ELIMINATING FAILURE BY LEARNING FROM IT – SYSTEMATIC REVIEW OF IS PROJECT FAILURE

Completed Research Paper

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Abstract

Researchers analyzing project success and failure emphasize the prevailing challenge of successfully completing information system (IS) projects. We conduct an extensive systematic literature review of factors that contributed to failure of real-life IS projects. Our resulting overview entails 54 failure factors, which we grouped in 10 categories applying data-driven qualitative content analysis. We extend our holistic overview by linking the factors to specific project failure dimensions and integrating a stakeholder perspective to account for failure responsibility. Our analysis yields widely acknowledged failure factors like insufficient stakeholder involvement as well as less common factors like history of prior successes. Researchers gain insights into project failure factors along with responsible stakeholders and affected failure dimensions, and can use our overview to identify factors or areas of concern to guide future research. Our overview provides a pillar for IS practitioners to learn from others and to eliminate failure by avoiding past mistakes.

Keywords: Project failures, Information systems project management, Literature review, Qualitative research, Information system development, IS project success

"We wanted it really bad, and at the end it was really bad."

(Special Agent Larry Depew in retrospect of the historical failure of FBI's Virtual Case File project. Goldstein 2005, p. 34)

Introduction

Researchers analyzing project success and failure over the past decades (e.g., Cerpa and Verner 2009; Keider 1984; Keil 1995; Yeo 2002) emphasize the (still prevailing) challenge of successfully completing information system (IS) projects. Overcoming this challenge can be approached in different ways. Numerous studies focusing on achieving success in IS projects (e.g., Fortune and White 2006; Napier et al. 2009; Pankratz and Loebbecke 2011) aim to identify success factors, that is, aspects that contribute to success. In contrast, another research stream focuses on project failure and identifies failure factors. Such factors are derived to prevent project failure, that is, to learn from previous unsuccessful projects to avoid similar mistakes in the future. Failure factors are not simply the opposite of success factors – while certain aspects (e.g., lack of rapport with the client) strongly affect project failure, their opposites not necessarily contribute to success (Baker et al. 1988, cf. next section for a detailed elaboration). For this reason, it is crucial not to limit oneself to identifying success factors but to place emphasis on investigating failure factors as well.

We focus on studies of real-life IS projects and factors that contributed to their failure. Such studies are particularly valuable since they provide in-depth insights into failure factors that occurred in real-life IS projects (rather than theoretically derived factors). A systematic synthesis of such failure factors collected in literature is missing. An extensive overview of factors contributing to failure is needed to help the community of IS professionals to facilitate successful management of their projects. Accordingly, we state the following research question:

Which factors contributed to project failure in IS practice to date?

To answer this question, we apply a research approach consisting of three subsequent steps. First, we identify common stakeholder groups in IS projects based on project management standards and literature. Second, we conduct a systematic, comprehensive literature review to identify IS project failure factors. We focus on studies of failed real-life IS projects (see next section for our definition of a failed project) and gather information about factors that contributed to their failure. For each factor, we elicit (1) factor description, (2) responsible stakeholders empowered to influence the factor at least to a certain degree, and (3) failure dimensions according to which the project is considered a failure. In contrast to factors (aspects contributing to success or failure), dimensions are measures by which success or failure is judged (Cooke-Davies 2002). This review results in a consolidated list of failure factors, responsible stakeholders, and according failure dimensions for each factor. Finally, we apply qualitative content analysis (Jankowicz 2004) to categorize the identified factors, resulting in 10 categories that include 54 failure factors. In the following, we refer to this consolidated, categorized list that includes information about stakeholders and dimensions as a holistic, integrated overview of project failure factors.

This holistic, integrated overview contributes to research and practice in the following ways. Researchers obtain a consolidated picture of failure factors in real-life projects, containing expected as well as less obvious factors, and as further benefit the integrated linkage of these factors to responsible stakeholders and affected dimensions. These insights can be used to select factors or areas of concern for future research. Practitioners can use our overview as a checklist for the according stakeholder groups. Identifying potential risks in concrete projects and handling them accordingly, thus preventing mistakes of previous IS projects, should considerably reduce the probability of failure in future projects.

The remainder of this paper is organized as follows. Next, we address prior research on IS project success and failure, and define the understandings applied in our study. Subsequently, we describe our research approach by explaining our three steps in detail. We then present our review results concerning the failure factors in IS projects. Finally, we discuss the results and conclude with our contribution and outlook.

IS Project Success and Failure in Literature

In this section, we present relevant literature while discussing and defining relevant concepts for our study: IS project, IS project success and failure, and factors contributing to IS project success and failure.

IS Projects

Regarding projects in general, we consolidate existing definitions in the project management literature (Kerzner 2006; Nicholas and Steyn 2012; Project Management Institute 2008; Turner 1993). A project is a unique series of multi-functional activities within several phases with a specific objective to create a product or service within certain specifications, defined start and end dates, and funding limits. A project consumes resources and, due to its uniqueness, entails risks and uncertainty. An IS "can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization" (Laudon and Laudon 2009, p. 46). We define an IS project as a project in above terms with the goal to develop, extend, or adapt an IS.

IS Project Success

In order to understand IS projects failure, it is important to consider the concept of IS project success. Researchers discuss the definition and measurement of the latter concept for a long time. Still, there is no agreed-on understanding of IS project success as demonstrated by diverging approaches (e.g., Agarwal and Rathod 2006; Aladwani 2002; Baccarini 1999; Barclay and Osei-Bryson 2009; Egorova et al. 2009; Nelson 2005; Wateridge 1998; Yetton et al. 2000).

IS project success (as well as success of projects in general) is traditionally assessed by adherence to planning, that is, applying the success criteria (=dimensions) adherence to schedule, adherence to budget, and conformance with specified functional and non-functional requirements (Agarwal and Rathod 2006; Ika 2009; Karlsen et al. 2005; Pinto 2004; Wateridge 1998). This traditional approach is also called Iron Triangle (Atkinson 1999) or Triple Constraint (Pinto 2004). However, there is agreement among scholars in IS as well as general project management research that this planning-related approach is insufficient for assessing (IS) project success (Agarwal and Rathod 2006; Atkinson 1999; Dvir et al. 1998; Pinto 2004; Shenhar et al. 2001; Wateridge 1995). The insufficiency of the traditional perspective is demonstrated by many projects which are considered successful despite not meeting plans and projects that are perceived as failures in spite of satisfying the traditional criteria (Baker et al. 1988; Ika 2009; Pinto and Slevin 1988b); also referred to as *successful failures* or *failed successes*, respectively (Nelson 2005).

