Process improvement project failure: a systematic literature review and future research agenda

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Abstract

Purpose – Although scholars have considered the success factors of process improvement (PI) projects, limited research has considered the factors that influence failure. The purpose of this paper is to extend the understanding of PI project failure by systematically reviewing the research on generic project failure, and developing research propositions and future research directions specifically for PI projects.

Design/methodology/approach – A systematic literature review protocol resulted in a total of 97 research papers that are reviewed for contributions on project failure.

Findings – An inductive category formation process resulted in three categories of findings. The first category are the causes for project failure, the second category is about relatedness between failure factors and the third category is on failure mitigation strategies. For each category, propositions for future research on PI projects specifically are developed. Additional future research directions proposed lay in better understanding PI project failure as it unfolds (i.e. process studies vs cross-sectional), understanding PI project failure from a theoretical perspective and better understanding of PI project failure antecedents.

Originality/value – This paper takes a multi-disciplinary and project type approach, synthesizes the existing knowledge and reflects upon the developments in the field of research. Propositions and a framework for future research on PI project failure are presented.

Keywords Six Sigma, Lean, Process improvement, Continuous improvement, Project failure, Systematic literature review

Paper type Literature review

1. Introduction

Process improvement (PI) projects are a prevalent vehicle for improvement activities in organizations (Choo *et al.*, 2007; Easton and Rosenzweig, 2012), generally embodied by PI

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methodologies such as Lean, Six Sigma and Lean Six Sigma (Kumar *et al.*, 2006). In a project-by-project fashion, organizational problems are investigated, and fact-based improvements are designed and implemented (for exemplary applications, see Chen and Lyu, 2009; Sunder and Antony, 2015). To date many organizations have achieved significant results with the implementation of such PI projects (Hann *et al.*, 1999 for Motorola; Lucier and Seshadri, 2001 for General Electric; Dedhia, 2005 for Samsung Electronics, American Express, Du Pont and others). Despite the reported successes there has also been criticism on the results of PI project implementations. Examples include stock underperformance for organizations that announced PI project implementation (Richardson, 2007) and failure to generate lasting (Chakravorty, 2010; Easton and Rosenzweig, 2012) and visible results (Breyfogle, 2010). Research by Bain and Company (global consultancy firm) reported that 80% of 184 companies claimed PI projects are failing to deliver the anticipated value (Comprehensive Business Improvement Solutions, 2017).

Project failure manifests itself in various forms and is defined as "the termination of an initiative designed to create value that has fallen short of its goals" (Nelson, 2005; Shepherd *et al.*, 2011). An important distinction between failure and termination must be made. Pre-completion termination can have sound reasons, such as changes in requirements, changing market conditions or other anticipated circumstances. We speak of project failure when termination is caused by unanticipated under-delivery of anticipated value. Following the same logic, pre-completion termination due to recognition and anticipation of under-delivery is not classified as failure (Boehm, 2000). By better understanding the internal and external factors that affect PI project failure, managers can mitigate the consequences, prevent PI project failure from happening or reduce the likelihood of failure or make early termination decisions to mitigate the downside of project failure.

Operations management research to date has focused on explaining PI project success at the project level (Linderman *et al.*, 2006; Choo *et al.*, 2007; Easton and Rosenzweig, 2012; Aleu and Van Aken, 2016) and PI implementation failures at the organizational level, taking the strategic process of implementation as unit of analysis (Swink and Jacobs, 2012; Jadhav *et al.*, 2014; Swarnakar *et al.*, 2020). Recent attempts to better understand PI project failure have emerged and provide preliminary insights into dominant failure factors (Antony and Gupta, 2018; Antony *et al.*, 2019). Going forward, we argue, apart from what, questions about why and how PI project failure occurs need to be answered for several reasons: to corroborate the preliminary insights, to advance the understanding of how project failure develops, and thereby to provide practical guidance on how to ultimately mitigate PI project failure. Hence, we argue that the understanding of PI project failure, at the project level of analysis, is an underdeveloped research domain in the operations management literature (Bolin, 2012). The first step in developing PI project failure understanding is to identify existing research on *generic* project failure and develop propositions and a future research agenda specifically for PI project failure. We argue this is a feasible approach as both project types share characteristics, such as a clear focus on project goals (Atkinson, 1999; Linderman *et al.*, 2006), a parallel project organization (Lundin and Söderholm, 1998; Schroeder *et al.*, 2008), the use of trained specialists and a structured project approach (Schroeder *et al.*, 2008; Radas and Bozic, 2012). Despite the similarities between *generic* and PI projects there are fundamental differences that consequently justifies future research on PI project failure specifically: PI projects have a strong focus on existing organizational performance metrics and the impact the project is able to make on these (Schroeder *et al.*, 2008), the specific role of leadership engagement in the execution of PI projects (Snee and Hoerl, 2003) and, finally, the application of statistical problem-solving techniques for fact finding and empirical verification of ideas (De Mast and Lokkerbol, 2012).

