
Criteria of Successful IT Projects from Management's Perspective

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ABSTRACT

The aim of this paper is to compile a model of IT project success from management's perspective. Therefore, a qualitative research approach is proposed by interviewing IT managers on how their companies evaluate the success of IT projects. The evaluation of the survey provides fourteen success criteria and four success dimensions. This paper also thoroughly analyzes which of these criteria the management considers especially important and which ones are being missed in daily practice. Additionally, it attempts to identify the relevance of the discovered criteria and dimensions with regard to the determination of IT project success. It becomes evident here that the old-fashioned Iron Triangle still plays a leading role, but some long-term strategical criteria, such as value of the project, customer perspective or impact on the organization, have meanwhile caught up or pulled even.

TYPE OF PAPER AND KEYWORDS

Regular research paper: *Project management, IT projects, success criteria, success dimensions, project evaluation, Iron Triangle*

1 INTRODUCTION

In 1994 the Standish Group published a study that drew wide attention. It was even spoken of a "software crisis" because the so-called chaos report revealed exiguous success and enormous failure rates for IT projects [23]. According to the chaos report only 16.2% of the reviewed projects were rated as successful and it was estimated that a sum of 81 million US dollars would be spent on cancelled software projects in 1995 [56]. Over the years, researchers have reviewed the results of the chaos report and spread them further [21]. Eveleens and Verhoef [15, p. 31] write: "The figures impact and their widespread use indicate that thousands of authors have accepted the Standish findings." Glass [21, p. 110] sees the main reason for this in "lazy

research", considering that the Standish Group charged about 5.000 US dollars for granting insight into the chaos report [21].

This seems odd considering the early emergence of critical voices on the results of the chaos report [15, 21, 22, 26, 48]. The main objections were:

- The Standish Group has always refused to disclose their data [15, 21]. This raises doubts about the validity [22].
- Jorgensen and Molokken [26] report that the Standish Group requested the participants of the study to mainly regard failures. This information sheds new light on the large percentage of unsuccessful projects.

- Other studies should have raised doubts: Jenkins, Naumann and Wetherbe [25] calculate an average cost overrun of 34% for a software project, Phan, Vogel and Nunamaker [43] as well as Bergeron and St-Arnaud [5] calculate 33% each. These results are far from the 189% stated in the chaos report [56]. Jorgensen and Molokken [26] conclude that even though the results of the chaos report may not be disproved, they still raise reasonable doubts.
- The categorization of projects, as conducted in the chaos report, in "project success", "project challenged" and "project impaired" is insufficient [15, 21, 26] due to its strict adherence to the following definition: "The project is completed on time and on budget, offering all features and functions as initially specified" [56, p. 4]. This raises the question if the strictness of the definition excludes projects, which are considered as success although they do not comply with all three criteria [15, 21, 26].

The present paper addresses the last point of criticism. On the one hand, there have been critical voices for decades, which refer to the classical project success criteria time, budget and achievement of predefined requirements as insufficient in terms of the success rating of projects [3, 8, 13, 28, 36, 57]. On the other hand, the rating of a project also depends on the perspective of the rating person [13, 28, 36, 39]: Project managers, for example, apply other criteria when rating the success of a project rather than the project team or the end user [9]. The objective is to develop a model of IT project success, which only considers management's perspective.

2 THEORETICAL EMBEDDING

2.1 Success Rating with the Iron Triangle

Since the 1970s, the compliance with planning, that is the compliance with budget and time specifications as well as the implementation of defined requirements, is referred to as a rating criterion for project success [3, 8, 13, 28, 36, 57, 60]. Project management research calls these criteria the Iron Triangle [2]. Research considers the Iron Triangle to be a traditional measurement of project success [4, 47, 52], or even a standard [58]. Scholars made early arguments to add further criteria like user satisfaction, impact on computer operations [45] or technical performance [7]. These early arguments were accompanied by increasing criticism of the Iron Triangle:

- Success measurement is only conducted on the implementation or execution level as only the

efficiency and the developed system are taken into consideration [34, 52]. Many researchers argue that an assessment of project success depends on the time required to complete the project and that a comprehensive success measurement is only possible with a certain time interval after project completion [8, 13, 38, 44, 55].

- Projects can be rated as successful even though they do not or only partly fulfill the Iron Triangle's criteria [13, 14, 24, 38, 57, 60]. This is due to the fact that the Iron Triangle only measures the success of the project management process and thus only one aspect of the overall success [27, 38, 42]. As a result, project success should be seen as multidimensional and should be measured with respect to all dimensions. [24, 27, 38, 55, 57].
- Project success depends on the perception of the involved stakeholders [27, 46, 55, 60]. It is thus possible that a project manager would consider a project a success while a customer perceives it as failure because of its lack of business success [54].
- During the life cycle of a project serious modifications arise frequently due to altered requirements. Savolainen, Ahonen and Richardson [47] thus claim that neither budget nor time can be reliably estimated at the beginning of the project. Glass [20] states that the scope of the project is vague at the beginning and that no reliable estimations can be made. This inaccuracy of estimation is moreover intensified by the fact that it is often politically biased [23, 31].

Although there is wide agreement on the Iron Triangle's insufficiency in terms of rating a project success, there is no general consensus on which criteria are necessary for it [1-4, 8, 13, 14, 28, 33, 36, 46, 57, 60]: "There are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as the notion of project success" [44, p. 67]. It is thus not surprising that a multitude of models of project success exist. In the following sections, this paper presents three models that will attempt to showcase an alternative draft to the simple measurements used with the Iron Triangle.

Pinto and Slevin [44] pick up the aforementioned points of criticism of the Iron Triangle that are related to the project success' dependence on time and the consideration of different perspectives. The developed model consists of internal and external factors for calculating a success rating. The internal factors time, cost and performance refer to the implementation of the project and are relevant for the project manager and his team. They form the organization's internal view on the project. The external factors use (by intended users),

satisfaction and effectiveness (benefits) comprise the external perspective of the customer. The more time passes, the higher the external factors' relevance becomes for the end rating: During the project the internal factors are of major significance. After completion it's the external factors [44].

Baccarini [3] focuses on the multidimensionality of project success and criticizes the short-term view on project success caused by the simple application of the Iron Triangle. He thus developed a model, which is comprised of the component project management success as well as the component product success. Project management success is the short-time view on project success and considers the project handling. It consists of the Iron Triangle, the quality of the project management process ("how efficiently the project has been managed" [3, p. 28]) and the stakeholder satisfaction with regard to the project management process. Product success is the long-term view and refers to the effects of the developed product. It includes the criteria project goal, project purpose ("Fitness for use", [3, p. 29]) and stakeholder satisfaction with regard to project goal and project purpose. Product success is superordinate to project management success; a project can thus be rated as successful even if it does not comply with time or budget specifications [3].

Shenhar et al. [55] criticize as well that project success is mostly looked upon traditionally in terms of the Iron Triangle, while strategic components are not considered. That is why they developed a multidimensional model, which integrates not only integrates business aspects but also the customer's perspective and the significance for the organization. The model considers the following dimensions: Project efficiency (with the criteria meeting schedule goal, meeting budget goal); impact on the customer (meeting functional performance, meeting technical specifications, fulfilling customer needs, solving a customer's problem, if the customer is using the product, customer satisfaction); business success (commercial success, creating a large market share) and preparing for the future (creating a new market, creating a new product line, developing a new technology). The model also points out the significance of the time elapsed for the rating of success: Project efficiency and impact on the customer represent the short-time success dimensions, and business success and preparing for the future are long-term dimensions. Long-term components are superordinate to short-term components [54, 55].

The model was revised by Shenhar and Dvir [53] and was extended in the following dimensions: Team satisfaction (team morale, skill development, team member growth and team member retention), which

represents a short-time view on project success. Success criteria and their weighting can vary depending on the type of project [32, 41, 55] so that e.g. within a construction project importance is attached to safety [6], while the emphasis of a R&D project is placed on publications and patents [40].