Therefore, while agreeing that adherence to planning is important for measuring IS project success, researchers see the latter as a so-called multidimensional construct (Aladwani 2002; Ika 2009; Shenhar et al. 2001; Thomas and Fernández 2008; Yetton et al. 2000) and suggest further criteria for its assessment; for instance, efficiency of the development process (Thomas and Fernández 2008; Wateridge 1998) and customer and/or user satisfaction (Karlsen et al. 2005; Procaccino and Verner 2006). One common approach to organize the multiple criteria is to divide IS project success in two major dimensions: Process success (synonymously project management success, implementation success) and product success (Baccarini 1999; Collins and Baccarini 2004). For measuring process success, three sub-criteria are suggested in this approach: 1. time/cost/quality (adherence to planning), 2. quality of the project management process (efficient use of resources), and 3. stakeholder satisfaction related to the project management process (Baccarini 1999). For product success, the following three sub-criteria are said to be relevant: 1. project goal (the project makes a valuable contribution to the enterprise strategy), 2. project purpose (the produced system satisfies real needs of the end-users), and 3. stakeholder satisfaction related to the product (Baccarini 1999). Similarly, other researchers differentiate (process) efficiency and (product) effectiveness as two major dimensions of project success (Liu et al. 2011). Yet another approach also divides IS project success in two major criteria process and outcome (Nelson 2005); however, here the sub-criteria suggested for process are (1) meeting time, (2) cost, and (3) product objectives, and for outcome (1) product is used by client, (2) project stakeholder learned for future challenges, and (3) project is of value for the client. Overall, while the various approaches to assess IS project success partly differ in suggested dimensions, it is evident that they aim to incorporate both aspects: The development process and the impact of the product (i.e., the developed IS).

IS (Project) Failure

The notions of IS failure and IS project failure can be seen as different or alike, depending on their definition. If the term project implies that its assessment takes place right after the deployment of the developed system, then it is different from the concept of IS failure, which usually includes the development as well as the use and maintenance of the IS (i.e., the entire IS life-cycle) in the assessment. In our view, however, a project is to be considered failed if for instance the developed system is deployed but not used in the client organization. In other words, project assessment goes beyond system development and expands to the entire IS life-cycle. This perspective is in line with the view of project success described above, which also accounts for these two aspects of the project – the development process and the developed product (in use). Defined in these terms, IS project failure equals the notion of IS failure used by multiple researchers; thus these terms are used interchangeably in this paper.

There are two well-established concepts of IS failure in literature: Expectation failure (Lyytinen and Hirschheim 1987) and terminal failure (Sauer 1993). These concepts are applied in numerous works (e.g., Beynon-Davies 1995; Wilson and Howcroft 2002; Yeo 2002). The concept of expectation failure defines IS failure as the "inability of an IS to meet a specific stakeholder group's expectations" (Lyytinen and Hirschheim 1987, p. 263). This is not limited to the clearly specified requirements – not fulfilled inexplicit expectations also lead to expectation failure. In this view, three notions are interpreted as special instances of expectation failure: Correspondence failure, process failure, and interaction failure. Correspondence failure occurs when system design objectives are not met. It is assumed that these objectives can be specified in advance and their achievement can be accurately measured. Process failure relates to the development process and occurs if the development process fails to "produce any workable system [..., which usually] involve[s] unresolvable problems in designing, implementing, or configuring the IS" or, more commonly, if the process "produces an IS, but one which involves vast amounts of overspending both in cost and time, thus limiting or negating the global benefits of the system" (Lyytinen and Hirschheim 1987, p. 265). Interaction failure occurs if the system is produced as planned, but is not used by the end-users as intended. This user-system interaction is likely to be linked to user satisfaction – assuming that intensive system use correlates with higher satisfaction and vice versa. However, empirical evidence for this assumption is inconclusive (cf. Lyytinen and Hirschheim 1987). Table 1 juxtaposes one comprehensive and widely cited IS project success concept (Baccarini 1999) described in the previous subsection and the view of expectation failure.

Table 1. Juxtaposition of IS Project Success (Baccarini 1999) and Expectation Failure (Lyytinen and Hirschheim 1987)

Success dimensions (Baccarini 1999)		Expectation failure (Lyytinen and Hirschheim 1987)
Process success	Time/Cost/Quality	Correspondence and process failure
	Quality of the project management process	Process failure
	Stakeholder satisfaction related to project management process	Process failure
Product success	Project goal	Correspondence failure
	Project purpose	Interaction failure
	Stakeholder satisfaction related to product	Correspondence and interaction failure

However, expectation failure does not take different contexts into account, for instance, appropriateness of individual expectations and the degree of various stakeholders' intention and power to achieve their interests (Sauer 1993). Another well-established concept incorporates a triangle of dependencies between the developed IS, project organization, and IS supporters (Sauer 1993). According to this terminal failure view, failure occurs when the supporters cease to provide sufficient support to keep the project alive. This definition takes into account that in course of the project, there are always unsatisfied expectations due to diverging stakeholder interests and process uncertainties. If project support is sufficient despite unsatisfied expectations, the project is still considered serving relevant interests and should not be deemed a failure (contrarily to the expectation failure view).

In our view, if expectation or terminal failure occurs, it means that at least one of above success dimensions (Baccarini 1999, cf. Table 1) is not met. In order to be able to establish links between failure factors and specific dimensions, we consider the counterparts of these success dimensions to be failure dimensions (i.e., not meeting a success dimension means that the IS project fails in that dimension). Moreover, we consider a project a failure in our analysis if at least one of these dimensions is not met. Accordingly, we consider a factor to be a failure factor if it leads to at least one failure dimension. We choose this rigorous view (including projects in the analysis which failed in only one dimension) to enable establishing direct connections between failure factors and failure dimensions. We do not recommend this rigorous view as a general model for project failure; rather, we use it for an effective analysis of failure factors and their impact on specific failure dimensions. In summary, our concept of IS project failure is based on dimensions presented in Table 2.

