

Evaluation of project success: a structured literature review

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Abstract

Purpose – Barnes' Iron Triangle was one of the first attempts to evaluate project success based on time, cost and performance, which were portrayed as interdependent dimensions. Over time, these criteria were expanded and especially criteria taking the satisfaction of stakeholder groups into account are becoming more and more popular. The purpose of this paper is to find out whether specific patterns for the selection of project success criteria across various fields of applications emerged which has not been regarded in literature before. Furthermore, the authors seek to identify of additional key factors influencing project success assessment next to the choice of project success criteria.

Design/methodology/approach – The paper uses a review of recent literature published in academic journals, in standard references and in widespread project management frameworks (Organisational Competence Baseline, PRINCE2 and PMBoK Guide).

Findings – The findings show that Barnes' ideas are an integral part of all approaches investigated in the study. Additionally, the relevance of the so-called "soft criteria" related to the satisfaction of stakeholder groups, could be substantiated. However, the authors found no indications that patterns for the selection of project success criteria have emerged across various fields of applications. Factors influencing project success assessment are not taken into account in the examined articles in a systematic manner. This motivates for further research in this field.

Research limitations/implications – Access limitations, papers not yet digitally available or the interpretations have an impact on the results.

Practical implications – For appropriate project assessment the sound and well-rounded selection of hard and soft criteria and the consideration that not the field of application, but influencing factors yet to be analysed influence the selection of project success criteria are crucial. Project management professionals should choose the criteria suitable for their projects individually on a project-by-project basis.

Originality/value – This paper reveals that no patterns have so far been developed to assess project success in various fields of application. Furthermore, factors influencing project success assessment are not considered in a systematic manner.

Keywords Project success assessment, Project success criteria, Stakeholder satisfaction

Paper type Literature review

1. Introduction

People in organisations work more and more closely in temporary teams to solve incoming tasks (Bakker, 2010; Shenhar and Dvir, 2007). These findings indicate that the execution of projects has an important influence on organisations (Gassmann and Granig, 2013). Hence, project management methods and tools play crucial roles in project administration and management, and the success or failure of a project seems to be closely connected to a suitable application of them. The increased use of project management methods and tools arises from the growing complexity of the tasks companies are confronted with (Grimm, 2009; Schoeneberg, 2014).

Organisations can focus on tasks with the highest impact on their organisational success by pooling employee skills in project teams. Organisations grouping suitable employees in project teams to solve important tasks will have better chances to stay on the market by



creating value for their customers than organisations not applying this approach (Scott-Young and Samson, 2008). This indicates that projects are not an end in themselves, they should be completed successfully to make a valuable contribution to corporate success. This leads to the question: how can the success of a project be assessed? Project managers need target values to control project execution. The criteria to measure project performance must be clear to enable proper project assessment. However, the question: what criteria should be used for project success assessment? arises. It is necessary to prevent people from comparing apples and oranges discussing project success.

Project success is highly topical in project management and has been widely researched. Literature describes different approaches to measure the success of a project. The basis of nearly all approaches is Barnes' Iron Triangle (Cao and Hoffman, 2011; Chan and Chan, 2004; Chang *et al.*, 2013; Gemünden, 2015; Khan, 2014; McLeod *et al.*, 2012; Serra and Kunc, 2015; Serrador and Turner, 2015). In the 1970s, Barnes found that the connection and collaboration between his production engineers, the engineers, who assigned responsibility for monitoring costs, and management holds potential for substantial improvement. At that time, there were neither project management nor research efforts that consider project management. The aim of the Iron Triangle was to visualise the dependencies between monitoring the independent dimensions time, budget and performance (Delo, 2013; Weaver, 2007). Barnes is not a researcher, and this is the reason why his pragmatic approach did not lead to independent scientific publication. However, his ideas influenced the development of further approaches (Howsawi *et al.*, 2014; Milis *et al.*, 2003).

In the decades that followed, literature focussed more on project management, leading to a rising number of published articles (Kloppenborg and Opfer, 2002). In the early 1970s, research on cost and schedule control can be regarded as the first steps in assessing project success (Olsen, 1971). From the outset, the Iron Triangle has been exposed to severe criticism, presumably dealing with its limitations on the three success dimensions time, budget and performance (Berssaneti and Carvalho, 2015; Creasy and Anantatmula, 2013; Williams *et al.*, 2015; Baker, Fisher and Murphy, 1997). These limitations tend to result in an optimisation in the view of the company running the project and to disregard the satisfaction of the customer (Morris, 2013; Pinto *et al.*, 2000).

Obviously, the assessment of project success differs among stakeholders because of their different motivations to execute the project (Aaltonen, 2011; de Bakker *et al.*, 2011; Gemünden, 1990; Mir and Pinnington, 2014). The following example illustrates the varying objectives of stakeholders (Belassi and Tukel, 1996): an accountant may consider a project successful if real costs are below the budget. In contrast, an architect assesses the project on the basis of aesthetic aspects, while the end-user of the project product puts primary emphasis on its usability.

A distinction is drawn between hard and soft criteria to assess project success in scientific articles about project assessment (Pinto and Slevin, 2006; Baccarini, 1999). Hard criteria, also called quantifiable assessment criteria, are rather objective and measurable with comparatively little expenditure (Baccarini, 1999). For example, time, cost and performance criteria pertain to the category of hard criteria. Besides making use of hard criteria for assessing project success, there are first approaches suggesting that project success depends on the perception of the stakeholders involved in a project or affected by it (Davis, 2014; Freeman and Beale, 1992). Soft criteria are often closely connected to this so-called human factor (Chiocchio and Hobbs, 2014) and are rather subjective and difficult to evaluate (Hussein, 2013; Pinto and Slevin, 2006). They constitute an essential part of project success assessment (Pinto and Slevin, 2006; Briner *et al.*, 1990). According to Müller and Jugdev (2012), hard criteria only account for nearly 50 per cent of project success, while soft criteria make up the other 50 per cent.

The explanations above outline the controversial discussion about criteria to assess project success. The question arises why these disagreements exist in the first place.

One potential answer could be that approaches often only focus on special fields of application and do not refer to the findings in other areas. This leads to approaches suitable for projects in the chosen field and improper for project success assessment in other fields of application. An overview of the status quo of project success assessment in different fields of application has so far not been available in literature.

Lim and Mohamed (1999) argue that each industry will have its own unique set of success factors. So, the question arises whether the same holds true for success criteria. The aim of this literature review is, on the one hand, to reveal whether specific patterns for the selection of project success criteria across various fields of applications have emerged. Furthermore, the identification of differences in assessing project success in different fields of application through this paper should help researches and practitioners to understand the way of assessing project success in other fields. On the other hand, we intend to analyse whether influencing factors on project assessment are identified in a systematic manner.