2.2 Models of IT Project Success

This section presents the models that have been designed for the success rating of IT projects. Usually counted among IT projects are projects from the hardware, software and network area "to create a product, service or result" [50, p.4]. These are of main interest due to their still increasing significance [50]. Literature on IT project success frequently refers to the models of Atkinson [2], Wateridge [61], DeLone and McLean [10, 11] and Thomas and Fernandez [57]. That is why these are presented here.

Atkinson [2] criticizes the Iron Triangle because it simply measures the process success. His model is therefore a multidimensional construct that includes the perspectives of different stakeholders. It has four dimensions whose relevance depends on the time elapsed. The short-term delivery stage is represented by the dimensions of the Iron Triangle, which is used to measure the process success, and an information system for rating the same features (maintainability, reliability, validity, information quality, use). The long-term post-delivery stage is represented by the following dimensions: Benefits to the organization (improved efficiency, improved effectiveness, increased profits, strategic goals, organizational-learning, and reduced waste) and benefits to the stakeholder community (satisfied users, social and environmental impact, personal development, professional learning, contractors profits, capital suppliers, content project team, economic impact to surrounding community) [2].

Wateridge [61] turns toward the perception of IT project success by different stakeholders. He points out that projects can be successful without complying with the Iron Triangle because it is subordinate to business and organizational objectives. Project success is determined by analyzing the following criteria: Was the project profitable for the sponsor/owner and contractors? Did it achieve its business purpose in three ways (strategically, tactically and operationally)? Did it meet its defined objectives? Did it meet quality thresholds? produced to specification, within budget and on time and all parties (users, sponsors, the project team) are happy during the project and with the outcome of the project? The exact weighting of the criteria depends on the type of project and the perspective of the stakeholders [60, 61].

Thomas and Fernandez [57] state accordingly that project success is a multidimensional construct that depends on the perspective of those rating the project. They identify three dimensions of success criteria: Project management success (on-time, on-budget, sponsor satisfaction, steering group satisfaction, project team satisfaction, customer/user satisfaction, stakeholder satisfaction), technical success (customer/user satisfaction, stakeholder satisfaction, system implementation, met requirements, system quality, system use), and business success (business continuity, met business objectives, delivery of benefits). Project management success refers to the project handling and the satisfaction with it. Technical success refers to the project result and the satisfaction with it. Business success aims at the rating of benefits for the company. A novelty of this model, in contrast to those presented before, is that the satisfaction of project sponsor and steering group is taken into consideration as well as the criterion of business continuity, which represents the level of disturbance of business activity caused by the project [57].

DeLone and McLean [10] understand IT project success as a multidimensional construct that has to consider the perception of various stakeholders. They see six dimensions here: System quality (measuring the developed system), information quality (measuring the system's output), user satisfaction, system use, individual impact (effect on behavior) and organizational impact (effect on organizational performance). System quality and information quality form the direct result of the project and thus influence user satisfaction and system use. User satisfaction and system use may influence each other and generate impacts on an individual level, which may in turn cause effects within the organization [10].

Due to some criticism and the increasing significance of E-Commerce the model was revised in 2003 [11]. Starting points are now the three success dimensions: Service quality (assurance, empathy, responsiveness), system quality (adaptability, availability, reliability, response time, usability), and information quality (completeness, ease of understanding, personalization, relevance, security). These three dimensions affect use (nature of use, navigation patterns, number of site visits, number of transactions executed), and user satisfaction (repeat purchases, repeat visits, user surveys), which may still influence each other. They have an effect on net benefits (cost savings, expanded markets, incremental additional sales, reduced search costs and time savings), which in turn might affect use and user satisfaction. The perception of positive or negative net benefits, for example, has influence on the further

development of the system and thus affects use and user satisfaction [11].

2.3 Objectives of this Paper

Though not exclusively in the context of IT projects, Davis [9] investigated various stakeholders' perceptions of project success. She identifies different stakeholders such as project managers, customers or end users, the project team and senior management. With regard to the senior management's perception she recommends "to conduct an empirical study into assessing senior management perception of success" [9, p.197].

Ika [24] shows that there is a shift in project success research to the emphasis of "the links between project, program and portfolio" [24, p.14]. Due to this shift he argues that research should include the views of senior managers, project sponsors, project owners and other stakeholders, and therefore research should not be narrowed down to the Iron Triangle [24].

This paper discusses Davis' and Ika's statements, but does not confine itself to the senior management's perception as this is rarely involved in the very process of success rating of IT projects [62]. In order to develop a model from a management's viewpoint, only those persons' perspectives should be captured, who belong to the organization's management circle and are confronted with the evaluation of success of IT projects. This seems tempting since no model exists yet, which was solely derived from management's perspective.

A qualitative approach, as suggested by Ika [24], will cover the following questions in detail: Which criteria are relevant for the evaluation of IT project success from a management's perspective? Which criteria are actually being applied? Which criteria are mandatory for rating all IT projects in the respective company? Which success criteria are personally considered most important? Which criteria are often missing in the course of evaluation from the management's perspective? Do IT project success criteria exist, which might render a project successful even though other success criteria have not been fulfilled? Which criteria are suitable for the benchmarking of IT projects beyond company limits? Which significance do single criteria have for the determination of IT project success?

This paper thus not only pursues a theoretical objective, but also supplies managers with enough material to allow a reflection upon their individual rating practice so that other perspectives of IT project success might be added. The individual rating procedure can thus be optimized and criteria may be added, which have not been taken into consideration so far. Furthermore, a model of IT project success based

on the management's view could help colleagues, and subordinates to understand the way the management evaluates an IT project and what IT success criteria are the most important to them.

3 METHODOLOGY

3.1 Research Procedure

In order to answer the raised questions, this paper follows a qualitative rather than a quantitative approach because the focus is not on the verification of a hypothesis but on the interpretation statements and the gathering of new findings [12, 16]. As common in qualitative research, the procedure is inductive: Based on a mostly small number of research units, findings are deduced that result in general theories [16, 17].

The first step was to design a questionnaire that could serve both as a guideline for a partly structured interview and as a written questionnaire. This was due to the assumption that the potential target group is usually short in time and might prefer a written questionnaire, which is not depending on time, to a personal interview. The first version consisted of 33 questions referring to success rating of IT projects in the company and the personal view of the respondent. Additionally, the questionnaire collected statistical personal data. To check structure and content of the questionnaire, a pre-test was conducted. The target group for this research was members of the company's management team who are engaged in success ratings of IT projects.

As access to this target group is restricted, the group of participants of the pre-test was extended: Apart from members of the actual target group, persons participated who possess long-time experience in IT project management though they are not counted among the classic members of the management team, e.g. project manager and lead developer. The author recruited participants from his personal network or by recommendation from other participants. The test group's feedback was evaluated and showed a general consensus on the questions, the handling of the questionnaire and the short processing time. However, some of the participants expressed criticism regarding the arrangement of questions, the protection of data privacy and the comprehension of single questions. These points of criticism were taken seriously and resulted in a revision of the questionnaire. The final questionnaire thus consisted of 27 questions only.

As in the pre-test, the author initially referred to his personal network to select participants for the actual data collection. Emphasis was laid on the participants' field of duties and long-time professional experience in

project business. 18 subjects were identified as potential participants of the survey. Considering that these potential participants might be short on time, the author made three proposals on how to participate in the survey: Interview by telephone, personal interview and a written questionnaire. Additionally, the participants were asked if they knew other managers eligible for participation in the study. In case the interviewed manager named other persons, the author tried to integrate them into the study. Furthermore, the author contacted potential participants of the study at conferences and events. Thus the author won 59 contacts in total of which 21 participated in the study. This equals a participation rate of 36%.