Table 2. IS Project Failure Dimensions

IS project failure dimension			Description
Process failure	1	Time	Schedule is not met
	2	Cost	Budget is not met
	3	Quality	Specified requirements are not fulfilled
	4	Quality of the project management process	Project is not managed efficiently (e.g., inappropriate use of resources)
	5	Stakeholder satisfaction related to process	Concerned stakeholders are not satisfied with the project management process
Product failure	6	Project goal	Project does not support organization’s strategic goals
	7	Project purpose	Developed IS does not satisfy real needs of the users
	8	Stakeholder satisfaction related to product	Concerned stakeholders are not satisfied with the product

Researchers also point out that the perception of project success or failure changes in course of system usage although the system is not changed (e.g., Wilson and Howcroft 2002). Therefore, the point in time at which project success is assessed needs attention. We do not determine a specific assessment time in our review since different studies assess project success or failure at different project stages (e.g., directly after system launch or after several years of system usage). Defining one specific point in time for success assessment would lead to exclusion of all studies that use a different one. Instead, we aim to identify a wide range of failure factors and their relations to failure dimensions.

IS Project Success and Failure Factors

In contrast to project success or failure dimensions, which are measures by which success or failure of a project is judged, project success or failure factors are project characteristics that directly or indirectly contribute to success or failure of the project (Collins and Baccarini 2004; Cooke-Davies 2002; Müller and Turner 2007; Poon and Wagner 2001).

Project success factors have been topic of discussion for decades (for selected works see Barclay and Osei-Bryson 2009; Belassi and Tukel 1996; Cooke-Davies 2002; Hyväri 2006; Kendra and Taplin 2004; Pankratz and Loebbecke 2011; Pinto and Slevin 1988a; Yetton et al. 2000). They are described as factors that contribute to project success but do not ensure success (Baker et al. 1988). Critical success factors are considered necessary for an organization to be successful (Rockart 1979). This definition can be transferred to project success (following Pinto and Slevin 1987) – critical project success factors must be fulfilled for a project to be successful. However, the notion of critical is not used consistently in literature. Other researchers define critical project success factors as factors that contribute to project success in a predominant number of projects (Bryde 2008). This definition accounts for the uniqueness of a project and implies that no factor is crucial in every project. We do not consider factors’ criticality (according to neither of above definitions) but intend to provide a wide coverage of such aspects and their impact on project failure.

Compared to project success factors, failure factors seem to have been less discussed in literature. It is important to point out that failure factors are not just counterparts of success factors. Amongst others, this is demonstrated in a study that provides three different lists: (1) factors that strongly affect project failure but their absence does not ensure success, (2) factors that are strongly associated with project success, and (3) factors related to both success and failure (Baker et al. 1988). In that study, the first list includes factors like unrealistic project schedule and the second list contains aspects like enthusiastic public support. The third list includes aspects that, being present or absent, contribute to success or failure, respectively (e.g., adequate team member skills) – in such cases, failure factors are opposites of success factors. However, a clear majority of factors are found in the first two lists, showing that research is necessary on both success and failure factors. In this paper, we investigate factors that contribute to failure of IS projects.

Research Approach

Our research approach consists of three steps: (1) identifying common stakeholder groups in IS projects based on related literature and project management standards; (2) a comprehensive literature review (Webster and Watson 2002) on project failure factors; and (3) qualitative content analysis (Jankowicz 2004) to categorize the identified factors. These steps are elaborated below.

Identifying IS Project Stakeholder Groups

In order to identify relevant stakeholder groups in IS projects, we first reviewed established project management standards (Project Management Institute 2008), IPMA Competence Baseline (Caupin et al. 1999), PRINCE2 (Office of Government Commerce 2009), and APM (Dixon 2000). These are general project management standards covering a wide range of projects. However, IS projects differ from other projects (e.g., engineering) considerably: Among others, IS projects' progress is less transparent and they are more prone to technological changes during the project (Fuller et al. 2008; Sommerville 2011). In order to account for peculiarities of IS projects, we also considered the software-specific standard SWEBOK (Abran and Moore 2004) and selected IS literature which refers to stakeholders of IS projects (e.g., Baccarini 1999; Kendra and Taplin 2004). This tailoring of standard stakeholders to the IS domain resulted in refined and additional stakeholders, for instance, requirements specialists and testers. Both authors independently accomplished this task with a perfect match of extracted stakeholder groups. Overall, our analysis yielded 13 IS project stakeholder groups (cf. *Results*).

Literature Review

We selected leading journals in IS research (Senior Scholars' Basket of Eight, leading software engineering, IS, and project management journals) as our starting point for the search process. These journals and periods are listed in Table 3. We searched the journals manually, that is, both authors read titles and abstracts (and full text, if further clarification was required) of the articles and decided upon inclusion in the analysis. We included research articles describing at least one real-life IS project that failed according to our definition. We included all articles for which at least one of us suggested inclusion. We complemented our manual search by conducting a keywords search in EbscoHost (Academic Search Complete, Business Source Complete), ACM Digital Library, and ScienceDirect to ensure including important articles from other journals and research fields. Among others, we used the keywords *failure, success, factor, project, information system, and risk*.

Subsequently, both authors independently read all identified potential articles to make a final decision upon their inclusion or exclusion in the analysis. To be included, the article needed to contain a sufficient description of project failure and its reasons. It was not a necessary condition that illuminating failure and its reasons was a primary objective of the study as our goal was to collect a wide range of failure factors rather than to assess the quality of failure analyses in the articles. In case of agreement (both authors suggesting inclusion or exclusion), we included or excluded the article, respectively. Our inter-coder reliability (87.3%; number of agreements divided by the total number of agreements and disagreements; cf. Miles and Huberman 1994, p. 46) is thus above the threshold of 80% (Nunnally 1978, pp. 245-246), which can be seen as recommended standard for the majority of purposes (Lance et al. 2006). In case of disagreement (one author suggesting inclusion, the other suggesting exclusion), we conjointly reviewed the article to make a final decision. This approach resulted in 15 identified cases described in 17 articles (cf. *Results*).