A growing academic interest in understanding generic project failure has emerged. Initially, multiple researcher efforts have identified critical project failure factors (Might and Fischer, 1985; Slevin and Pinto, 1986; Pinto and Slevin, 1987; Pinto and Prescott, 1988), and these have been reviewed and summarized in earlier review articles (Nixon *et al.*, 2012; Gupta *et al.*, 2019). Other

reviews on generic project failure have a narrower research scope and have exclusively focused on specific types of projects and industries (Nelson, 2005, 2007; Al-ahmad *et al.*, 2009; Savolainen *et al.*, 2012). This systematic literature review complements earlier reviews in several ways. First, a more comprehensive research scope is applied: the preliminary research on PI project failure and the research on generic project failure from adjacent disciplines such as information systems, information technology and engineering are reviewed, taking a multi-disciplinary approach. Second, a broader perspective on project failure is applied: in addition to project failure factors additional emergent themes regarding project failure are captured and discussed. Questions we seek to answer are: what are common themes that are known to cause project failure, and what are the implications of the findings on generic project failure research to date for future PI project failure research specifically?

The subsequent sections provide details on the systematic review methodology applied (Section 2) and the descriptive findings (Section 3). In Section 4, the results are presented and propositions for future research are discussed. Finally, conclusions and additional future research directions, practical implications and limitations are presented in Section 5.

2. Systematic literature review methodology

The systematic literature review methodology that is applied is based on the suggestions by Webster and Watson (2002), Tranfield *et al.* (2003) and Wolfswinkel *et al.* (2013). These authors have presented structures and procedures for sound and effective literature studies which are the basis for the research methodology and presentation of results (Figure 1). The search for publications on project failure was ultimately performed with the keywords "project" and "fail" or "failure" in titles and abstracts. The authors have used four journal databases, which included the Google Scholar-, Web of Science-, the EbscoHost- and the Scopus database. First, a duplicate check was performed, and the initial sample comprised 878 articles for which a quick scan for inclusion and exclusion criteria in both titles and abstract was performed (Table 1).

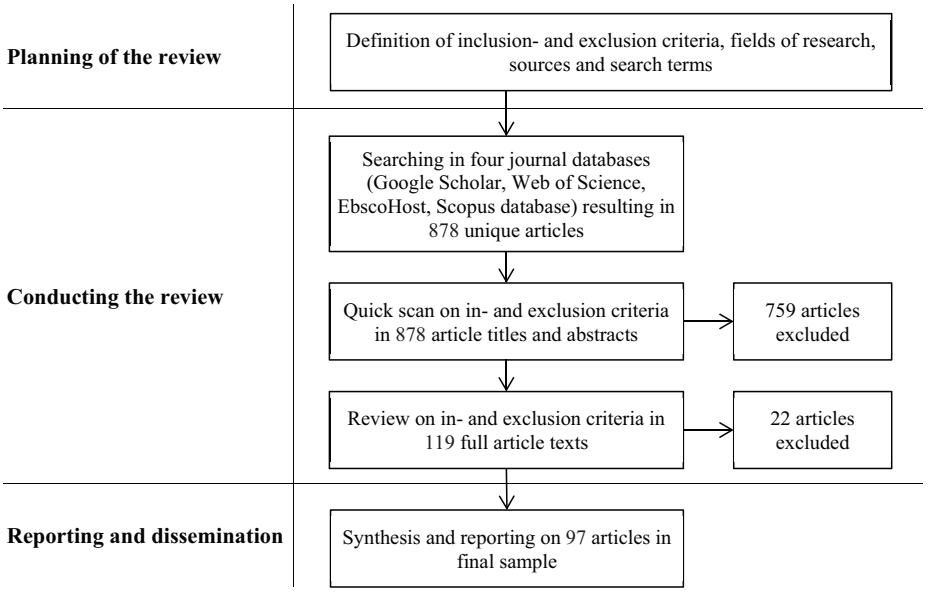

Figure 1.
Process flow of systematic review process

After the first round of in- and exclusion criteria-based selection, 119 peer-reviewed publications remained for further consideration. Second, a complete article read was performed and based upon the in- and exclusion criteria 22 more articles were excluded from the sample. Finally, the rigorous search and selection procedure resulted in 97 articles that are part of this systematic literature review.

After the article selection process was completed, a research database with article citations was developed and the process of extracting relevant information from the sample of articles commenced. To ensure the validity of this humanly performed data collection- and coding process, the information of interest was coded by making use of pre-defined labels (author, author profile, country, year, title, journal, finding, finding category, methodology, project type and industry). To enable structured presentation of the findings, a procedure for inductive category formation was followed (Mayring, 2014). The procedure comprised eight consecutive steps (Figure 2), to ensure true descriptions of the reviewed literature and minimize researcher bias in defining emerging themes from the literature.