The recorded telephone and personal interviews were transcribed and analyzed together with the written questionnaires. As common in qualitative studies, no strict separation was made between data collection and data analysis. Both phases were interactive: As soon as evaluable data were present, they were analyzed. The reason for this is theoretical saturation. It signals when further data collection will not provide new findings [19]. After having evaluated 16 documents, it was noticed, during the analysis of five more, that no further findings were to be made. Theoretical saturation was thus assumed.

3.2 Evaluation

The evaluation was conducted by means of the Gioia methodology, which is marked by its inductive character and its orientation on the Grounded Theory [18]. The basic issue is to gather new findings by systematical evaluation of present documents. The evaluation itself is conducted in four steps that were adapted by the author to the context of the study [18]:

- 1) The author extracted text passages that he considered relevant. One can see statements in context of this study as relevant that refer to criteria used for rating IT project success and that provide information relating to the research questions. This procedure was repeated until all relevant text passages had been extracted.
- 2) Next the author encoded the found text passages with simple denominations or concepts of the respondents to allow an improved overview and readability for further evaluation. The codes should adequately convey the meaning of the respective text passage. These codes are called 1st order categories. If the author identified text passages that were equal in content, he marked them with the same code.

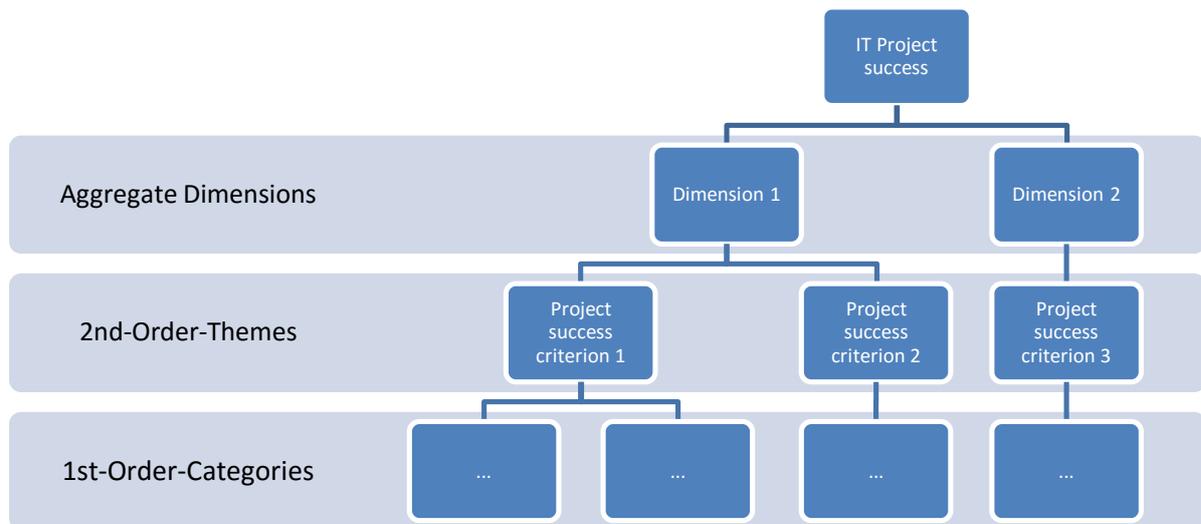


Figure 1: Relationship between evaluation and modeling

- 3) 2nd order themes were formed that summarize the 1st order categories with regard to the theory being developed. This is a theoretical level at which it is tried to form a theoretical construct. To be precise, this means that the gathered information is now transferred into IT project success criteria. Two examples for illustration:
- Different companies apply criteria like customer retention, recommendation by customer and customer satisfaction (1st order categories) to evaluate IT project success. All those criteria reflect the customer's view on the project, which is why the author summarized them in the success criterion customer perspective (2nd order theme).
 - The author discovered that many companies rate project success by checking the adherence to predefined schedules (1st order category). As only one 1st order category dealing with this issue was identified, no further summary can be made. Instead, the author made a redefinition to adherence to schedule, as he considered this description shorter and more concise.
- 4) For the purpose of an improved structuring and to support the building of a theory, the 2nd order themes were combined into aggregate dimensions. These aggregate dimensions form the dimensions of the construct IT project success and consist of the identified success criteria.

Figure 1 illustrates the process of evaluation, which leads to a model of IT project success.

3.3 Verifying the Quality of the Research

In order to guarantee the high quality of the present work, the semantic validity as well as the inter- and intracoder reliability were checked. The semantic validity examines the significance assigned to the extracted text passages and determines the adequacy of both the 1st order categories and the coding rules for other researchers [29].

To check the semantic validity, the author inspected the text passages assigned to the single 1st order categories with regard to similarity of content. Text passages, which differ by content, must be assigned to other 1st order categories. Therefore the author checked all identified text passages by content if they correspond with the 1st categories they were assigned to. As the author discovered a high homogeneity within the respective 1st order categories, he had only to make a few revisions regarding the codes, the coding rules and the descriptions for other researchers.

Inter- and intracoder reliability are quality criteria used to rate the reliance of the conducted study. Intercoder reliability determines the reproducibility of the results by other researchers. [29]. For this, the author introduced two external coders to the subject and gave them the coding rules, the final 1st order categories, 2nd order themes and their explanations. An exact assignment of 1st order categories to 2nd order themes was not included.

The external coders' task was to independently encode three randomly chosen texts with the specified 1st order categories and then assign them to the provided 2nd order themes. They completed both tasks with an accordance of over 70% with the previous encoding of the author (76% for assigning the 1st order

categories, 83% for the 2nd order themes), which one can consider as sufficient in explorative studies [37].

Intracoder reliability refers to the consistency of encoding by the same coder [59]. To check the intracoder reliability the author re-encoded the complete material eight weeks later, which resulted in an accordance of 98%. This speaks in favor of the analysis' stability, while it must be critically noted that the author could still remember many of the encodings made eight weeks before.

In order to verify the final results of the evaluation the author conducted a member check [35]. For this reason, the results were transmitted to the participants of the survey, asking them for feedback on model, dimensions and success criteria. 15 participants out of 21 in total gave feedback and agreed with the identified IT project success criteria and the deduced model. Additionally, the author transmitted the results to academics in business informatics with a request for feedback. Four of the contacted persons gave feedback and supported the developed model as well.

4 MAIN RESULTS

4.1 Sample

21 managers, who are engaged in analyzing IT projects with regard to their success, were interviewed. Table 1 illustrates the participants' affiliation to particular management levels. This study separates between lower management level (team or group leader), middle management level (head of department or divisional head) and senior management (executive or board member).

One can find the participants' job definitions in Table 2. The job definitions indicate that the participants are all members of the company's management team. They also allow the assumption that the interviewed persons are confronted with the evaluation of project success in their daily business routine.

According to Table 3, 95.2% of the participants have a professional experience of more than 10 years. Combined with the present information, one might assume that the participants do not only dispose of knowledge in success rating of IT projects, but also possess expert knowledge due to their long-time professional experience.

Table 4 provides information about the respondents' professional fields. Although the main focus is on IT/E-Commerce with 33.3% of participants, one can recognize that the study tempted to gather information across different professional fields.