The structure of the paper is as follows: in Section 2, we describe different facets of project success, namely, the terms product success, project management success, consistent project success, success factors and success criteria, and demonstrate the differences between short-term and long-term success. Section 3 describes the fields of application we selected, and Section 4 demonstrates the research questions, the methodology and sources. In Section 5, we present our research findings consisting of hard and soft criteria to assess project success, differences between and within fields of application, influencing factors on project assessment and the limitations of the study. Finally, the paper ends with the conclusion and suggestions for future research in Section 6.

2. Different facets of project success

Project success is a topic frequently discussed in project management research, and researchers are not in agreement as to the definition of the construct project success (Pinto and Slevin, 1988). Different research findings show that project success is a multi-dimensional concept: it means different things to different people and the context is crucial (Jugdev and Müller, 2005). Since the term “project success” can be viewed from different angles (Davis, 2014; Unterkalmsteiner *et al.*, 2012), the following explanations will contribute to a better understanding referring to various classifications and interpretations propounded in relevant literature (Gemünden, 1990).

2.1 Success factors and success criteria

First of all, a differentiation has to be made between success factors and success criteria (Cooke-Davies, 2002). Success factors through which a project manager can increase the likelihood of completing a project successfully are not explicitly defined levers available to him during the implementation of a project (Ashley *et al.*, 1987; Müller and Jugdev, 2012). Success criteria are used to assess the success of a project (Atkinson, 1999; Westerveld, 2003).

In analogy to Herzberg’s hygiene factors of motivation, taking success factors into account increases the probability of project success, whereas disregarding them raises the probability of project failure (Belassi and Tukel, 1996; de Wit, 1988). For example, paying attention to construction site safety helps to prevent project members from ill health or accidents and thus avoids unnecessary costs and delays (Bansal, 2011). Other important success factors are, for example, communication among project parties, integration of team members, user advocacy and project spirit (Aronson *et al.*, 2013; Baiden and Price, 2011; Tam *et al.*, 2011; Wang *et al.*, 2011).

Assessing project success through project success criteria allows for comparing projects and acts as the basis for future developments of the project management process (Lam *et al.*, 2008). Furthermore, it plays an important role in the selection of future

projects, as only those projects providing the potentially highest benefit to the organisation's success will be chosen (Piscopo *et al.*, 2010).

Ashley *et al.* (1987) found that success factors and success criteria can be intertwined as direct cause-effect relationships. For example, there is such a relation between the technical uncertainty and the end user satisfaction. Since the assessment of project success in different fields of application is in the spotlight of our study, only project success criteria are considered. Factors to reach project success are not taken into account because they represent levers to increase the probability of project success and cannot be used to evaluate the success of the project. Furthermore, this is precisely what makes the difference between the present paper and the multitude of suggestions for ensuring process success published in articles, books, etc. (Baker, Murphy and Fisher, 1997; Jacobson and Choi, 2008; Khan, 2014).

2.2 Project management success and product success

From our perspective, the second necessary distinction is the difference between product success and project management success (Baccarini, 1999; Creasy and Anantatmula, 2013; Munns and Bjeirmi, 1996; Toor and Ogunlana, 2008; de Wit, 1988). It is important to be aware of such differentiation, because the outcome of a project could be a success, even if the project was poorly managed and vice versa (Rolstadås *et al.*, 2014).

On the one hand, project success can be understood as the success of the management being in charge of the project. As soon as a project has been executed successfully in terms of time, budget and performance, project management success is reached. In addition, effective and efficient use of project management methods is necessary, and the customer should be satisfied with the execution of the project (Möller, 2009; de Wit, 1988). So, project management success can be assessed at the end of the project (Andersen, 2014). Assessing project management success according to the above-mentioned success criteria allows to judge the performance of a project team on the basis of criteria they can influence (Cooke-Davies, 2007).

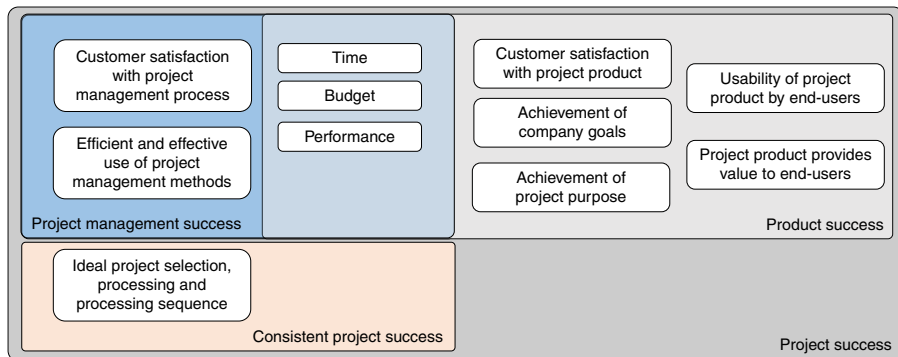
On the other hand, project success can be understood as the success of the developed product (Andersen, 2014; Munns and Bjeirmi, 1996). Besides time, cost and budget aims, the focus is set on the achievement of company goals, the project purpose and the customer's satisfaction with the product. An additional criterion covers the evaluation, whether the developed product can be used by end-users and ultimately provides value to them (Baccarini, 1999). Cooke-Davies (2007) suggests adding a third dimension to the construct of project success: consistent project success. Consistent project success assesses whether the right projects were done right and in the right sequence to generate competitive advance. The present paper considers consistent project success and the associated criteria as part of the success of the developed product.

Hence, it may be concluded that product success assesses the project product and that project management success is dependent on compliance with the creation process. Product success and project management success are not always clearly separated from each other and are therefore extensively discussed in literature (Collins and Baccarini, 2004; Ika, 2009; Munns and Bjeirmi, 1996). In some cases, project success focusses on both project management success and product success (Albrecht, 2015; Baccarini, 1999). In other cases, the focus is either on product success or project management success (Agarwal and Rathod, 2006; Might and Fischer, 1985). The common opinion in articles dealing with project success is that project management success is part of the assessment of project success (Spang and Altefroehne, 2008). This study follows the broad understanding of project success shown in Figure 1. Project success contains project management success, product success and consistent project success.