The procedure commenced with setting the criterion for selecting research in the category formation process equal to inclusion criteria 1 and 2: research exploring and explaining the causes for project failure, taking the project and its failure as dependent variable. Consequently, the literature was worked through and based upon its findings categorized in preliminary categories. Per consecutively reviewed research it was determined whether it's findings could be categorized under the existing preliminary categories, or whether a new category had to be established. After having reviewed the majority of the articles, no new categories were discovered. Where needed category definitions were refined and mutual exclusivity and collective exhaustiveness of the categories was ensured. After each round of coding, a second researcher independently validated the coding for error-sensitive information (author profile, journal finding, finding category and methodology). Finally, conflicting coding results were discussed and resolved, thereby ensuring triangulation of the data and enhancing the reliability of the resulting database (Chugh and Wang, 2015).

3. Descriptive analysis of the data

3.1 Distribution of research papers over time

With an increasing trend the average number of publications steeply rose from 1998-2004 to noticeably more articles per year during 2005-2016. Moreover, Figure 3 demonstrates that

Table 1.
Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
1. Research focus on exploring the causes for failure of the project, taking the project and its failure as dependent variable	1. Research focus on exploring project success-contrary to project failure factors
2. All types of research on project failure, ranging from exploratory- (e.g. case studies) to confirmatory research (e.g. empirical survey research)	2. Research focus on failure of the subject matter of the project instead of failure of the project (e.g. social development projects or healthcare projects that examined health-related failures
3. Publications in Google Scholar-, Web of Science-, the EbscoHost- and the Scopus database	3. Research focus on phenomena with project failure as independent variable instead of dependent variable (e.g. difference between public and private sector organizations)
4. Peer-reviewed academic journals	4. Non-peer reviewed journals or publications (books, magazines, doctoral dissertations, workshops summary slideshow presentations, books, prefaces and news reports)

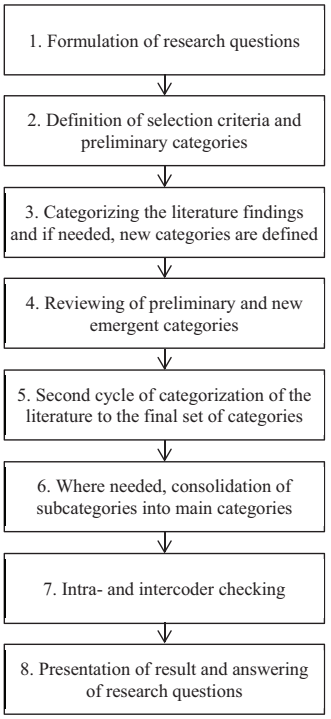

Figure 2. Inductive category formation process (based on Mayring, 2014)

there are three peaks in 2006, 2009 and 2011-2012, which signals the growing research interest in project failure.

3.2 Geographical distribution of research papers

The geographical distribution of the publications in Figure 4 shows that the USA (N = 39, 41% of total sample) is the leading continent where research has been performed, followed by Europe (34%), Asia (17%), Middle East (5%) and Africa (3%). The earliest studies originated from North America (Avots, 1969; Pinto and Mantel, 1990), whereas Europe entered into project failure research in 1995 with an analysis of the London Ambulance Service computer-aided dispatch system failure (Beynon-Davies, 1995).

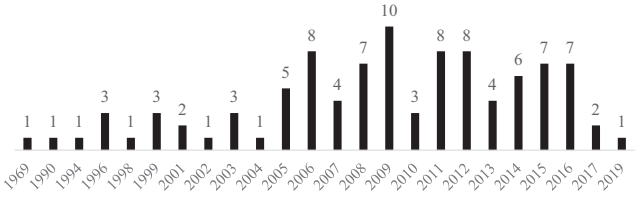

Figure 3. Project failure publication trend in amount of publications per year

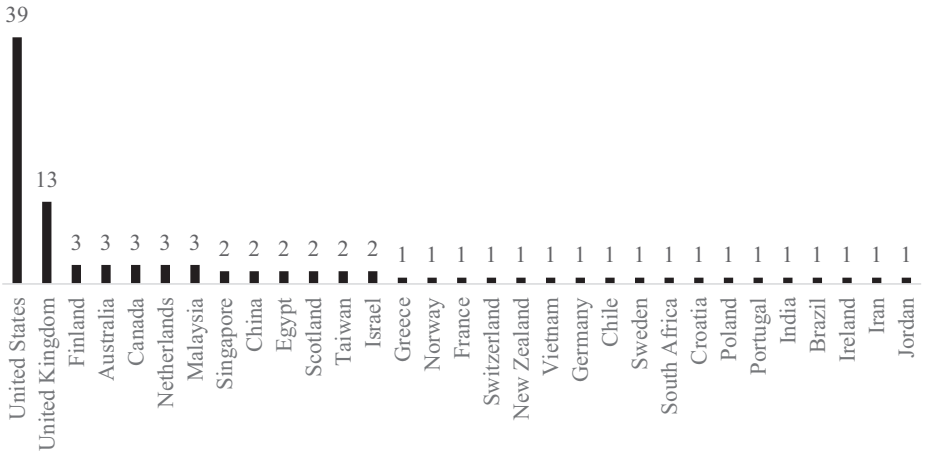

Figure 4.
Geographical distribution of publications

3.3 Distribution of research methodologies

Results shown in Figure 5 show that research on project failure is often performed by case-based research methods (N = 31, 32% of total sample). Case-based research is characterized by intensive exploration of one or few project situations through observations, archival reconstructions and interviews. This finding corroborates that the highly customized nature of project activity most likely requires in-depth analysis of the failure case through qualitative inquiry. To overcome the limitation of generalizability of the findings from case-based research, empirical research has received good attention from researchers (33%), which is mostly based on cross-sectional surveys from project managers and executives. Cross-sectional research was represented more than longitudinal research in the empirical researches in the sample. In more recent theoretical studies, project management literature has been linked with mainstream management theories (such as stakeholder-, institutional-, organizational- and agency theory), which signals a maturing of the research area.