Table 1: Management levels of participants

Management level	Count	Share
Lower	4	19.0%
Middle	9	42.9%
Senior	8	38.1%
Total	21	100.0%

Table 2: Job definitions of participants

Job definition	Count
Board Member/Executive	5
CTO/CIO	3
Head of Software Development/ Application Development	2
Head of IT/Infrastructure	4
Head of Project Management/PMO	2
Head of E-Commerce/Web applications	2
Head of System Security	1
Head of Business Development/Products	2
Total	21

Table 3: Professional experience of participants

Professional experience	Count	Share
<= 10	1	4.8%
11 – 20	10	47.6%
21 – 30	7	33.3%
31 – 40	2	9.5%
> 40	1	4.8%
Total	21	100.0%

Table 4: Overview of professional fields

Professional field	Count	Share
Banking/Insurance	1	4.8%
Services	2	9.5%
Media	2	9.5%
IT/E-Commerce	7	33.3%
Trading/Distribution	3	14.3%
Administration/Public Service	1	4.8%
Industry	3	14.3%
Other	2	9.5%
Total	21	100.0%

Table 5: Participants as contractors

Contractor	Count	Share
Yes	8	38.1%
No	13	61.9%
Total	21	100.0%

Table 6: Overview of 1st order categories

1st-Order-Category	Count
Realized scope	28
Adherence to budget	27
Adherence to schedule	26
Contribution to business result	23
Customer satisfaction	22
Achieving strategical benefits	17
User satisfaction	12
Reasonable cost-benefit ratio	12
Advancement of organization	12
Adherence to quality requirements	10
Expected profitability	9
Human resources development	7
Perceived usability	6
Efficient implementation	4
Sustainable use	4
Customer retention	4
Support of company culture	4
Personal goals of project team	3
Recommendation	3
Adherence to resource planning	3
Positive user behavior	3
Flexibility of use	3
Team satisfaction	3
Cooperation in project	2
Extensive preparation	2
Consideration of follow-up costs	2
Avoidance of capacity overload	2
Intended use	1
Performance of project team	1
Success per definition	1
Total	256

Final information about the participants is given in Table 5. It shows that 38.1% of the participants' companies are conducting projects as contractors. This means that the present study incorporated the perspectives of both - contractors and sponsors.

4.2 Found IT Project Success Criteria and Assignment to Dimensions

Relevant statements of the participants were extracted from the present documents and designated with 1st order categories. By this, 256 codes originated, as one can see in Table 6. The respective count illustrates how often a particular 1st order category was referred to by the interviewed managers.

In the following, the author formed the 2nd order themes, which represent the final success criteria of IT project success. The following 1st order categories were combined into 2nd order themes:

- The 1st order categories; positive user behavior, perceived usability (of the project result by the user) and user satisfaction were summarized in the 2nd order theme user perspective because they reflect the user's perspective on the project.
- Achieving strategic benefits, support of company culture and advancement of organization form the criterion impact on the organization.
- The 2nd order theme, value of project, was derived from the 1st order categories reasonable cost-benefit ratio, contribution to business result and profitability.
- The 1st order categories intended use of project result, flexibility of use and sustainable use refer to the use of what is realized through the project and were thus summarized in use of generated results.
- As described earlier, customer retention, customer satisfaction and recommendation form the customer perspective.
- Team perspective was composed of human resources development, personal goals of team members (e.g. writing a professional article) and team satisfaction.
- The 2nd order theme cooperation in project describes the cooperation of all involved stakeholders in the project and the project team's performance.
- Adherence to resource planning and avoidance of capacity overload add up to reasonable resource planning.

Table 7: General definitions

Success criterion/2nd order theme	1st order category
Reasonable resource planning	Adherence to resource planning, avoidance of capacity overload
User perspective	Positive user behavior, perceived usability, user satisfaction
Impact on organization	Achieving strategical benefits, support of company culture, advancement of organization
Evaluation of utility costs	Consideration of follow-up costs
Adherence to budget	Adherence to budget
Use of generated result	Intended use, easy adjustability, sustainable use
Achieved quality	Adherence to quality requirements
Realized scope	Realized scope
Customer perspective	Customer retention, customer satisfaction, recommendation
Team perspective	Human resources development, personal goals of team members, team satisfaction
Cooperation in project	Performance of project team, cooperation in project
Adherence to schedule	Adherence to schedule
Value of project	Reasonable cost-benefit ratio, contribution to business result, profitability
Goal-oriented proceeding	Efficient implementation, extensive preparation

- Goal-oriented proceeding consists of the 1st order categories efficient implementation of tasks in project and extensive preparation of project.

The 1st order categories adherence to budget, consideration of follow-up costs, achieved quality, adherence to schedule and realized scope are simply converted into 2nd order themes and concisely redefined. The 1st order category success per definition describes an exception reported by a single participant of the survey: "And later on, though the project only met its goals by, I don't know, sixty percent, it is yet declared successful in order to save face." (respondent 15). As the project's success is ordered for reasons of company policies instead of being determined by rating, this 1st order category was disregarded in the further course of the study. Table 7 provides an overview of the identified success criteria.

Four dimensions were generated by summarizing the 14 success criteria in different success dimensions of IT project success: implementation success, result success, planning success and perception success

(see Figure 2). Planning success results from the comparison of target figures and actual figures like the Iron Triangle. Implementation success consists of those success criteria that deal with the actual handling of the project. Perception success represents the perception of the project by the stakeholders, customer/sponsor, user and project team. Result success evaluates the absolute result of the project from the company's perspective.

The dimensions result success and perception success are long-term success dimensions, which can only be rated after some time has elapsed since project completion. Planning success and implementation success define the short-term view on the project and can be rated on project completion. A comprehensive assignment of 1st order categories to success criteria (2nd order themes) and of success criteria (2nd order themes) to success dimensions (aggregate dimensions) is to be found in Figure 4 in Appendix A, exemplary findings from the interviews can be found in Table 9 – 12 in Appendix B.