We independently analyzed this final set of articles focusing on failure factors. For each factor, we gathered information about (1) factor description, (2) responsible stakeholders empowered to influence the factor at least to a certain degree, and (3) failure dimensions that were affected by this factor. The two authors discussed the collected data subsequently until full agreement was reached regarding all three aspects. Regarding responsible stakeholders and failure dimensions, our goal was to include only information actually present in the analyzed projects rather than to draw general conclusions. Building connections between factors and stakeholders or dimensions was in many cases inhibited by lack of explicitly provided information. For instance, in some cases failure factors and failure dimensions were described but no explicit information was provided which factor actually contributed to which dimension. Such cases were discussed and both authors derived the connections by analyzing given information and making according assumptions. Overall, our analysis yielded a list of 103 failure factors along with responsible stakeholders and failure dimensions.

Finally, we conjointly consolidated this list by discussing the factors and merging duplicates. Our review resulted in a consolidated list of 54 failure factors with responsible stakeholders and failure dimensions (cf. *Results*).

Table 3. Manually Searched Journals

Journal	Searched period
Communication of the ACM	1958 - 2012
Communications of the Association for Information Systems	1999 - 2012
European Journal of Information Systems	1991 - 2012
IEEE Software	1984 - 2012
IEEE Transaction on Software Engineering	1976 - 2012
Information & Management	1977 - 2012
Information Systems Journal	1991 - 2012
Information Systems Research	1990 - 2012
International Journal of Project Management	1983 - 2012
Journal of Information Technology	1986 - 2012
Journal of Management Information Systems	1984 - 2012
Journal of Strategic Information Systems	1991 - 2012
Journal of Systems and Software	1979 - 2012
Journal of the ACM	1954 - 2012
Journal of the Association for Information Systems	2000 - 2012
Management Science	1954 - 2012
MIS Quarterly	1977 - 2012
Project Management Journal	1997 - 2012

Content Analysis of Failure Factors

We applied data-driven qualitative content analysis to categorize the identified failure factors following a two-step approach. First, both authors conjointly followed the content analysis procedure (Jankowicz 2004), successively considering the 54 identified factors. The first factor equaled the first category; for each following factor, we decided if it fits into an existing category, otherwise a new category was created. During the procedure, categories were merged, divided, and redefined according to the assigned factors. This process continued until all factors were assigned to categories, forming an initial scheme. In the second step, both authors independently reviewed the overall categorization (category definitions and comprised factors). We agreed on all categories' definitions and 48 of the 54 factor assignments. Our inter-coder reliability of 88.9% is thus again above the recommended threshold. We discussed deviating assessments until agreement was reached on all factor assignments.

Results

In this section, we present the identified IS stakeholder groups, relevant project cases, and the categorized failure factors along with responsible stakeholders and failure dimensions.

IS Project Stakeholder Groups

Our analysis yielded 13 IS project stakeholder groups with according definitions (cf. Table 4). Table 4 also provides abbreviations for each stakeholder group used later in this paper. Note that presented stakeholders are roles that can be held by the same person or group of people. We added one extra stakeholder group to our list, namely *project*, which comprises all stakeholders affected by the project (i.e., all listed stakeholders except regulators) and is useful for our results presentation later.

Table 4. Identified IS Project Stakeholders

Stakeholder	Definition	Abbr.
End-users	Those who will operate the developed system. Often a heterogeneous group of people with different roles and requirements	EU
Sponsor	Person or group that champions and provides resources for the project. This includes gathering support throughout the organization, promoting project benefits, leading project through engagement or selection process until authorization, playing a key role in development of initial scope, serving as escalation path for issues beyond project manager's control etc.	Spo
Top management	Top management of the customer organization, that is, the organization that commissioned the product	TM
Customer	In contrast to more concrete roles defined above, this group comprises all members of the customer organization affected by the project	Cus
Contractor	All members of the contractor organization affected by the project	Con
Requirements specialists	Responsible for collecting customer requirements. Requirements specialists also mediate between the domain of users and the technical world of engineers	RS
Software engineers	Responsible for designing and implementing the IS	SE
Testers	Test team that can be composed of internal and/or external members, the latter to add an unbiased, independent perspective	Tes
Portfolio / program management	Organizational entity or individual(s) responsible for the high-level governance of a collection of projects or programs (on program level, for managing related projects in a coordinated way)	PPM

Table 4. Identified IS Project Stakeholders (Continued)		
Project management office / project manager	Organizational entity or individual(s) whose responsibilities range from providing project management support functions to being responsible for direct management of a project. In charge of all aspects of the project including planning, keeping the project on track according to plan, identifying, monitoring, and responding to risk, communicating with all stakeholders, particularly the project sponsor and project team	PMO
Team members	Individuals from different groups with a specific skill set who carry out project tasks but are not necessarily involved with project management. Includes RS, SE, and Tes, but excludes PMO	Team
Suppliers	External companies making a contractual agreement to provide components or services for the project	Sup
Project	All stakeholders affected by the project (i.e., all groups above)	Pro
Regulators	Authorities regulating the domain (e.g., banking) for which the IS is developed	Reg

Identified IS Project Cases

We identified 15 relevant IS project cases, listed in Table 5 along with the according sources. For projects 5 and 9, two articles were found, respectively (describing the project from different angles); in these cases both articles were included to prevent missing important factors.

