revelation, *International Journal of Project Management*, 24, 4, 358–370.

Aladwani, A. M. (2002) An Integrated Performance Model of Information Systems Projects, *Journal of Management Information Systems*, 19, 1, 185–210.

Atkinson, R. (1999) Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria, *International Journal of Project Management*, 17, 6, 337–342.

Baccarini, D. (1999) The Logical Framework Method for Defining Project Success, *Project Management Journal*, 30, 4, 25–32.

Baker, B. N., Murphy, D. C., and Fisher, D. (1988) Factors Affecting Project Success, in D. I. Cleland, and W. R. King (eds.) *Project Management Handbook*, New York, John Wiley & Sons, 902–919.

Basten, D., and Mellis, W. (2011) A Current Assessment of Software Development Effort Estimation, in *Proceedings of the 5th ACM / IEEE International Symposium on Empirical Software Engineering and Measurement*, September 22-23, Banff, Canada.

Chin, W. W. (1998) The partial least squares approach to structural equation modeling, in G. A. Marcoulides (ed.) *Modern methods for business research*, Mahwah, Erlbaum, 295–358.

Chin, W. W. (2010) How to write up and report PLS analyses, in V. Esposito Vinzi, W. W. Chin, J. Henseler, and H. Wang (eds.) *Handbook of Partial Least Squares: Concepts, Methods and Application*, Berlin, Springer, 645–689.

Chin, W. W., and Newsted, P. R. (1999) Structural Equation Modeling Analysis With Small Samples Using Partial Least Squares, in R. H. Hoyle (ed.) *Statistical Strategies for Small Sample Research*, Thousand Oaks, Sage, 307–341.

Cho, W., Subramanyam, R., Lee, F., and and Krishnan, M. S. (2007) Reexamining Software Project Success: The Perspectives of Developers and Users, in *Proceedings of the 28th International Conference on Information Systems,* December 9-12, Montreal, Canada, Paper 78.

Cohen, J. W. (1988) Statistical power analysis for the behavioral sciences, Erlbaum, Hillsdale.

Collins, A., and Baccarini, D. (2004) Project Success - A Survey, *Journal of Construction Research*, 5, 2, 211–231.

Cooke-Davies, T. (2002) The "real" success factors on projects, *International Journal of Project Management*, 20, 3, 185–190.

Cuellar, M. (2010) Assessing Project Success: Moving Beyond the Triple Constraint, in *International Research Workshop on IT Project Management*, 19–28.

Deephouse, C., Mukhopadhyay, T., Goldenson, D. R., and Kellner, M. I. (1996) Software processes and project performance, *Journal of Management Information Systems*, 12, 3, 187–205.

Dvir, D., and Lechler, T. (2004) Plans are nothing, changing plans is everything: the impact of changes on project success, *Research Policy*, 33, 1, 1–15.

Dvir, D., Lipovetsky, S., Shenhar, A. J., and Tishler, A. (1998) In Search of Project Classification: A Non-Universal Approach to Project Success Factors, *Research Policy*, 27, 9, 915–935.

Evermann, J., and Tate, M. (2010) Testing Models or Fitting Models? Identifying Model Misspecification in PLS, in *Proceedings of the 31th International Conference on Information Systems*, December 12-15, Saint Loius, Missouri, Paper 21.

Faul, F., Erdfelder, E., Buchner, A., and Lang, A.-G. (2009) Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses, *Behavior Research Methods*, 41, 4, 1149–1160.

Faul, F., Erdfelder, E., Lang, A.-G., and Buchner, A. (2007) G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences, *Behavior Research Methods*, 39, 2, 175–191.

Fornell, C. (1987) A Second Generation of Multivariate Analysis: Classification of Methods and Implications for Marketing Research, in M. J. Houston (ed.) *Review of Marketing*, Chicago, American Marketing Association, 407–450.

Fornell, C., and Cha, J. (1994) Partial least squares, in R. P. Bagozzi (ed.) *Advanced Methods of Marketing Research*, Cambridge, Basil Blackwell, 52–78.

Fornell, C., and Larcker, D. F. (1981) Evaluating Structural Equation Models with Unobservable Variables and Measurement Error, *Journal of Marketing Research*, 18, 1, 39–50.

Freeman, M., and Beale, P. (1992) Measuring project success, *Project Management Journal*, 23, 1, 8–17.

Furulund, K. M., and Moløkken-Østvold, K. (2007) The role of effort and schedule in assessing software project success – An Empirical Study. Unpublished Paper, Oslo.

Gefen, D., Straub, D. W., and Boudreau, M. C. (2000) Structural equation modeling and regression: Guidelines for research practice, *Communications of the AIS*, 4, 7, 2–76.

Henseler, J., Ringle, C. M., and Sinkovics, R. R. (2009) The Use of Partial Least Squares Path Modeling in International Marketing, *Advances in International Marketing*, 20, IV, 277–319.

Ika, L. A. (2009) Project Success as a Topic in Project Management Journals, *Project Management Journal*, 40, 4, 6–19.

Jiang, J. J., Klein, G., and Shepherd, M. (2001) The Materiality of Information System Planning Maturity to Project Performance, *Journal of the AIS*, 2, 5, 1–23.