2.3 Point of success assessment (short- and long-term success)

Short- and long-term aspects of project assessment are also worthy a discussion (Stewart, 2001; Jessen, 2011). Depending on the selected point of assessment, the project can

Figure 1.
Understanding of
the concept of
project success



Sources: Collins and Baccarini (2004) and Cooke-Davies (2002)

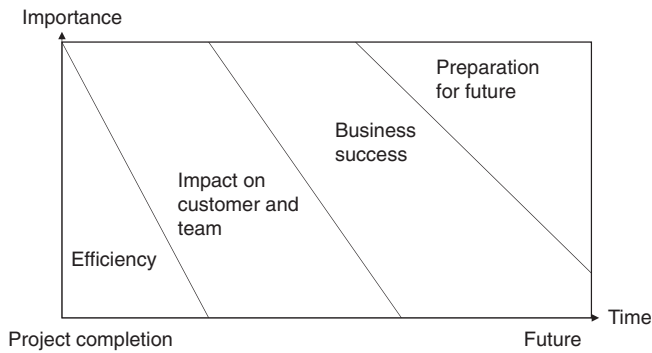
be assessed as a success one day and as a failure the another day (de Wit, 1988; Kloppenborg *et al.*, 2014). A project product may appear promising during commissioning, but may prove to be faulty during operation or not be accepted on the market. Project success assessment takes place at different points of time in public perception (Turner, 1999). For example, London Heathrow Terminal 5 was completed on time and within budget but could not meet the modified requirements more than half a year after commissioning (Sato and de Freitas Chagas, 2014). Another example is the launch of the first Microsoft Windows operating system: introduced late and over budget, approximately 90 per cent of all computers over the world are today equipped with Microsoft Windows as operating system (Shenhar *et al.*, 2001).

The two examples mentioned above illustrate the need to differentiate between short- and long-term success. Project managers are working on an operational level to complete the project in time, in budget and in scope to reach short-term success without taking into account profitability aspects (Shenhar *et al.*, 2001; McLeod *et al.*, 2012). The reason for this is that performance of project managers is often assessed based on the adherence of deadlines and budgets (Turner and Zolin, 2012, p. 90). As a result, strategic and long-term success is often neglected in the day-to-day business (Stewart, 2001; Mokoena *et al.*, 2013; Atkinson *et al.*, 2006). However, it is not sufficient to simply consider the short-term perspective, since a technically brilliant project product can be extremely unsatisfactory from a financial point of view (Wieczorrek and Mertens, 2011).

The two examples mentioned above also show that the importance of criteria to assess project management success decreases with increasing duration after project completion. During planning and execution of a project, the assessment focus is more on management efficiency. Upon the expiry of a project, soft criteria such as customer satisfaction or the contribution to business success are increasingly gaining in importance. As shown in Figure 2, long-term goals, such as preparation for the future, come to the fore with increasing duration after project completion. (Sato and de Freitas Chagas, 2014; Shenhar and Dvir, 2007; Pinto and Slevin, 1988).

3. Selected fields of application

After pointing out our understanding of project success in this paper, we need to define the fields of application. The fields of application were selected based on project product type (physical or immaterial) and number of units manufactured (mass production or one-off production). Every combination of project product type and manufactured units should be represented at least once. The identified fields of



Sources: Shenhar and Dvir (2007) and Shenhar *et al.* (2001)

Figure 2.
Importance of success
criteria over time

application and their respective characteristics are listed in Table I and described below. Furthermore, we explain in detail why these fields were chosen as representative of the corresponding category and not others.

3.1 *Factory planning and construction*

Projects in this field of application can typically be characterised by the development of one unique physical facility in a defined place (Pinto and Covin, 1989; Fang and Wu, 2013).

Field of application	Typical characteristics
Factory planning and construction	Typically unique physical product Long planning phase and project duration Material costs exceed labour costs Stationary place of project execution Detailed specification with many standards and norms to meet Plan-driven approach to design and implementation
Product development in mechanical engineering	Physical product Project product is normally manufactured more than once More likely short project duration More likely detailed specification
Software development	Immaterial product Mass production or one-off production Labour costs exceed material costs Flexible place of project execution Rather rudimentary specification Rather iterative development process
Aerospace and army	Physical or immaterial product Mass production or one-off production High innovation potential Cost-intensive projects Complex regulatory framework Plan-driven development approach
Organisation and personnel development	Immaterial product One-off production Labour costs exceed material costs Humans take centre stage
General approaches	Universal approach without specialisation Adaptable to industrial sectors or product types High level of abstraction

Table I.
Characteristics of
the chosen fields
of application

Examples include a bridge, a building or the layout of a large factory (Alzahrani and Emsley, 2013; Aggteleky, 1990). A long planning phase, a project duration of up to several years, and numerous legal regulations and procedures led to plan-driven approaches in most of the projects. It is typically of such an approach that a detailed specification of the product exists prior to the ground-breaking ceremony. Furthermore, this product specification is performed by contracting parties and public authorities before the actual implementation stage starts. Projects in this field of application were selected as own field because they make a big contribution to the economic growth and employment in each country and influence governments and communities (Alzahrani and Emsley, 2013).

3.2 Product development in mechanical engineering

Like projects in factory planning and construction, projects in product development in mechanical engineering largely deal with physical products. Further, detailed specifications are usually part of them. However, there is a major difference between these two application fields. Instead of developing and realising one unique physical product, a product is developed once and manufactured multiple times afterwards (Cichos and Aurich, 2016). Compared to building a bridge or a turnkey factory, the development of a tooling machine or a car assembly line is characterised by a short project duration and a rather iterative development approach (Finger and Dixon, 1989). This field of application was chosen because the industrial sector of mechanical engineering is influencing other economic sectors of a country and is therefore a main driver of an economy and a suitable indicator of the current state of science and technology (Loschilova *et al.*, 2015).

3.3 Software development

In contrast to the fields of application described above, software development projects always deal with the development of an immaterial product. The software developed in a software development project can be a standard software for mass utilisation or a customised computer programme for specific use (Hoermann *et al.*, 2012). Irrespective of any subsequent application, costs for the staff developing the software can easily exceed material costs. This provides for high scalability with rather little initial investments. Project execution in software development changes from writing detailed specifications in the beginning (waterfall approach) to starting the project with rather rudimentary specifications. This change provides the possibility to react to changes during project execution and in project environment. Hence, detailed specifications are made during project implementation (agile approach). Thus, another typical characteristic of this field of application is an iterative and adaptive development process with rudimentary specifications at the beginning of the project (Jahr, 2014). Software development was chosen as field of application because of its central role for the so-called fourth industrial revolution (Lasi *et al.*, 2014), its wide importance for business processes (Ullah and Lai, 2013) and its fresh impetus to the development of project management in general (Stettina and Hörz, 2015).