3.4 Distribution of research papers based on industry

As presented in Table 2, most research originates from the public sector (20%), professional services (18%), manufacturing (11%) or covers multiple sectors (11%). Research papers that covers multiple sectors are predominantly surveys aimed at practitioners. The not applicable (N.A.) industry category has been assigned to those papers that cover research not specifically focused on an industry, such as theoretical and commentary papers.

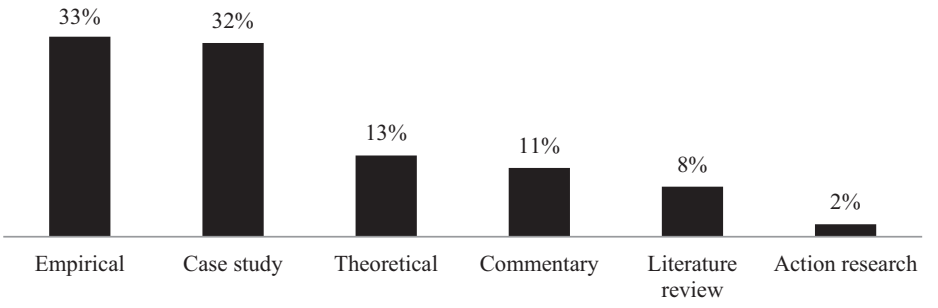

Figure 5.
Distribution of publications based on research methods

Industry \ Project type	Information Technology (%)	Information Systems (%)	General (%)	Engineering (%)	Research and Development (%)	Process Improvement (%)	(#)	Total (%)
N.A.	11	5	4	3	2	2	*27*	*28*
Public sector	6	7	2	1	2	1	*19*	*20*
Professional services	7	2	4	1	2	1	*17*	*18*
Manufacturing	4	3	1	1	1	1	*11*	*11*
Multiple		3	4	2	1	1	*11*	*11*
Construction	1	1	2	2			*6*	*6*
Aerospace	1		1	1			*3*	*3*
Education		1	1				*2*	*2*
SME	1						*1*	*1*
Total	*32*	*23*	*20*	*11*	*8*	*6*	*97*	*100*

Table 2.
Distribution of publications

Project types that are predominantly represented in the sample comprise Information Technology (IT) (32%) and Information Systems (IS) (23%). The dominant focus of these studies is on project failure factor identification. Finally, research specifically into PI project failure is scarce (6%), which is remarkable given the substantial body of research on PI project methodologies (e.g. Lean, Six Sigma, Total Quality Management, etc.) (Bhamu and Sangwan, 2014). Hence, the objective of this systematic literature review.

3.5 Distribution of research papers across journals

The research on project failure has been published in management and technically orientated journals. Figure 6 presents a selection of journals that have published most research on project failures, with a total of 69 different journals. The top five publishing journals account for about 25% of the total publications, and the top twenty accounts for about 50%. This indicates a wide range of journals that are publishing on project failure.

4. Results and discussion of the findings

Systematically reviewing the existing literature revealed a taxonomy whereby the results and the propositions for future research are discussed. The categories that are discussed are the types of project failure factors and their relative importance, how project failure factors are related by topic and in time and before, during and after the project failure mitigation strategies. These findings are conceptualized in Figure 7.

4.1 Project failure factors

The largest and most researched category is about project failure factor identification. Project failure factors are primarily established through empirical and case-based research and are discussed per category (Table 3).

4.1.1 Project managerial project failure factors. Project failure factors that originate from the way the project is being managed before, during and when nearing completion are widely represented in the literature.