Table 5. Identified Cases

#	Case	Article(s)
1	Sophisticated IS to modernize air-traffic control in US	Barlas 1996
2	Electronic work time registration system in Central-Eastern Europe	Bartis and Mitev 2008
3	IS to enhance organ procurement and placement in US	Beard et al. 2006
4	IS to improve effectiveness and efficiency of Common Agricultural Policy grants and subsidy administration in the public sector in UK	Berger and Beynon-Davies 2009
5	IS to automate processes of manual dispatch systems associated with ambulance services in the UK	Beynon-Davies 1995; Fitzgerald and Russo 2005
6	Executive IS to monitor business performance in a large manufacturing and distribution organization in New Zealand	Bussen and Myers 1997
7	Integrated case file information system for the FBI	Goldstein 2005
8	IS to computerize commercial lines in an insurance company in US	Hirschheim and Newman 1988
9	Expert system to help sales representatives of a large computer company to produce error-free configurations	Gallivan and Keil 2003; Keil 1995
10	Integrated IS to re-engineer requisitioning at a food producer in US	Kirby 1996
11	IS for all Danish universities to streamline university administration and evaluate institutional performance	Mähring et al. 2008
12	IT-based baggage-handling system at Denver International Airport	Montealegre and Keil 2000
13	IS to support a comprehensive reservation program combining airline, rental car and hotel information in the travel industry in US	Oz 1994
14	IS for better land planning of a state planning agency	Schmitt and Kozar 1978
15	Nurse management system at the Eldersite Hospital in England	Wilson and Howcroft 2002

Figure 1 illustrates the saturation curve by providing the number of new failure factors identified in the advancing analysis of the 15 cases. As no new factors were identified in the last three cases, we are confident to have reached saturation and a wide coverage of failure factors in our analysis.

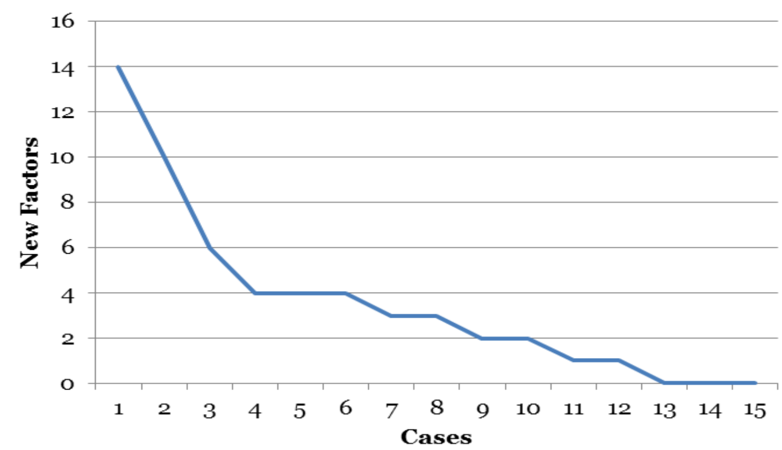

Figure 1. Saturation Curve

IS Project Failure Factors

We identified 54 IS project failure factors in the analyzed projects and grouped those factors in 10 categories. Each factor led to failure in at least one failure dimension in the respective cases. We provide the categories and factors in Table 6 along with categories' definitions and factors' descriptions, responsible stakeholders (SH, cf. also Table 4), failure dimensions (FD, cf. also Table 2), and source cases in which they were identified (SC, cf. also Table 5). The order of the categories does not reflect their importance. If factors occurred in more than one project, we provide cumulated values for both responsible stakeholders and failure dimensions. For example, *unclear project goals* (cf. category 4) contributed to failure in three cases (11, 13, 14); the given values for SH and FD are cumulated over these three projects.

Table 6. Identified IS Project Failure Factors

Factor	Description	SH	FD	SC
1. Conditions: This category comprises conditions present at project initiation				
Lack of clear responsibility for IT	Lack of a single entity responsible for IT leads to objective conflicts and absence of a clear strategic vision	TM	6	5
High system complexity	The process structure to be supported by the system is highly complex, leading to a vast amount of dependencies to consider during development	Spo, PMO, SE	1,2, 3	12
Climate of mistrust within customer organization	Climate of mistrust and obstructiveness leads to conflicts, ineffective communication, anxiety, and resistance within the customer organization, e.g., employees not accepting a system as a result of mistrust in management	Cus	4,5	5
Unclear strategic goals	Initiating a project without clearly defined customer's strategic goals	Cus, Con	6,7, 8	14

Table 6. Identified IS Project Failure Factors (Continued)

Factor	Description	SH	FD	SC
2. Directive decisions: Key stakeholder decisions that have a significant impact on project course				
Requirements not regulated contractually	Refers to (partially) agreeing on requirements verbally rather than regulating them contractually, which often leads to unfulfilled requirements	PMO	3,5, 6,7, 8	2
Lack of acceptance criteria	No formal criteria are specified for acceptance or rejection of the completed system	PMO	6,8	7
Insufficient contractor experience	Contractor's experience in developing information systems is not sufficient for the degree of complexity in the given project	TM, Spo	3	5
Prolonged contrac-tor competition	Competition between contractors for the project is protracted too long, leading to reduced morale and delays	TM	1,3, 4	1
Replacement of the contractor	Changing contractor during project leads to setbacks as new people need to be brought up to speed	TM	1	10
3. Insufficient consideration of customer: Comprises factors concerning the insufficient consideration of the customer organization in the project				
System does not fit culture of customer organization	IS does not suit organizational culture, e.g., a decentra-lized organization with several business units (each with its own way of thinking) implementing a centralized IS	RS, PMO	3,6, 7,8	2,8
Inappropriate development approach	Development approach is inappropriate in the given context, e.g., a development approach that requires fast and authoritative decisions applied in a culture of personal responsibility and allocating blame, leading to unwillingness to take risks and delayed decisions	Cus, PMO	1,2, 4	4,7
System does not suit customer's strategic goals	Applies if customer's strategic and system objectives are not aligned or if the customer's strategic goals are inappropriate	Cus	6,7, 8	6,14
Requirements discrepancies among user groups not considered	Insufficient consideration of the different needs of various user groups, e.g., different level of detail for data input of employees and managers, leading to resistance of disadvantaged groups	RS, PMO	3,6, 7,8	2
Developers lack understanding of users' needs	Developers lack professional understanding of end-users' work practice and real needs, leading to inadequate design concept and a system that is not accepted by users	Con, Spo	6,7, 8	9
4. Project planning: Factors relating to the estimating and planning of the project				
Unclear project goals	Project goals are vague and not clearly defined in the project contract, including unclear requirements	Cus, PMO	1,3, 6,7, 8	11, 13, 14
False business case	Business case that underlies the project is false, e.g., due to underestimated personnel or operating costs	PPM, PMO	6	13
Lack of time planning	No formal project schedules including important milestones are specified	PMO	1,5	7
Underestimation of effort	Contractor underestimates project effort, resulting in too tight schedule and budget, and provides this false information to customer, raising unattainable expectations	PMO	1,2, 5	13
Lack of overall IS plan	Lack of an overall plan for implementation and operation of the system to achieve organizational objectives	PPM, PMO	4,5, 7,8	6,7