3.4 Aerospace and army

Project planning exists since people plan collaborative activities. Yet, it was not until the middle of the twentieth century that it was termed “project management” (Madauss, 2000). Project management is assumed to have arisen from the field of aerospace and army, because the first projects requiring project management in a systematic and structured way were projects such as the first landing on the moon, the Manhattan Engineering District Project to build the first atomic bomb, or the US Air Force’s intercontinental ballistic missile (Madauss, 2000; Shenhar and Dvir, 2007). High uncertainty, high costs and a complex regulatory framework are typical features of projects in this field of application

(Becz *et al.*, 2010). For instance, uncertainty is inherent in visionary project goals such as being the first person on the moon and in using innovative technologies, materials and software. Another characteristic is the multitude of legal regulations and procedures (Harvey and Holdsworth, 2005). The developed product can be mass or one-off production of physical products like rockets or tanks, but also mass or one-off production of immaterial products like a computer system. Aerospace and army was chosen as an individual field of application, because the used technologies are mostly new and innovative. Their transfer to other fields can create further innovations. Summing up, projects in this field of application may be regarded as driving forces for the economy (Mowery, 2010).

3.5 Organisational and personnel development

The result of an organisation or personnel development project is usually an immaterial product where the organisational structure or employees were focussed on. Due to little investments in physical products, labour costs exceed material costs. One common characteristic between factory planning and construction projects and projects in organisation and personnel development is the fact that the final product is produced once and is therefore neither mass-produced nor usually utilised a second time (Schwaninger and Kaiser, 2007). This field of application has been chosen because of its multidisciplinary nature, its crucial impact on the respective company and the limited possibility to standardise such projects (Schwaninger and Kaiser, 2007).

3.6 General approaches

In addition to the five fields of application introduced above, general approaches ensure that widespread practical approaches are taken into consideration. They do not deal with specialised requirements in a particular field of application, but have a higher level of abstraction to fit different project types. Next to approaches published in journals, the assessment of project success in the two major project management organisations Project Management Institute (PMI) and International Project Management Association (IPMA), their national member associations, and AXELOS (having published the PRINCE2 project management standard), is included in this field of application as well. The major concern of general approaches is to provide a framework for the management – including its assessment – of any kind of project. Thus, approaches in this field of application can be adapted to project success assessment criteria in different fields of application. Taking this field into account provides the opportunity to compare the specific success criteria used in the other five identified fields of application with the universally accepted criteria.

4. Literature review

Literature reviews play a pivotal role in scientific research because they integrate the knowledge published in several articles (Cooper, 1988, pp. 104-105). After developing a common understanding of project success and defining the fields of application investigated in this study, we describe the research question, the methodology and the research sources in this section.

4.1 Research questions

The starting point for our investigation was a pilot search for meta-studies on the assessment of project success. As result of this, two meta-studies dealing with the assessment of project success were taken into account. Kloppenborg and Opfer (2002) analysed the current state of project management research. At the beginning of project management research in the 1960s and 1970s, the focus was set on cost and schedule control. In the 1990s, a shift towards a

broader understanding of project success occurred and included human resources factors such as team building and staff motivation.

Ika (2009) investigated the appearance of project success criteria over a time range from 1986 to 2004. The results are summarised in Figure 3. Consistent with the findings of Kloppenborg and Opfer (2002), the assessment of project success started with the Iron Triangle, including the dimensions time, cost and performance. The number of publications dealing with project success criteria increased in parallel with the further development of project management. Between 1980 and 2000, satisfaction criteria of people who were involved in or affected by the project gained increasing importance. Ika (2009) identified a further shift towards strategic and sustainable success criteria at the beginning of the twenty-first century.

It is important to consider that the Ika (2009) study includes only articles from 1986 to March 2004. In contrast to the retrospective observation of the two time slots 1960-1980 and 1980-2000, the criteria to assess project success in the twenty-first century are predicted, because data are only available up to the beginning of 2004. There is no recent meta-study which investigates the criteria of project success. This gap in research may partially be filled by the present paper.

Only little research has been done to analyse the use of success criteria in different industries or fields of application. Collins and Baccharini (2004) tried to find out how people in different industries define the term “project success”. They pointed out that many projects were insufficiently assessed, because most case studies had only focussed on the compliance with the Iron Triangle and that customer satisfaction was the only criterion additionally used in the assessments.

As a first step of our study, we focussed on finding out the criteria used to assess project success in different fields of application. After identifying the success criteria, we scrutinised the similarities between the use of the criteria within the fields of application defined in chapter 3. The aim of this step is to identify the criteria representative of the particular field of application. This led us to the following specification of our first research question:

RQ1. Have specific patterns for the selection of project success criteria emerged in the selected fields of application?

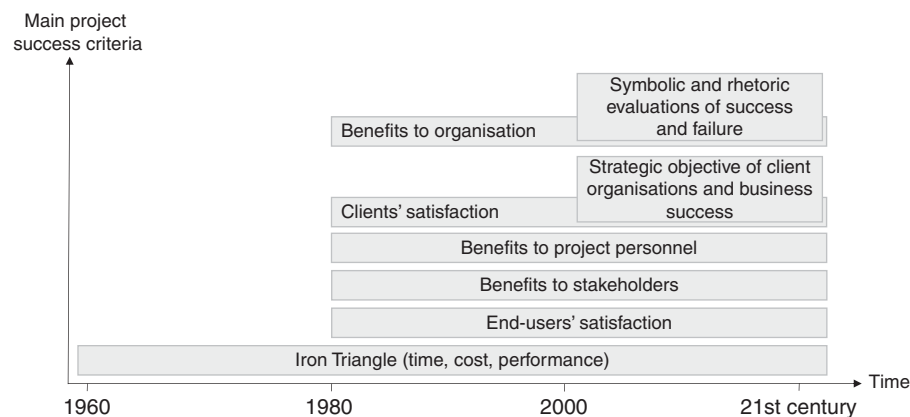


Figure 3.
Shifting of criteria
to assess project
success discussed in
literature over time

Source: Based on Ika (2009)

Answering this will help researchers and practitioners to answer the question if the choice of suitable project success criteria depends on the field of application in which a project is executed. After revealing potential specific patterns, we analyse the chosen articles to find further factors influencing project success assessment to answer the second research question:

RQ2. What additional important factors influence the assessment of project success?