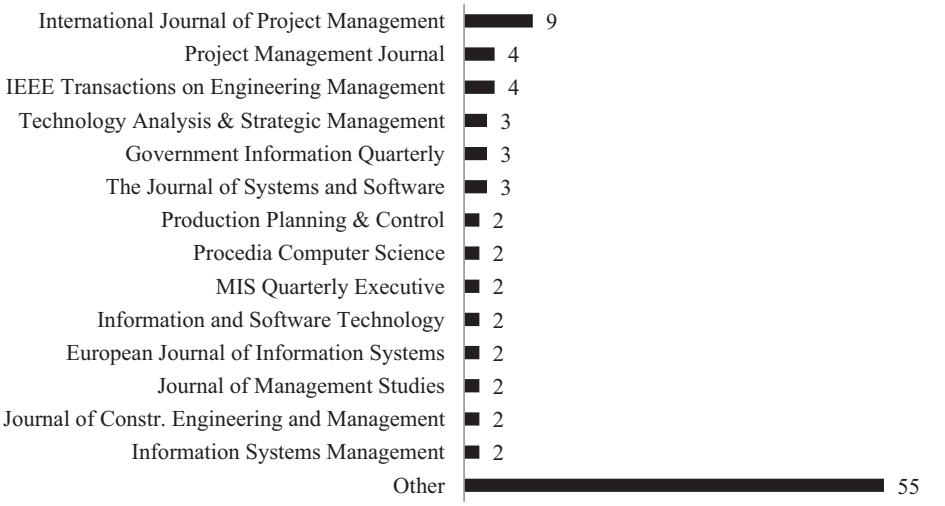

Figure 6.
Distribution of publications across journals

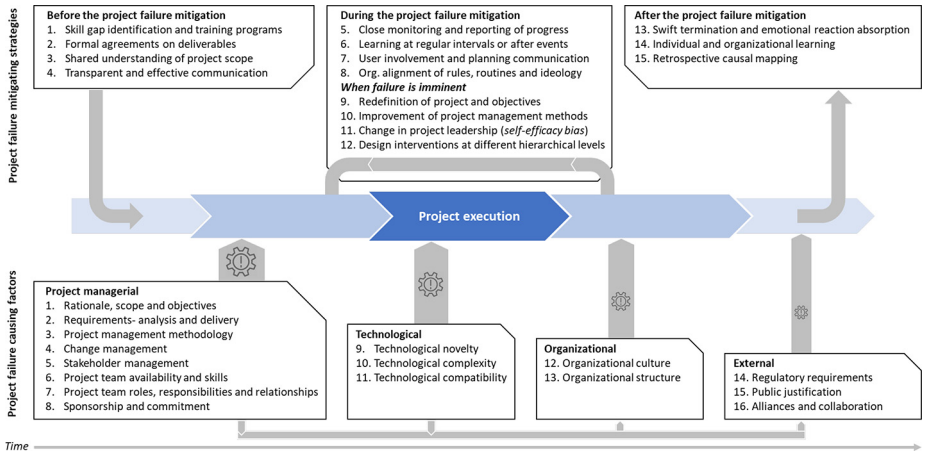

Figure 7.
A framework for process improvement project failure anticipation and mitigation

Rationale, scope and objectives: Ambiguous rationale, scope and intended objectives of projects reportedly result in reduced commitment from the project manager (Avots, 1969), reduced management attention (Kappelman *et al.*, 2006), inappropriate allocation of technical and organizational resources (Chen *et al.*, 2009) and exceeding project budgets (El Emam and Koru, 2008). Insufficient scope definition allows for "scope creep" and increases the likelihood for conflicts (Sweis, 2015) and failure due to differing views (Chakravorty, 2009; Montgomery, 2016) and is associated with the inability of organizations to implement large projects (Loukis and Charalabidis, 2011). Scope management techniques should be incorporated at the project planning stage and any necessary changes should occur through the formal control procedures within the predetermined time and costs (Antony and Gupta, 2018). Projects with clear (as defined by Iijima, 2012) and stretch-objectives are expected to yield higher results and stimulate experimentation and learning by organizational actors (Dillon and Madsen, 2015).

Requirements- analysis and delivery: In early project phases, a sound requirement analysis (Hussain *et al.*, 2016) and involvement of user groups is important (Gauld, 2007) to ensure clarity on functional performance and reliability requirements (Kappelman *et al.*, 2006). Proposed mechanisms comprise product breakdown structures (Avots, 1969), agile development structures (Nelson, 2007) and amendment of project requirements based upon new (external) developments. Thereby clarity on the project requirements is ensured and confused project members (Sweis, 2015), pressured team members (Nelson, 2007), conflict in the implementation phase, legal actions or delays (Loukis and Charalabidis, 2011) and immediate project failure (Burgers *et al.*, 2008) are prevented.

Project management methodology: Ineffective project management methodologies (Cule *et al.*, 2001) and incompetently applying project management methodologies (Doloi, 2013) are recognized as important failure factors. More specifically is recognized; incorrect project planning (Lawrence and Scanlan, 2007), risk- analysis and management (Natovich, 2003; Verner and Abdullah, 2012), dependency management, progress monitoring and project control (Conboy, 2010), process instructions (Lehtinen *et al.*, 2014), quality assurance (Anthopoulos *et al.*, 2016) and internal project member communication (Sweis, 2015).