Table 6. Identified IS Project Failure Factors (Continued)

Factor	Description	SH	FD	SC
5. Project management: Factors with regard to the actual management of the project after initiation				
Inexperienced project manager	Project manager is not sufficiently experienced for the project at hand (e.g., lack of required technical skills, leadership, professional competence)	PPM	1,4	4,7
Inadequate requirements specification	Requirements documents describe in detail how requirements are to be implemented instead of the actual requirements ("how" instead of "what")	Con, Cus	3,7, 8	7
Development approach not understood	Team members do not sufficiently understand the chosen development approach, leading to conflicts and inefficient use of resources	PMO, Team	4	4
Project management method applied incorrectly	Chosen project management method is not applied correctly, e.g., PRINCE prescribed but not followed by all project team members	PMO, Team	3,4, 5	5
Ineffective communication	Stakeholders do not get information affecting them or needed to perform their tasks (e.g., due to communication gaps or intentional misleading)	Pro	1,3, 4,5, 7,8	4,9, 12, 13
Loose project control	Poor project initiation and control mechanisms (feasibility study, formal reviews etc.)	Cus	4,6, 7,8	9,14
Prolonged development	Implementation is protracted very long. Leads to reduced motivation and greater chance of staff changes	Con	1,3, 4	6
Management forces fudging status reports	Employees are forced to adjust their status reports to formally meet a prescribed unrealistic schedule resulting in inevitable delays and frustration	PMO	1,2, 5	13
Insufficient quality assurance	Shortcomings in system testing (e.g., due to time pressure), resulting in too many defects in the delivered system	Spo, Tes, PMO	1,3, 5,6, 7,8	1,2, 5,15
6. Change management: Factors related to managing change induced by the introduction of a new IS				
Users lack experience in using IT	Users are unfamiliar with information technology, resulting in discomfort and reluctance to adopt a new system	Spo, PMO, EU	7,8	3,5, 6
Changes in traditional routines and practice	Users are often reluctant to use IT that changes their routines and familiar ways of work, especially if no benefits are perceived to emerge from using the system	Spo, PMO	7,8	3,6, 8
Redistribution of power	Stakeholders that are negatively affected by change of power exercise resistance	Spo, PMO	7	3, 8
Insufficient stakeholder involvement	Project stakeholders, especially users, are not sufficiently involved in planning, development, and deployment of the system. Important experiences are left out, developers lack essential information, and user needs are not met	Pro	1,2, 3,4, 5,6, 7,8	1,4, 5,8, 11, 14,15
Low morale of end-users	End-users lack motivation to deploy the new information system	Cus	8	5
Inadequate training	Shortcomings in training the end-users to use the system, including insufficient training, too early training (with system changes afterwards) etc.	Spo, PMO	4,5, 7,8	5,8, 9,15

Table 6. Identified IS Project Failure Factors (Continued)				
Factor	Description	SH	FD	SC
Limited prestige and status of project champion(s)	If project champions (being change leaders) are not well-known or lack status, e.g., when people move into new positions during the project, their influence on project stakeholders is limited	TM	8	3
Disregarding different perceptions of stakeholders	Failing to recognize that different stakeholders ascribe different meanings to the same events, e.g., if managers think that the system will help their employees, and employees consider the system a threat as it does everything they are supposed to do; leading to resistance	Spo, PMO	8	5,10
IT is considered a magic bullet	Assumption that the single introduction of the IS leads to changes in work routines and intended benefits, neglecting essential change management practices	TM, Spo, PMO	7,8	5,6
7. Top management attitude: Factors related to attitude of higher management towards the project				
Insufficient top management commitment	Top management fails to give the required attention to the project, leading to lack of resources and decisions	TM, Spo	3,5, 6,7, 8	2,6
Decision frame of key decision makers influenced by prior successes	Prior successful projects can cause responsible managers to be too confident about the current project and downplay the significance of negative information, reducing their willingness to reexamine the current course of action	TM, Spo	3,4, 5,6, 7,8	8,9
Stakeholders responsible for project not open for problems / criticism	If stakeholders responsible for a project do not acknowledge problems or criticism and do not handle it appropriately (e.g., due to their emotional attachment to the project, fear of failure), problems harden, leading to delays, unfulfilled requirements etc.	TM, Spo, PMO	1,2, 3,4, 5,6, 7,8	2,5, 9,13
Disregarding external advice	Advice of external consultants is ignored by stakeholders responsible for project	Cus, PMO	1,2, 3,5	11, 12
Ignoring alternative solutions	Not acknowledging possible courses of action alternative to the project and not willing to explore their feasibility	Spo, PMO	1,2, 3	12
8. Customer-contractor relationship: All factors with regard to the relationship between the customer and contractor organization				
Uncooperative relationship between customer and contractor	Lack of trust, hostile attitude, rivalry etc. can arise among customer's and contractor's stakeholder groups, leading to conflicts, ineffective collaboration, lack of understanding each other's needs, mutual recriminations etc.	Pro	1,3, 5,6, 7,8	2,4, 9
Too much trust in contractor	Customer organization entirely entrusts the contractor with various tasks that, at least to some degree, require customer involvement and control	Cus	6,7, 8	14
Too much pressure on contractor	Too much pressure on the contractor due to an over-ambitious timetable and the accordingly aggressive pace result in reduced performance	TM, PMO	3,5, 7,8	5,7
Too little accountability demanded from contractor	Customer stakeholders responsible for the project do not demand accountability from the contractor, leading to negligence, delays etc.	TM, Spo, PMO	1,5	7