4.2 Methodology and sources

The taxonomy for literature reviews developed by Cooper (1988) and displayed in Figure 4 was used to define our literature research. The focus is on the identification of research outcomes, theories and practices or applications, which show the possibilities of project success assessment in different fields of applications. A neutral representation was chosen, because we want to integrate the different approaches within and between the chosen fields of application without criticising differing opinions. We chose the representative coverage characteristic reasoned by the fact that it was our explicit objective to analyse review articles representative of the chosen fields of application. The organisation of this literature review is conceptual because abstract ideas appear together to show the assessment in different fields of application. The general public should benefit from the findings of the literature review to ensure that practitioners receive assistance in choosing suitable project success criteria, researchers obtain an insight in project assessment in different fields of application and both know factors influencing project success assessment.

The examination and evaluation of various project success criteria used in different fields of application determine the first step undertaken in this study. The identification of the success criteria is based on their consideration in publications and practical application. The three different groups: articles, books and standard references were chosen and are explained below.

The first group consists of articles published in academic journals with reference to project management. Journals as information source were chosen to reveal the current state of research in the field of project management. The recommendation of Vom Brocke *et al.* (2009) and Jaspersen *et al.* (2002) is to conduct a database search as starting point of a literature review. They recommend starting with a journal search only in exceptional cases. From our point of view, our review constitutes such an exceptional case, because the majority of research on project management in general and project success in particular has been published in just a few journals. So, we conducted a journal search instead of a database search and took into account *Project Management Journal*, *International Journal of Managing Projects in Business*, *International Journal of Project Management* and *Journal of Management in Engineering*. Table II illustrates the search results of the initial search performed by using the search engines EBSCOhost, Emerald Insight and Elsevier Science Direct. The availability of digitalised articles resulted in a restriction of the sources. Based on such restricted access, we considered the outlined periods of publication. The initial list of search terms consists of project

Characteristic	Categories			
	Research outcomes	Research methods	Theories	Practices or applications
Focus				
Goal	Integration		Criticism	Identification of central issues
Perspective	Neutral representation		Espousal of position	
Coverage	Exhaustive	Exhaustive and selective	Representative	Central or pivotal
Organisation	Historical		Conceptual	Methodological
Audience	Specialised scholars	General scholars	Practitioners/policymakers	General public

Sources: Cooper (1988) and Vom Brocke *et al.* (2009)

Figure 4.
Taxonomy of
literature reviews

Table II.
Results of
initial search

Journal	Covered period	Search engine	Project success		Search results Project performance		Total	
			std	dqm	std	dqm	std	dqm
<i>PMJ</i>	1997-2016	Ebscohost	242	172	174	94	374	252
<i>IJMPB</i>	2008-2016	Emeraldinsight	318	164	362	124	362	223
<i>IJPM</i>	1983-2016	Sciencedirect	1,709	775	1,820	658	1,820	1,079
<i>JMENE</i> A	1995-2014	Ebscohost	216	84	304	140	460	204
Total							3,016	1,758

Notes: dqm, double quotation marks: search terms are next to each other in the identified articles; std, standard search: search terms are not mandatory next to each other, but scattered across the paper

success and project performance. We used project performance as search term, because it is often used as a synonym for the term project success. We found a total of 1,758 articles in which the search terms “project success” and “project performance” are found next to each other (exact-match search) and 3,016 articles in which these search terms are not necessarily next to each other, but scattered all over the paper.

To obtain highly relevant papers within reasonable time, we selected the search terms project success criteria, project performance criteria, Iron Triangle and triple constraint. As shown in Table III, this adaptation allowed us to limit the number of potentially relevant articles to a manageable level. In total, 221 articles containing the defined search terms (exact-match search) were selected for further processing.

We followed the recommendations of Vom Brocke *et al.* (2009) and analysed the titles and abstracts of the identified, potentially valuable articles in the next step. First, we analysed title and abstract to determine whether the article could contain information about the assessment of project success in one of the fields of application defined in Section 3. The article only served as selection criterion, in case title and abstract contained no information about project success assessment. However, final assessment of the relevance of

Search terms	<i>PMJ</i>	<i>IJMPB</i>	Journals <i>IJPM</i>	<i>JMENE</i> A	Total
<i>Project success criteria</i>					
std	5	155	984	1	1,145
dqm	3	19	74	0	96
<i>Project performance criteria</i>					
std	0	175	1,001	2	1,178
dqm	0	1	17	1	19
<i>Iron triangle</i>					
std	0	34	84	1	119
dqm	0	34	84	1	119
<i>Triple constraint</i>					
std	3	21	59	0	83
dqm	2	10	33	0	45
<i>Total</i>					
std	7	217	2,768	2	2,994
dqm	4	52	164	1	221

Table III.
Results of final search

Notes: dqm, double quotation marks: search terms are next to each other in the identified articles; std, standard search: search terms are not mandatory next to each other, but scattered across the paper

an article only by reading the title and abstract did not always deliver the desired information. So, most articles were read completely. The remaining articles were potentially useful to answer the research questions either on the basis of the title, the abstract or the text. Here, we would like to mention that we are well aware that journals not included in our selection may also contain relevant articles. However, this restriction had to be made to conduct the research within reasonable time. As recommended by Webster and Watson (2002), we included further articles if they were cited in an article of the above-mentioned journals. Finally, we selected articles suitable to describe the assessment of project success in the above-mentioned fields of application.

The second group is characterised by standard references in the respective field of application and books written by project management experts on practical application, as well as books written by researchers. With respect to the doctoral work, dissertations are displayed separately. This group was included in the course of this study, because it rounds off the broad variety of project success criteria. The selection of relevant books was primarily based on our prior research or past experience. Out of a large number of standard references and books we found, only books containing relevant content were included in the overview. If it was not possible to find an article explaining project success assessment in a field of application, at least three books were taken into account.

The third and last group comprises those methods dealing with project management success which are recommended by the two international project management associations PMI and IPMA and the PRINCE2 owner AXELOS. The IPMA Organisational Competence Baseline, projects in controlled environments (PRINCE2) and a Guide to the Project Management Body of Knowledge (PMBok Guide) are *de facto* project management standards, and hundreds of thousands of certified people act in accordance with them (Project Management Institute, 2015; Deutsche Gesellschaft für Projektmanagement e.V., 2015; Axelos, 2015). Therefore, those standards, quite obviously, had to be included in our investigation.

5. Findings of the study

This section presents the findings of our literature review. Table IV depicts the varying utilisation of project success criteria in the above defined fields of application. According to the widespread classification in literature, the identified criteria are subdivided into hard criteria which are rather objective and measurable and soft criteria which are subjective and difficult to evaluate (Baccarini, 1999). Hard criteria include measurement of time, cost, performance, economic success and quality. Soft criteria consist of several criteria to assess the satisfaction of the stakeholders. Connections and trade-offs between the criteria may exist (Eriksson and Westerberg, 2011). The identified criteria are explained below, but it should be pointed out that the importance and detailed determination of them varies from project to project (Müller and Turner, 2007). Table IV includes a selection of criteria to assess project success and a selection of papers or books dealing with project success criteria. Success criteria used just in a few approaches were excluded. From our point of view, solely approaches characteristic of projects in the respective field of application were included in the evaluation. We made this simplification to focus on key findings and to ensure clarity in the table.