Change management: Where project management is process related, change management is people related (Chua, 2009; Antony *et al.*, 2019) and consists of clear communication and coordination of roles and responsibilities (Caffrey and Medina, 2011),

No.	Failure factor categories	References
Project managerial		
1	Rationale, scope and objectives	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Avots (1969), Chakravorty (2009), Chen *et al.* (2009), Cule *et al.* (2001), Dillon and Madsen (2015), El Emam and Koru (2008), Iijima (2012), Kappelman *et al.* (2006), Lesca and Caron-Fasan (2008), Loukis and Charalabidis (2011), Pinto and Mantel (1990), Sweis (2015), Montgomery (2016)
2	Requirements-analysis and delivery	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Avots (1969), Burgers *et al.* (2008), Cule *et al.* (2001), Doloi (2013), El Emam and Koru (2008), Ewusi-Mensah and Przasnyski (1994), Hussain *et al.*, 2016; Kappelman *et al.* (2006), Lehtinen *et al.* (2014), Lesca and Caron-Fasan (2008), Loukis and Charalabidis (2011), Nelson (2007), Nitithamyong and Skibniewski (2006), Pinto and Mantel (1990), Sweis (2015), Gauld (2007)
3	Project management methodology	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Avots (1969), Chen *et al.* (2009), Chua (2009), Conboy (2010), Cule *et al.* (2001), Doloi (2013), El Emam and Koru (2008), Ewusi-Mensah and Przasnyski (1994), Kappelman *et al.* (2006), Lehtinen *et al.* (2014), Loukis and Charalabidis (2011), Nelson (2007), Pinto and Mantel (1990), Sweis (2015), Gauld (2007), Lim *et al.* (2011), Natovich (2003), Lawrence and Scanlan (2007), Verner and Abdullah (2012
4	Change management	Al-Ahmad *et al.* (2009), Chen *et al.* (2009), Chua (2009), Cule *et al.* (2001), Doloi (2013), Kappelman *et al.* (2006), Loukis and Charalabidis (2011), Nitithamyong and Skibniewski (2006), Sweis (2015), Caffrey and Medina (2011), Antony *et al.* (2019)
5	Stakeholder management	Al-Ahmad *et al.* (2009), Chipulu *et al.* (2014), Ewusi-Mensah and Przasnyski (1994), Kappelman *et al.* (2006), Lesca and Caron-Fasan (2008), Nelson (2007), Sweis (2015) , Kirby (1996), Lim *et al.* (2011), Sutterfield *et al.* (2006), Pinto and Kharbanda (1996)
6	Project team availability and skills	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Avots (1969), Chen *et al.* (2009), Chua (2009), Cule *et al.* (2001), El Emam and Koru (2008), Ewusi-Mensah and Przasnyski (1994), Kappelman *et al.* (2006), Lesca and Caron-Fasan (2008), Loukis and Charalabidis (2011), Perkins (2006), Sweis (2015), Gauld (2007; Gal and Hadas (2015), Montgomery (2016), Rwelamila and Ssegawa (2014), Antony *et al.* (2019)
7	Project team roles, responsibilities and relationships	Cule *et al.* (2001), Kappelman *et al.* (2006), Lesca and Caron-Fasan (2008), Lehtinen *et al.* (2014), Nelson (2007), Nitithamyong and Skibniewski (2006), Hayden (2006), Whitney and Daniels (2013), Zhu and Kindarto (2015), Linberg (1999), Vanasupa *et al.* (2012)
8	Sponsorship and commitment	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Avots (1969), Burgers *et al.* (2008), Cule *et al.* (2001), El Emam and Koru (2008), Ewusi-Mensah and Przasnyski (1994), Kappelman *et al.* (2006), Lesca and Caron-Fasan (2008), Nelson (2007), Nitithamyong and Skibniewski (2006), Pinto and Mantel (1990), Sweis (2015), Standing *et al.* (2006), Caffrey and Medina (2011), Montgomery (2016), Link and Wright (2015), Antony *et al.* (2019)
Technological		
9	Technological novelty	Cule *et al.* (2001), El Emam and Koru (2008), Loukis and Charalabidis (2011), Link and Wright (2015)
10	Technological complexity	Anthopoulos (2016), Chua (2009), Doloi (2013), Ewusi-Mensah and Przasnyski (1994), Lehtinen *et al.* (2014), Nitithamyong and Skibniewski (2006), Ravasan and Mansouri (2016)
11	Technological compatibility	Anthopoulos (2016), Cule *et al.* (2001), Ewusi-Mensah and Przasnyski (1994), Loukis and Charalabidis (2011), Nitithamyong and Skibniewski (2006)

(*continued*)

Table 3.
Categorized project failure factors

No.	Failure factor categories	References
Organizational		
12	Organizational culture	Anthopoulos (2016), Burgers *et al.* (2008), Cule *et al.* (2001), Ewusi-Mensah and Przasnyski (1994), Shore (2008), McLean *et al.* (2017)
13	Organizational structure	Al-Ahmad *et al.* (2009), Anthopoulos (2016), Cule *et al.* (2001), Ewusi-Mensah and Przasnyski (1994), Chanda and Ray (2016), Link and Wright (2015)
External		
14	Regulatory requirements	Anthopoulos (2016), Pawłowska (2004)
15	Public justification	Mahlendorf and Wallenburg (2013)
16	Alliances and collaborations	Burgers *et al.* (2008), Chen *et al.* (2010), Cule *et al.* (2001), Doloi (2013), Radas and Bozic (2012), Lhuillery and Pfister (2009)

Table 3.

especially for larger projects, (Sweis, 2015) and managing partnerships and maintaining clear relations to corporate strategy (Chen *et al.*, 2009).