Table 6. Identified IS Project Failure Factors (Continued)				
Factor	Description	SH	FD	SC
9. Technology: Factors in any way related to technology				
Technical problems	Comprises technical problems in all phases of the system life-cycle, e.g., hardware failure, data loss etc.		1,2, 4,5, 8	2,6, 7,13
Limited technology	Applied technologies are still in their infancy and not sufficiently powerful for intended application environment	Spo, PMO	7,8	3
Technological uncertainty	Various aspects of technological uncertainty, e.g., applied technologies maturing at different pace, uncertainty about future support of applied applications etc.	Spo, PMO	6	3
Poor system quality	Different shortcomings in system quality like defects in software or hardware, poor usability, poor response time etc., leading to development delays and user resistance	Con, Spo, SE	3,8	5,8, 9
10. Unexpected events: Unanticipated events occurring during the project				
New legal regulations	Authorities enact new legal requirements, which must be fulfilled; usually involves fixed deadlines and plan changes	Reg	6	4
Key staff changes	In case one or several key stakeholders leave (for various reasons), negatively affecting the project, others have to take over their tasks. This leads to process disruptions and delays; often, equivalent substitutes are not found at all	Pro	1,3, 4	1,6, 7,9, 10
Late changes of requirements	Requirements are changed in late phases of the development process, usually leading to cost and budget overruns	Spo, PMO, EU	1,2, 3	12
Supplier delays	Supplier delivers too late, e.g., due to unrealistic schedule	Sup	1	7

We included several factors that actually correspond to failure dimensions (e.g., *system does not suit customer's strategic goals* (cf. category 3), *prolonged development* (5), and *poor system quality* (9)), if such aspects led to further failure dimensions. For instance, *prolonged development* not only implied schedule overruns but also led to unfulfilled requirements and reduced process efficiency. Also, we included factors of all hierarchical levels in our overall list; in other words, some factors may contribute to others in Table 6 (e.g., *users lack experience in using IT* (6) led to *low morale of end-users* (6)). We chose this approach in order to ensure including all important factors, considering that a subordinate factor can lead to different superordinate factors, as well as that a superordinate factor may occur for different reasons. Table 7 provides the total count of individual failure dimensions in column FD of Table 6.

Table 7. Distribution of Failure Dimensions								
Failure dimension	1 (time)	2 (cost)	3 (quality)	4 (process efficiency)	5 (satisfaction with process)	6 (strategic goals)	7 (end-user needs)	8 (satisfaction with product)
Total count	22	10	23	16	19	20	25	30

Discussion

Some identified failure factors might seem more common than others. For instance, it is not surprising that *ineffective communication* (cf. category 5), *insufficient stakeholder involvement* (6), and *insufficient top management commitment* (7) contributed to failure according to our analysis as these aspects have been emphasized in success factors research (for these three factors see Hyväri 2006, Petter 2008, and Young et al. 2011, respectively). Our analysis shows that the opposites of these success factors actually are failure factors. This is in line with previous significant quantitative works on IS project failure which also include those aspects (e.g., Schmidt et al. 2001; Wallace and Keil 2004). In general, comparing our list of failure factors with previous research reveals a high degree of conformance. Other examples of commonly mentioned factors are *inexperienced project manager* (5), unclear project goals (4), *poor project planning* (4) and *control* (5), *inadequate change management practices* (6), and *key staff changes* (10) (e.g. Baker et al. 1988; Schmidt et al. 2001; Wallace and Keil 2004).

Some factors included in previous theoretical works did not emerge in our analysis of concrete project failures. For example, several aspects attributed to the environment like *unstable organizational environment*, *organizational restructuring during the project*, *many external suppliers involved in the project* (Wallace and Keil 2004), and *unfavorable public opinion* (Baker et al. 1988) were mentioned in previous research but are not found in our list. A likely explanation is that we analyzed concrete project failures retrospectively, and since every project is unique (cf. our project definition in the subsection *IS Projects*), not all potential risks materialized in those failures. Each one of the analyzed projects exhibits a setting that is a unique combination of project characteristics (e.g., type of IS, chosen development approach, customer's characteristics). For instance, one of such characteristics in case 4 (Berger and Beynon-Davies 2009) is the highly hierarchical and risk-averse organization. While contributing to failure due to an unsuitable development approach in this case, this condition is clearly not present in all projects. Furthermore, we rely on the information provided in the research articles and therefore the viewpoint taken by the authors. For example, considering case 9 in our analysis, one of the source articles particularly focuses on one specific pattern of failure – project escalation (i.e., a project that continues to absorb valuable resources but does not reach its objectives) – and therefore factors that contributed to this specific form of failure (Keil 1995). Keeping this limited generalizability in mind, our list of factors is not supposed to be used as rigid framework to address every potential failure. We rather hope that our holistic overview lays the groundwork for awareness and effective handling of factors that are to be identified as potential reasons for failure in concrete situations.

Finally, there are factors in our list that are less usual and not commonly mentioned in previous works; thus, knowledge about them is particularly valuable. While a history of successful projects can be motivating and encouraging and lead to necessary confidence, it was this positive experience that resulted in hubris and underestimation of problems by key decision makers (cf. category 7), eventually contributing to failure in two analyzed cases. Another example is *too much trust in contractor* (8) – this resulted in too little customer attention and control of contractor's activities. These factors show that it is imperative to find the right balance and bear in mind that too much of anything can become counterproductive. Other examples of such less common factors are *management forces fudging status reports* (5), *stakeholders responsible for project not open for problems/criticism* (7), and *too little accountability demanded from contractor* (8). As we did not find these factors in previous lists, we encourage scholars to place emphasis on such under-researched aspects in future studies.

The comparison with previous works regarding the categorization of failure factors is impeded by the fact that different researchers pursue different goals with the classification process. For instance, while Schmidt et al. (2001) categorize IS project risks into 14 groups based on the source of the risk (personnel, sponsorship, project management etc.), Wallace and Keil (2004) map their factors into the four groups (customer mandate, scope and requirements, execution, and environment) of an existing framework for identifying software project risks (developed by Keil et al. 1998). In yet another work (Yeo 2002), an integrative *triple-S* framework (process-, context-, and content-driven issues) is used as basis to group and analyze possible failure factors. As we focus on failure factors that occurred in real-life IS projects and explicitly consider the responsible stakeholders for each factor, we believe our data-driven approach to be most suitable for the given purpose.