Joosten, D., Basten, D., and Mellis, W. (2011) Measurement of Information System Project Success in Organizations - What Researchers Can Learn From Practice, in V. Tuunainen, J. Nandhakumar, M. Rossi, and W. Soliman (eds.) *Proceedings of the 19th European Conference on Information Systems*, June 9-11, Helsiniki, Finland.

Judgev, K., and Müller, R. (2005) A Retrospective Look at Our Evolving Understanding of Project Success, *Project Management Journal*, 36, 4, 19–31.

Karlsen, J. T., Andersen, J., Birkely, L. S., and Ødegård, E. (2005) What Characterizes Successful IT Projects, *International Journal of Information Technology & Decision Making*, 4, 4, 525–540.

Linberg, K. R. (1999) Software developer perceptions about software project failure: a case study, *Journal of Systems and Software*, 49, 2-3, 177–192.

Liu, A. M. M., and Walker, A. (1998) Evaluation of project outcomes, *Construction Management and Economics*, 16, 2, 209–219.

Liu, J. Y.-C., Chen, H.-G., Chen, C. C., and Sheu, T. S. (2011) Relationships among interpersonal conflict, requirements uncertainty, and software project performance, *International Journal of Project Management*, 29, 5, 547–556.

Lohmöller, J. B. (1989) Latent Variable Path Modeling with Partial Least Squares, Physica-Verlag, Heidelberg.

Malhotra, N. K., Kim, S. S., and Patil, A. (2006) Common Method Variance in IS Research: A Comparison of Alternative Approaches and a Reanalysis of Past Research, *Management Science*, 52, 12, 1865–1883.

Na, K.-S., Simpson, J. T., Li, X., Singh, T., and Kim, K.-Y. (2007) Software development risk and project performance measurement: Evidence in Korea, *Journal of Systems and Software*, 80, 4, 596–605.

Nunnally, J. C. (1978) Psychometric theory, McGraw-Hill, New York.

Pankratz, O., and Loebbecke, C. (2011) Project Managers' Perception of IS Project Success Factors - a Repertory Grid Investigation, in V. Tuunainen, J. Nandhakumar, M. Rossi, and W. Soliman (eds.) *Proceedings of the 19th European Conference on Information Systems*, June 9-11, Helsiniki, Finland.

Pinto, J. K. (2004) The Elements of Project Success, in D. I. Cleland (ed.) *Field Guide To Project Management*, Hoboken, Wiley, 14–27.

Pinto, J. K., and Slevin, D. (1988) Critical success factors across the project life cycle, *Project Management Journal*, 19, 3, 67–75.

Ringle, C. M., Wende, S., and Will, S. (2005) SmartPLS 2.0 (M3) Beta, http://www.smartpls.de, Hamburg.

Saarinen, T. (1996) An expanded instrument for evaluating information system success, *Information & Management*, 31, 2, 103–118.

Saarinen, T., and Sääksjärvi, M. (1992) Process and Product Success in Information Systems Development, *Journal of Strategic Information Systems*, 1, 5, 266–275.

Shenhar, A. J., Dvir, D., Levy, O., and Maltz, A. C. (2001) Project Success: A Multidimensional Strategic Concept, *Long Range Planning*, 34, 6, 699–725.

Stuckenbruck, L. C. (1986) Who determines project success?, in Project Management Institute (ed.) *Proceedings of the 18th Annual Seminar/Symposium*, Upper Darby, Project Management Institute, 85–93.

Tenenhaus, M., Vinzi, V. E., Chatelin, Y.-M., and Lauro, C. (2005) PLS path modeling, *Computational Statistics & Data Analysis*, 48, 1, 159–205.

The Standish Group International (2009) CHAOS Summary 2009. The 10 laws of CHAOS.

Thomas, G., and Fernández, W. (2008) Success in IT projects: a matter of definition, *International Journal of Project Management*, 26, 7, 733–742.

Werts, C. E., Linn, R. L., and Jöreskog, K. G. (1974) Intraclass Reliability Estimates: Testing Structural Assumptions, *Educational and Psychological Measurement*, 34, 1, 25–33.

Yetton, P., Martin, A., Sharma, R., and Johnston, K. (2000) A model of information systems development project performance, *Information Systems Journal*, 10, 4, 263–289.

APPENDIX A

Success Dimension	Items
Process Efficiency	The project was efficiently completed.
	We spent more effort than necessary. (r)
	We could not have achieved a better outcome with the resources used.
	Employees worked below full capacity. (r)
	The same outcome could have been achieved using fewer resources. (r)
	Delays occurred due to a lack of preliminary work. (r)
Customer Satisfaction	From my point of view, the customer was satisfied with the project and the product.
	The customer was satisfied with the overall project all the time.
	The customer often showed his dissatisfaction concerning the overall project. (r)
Conformance with Functional Requirements	From the perspective of the customer, the system contains every feature required.
	All features were implemented according to their specification.
	A complete implementation of the specified features could not be realized. (r)

Table 6. Sample Items for the Dimensions Process Efficiency, Customer Satisfaction, and Conformance with Functional Requirements. Reverse specified items are marked with “(r)”.