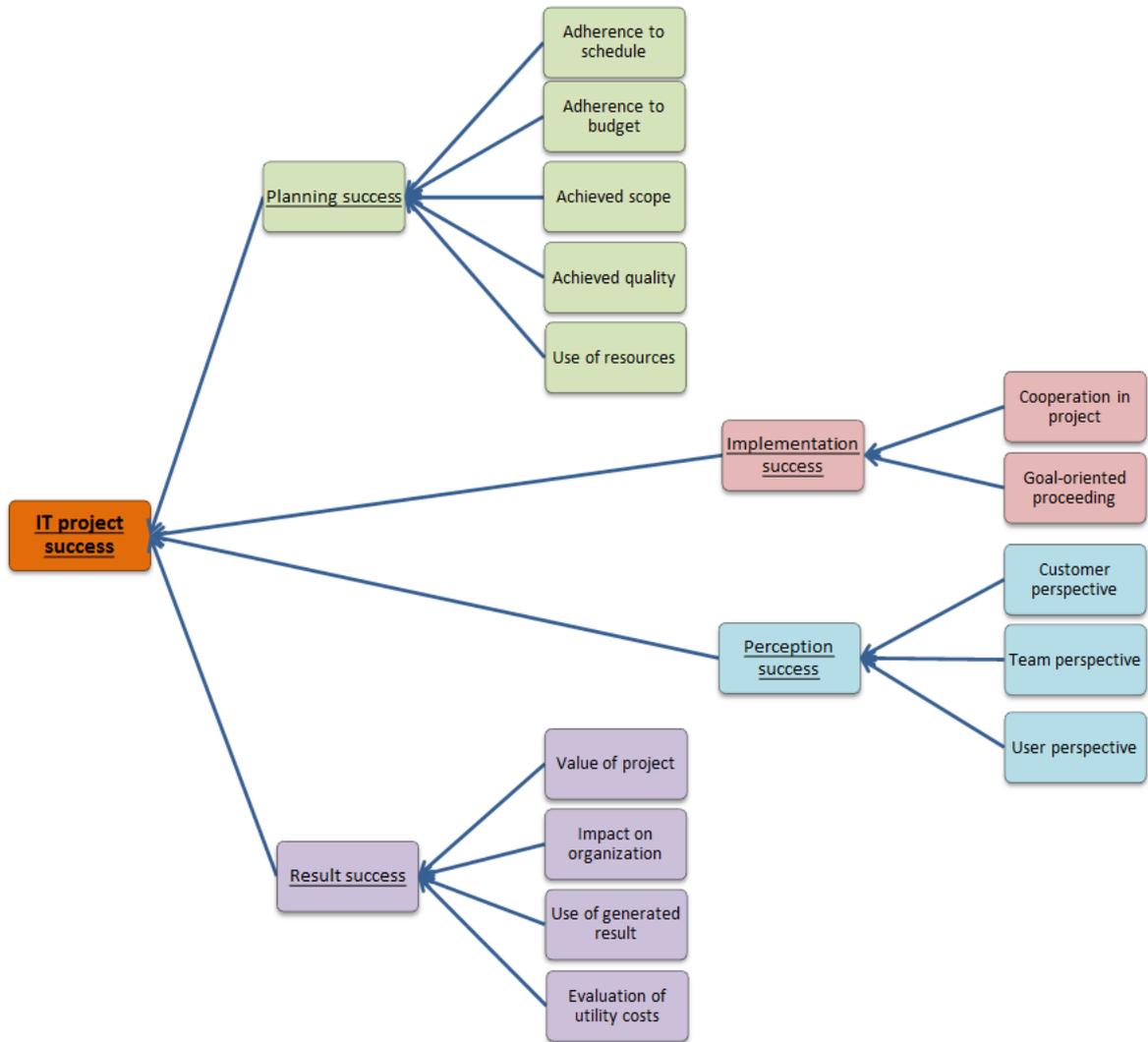


Figure 2: Relationship between evaluation and modeling

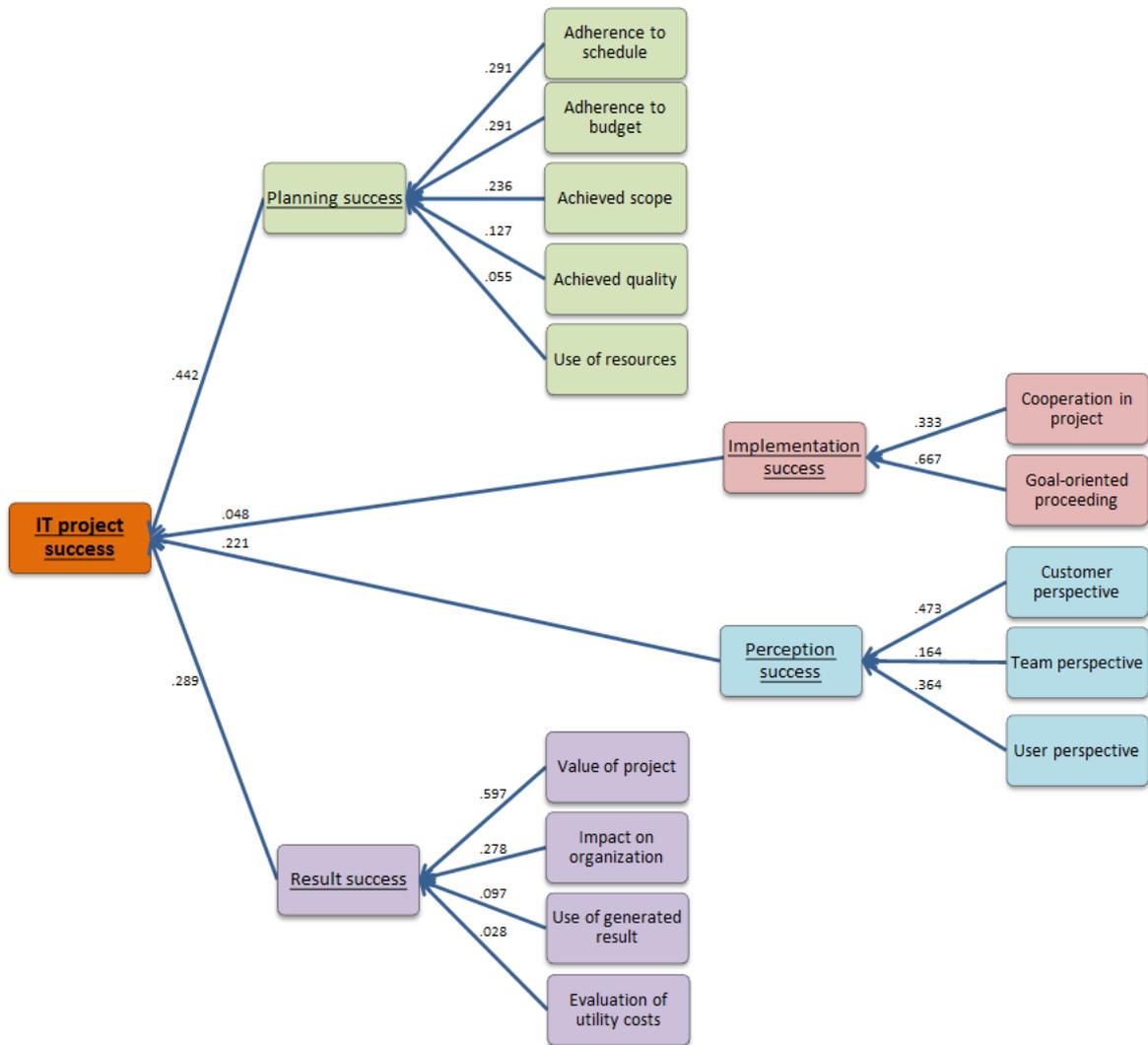


Figure 3: Model of IT project success including all success criteria

Table 8: Generally applied in daily business

Success criterion	Generally applied in daily business	Mandatory criteria for every IT project	Personally considered important success criteria	Missed success criteria	Outstanding success criteria	Success criteria suitable for benchmarking
Achieved quality	6	3	1	2	1	1
Achieved scope	9	8	3	1	1	4
Adherence to budget	11	10	4	0	1	6
Adherence to schedule	12	10	2	1	1	6
Cooperation in project	1	1	1	1	0	0
Customer perspective	9	3	2	2	7	3
Evaluation of utility costs	0	0	1	0	0	1
Goal-oriented proceeding	4	1	0	2	0	1
Impact on organization	6	2	2	5	3	2
Reasonable utilization of resources	1	1	1	2	0	1
Team perspective	3	1	1	3	0	1
Use of generated result	3	1	3	0	0	0
User perspective	9	2	4	0	2	3
Value of project	11	7	9	4	5	7

5. DISCUSSION

5.1 Responses to Research Questions

Which criteria are relevant for the rating of IT project success from the management's perspective?

14 IT project success criteria were identified in total, which were assigned to four different success dimensions. This matches the findings of the theoretical part, in which the multidimensionality of the construct was emphasized [24, 27, 38, 55, 57]. The four dimensions form IT project success and lead to the model represented in Figure 3. Looking at the model more closely, the high quantity of integrated success criteria is striking. As shown before, project success depends, among other things, on the involved persons' perspectives [27, 46, 55, 60], on the type of project [41, 32, 55] and on the time elapsed [8, 13, 38, 44, 55]. With the model combining different professional fields and hierarchy levels, internal and external perspectives as well as short-term and long-term dimensions, the quantity of success criteria and dimensions appears plausible. Not all criteria are used for success rating in business practice though. In fact, only some selected criteria are taken into consideration. The weighting of the single criteria can vary from project to project [32, 55, 60].

Which success criteria are actually being applied?

What is striking when analyzing the criteria applied in daily business routine is the dominance of the Iron Triangle (see Table 8¹). As remarked before, there is wide agreement on the insufficiency of the Iron Triangle and the necessity of more criteria to not only rate the success of the project management process [8, 13, 38, 44, 55]. The still frequent use of the Iron Triangle might have the following reasons:

- 1) The Iron Triangle's criteria are considered to be objective and easily measurable, while project success is subjective and difficult to measure according to the stakeholders' and the organization's opinion [27, 38, 60].