Stakeholder management: Stakeholders, such as subject matter professionals, end-users and senior managers (Ewusi-Mensah and Przasnyski, 1994) that are improperly managed can result in conflicting interests and expectations (Kirby, 1996; Sutterfield *et al.*, 2006). Stakeholder attitudes, expectations, interplay and influence must be managed (Yuttapongsontorn, 2008; Lim *et al.*, 2011), monitored (Nelson, 2005) and assessed periodically (Nelson, 2007) wherein the cultural background (Chipulu *et al.*, 2014) of stakeholders must be taken into account. Stakeholders deliver the appropriate resources (Kappelman *et al.*, 2006) and known reasons for weak participation are engagement in operational activities or geographical distance from the project location (Lesca and Caron-Fasan, 2008).

Project team availability and skills: Unavailability of a knowledgeable project team (Montgomery, 2016; Antony *et al.*, 2019), unwillingness to share knowledge (Gal and Hadas, 2015), an insufficiently knowledgeable project manager (Perkins, 2006), unavailable specialized subject matter experts (Kappelman *et al.*, 2006) or departure of critical members (Ewusi-Mensah and Przasnyski, 1994) are known to cause project failure.

Project team roles, responsibilities and relationships: The need for active participation from project team members is acknowledged (Lehtinen *et al.*, 2014) and the quality of relationships (Nelson, 2007), cohesive behaviour (Whitney and Daniels, 2013), effective conflict management (Hayden, 2006), as well as the distance of the physical working locations (Lesca and Caron-Fasan, 2008) between project members is an important reason for project failure. Vanasupa *et al.* (2012) have highlighted the importance of team member self-reflection, shared intention and corresponding egalitarian forms of responsibility, progress monitoring and conflict resulting mechanisms. Linberg (1999) found that project member's job satisfaction is not directly associated with adhering to deadlines or cost objectives.

Organizations should optimize the team size with a particular focus on the long-term benefits (Antony and Gupta, 2018; Snee, 2010). Employing a cross-functional team will also mitigate project failure as teamwork encourages people with varied skill sets to work together as opposed to the silo-mentality (Sin *et al.*, 2015).

The leading role and the people skills of the project manager are recognized (Rwelamila and Ssegawa, 2014), though the impact on projects failure remains inconclusive (Nixon *et al.*, 2012). Recent results indicate that more participative-decision structures have a positive effect on project failure prevention over a hierarchical-decision structure (Zhu and Kindarto,

2015). Project leaders must hold a facilitator position in the organization to ensure management commitment and appropriate allocation of resources (budget and time) (Hariharan, 2006).

Sponsorship and commitment: Employees tend to focus on activities that their management deems important (Montgomery, 2016). Senior managers have an important role in safeguarding projects from excessive business pressure and loss of autonomy (Burgers *et al.*, 2008), realization of the business changes resulting from the project (Ewusi-Mensah and Przasnyski, 1994), ensuring alignment with corporate strategy (Lesca and Caron-Fasan, 2008) and in providing the necessary resources and authority to the project (Pinto and Mantel, 1990).

Laureani and Antony (2018) indicate that the main role of senior managers is to lead and monitor projects, provide the resources for their implementation and establish work policies for the improvement teams. At the same time, management must also carry out a process for integrating the different departments, which enables everyone to have common objectives in their improvement projects.

The strength of sponsorship is determined by the importance of the project for the strategic objectives of the organization (Ewusi-Mensah and Przasnyski, 1994) and the stability of the senior management positions (Kappelman *et al.*, 2006; Sweis, 2015). It is important to identify the right sponsor from the beginning and secure active participation throughout the life of the project (Caffrey and Medina, 2011; Antony *et al.*, 2019). Standing *et al.* (2006) found that senior management is taking significant personal responsibility in case of project failure, as opposed to attributing failure to external factors.

4.1.2 Technological project failure factors. Project failures due to complexities that are rooted in technology consist of three categories, being that the project is technologically novel, complex or incompatible.

Technological novelty: New technology is known to create risks (Cule *et al.*, 2001) and has caused project terminations (Loukis and Charalabidis, 2011). Prior experience with the technology decreases the chance for failure (Link and Wright, 2015).

Technological complexity: Unforeseen problems due to complexities (Anthopoulos *et al.*, 2016), caused internally or externally (Lehtinen *et al.*, 2014), can surface in the design or when building the deliverable (Ravasan and Mansouri, 2016) and when not corrected, cause project failure (Ewusi-Mensah and Przasnyski, 1994).

Technological compatibility: Compatibility of project deliverables with existing IT infrastructure or data models (Anthopoulos *et al.*, 2016) and software (Nitithamyong and Skibniewski, 2006) are known to cause project failure.