5.1 *Hard criteria*

In addition to the traditional success criteria cost, time and performance, we added economic success and quality to the field of hard criteria. This is substantiated by the fact that quality replaces performance in some publications (Atkinson, 1999; Tükel and Rom, 1998). Moreover, economic success is easily measurable and can also be seen as part of the cost dimension. Accordingly, there is a connection between both criteria and the dimensions of the Iron Triangle. (Stein, 2004) Time, cost and performance are part of Barnes' Iron Triangle

Table IV.
Utilisation of project
success criteria in
different fields of
application

References	Type	Fields of application	Hard criteria				Criteria				Soft criteria		
			Time	Cost	Performance	Quality	Economic success	The company	Line managers	Satisfaction of Project members	Customers	End users	Suppliers
Schmelzer (1986, p. 46)	b	PO	●	●	●	●		●			●		●
Stein (2004, p. 43ff.)	b		●	●	●	●				●			●
Stockstrom (2009, p. 204ff.)	p		●	●			●						
Kessler and Winkelhofer (2002, p. 14)	b	OD	●	●	●								
Schiersmann and Thiel (2011, p. 207ff.)	b		●	●	●	●							
Sterrer (2014, p. 166f.)	b		●	●	●	●		●					
Hough and Morris (1987, p.193)	b	AA	●	●	●	●		●			●		●
Madauss (2000, p. 238)	b		●	●	●	●		●					●
Turner and Zolin (2012, p. 87)	a		●	●	●	●	●						●
Chang <i>et al.</i> (2013)	a		●	●	●	●				●	●		
Aggteleky (1990, p. 873ff.)	b	FC	●	●	●	●	●						
Lim and Mohamed (1999, p. 245)	a		●	●	●	●		●					●
Yeung <i>et al.</i> (2009)	a		●	●	●	●							
Meng (2012, p. 188ff.)	a		●	●	●	●							
Al-Tmeeny <i>et al.</i> (2011)	a		●	●	●	●	●				●		
Henjewe <i>et al.</i> (2014)	a		●	●	●	●		●					
Wiendahl <i>et al.</i> (2014)	b		●	●	●	●							
Wateridge (1995, p. 169f.)	a	SD	●	●	●	●							
Atkinson (1999, p. 337ff.)	a		●	●	●	●		●		●			●
Agarwal and Rathod (2006, p. 360)	a		●	●	●	●					●		
Mahaney and Lederer (2006)	a		●	●	●	●				●			
Köhler and Oswald (2009, p. 9ff.)	b		●	●	●	●		●			●		●
Schoeneberg (2011, p. 115)	p		●	●	●	●	●						●
de Bakker <i>et al.</i> (2012, p. 448f.)	a		●	●	●	●					●		
Delo (2013)	b	GA	●	●	●	●					●		
Baker, Murphy and Fisher (1997, p. 903)	b		●	●	●	●		●			●		●

(continued)

(continued)

References	Fields of application		Hard criteria			Criteria				Soft criteria			
	Type	application	Time	Cost	Performance	Quality	Economic success	The company	Line managers	Satisfaction of Project members	Customers	End users	Suppliers
Lechler (1997, p. 44)	p		●	●		●	●			●	●	●	●
Turner (1999, p.72)	b		●	●	●	●	●	●		●	●	●	●
Kerzner (2006, p. 7)	b		●	●	●			●		●	●		
Shenhar and Dvir (2007, p. 12ff.)	b		●	●	●	●	●	●		●	●	●	
Deutsche Gesellschaft für Projektmanagement e.V. (2014, p. 21ff.)	s		●	●	●	●				●	●		●
IPMA													
Office of Government Commerce (2009, p. 4ff.)	s		●	●	●	●							
PMI (2013, p. 835)	s		●	●	●	●	●				●		
Supraption et al. (2015)	b		●	●	●	●	●	●			●	●	

Notes: Relevance: ●, inherent part of judgement; ○, medium relevance. Type: a, article; b, book; p, PhD thesis; s, standard reference. Fields of application: AA, aerospace and army; FC, factory planning and construction; GA, general approaches; OD, organisation and personnel development; PO, product development in mechanical engineering; SD, software development

Table IV.

and will therefore not be explained in detail. The achievement of business purpose was added to the criterion “performance” to consider the aims of project execution (Turner, 1999). Some authors criticise the use of the term “quality” because of the missing guidance of the project team during project execution (Turner, 1999). This is rather unspecific, not consistently used and can be interpreted in various ways. The fifth criterion in this category is economic success. The integration of this criterion avoids assessing technical achievements *per se* as success, as the financial point of view is not taken into account (Wieczorrek and Mertens, 2011).

5.2 Soft criteria

Soft criteria cannot be measured simply by analysing the key performance indicators of a project. The elements of each criterion should be analysed to ensure a suitable assessment. Each criterion consists of the combination of various elements with different weightings (Rashvand and Zaimi Abd Majid, 2014). Since elements can be part of more than one satisfaction criterion, assessment is not free in terms of overlaps. The criteria do not have to be free of overlaps, because assessment of project success by different stakeholders also has similar parts. People execute, decide and are affected by the course of the project and thus have a high impact on its success (Belout, 1998). Different stakeholders can be involved in planning, executing and approving a project (Cserhádi and Szabó, 2014).

Many articles use a poorly specified definition of the term “stakeholder”. As a consequence, the elements to assess stakeholder satisfaction are separated accurately in few approaches only (Sterrer, 2014). For example, Westerveld’s (2003) project excellence model does not include a comprehensive list of different stakeholders and their influence on project success. Westerveld specifies client, project personnel, contracting partners and users, but also uses the general term “stakeholders” as conglomeration.

5.2.1 Company satisfaction. The first criterion assesses the satisfaction of the company conducting the project. It is a multi-part criterion consisting of highly individual company-dependent elements. Here, to some extent, strategic objectives such as the achievement of strategic goals, organisational learning, preparing for the future, operating expenses, influence on corporate culture and influence on other processes in the company are included (Kerzner, 2006; Rank *et al.*, 2015; Shenhar *et al.*, 2001).