¹ Multiple nominations of a success criterion by a respondent with regard to certain issues are summarized in a single nomination. If, for example, a respondent states two times that adherence to schedule is applied as a criterion in his company, this is considered as a single nomination of this criterion here and in the following evaluations. This is supposed to prevent a criterion from being perceived as frequently applied in the companies, though, in fact, only a single respondent mentioned this criterion very frequently in this context during his interview.

- 2) Wateridge (1999) writes that short-term criteria like the Iron Triangle's are often set as guidelines by senior management to rate the performance of a project manager on these.
- 3) According to one's personal perception, a project is often finished at delivery. This might explain the strong focus on the short-term criteria of the Iron Triangle. [52].
- 4) Various models consider an efficient project handling, and thus the evaluation of the project management success, as an integral component in matters of the success rating of projects [3, 44, 52, 55, 57, 60]. Therefore it is not surprising that many companies which are highly interested in an efficient handling of projects apply the Iron Triangle's criteria more frequently than others.

The frequency of nominations illustrates though that the Iron Triangle's dominance is being weakened and that long-term criteria like value of project, customer perspective and user perspective are included in the evaluation of project success as well. The nonexistent or only slight consideration of the evaluation of utility costs, reasonable utilization of resources and cooperation in project may derive from them being considered as sufficiently covered by e.g. team perspective or customer perspective in some companies.

Which criteria are mandatory for the evaluation of all IT projects in the respective company?

Kloppenborg et al. [30] state that any rating of project success still includes the Iron Triangle. This may not apply for every respondent, but it becomes apparent though that the Iron Triangle's criteria are still mandatory for conducted projects in many companies (see Table 8). There is thus a strong focus on the rating of the project management success. Besides the already mentioned reasons, this may be because the comparability of projects is seen as difficult and the criteria of the Triple Constrain could be perceived as hard facts that are easier to measure and to calculate [27, 57], so companies use them to compare their projects. It is nevertheless recognizable that the criterion value of a project increasingly includes a strategic and long-term perspective on projects.

Which criteria are personally considered most important?

The Iron Triangle's great significance in daily business routine is slightly contrary to the success criteria that were considered important by the respondents: Here, the value of project, and thus a strategic long-term success criterion, is named most

frequently. Considerably fewer nominations were given to adherence to budget, user perspective, achieved scope and use of generated result (see Table 8). This shows that the management is highly interested in strategical success criteria. The completion of the project on time seems to be subordinate to these.

Which criteria are often being missed in the course of evaluation from the management's perspective?

The findings on the missed criteria complement the earlier results. Primarily named as being missed are impact on the organization and value of project (see Table 8), which expresses the desire for a consideration of long-term criteria as recommended by various authors [3, 8, 10, 13, 27, 38, 46, 52, 55, 57, 60]. This desire, and the high interest of the management in strategical success criteria, might result in a more frequent use of these success criteria and an increased weighting in the course of evaluation of IT project success

Do outstanding IT project criteria exist that might render a project successful, even if other success criteria have not been fulfilled?

The high relevance of strategical long-term success criteria is also reflected in the question of outstanding success criteria. Many respondents use value of project, customer perspective or user perspective as main criteria in the course of success evaluation (see Table 8). The Iron Triangle hardly receives consideration, which matches the findings in literature because the long-term view on the project can outplay the short-term implementation and planning success [13, 14, 24, 38, 57, 60].

Which criteria are suitable for benchmarking beyond company limits?

The present results show that the participants of the survey mainly regarded quantifiable and easily measurable figures as suitable for benchmarking: The Iron Triangle and value of project (see Table 8). This may be due to the fact that many success criteria are being perceived as subjective and the wish to rely on figures that are perceived as objective [27, 38, 60]. This proceeding is tricky: Many IT projects are conducted with agile methods like e.g. Scrum [51]. As the requirements often change during the life cycle of a project [47], it is proposed to refrain from extensive planning regarding budget, time and scope [49]. In case companies followed this proposal, a benchmarking by help of the Iron Triangle would hardly be possible in agile projects with Scrum. Moreover it must be respected that reliable estimations at the beginning of a project are generally seen skeptical due to inaccuracy [20] or political color [23, 31].

Apart from the described difficulties, a benchmarking based on the named criteria would suffer the disadvantage of not taking into consideration strategical relevant criteria and dimensions, which would reduce the informative value. In order to conduct a meaningful benchmarking though, it has to be determined which dimensions and criteria are taken into consideration for this and how an objective measuring by comparable values can be rendered possible for all projects participating in benchmarking.

Which significance is assigned to single criteria in the evaluation of IT project success?

Concerning the interpretation of the results, one may even take one step further by understanding the total of nominations of a success criterion as index for its relevance. It is obvious that the findings gathered with this approach are not statistically relevant. Yet they can be perceived as a rough estimation of their weighting in the evaluation of IT project success. The dimension planning success will serve as an example for this. Planning success is formed by the criteria adherence to schedule (32 nominations), adherence to budget (32), achieved scope (26), achieved quality (14) and reasonable utilization of resources (6). These criteria are named 110 times in total which means that adherence to schedule makes up 29.1%, adherence to budget 29.1% as well, achieved scope 23.6%, achieved quality 12.7% and reasonable utilization of resources 5.5% of all nominations of this dimension (see Figure 3).

Even though the calculated weightings are statistically not significant, they can still be taken as a hint that the Iron Triangle still plays a major role in the evaluation of planning success. This matches the conclusions already made. Within the evaluation of implementation success goal-oriented proceeding (66.7%) is considered more important than cooperation in project (33.3%). In matters of determining the weightings of perception success customer perspective (47.3%) is clearly more relevant than user perspective (36.4%) and team perspective (16.4%). That is hardly surprising as the project is conducted for the sponsor. Regarding result success, value of projects stands out with 59.7% of all nominations, while impact on organization makes up 27.8%, use of generated result 9.7% and evaluation of utility costs 2.8%. Although this distribution was to be expected, it displays that the further use, and thus the actual use of the project result as well as its follow-up costs, are of no high relevance for the determination of result success.

In conclusion, the significance of the different dimensions can be determined accordingly. 249 nominations regarding success criteria were made in

total. 44.2% of these are assigned to planning success, 4.8% to implementation success, 22.1% to perception success and 28.9% to result success. This provides two interesting points: On the one hand, implementation success of an IT project seems to be a negligible figure. This is intuitively comprehensible when considering the significance of the project result or the perception of the project in relation to the project conduction. On the other hand, this analysis affirms the disproportionately high significance of planning success. As it was already shown how high the management's interest is in strategical and long-term criteria, it will be interesting to see whether the great significance of the short-term planning success will persist.

5.2 Limitations

The present study is subject to the described statistical inadequateness and some limitations that are specified in the following. As common in qualitative studies, and in contrast to quantitative studies, this study is marked by a small number of cases. As a result, it may be possible that not all criteria for the evaluation of project success were identified, even though data were collected until theoretical saturation was achieved. Furthermore, the developed model is not representative for management because of the small number of cases. This becomes obvious regarding the selection of the participants of the survey, as the sample was not randomly chosen. Another limitation is due to the local limitation of the research: excluding some exceptions, most of the interviewed managers are employed in German companies or act as contractors for German companies.

Despite these limitations the presented multidimensional model of IT project success from the management's perspective can be considered valid: On the one hand, it respects different perspectives as well as the dependence on time of single dimensions; on the other hand, the communicative validation by incorporation of researchers has resulted in broad consensus on this model.

5.3 Recommendations for Further Research

As the evaluations of the relevance of single criteria and success dimensions presented in this study are of no statistical value, it is an obvious step to determine the significance and correlation of single IT success criteria and their success dimensions for IT project success by conducting extensive quantitative research. Due to the small size of the sample, it cannot be excluded that despite the achievement of theoretical

saturation other important criteria have not yet been included into the model. It would thus be important to check the deduced model for completeness within a quantitative study.