Revisiting top management commitment, it is also interesting that the opposite of this prominent success factor (emphasized for example by Young and Jordan 2008; Young et al. 2011) is not *the* single decisive failure factor in its category (7). In fact, *insufficient top management commitment* was found to have contributed to failure in two cases, whereas *stakeholders responsible for project not open for problems/criticism* led to failure in four projects. Further most frequent failure factors in our analysis were *insufficient stakeholder involvement* (cf. category 6/mentioned in 7 cases), *key staff changes* (10/5), *ineffective communication* (5/4), *insufficient quality assurance* (5/4), *inadequate training* (6/4), and *technical problems* (9/4). We do not highlight these factors as particularly important since making significant quantitative statements is not in scope of our study. Rather, we invite researchers and practitioners to examine our overview and gain insights into factors relevant for their projects; especially into less common ones as described above.

There is another interesting insight regarding the relevance of single factors. In all analyzed projects, the reason for failure was not any single factor but rather the combination of different factors as a whole. This fact was in some cases also acknowledged by the authors describing the project, for instance, “Clearly, it is impossible to point to any single element of the case as being *the* cause of [...] failure. The description demonstrates how the explanation of a particular information systems failure must be multi-faceted or web-like in nature” (Beynon-Davies 1995, p. 181). Both researchers and practitioners should be aware that mostly there is not *the* reason for failure but a combination of various aspects that need to be considered. Along those lines, most projects failed in more than one dimension. This might be the result of certain interdependencies between failure dimensions. For example, if a system does not meet real needs of the end-users, it is likely that concerned stakeholders are dissatisfied with the product.

We found that in many cases no direct linkage between failure factors and responsible stakeholders is explicitly described in the research articles. This might be due to the fact that “there appears to be a great deal of 'interpretative flexibility' available to people wishing to explain such [technical systems] failures” (Beynon-Davies 1995, p. 183). Furthermore, while stating various failure factors as well as failure dimensions that were relevant in the analyzed projects, most articles do not describe explicitly which factor led to which failure dimension(s). It appears that not only is it impossible to identify a single reason for failure (as described above), but also factors mostly do not affect single failure dimensions. Rather, there is an ambiguous picture of interlacing dependencies. We hope to contribute to clarification of this picture by analyzing these relations and providing them in our overview.

In our analysis, aside from few exceptions (e.g., *technical problems* (cf. category 9), *new legal regulations* (10)) the vast majority of factors could have been prevented, or at least the likelihood for failure reduced considerably, by responsible project stakeholders. This requires awareness and application of appropriate countermeasures. As an example, consider the factor *high system complexity* (1), a condition present at project initiation. High complexity of the processes to be supported by the system is a challenge that can be met with process reengineering prior to system development or applying an incremental development approach, that is, increasing system complexity in stages. Overall, this finding makes us confident that most failures can be prevented if stakeholders are aware of potential pitfalls and take the right measures.

While we do not aim to make statistically significant quantitative statements in our qualitative study, it is still interesting to consider the distribution of failure dimensions (cf. Table 7). The first three failure dimensions represent the counterparts to adherence to planning, which is traditionally used to assess project success (cf. subsection *IS Project Success*). These failure dimensions were fulfilled in several cases, leading to the failure assessment of the project. This fact supports the notion that adherence to planning plays an important role in project success measurement. However, these failure dimensions are not the dominant ones. On the contrary, the most frequent dimensions are 7 (developed IS does not satisfy real user needs) and 8 (concerned stakeholders are not satisfied with the product), with 25 and 30 occurrences, respectively. Both dimensions reflect the assessment of the product rather than the development process. This insight is amplified by the fact that our analysis includes projects that were cancelled before the system could be put in operation (e.g., baggage-handling system at Denver airport, cf. case 12 in Table 5). In such cases, product-related dimensions were not evaluated. This finding reinforces the notion that project success or failure is not adequately assessed by using adherence to planning only. Emphasis should also be placed on product-related aspects that come into effect after system deployment.

Conclusion

In our qualitative study, we conducted an extensive systematic literature review (Webster and Watson 2002) of failure factors in real-life IS projects. We identified 54 failure factors in research articles and grouped these factors in 10 categories applying data-driven qualitative content analysis (Jankowicz 2004). Our resulting overview provides an integrated, holistic picture of failure factors that occurred in real-life projects and offers insights into responsible stakeholders as well as affected failure dimensions.

As with every study, there are some limitations that need to be taken into account. First, our analysis and the resulting categorization are limited to what is reported in the identified studies, as is typical for meta-analyses like ours. Therefore, factors that contribute to project failure but were not reported or did not occur in the analysed cases are missing, which affects our categorization as well. Second, the identified factors are based on retrospective analyses of participants or observers. The collected evidence is thus inherently interpretive (cf. also *Discussion*) and may be subject to various biases. For instance, as some of the analysed IS project failures are reported by various participants of those projects (in other cases by researchers studying the failures), these participants might be biased towards a tendency not to blame themselves. Accordingly, factors and categories attributed to participants that report the failures might be underrepresented or missing. Finally and as elaborated in the previous section, our classification scheme matches the factors extracted in our analysis but might not be suitable for every purpose. Other empirical studies develop or adopt different classification schemes that match their goals (e.g., Wallace and Keil 2004; Yeo 2002). As our study focuses on failure factors that occurred in real-life projects and is the first to explicitly consider the responsible stakeholders for each factor, we believe our data-driven approach to be most suitable for the given context.

Nevertheless, we believe that our results contribute to research and practice in the following ways. Researchers gain insights into project failure factors along with responsible stakeholders and impacts on failure dimensions. Further, they can use our overview to identify factors or areas of concern to guide future research. As pointed out above, no single factor is usually *the* reason for failure. Combinations and interdependencies of factors should be put in focus of analysis more extensively. Practitioners can utilize the overview as a checklist for according stakeholders to identify hazards in concrete projects. Creating awareness is often at least as difficult and crucial as finding effective countermeasures.

Several identified failure factors might not seem groundbreaking at first glance. However, each of the identified factors contributed to failure and substantial losses in at least one of the analyzed real-life IS projects. We thus hope that our overview of such factors provides a pillar for practitioners to learn from experience of others and to eliminate or at least reduce failure by avoiding past mistakes.

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