The influence of other processes and the learning of project members are exemplified below. The indicator mentioned above measures the influence of project execution on the execution of day-to-day operations in the company (Kerzner, 2006). A project should not be considered a success when day-to-day operations were not finished due to disturbances originating in the execution of the project. According to Kerzner (2006), project managers often try to manage a project like an enterprise, applying their own project-specific rules, procedures and guidelines. In the view of an organisation, a project is regarded as successful if it was implemented on the basis of company-wide rules. Part of this aspect is also the observance of an existent corporate culture. For example, the ethical code of conduct of an enterprise should also be taken into consideration. The learning of project members during project planning, execution and retrospective inspection is another feature to measure company satisfaction. Because of the fact that task execution within a project differs from the day-to-day work of line operation, the qualification of project members will be higher at the end of a project.

5.2.2 Line-manager satisfaction. Line managers of an organisation which is executing a project are also affected by a project. The staff assigned to projects is only partly available for assuming day-to-day operations. Besides the company’s satisfaction, the increased qualification of the returning staff and the influence of performed project tasks on daily operations can be indicators for line-manager satisfaction as well.

5.2.3 Project-member satisfaction. The satisfaction of project members is often used as a criterion to judge project success. Included in this group of stakeholders are project managers, employees in the project office and the project team (Shenhar and Dvir, 2007). Turner (1999) suggests measuring the satisfaction of project members should be based on their project work experience and whether or not the project fulfilled their needs. The satisfaction of project members has a crucial influence on project success (Müller and Turner, 2007).

5.2.4 Customer satisfaction. The term “client” includes the two stakeholder categories customer and end-user (Westerveld, 2003). Customers are persons or companies ordering a product. This ordering should be linked to the initiation of a project in the assigned company. Essential part of achieving customer satisfaction is the generation of customer value (Shenhar and Dvir, 2007; Williams *et al.*, 2015). For instance, the willingness to order enhancements of the project product or to start future projects to develop new products can be an indicator to measure customer satisfaction (Shenhar *et al.*, 2001).

5.2.5 End-user satisfaction. Individuals using the project product are called “end-users”. To the downstream users of a project product the ultimate ambitions are: the product shows the expected functionality and it can be used (Dvir *et al.*, 2003; Davis, 2014). The end-user does not have to be an employee of the customer’s organisation. For example, the end-user of a bridge can be the community.

5.2.6 Supplier satisfaction. The final criterion in this section is the satisfaction of the suppliers involved in a project. Turner and Zolin (2012) subdivide the term “supplier” in “senior suppliers” and “other suppliers”. In contrast to their approach, this paper deals with aggregated supplier satisfaction. The long-term objective of suppliers acting in a project is the generation of profit (Westerveld, 2003). If the supplier generates profit by acting in the project, a positive project success assessment can be expected. Further indicators influencing the assessment of project success can be learning by project execution and generation of follow-up business.

5.3 Patterns for the selection of project success criteria

Table IV shows differences in the assessment of project success within the fields of application. The approaches in each field differ in the composition of the used criteria. None of the approaches is identical to any other one. Some criteria taken into account by one approach are not considered by another and vice versa. Furthermore, Table IV also shows that the approaches cannot be differentiated on the basis of the field of application in which they were used. Except for line manager satisfaction and economic success, the identified criteria are at least part of approaches in five out of six fields of application in most instances. Here, these findings indicate that approaches from different fields of application use similar project success criteria and that there is a smooth transition between the assessment in the different fields of application. The assumptions made in the beginning of the study that the dimensions of Barnes’ Iron Triangle are a fundamental part of approaches could be substantiated, because the dimensions could be identified in nearly all approaches. At least two of the three hard criteria were found in all of the investigated resources. But the study findings also show that the hard criteria consolidation process has not yet come to an end: on the one hand, performance and quality are used individually or in combination and, on the other hand, economic success is taken into consideration only in part.

Many articles in the field of application factory planning and construction included safety as hard criteria in the assessment of project success (Chan and Chan, 2004; Hughes *et al.*, 2004; Yeung *et al.*, 2009). From our point of view, this is done because construction projects hold a threat to life or physical condition. In particular, if human lives are at stake, the assessment of project success should be adjusted.

Furthermore, the above-mentioned findings of Müller and Jugdev (2012), who stated that hard criteria are only responsible for nearly 50 per cent of project success and that the so-called soft criteria determine the other 50 per cent, could be substantiated. Only 8 of the 34 chosen approaches do not explicitly include soft criteria to assess project success.

Another interesting study finding is the frequency with which criteria are used to judge project success. While the well-known soft criterion customer satisfaction is taken into account in nearly every approach to assess project success, little-known criteria are used less often. For example, line-manager satisfaction is not taken into account in factory planning and construction, product development in mechanical engineering, aerospace and army or general approaches. Only three approaches integrate line-manager satisfaction as criterion to assess project success.

In conclusion, it can be said that there are no patterns for the selection of project success criteria in the chosen fields of applications. Project success assessment differs within and between the selected fields of application.

5.4 Factors influencing the choice of project success criteria

We found some factors influencing the choice of project success criteria and, thus influencing project success assessment in general. Not every article contains findings on this topic. We clustered the identified factors into project-specific factors, factors depending on the assessment basis, factors depending on the assessment date and factors depending on the stakeholders.

According to different authors, the choice of success criteria is dependent on the project type (Cserhádi and Szabó, 2014; Müller and Turner, 2007; Shenhar and Dvir, 2007; Chang *et al.*, 2013). They found that factors such as complexity, novelty, urgency or performance have a crucial influence on the choice of suitable assessment criteria (Müller and Turner, 2007; Shenhar and Dvir, 2007; Chang *et al.*, 2013). This finding can be illustrated by the example of the Olympic Games. If the Olympic village was not completed on time, the impact on project success would be more critical than shifting the launch of an IT project. The additional factors which need to be considered in this cluster are project structure, differentiation of the project period into phases or modifications while the project is running (Kerzner, 2006; Chang *et al.*, 2013).

The second cluster contains the underlying conditions, which need to be defined before any meaningful success assessment is possible. Here, it is necessary to decide whether the process of project execution or project performance should be assessed (Atkinson, 1999). Furthermore, Schiersmann and Thiel (2011) suggest considering the external and internal perspective to avoid a biased view.