With regard to the significance of the success criteria and dimensions for IT project success, it might be interesting to find out which distinctions depending on professional field, hierarchy level or type of project exist. Additionally, a longitudinal study is recommended to check if the significance and use of strategical success criteria will continue to increase. As the study shows that the criteria of the Iron Triangle are so far given priority in the context of benchmarking, the deduction of an extensive framework for benchmarking of projects might be of interest as well.

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DECLARATION OF CONFLICTING INTERESTS

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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APPENDIX A - RESULTS OF EVALUATION

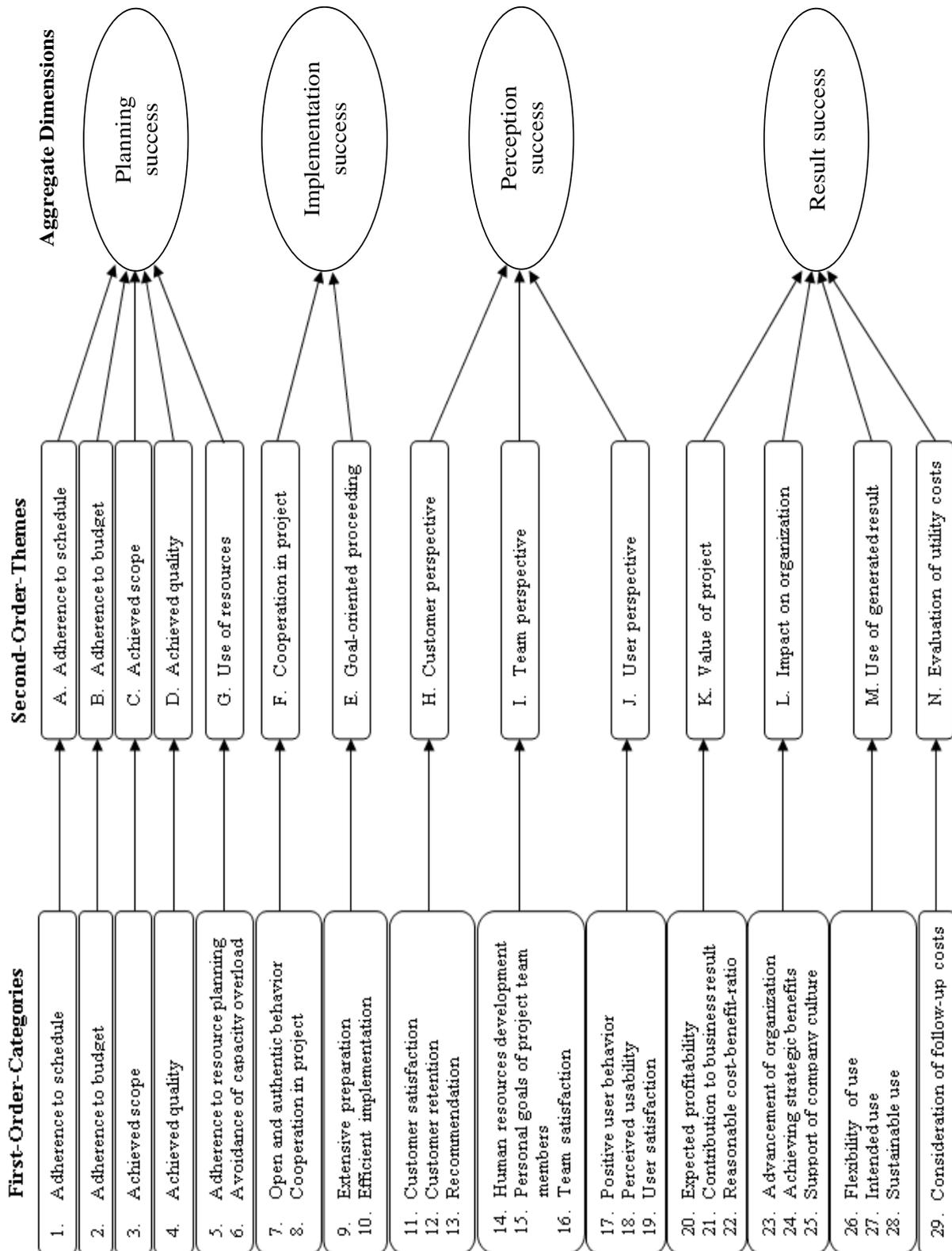


Figure 4: Results of evaluation

APPENDIX B - EXEMPLARY FINDINGS FROM THE INTERVIEWS

Table 9: Exemplary findings for planning success

Dimension	2nd-Order-Theme	1st-Order-Category	Exemplary findings
Planning success	Adherence to schedule	1. Adherence to schedule	<p>“Adherence to schedule and scope of provided function together with adherence to budget decide alone about the success of the project”</p> <p>“Adherence to time, budget and scope are objectives from the business perspective and apply for all projects.”</p>
	Adherence to budget	2. Adherence to budget	<p>“Defined (qualitative and quantitative) goals met in time und in budget (without producing additional/follow-up costs).”</p> <p>“On the one hand the success criteria of a project, very classical: budgets that have to be met, qualities that need to be generated with the project and above this, however, we need to calculate the project's value proposition at first.”</p>
	Achieved scope	3. Realized scope	<p>“The classical triad of adherence to schedule, adherence to budget and quality defines the success of an IT project.”</p> <p>“To me personally the compliance with the desired scope of functions is most important. Not delivered functions have otherwise to be added later under great pressure, outside of the project. This leads to considerable extra work and increases the pressure on the team. It is thus important to me to set the delivered functions as criterion.”</p>
	Achieved quality	4. Adherence to quality specifications	<p>“For projects at fixed price the criteria are: scope according to previous agreement, in acceptable quality, on time, on budget.”</p> <p>“Our 6 software development teams rely on the agile proceeding of Scrum and mainly rate sprints as successful when the planned requirements (User Stories) were implemented to the stakeholder's satisfaction and can be taken productively with high quality. Larger projects are not being measured standardized. We measure the velocity of our teams and the number of bugs closed in the sprints.”</p>
	Use of resources	5. Adherence to resource planning	<p>“In my opinion the measuring of the used internal resources is missing, which might identify a project as unprofitable in the cost-benefit-analysis and would thus render the total costs measurable. These data are not part of the planning so far so that the budget can mostly be adhered to and the timeline is being met by using new resources.”</p> <p>“Adherence to schedule. Adherence to resource planning. Minimum number of mistakes in software. Maybe usability by customer.”</p>
		6. Avoidance of capacity overload	<p>“Internal resource load, the overload situation of key resources is hardly being respected.”</p> <p>“Resource load.” [As personally important success criterion]</p>

Table 10: Exemplary findings for implementation success

Dimension	2nd-Order-Theme	1st-Order-Category	Exemplary findings
Implementation success	Cooperation in project	7. Open and authentic behavior	“Sustainable use of developed solutions by the end user with a high share of satisfied end users. An open and authentic behavior of the team belongs to this as well.”
		8. Cooperation in project	“Quality in communication toward the stakeholders.” “Regarding success criteria I am personally missing figures on the criteria cooperation in team and with customer and code quality.”
	Goal-oriented proceeding	9. Extensive preparation	“Being successful also means that a bilateral approach is taken, that is IT experts and experts of the technical division collectively talk about requirement specifications and target specifications.” “The criterion which is missing is to look for standard solutions first [...] Standard solutions means: low costs, little configuration needs, lower risk, velocity, experience of other companies is incorporated, service by external specialists.”
		10. Efficient implementation	“Implementation effort in sprints is lower than originally estimated by the team.” “Our 6 software development teams rely on the agile proceeding of Scrum and mainly rate sprints as successful when the planned requirements (User Stories) were implemented to the stakeholder's satisfaction and can be taken productively with high quality. Larger projects are not being measured standardized. We measure the velocity of our teams and the number of bugs closed in the sprints.” “In order to get qualitative feedback as well. What worked out well? What went wrong? This is truly a subject we could improve in.”

Table 11: Exemplary findings for perception success

Dimension	2nd-Order-Theme	1st-Order-Category	Exemplary findings
Perception success	Customer perspective	11. Customer satisfaction	<p>“Customer satisfaction is the crucial criterion here. Even if the goals haven't been met from the company's perspective, the customer satisfaction, rated by recommendations or follow-up projects, may still lead to a project being perceived as successful.”</p> <p>“This question can easily be answered for us: project success is determined by sponsor satisfaction. Abstract figures like "in time - in budget" only play a minor part. They are evaluated and looked at, but actually pragmatism prevails that assumes that not everything is projectable in advance. If budget exceedance is comprehensible, it is approved with no argument.”</p>
		12. Customer retention	<p>“Making a turnover is nice, but that is a one-time effect. What's exciting is a long-term cooperation with a customer.”</p> <p>“Secondly there is the effect of eventually addressing the subject of customer retention. It doesn't matter, how I did it, as long as he is satisfied with it, he will always refer to me and thus confirm my position within the concern.”</p>
		13. Recommendation	<p>“It can of course happen that, if a customer breaks off a project, but we can still make a positive reference of it, which we can use for marketing and distribution, then it may nonetheless be rated as success. Because you don't leave scorched earth, but rather, the customer breaks off the cooperation for whatever reasons, maybe because we can no longer deploy the project leader he had so far or something like this - he might also say, no, i don't want to work with another person, so I'd rather switch. Well, if we can still get a reference from it, it's a success.”</p> <p>“ [...] maybe positive customer quotes as a soft factor. That's always nice, especially if you can use them for distribution purposes. [...] Because they weigh most somehow, if you can add a customer quote to a reference on your homepage.”</p>
	Team perspective	14. Human resources development	<p>“The learning curve is extremely important! Because we often have projects, of course, in which we get into a completely new technology. For example, I can remember going into a project with Intershop or with Hybris. This means, of course, the whole thing is a success, if the project enables the people to use the new technology they have learned more secure in the next project. That's an extremely important aspect, it wasn't on my radar before.”</p> <p>“No essential, I would say, as we don't have a strict cross-project rating system. We recently started a project, for example, whose secondary objective is transfer of knowledge - this is actually measured concretely.”</p>

		15. Personal goals of project team members	<p>“Adherence to time, budget and scope are objectives from business perspective and apply for all projects. Personal goals of the project team members like learning effects or publications are added for each project.”</p> <p>"An internal factor is that it's important to me and my team, external factor is what's important to the executives."</p>
		16. Team satisfaction	<p>“Basically none, it's a matter of design and measurability of the objectives. Above this, goals like team satisfaction, modification and tackling culture of a company have to be respected.”</p> <p>“Are we satisfied with what we delivered? By technical and functional aspects?”</p>
	User perspective	17. Positive user behavior	<p>“The user can as well be external. In this case the frequency of use determines the success. For example, if a company launches a B2B portal. How many customers get a login? How many customers use the portal sustainable? How long does the customer stay logged in?”</p> <p>“Well, on business side success is, of course, measured by the turnover it generates. Or by how many users or how much traffic it yields or something like that.”</p>
		18. Perceived usability	<p>“This might probably happen by comprehending the levels end user (Usability), Business (business goals) and IT (operation) in appropriate form beyond project completion.”</p> <p>“Qualitative: customer satisfaction, enhancement of usability.”</p>
		19. User satisfaction	<p>“User satisfaction - because it's decisive for the acceptance of an IT measure. If this is missing, so and so many other criteria may seem successful: the project failed.”</p> <p>“If it turns out during the project handling that requirements were nonsensical or inexact, these are modified. As said before, user satisfaction is mandatory and predominant.”</p>

Table 12: Exemplary findings for result success

Dimension	2nd-Order-Theme	1st-Order-Category	Exemplary findings
Result success	Value of project	20. Expected profitability	<p>“The Return on Invest is also fundamental in examination.”</p> <p>“Then, of course, positive profit-turnover ratio. They can well be compared.”</p>
		21. Contribution to business result	<p>“In the end we need to have a positive profit contribution. We have to draw profit. This is the only way to achieve acting power and freedom of decision. If you conduct projects just for zero-sum, yes, then you can't develop, you cannot grow by own strength because growth also costs money. It is thus the most important criterion, that's obvious.”</p> <p>“Are we satisfied with what we delivered? By technical and functional aspects? Did we generate a good code that provides a value for the customer? And in third row: Did we make the money we wanted to make? That is - has been paid what we delivered?”</p>
		22. Reasonable cost-benefit-ratior	<p>“To me, profitability and customer satisfaction are the essential figures at this point. That means, does it still makes sense what I'm doing, for this company, and is he satisfied with the result that I achieved, or with the implementation?”</p> <p>“Profitability - many IT projects simplify processes and have a positive influence on the income and loss statement with their Total-Cost-of-Ownership. As this is the main objective of a company, projects should always be checked with regard to this matter.”</p>
	Impact on organization	23. Advancement of organization	<p>“First off, of course: Is it an enhancement of the actual situation?”</p> <p>“In any case it's important to create room for learning from the projects within the organization.”</p> <p>“Well, I'd say we have many others more. We have something like: “Does it carry...”, well, if I'm supposed to name things that are important to me or my co-workers, it would surely be: Is this, what we are doing, future-oriented for our company? Is it sustainable? Is it a technology, for example, of which we assume that it might be helpful in further projects?”</p>
		24. Achieving strategic benefits	<p>“What I would measure it by, would, in first line, be the value of what came out of it. And value is again a complex definition. It might be, I generated turnover, it might be, I saved expenses. It might be I generated innovation, I strategically enhanced my initial position for the future.”</p> <p>“Well, regarding the really big strategic projects, it is, to me, mostly about seeing the total costs and the actual benefits on company level.”</p>

		25. Support of company culture	<p>“[...] above this, goals like team satisfaction, modification and tackling culture of a company have to be respected (put easy: sometimes it's more important to do something than not to do it).”</p> <p>“Has to support our values. That is: transparency, cooperation, trust. There are many solutions that rather try to... well, limitation of rights, for example. You can view it from the perspective of we have to minimize access because you can't trust everybody.”</p>
Use of generated result		26. Flexibility of use	<p>“Easy to adjust.”</p> <p>“That it's simple, that it's flexible, that it's just easy to use, that it generates benefits, that the cost-performance ratio is good, that it advances our company, that is mainly the internal factor. The external factor is budget, time (--). Another internal factor is quality.”</p>
		27. Intended use	<p>“The solution is used as intended.”</p>
		28. Sustainable use	<p>“The customer will use the solution for longer terms.”</p> <p>“To us, as product developers, sustainability is yet another important factor, of course.”</p>
Evaluation of utility costs		29. Consider-action of follow-up costs	<p>“This might probably happen by comprehending the levels end user (Usability), Business (business goals) and IT (operation) in appropriate form beyond project completion.”</p> <p>“Well, regarding the really big strategic projects, it is, to me, mostly about seeing the total costs and the actual benefits on company level. Unfortunately, it can happen very fast that you're thinking too local.”</p>

AUTHOR BIOGRAPHIES



Mark Harwardt was born in 1979 in Iserlohn, Germany. He first studied computer science with subject area economics at the University of Applied Dortmund and obtained his diploma. Later on he earned his master of computer science at FernUniversität in Hagen, Germany. Currently Mark Harwardt does research as an external PhD student at WHU - Otto Beisheim School of Management, Germany on the impact of specific management styles on the success of IT projects.