As already mentioned in chapter 1, the assessment of project success seems to be time-dependent (Kloppenborg *et al.*, 2014; Jugdev and Müller, 2005). Depending on the point of time when the assessment is carried out and what periods are covered, project success assessment differs (Turner and Zolin, 2012; Aggteleky, 1990; Lim and Mohamed, 1999; Lechler, 1997; Turner, 1999; Shenhar and Dvir, 2007; Hough and Morris, 1987; Baker, Murphy and Fisher, 1997). On the one hand, there are project outputs which can be measured at the end of the project. On the other hand, it is of great importance that the project generates outcome in form of better preparation for the future. These new capabilities can be measured some months after the end of the project at the earliest. The third part of project success is the long-term impact which cannot be measured shortly after project completion, but only some years after it (Gemünden, 2015; Serrador and Turner, 2015; Al-Tmeemy *et al.*, 2011; Shenhar and Dvir, 2007). The decision about the weighting of success criteria is also one factor which depends on the assessment date (Lechler, 1997). The selected criteria are of varying importance for project stakeholders (Hough and Morris, 1987). For example, in IT projects, project members keep the dimensions time, cost and budget in mind, but these are not the criteria to which the greatest importance

is attached (Agarwal and Rathod, 2006). Functionality and quality of the developed software outshines the Iron Triangle, and in the perception of an IT project manager, the cost aspect is the least important one.

The weighting also influences factors depending on the stakeholders. Every stakeholder involved in a project pursues different objectives during project execution, giving rise to different stages of success (Binnendijk, 2000; McLeod *et al.*, 2012; Turner, 1999; Turner and Zolin, 2012). This leads to assessments which depend on the assessor as well as the number and variety of stakeholders (Kerzner, 2006; Shenhar and Dvir, 2007; Turner and Zolin, 2012; Lim and Mohamed, 1999; Hough and Morris, 1987). Furthermore, political decisions, for example, providing knowledge build-up in enterprises in the region to increase their competitiveness, can have significant influence on project success assessment (Chang *et al.*, 2013).

5.5 Limitations

This study has its limitations. First of all, repeatability of the research is not guaranteed. The review of the journals is based on results provided by the search engines EBSCOhost, Emerald Insight and Elsevier Science Direct. Performing a search in exactly the same way as we described it, can lead to slightly different search results for a variety of different reasons. The decision to focus solely on the four above-mentioned journals in the chosen periods of publication was taken fully intentionally. We are aware of the fact that access limitations or papers not yet digitally available have an impact on the results. Furthermore, our experience shows that an update of the search engines' algorithms could also change the results. In addition, the text books included in the investigation were chosen based on our experience. Another limitation of the study is the specific selection of approaches representative of different fields of application. Depending on different experiences, preferences or interpretations, other researchers may make different selections.

A recent stream of research is discussing the term stakeholder related to sustainable project management. This view results in a broader definition of stakeholder and the need to satisfy groups like environmental pressure groups, human rights groups or non-governmental organisations (Silvius and Schipper, 2014). The novelty of the sustainability stream leads to small-scale approaches assessing the satisfaction of the groups mentioned above. Hence, we decided to focus on the six stakeholder groups: company, line managers, project members, customers, end users and suppliers in this research paper.

Yet, another limiting factor of the study is that there is no information about the importance of the hard and soft criteria used for assessment. It can only be assumed that the importance of the hard criteria will decrease in consideration of the fact that the importance of satisfaction criteria on the part of the stakeholders will increase.

6. Conclusion and future research

We examined similarities in the assessment of project success in different fields of application. To our knowledge, our review is the first of its kind, although project success criteria are a widely scrutinised topic in project management research. By means of a systematic literature review, we identified six different fields of application, extracted the characteristic project success criteria and gave an overview of the relevant approaches in the identified field of application. Similar to other articles on project success, we followed the broad understanding of the term project success, including project management success, product success and consistent project success (Baccarini, 1999; Creasy and Anantatmula, 2013; Cooke-Davies, 2007; Ika, 2009; Munns and Bjeirmi, 1996; Toor and Ogunlana, 2008; de Wit, 1988).

The study findings presented above confirm the results of Davis (2014) that there is no common definition for the term project success. An inconsistency was identified in the use of

definitions of project success criteria in literature. In addition to the criteria shown in Table IV, the PMBoK Guide also assesses project success on the basis of the criteria risk and resources (Project Management Institute (PMI), 2013). The definition of project success includes customer satisfaction early in the book, but there is also a definition which does not include the term a few pages later (PMI, 2013). Kerzner (2006) describes project success in different chapters with different elements. Furthermore, we illustrate that there is an inconsistent use of criteria to assess project success in different fields of application. Furthermore, there is an inconsistent use within the defined fields of application. A significant finding of our study is that the Iron Triangle criteria are still part of the approaches used to assess project success. However, the Iron Triangle's hard criteria are more and more often not the only elements for the determination of project success. They are supplemented by individually specified soft criteria. The study findings indicate that the field of application does not correlate with the application of project success criteria, because there is an overlap neither within nor between the fields of application. On the basis of these results, the answer to *RQ1* is that there is no relationship between the chosen project success criteria and the field of application and that not specific patterns for the selection of project success criteria across various fields of application have emerged.

In a second step, we tried to reveal factors influencing project success assessment in general. In those approaches examined, we could not determine patterns of factors taken into account in a systematic manner. Some authors named factors or decisions to be made. On the basis of the research results, the only answer to *RQ2* is that there are additional factors but they are not taken into account systematically in the selected articles. We clustered them in project-specific factors, factors depending on the assessment basis, factors depending on the assessment date and factors depending on the stakeholders. This leads to the question: how could these factors be systematically considered? Further research is necessary to answer this question.

The missing uniformity in assessing project success results in incommensurable success assessments. Furthermore, using two different approaches to judge the same project could result in success and failure in extreme cases. Additionally, evaluating project success implies a partially subjective assessment because of the necessary interpretations. Further research is necessary to avoid extreme differences in success assessment. A generic model to describe project success should be developed to provide a common guideline for assessing.

Future research is also necessary to check measuring systems in general. Quantitative and qualitative criteria should be combined to assess project success. The measurement of these criteria is partially vague, and a consolidation of different metrics is inevitable.

As mentioned above, time dependency of the criteria plays an important role in the assessment of project success. Further research is necessary to investigate the relation between success criteria, field of application and project phase to find out, whether the application of success criteria is also related to project phases. For example, it should be investigated, whether stakeholders attach importance to different success criteria in the different project phases planning, execution, close-out and utilisation.

The suggestions for future research made above show that the field of project success criteria still contains "yet undiscovered spots". This paper filled such research gaps by eliminating the assumptions that patterns for the selection of project success criteria have emerged within the chosen fields of application and by showing that influencing factors are not taken into consideration fully. Furthermore, the research findings hold implications for project assessment in practice. Thus, project management professionals can be certain that there is no standard model to assess project success suitable for the respective field of application. They should choose the criteria suitable for their projects individually and consider the above-mentioned influencing factors.

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