4.1.3 Organizational project failure factors. Organizational- culture and structure are recognized failure factors.

Organizational culture: Culture can be supportive or obstructive towards the intended project outcomes, also known as cultural fitness (McLean *et al.*, 2017). The availability and accessibility of technical knowledge in the organizational vicinity of a project (Burgers *et al.*, 2008), organizational units that can be used for benchmarking and learning (Cule *et al.*, 2001) and organizational politics are recognized as project failure factors (Anthopoulos *et al.*, 2016). Failed projects are found to be related to organizational cultures that are characterized by an internal focus on stability (Shore, 2008).

Snee and Hoerl (2003) suggest that some form of reward and recognition system is necessary for employees to be motivated and engaged in the execution of improvement projects. The incentive or reward system fosters a sense of achievement and company recognition, thus generating greater employee motivation and commitment in future improvement projects, producing a reinforcing effect (Ho *et al.*, 2008).

Organizational structure: Complexity due to the organizational units involved (Al-Ahmad *et al.*, 2009), the stability of the organizational structure (Cule *et al.*, 2001) and corporate headquarter design vs execution in local subsidiaries (Chanda and Ray, 2016) creates risks for project failure.

4.1.4 External project failure factors. The final category of project failure factors that are recognized in the literature are originating from outside the project and the organization.

Regulatory requirements: Changes, absence or incomplete legal frameworks and standards can lead to ambiguity and conflict that contributes to project failure (Pawłowska, 2004).

Public justification: External justification influences the commitment of actors involved in the project. Even for lower optimistic outcome expectations, public justification significantly influences the willingness to invest in failing projects and vice versa (Mahlendorf and Wallenburg, 2013).

Alliances or collaborations: Collaborations with parties outside of the organization affects project outcome via potential availability of new and needed knowledge (Radas and Bozic, 2012, especially for project failure in SME's), potential difficulties in partnerships or cooperation (Lhuillery and Pfister, 2009) or conflicts in the supplier-buyer relationship (Chen *et al.*, 2010).

4.1.5 Relative importance of project failure factors. Prior research on project failure factors identified significant failure factors. More recent research has recognized the relative importance of project failure factors (e.g. how important a factor is for project failure, see Table 4). A distinction is made between critical- and catalysing failure factors, whereby the latter are not sufficient on their own to induce project failure, but does contribute to project failure if other factors coexist.

Review of the literature yields a fragmented and inconclusive understanding of the relative importance of project failure factors. Critical project failure factors identified are software development difficulties, management capacity and procurement methods (Brown, 2001), poor project planning, project management and control issues (Yeo, 2002), stakeholder capabilities and fit between technological solution, strategy and culture (McLaughlin, 2009), organizational structure (Elkadi, 2013) and project planning, team experience and poor initial- and often changed designs (Nguyen and Chileshe, 2015). Finally, Dilts and Pence (2006) found that where project managers are driven by the need to complete a project in time, executives perceive complexity and completion time as less important.

Reviewing the literature on criticality of project failure factors shows agreement on the existence of critical failure factors, though ambiguity on the ultimate origins of project failure (e.g. in- or outside the sphere of influence of the project organization). Nevertheless, research to date reveals a predominant focus on failure factors that originate within the project organization (the project managerial and the technological categories, see Section 4.1.1-4.1.2) and less focus is on

Table 4. Critical project failure factors

No.	Critical project failure factor	References
1	Complexity of software development, management capacity, procurement methods	Brown (2001)
2	Project planning, project management and control	Yeo (2002)
3	Stakeholder capabilities, fit between technological solution and strategy and cultural fit	McLaughlin (2009)
4	Organizational structure	Elkadi (2013)
5	Project planning, project team experience, project design	Nguyen and Chileshe (2015)

failure influenced by forces outside of the project organization (the organizational and external categories) which leads to the following proposition for future PI project failure research:

P1. Failure factors that originated from within the project organization have a stronger positive influence on the likeliness for PI project failure than failure factors that have originated outside the project organization.

4.2 Interdependency of project failure factors

Recent research has started to address the interdependency of project failure factors, mostly hypothetical and based upon author experiences (Lehtinen *et al.*, 2014). One important reason for the scarce empirical research to date is that researching interdependency and causality is requiring a post hoc reconstruction of a string of events. Research methods that are being applied comprise case study research based upon causal mapping (Ackermann and Eden, 2005) and interpretive structural modelling (Hughes *et al.*, 2016). These methods in itself are subjective due to partial reports of the involved actors and provide an inevitably selective presentation of the events (Brown and Jones, 1998). For instance, Brown and Jones (1998) found that the narratives of project failure is simplifying events (to produce a coherent interpretation) and is attributing causes to elsewhere (to fate or the action of others). Hence, multiple researches have proposed models of interdependency, though all the following discussed researches refrain from more exogenous conclusive results.

Causality is being proposed by Belassi and Tukel (1996), whereby five exogenous project failure factor categories (factors related to the project manager, the project team members, the project, the organization and the external environment) are expected to influence more endogenous failure factors (client consultation and acceptance, project manager performance, project estimates and availability of resources) that are expected to determine project failure. Poon and Wagner (2001) researched the application of Critical Success Factors (CSF) on project outcome and similarly find that factors related to the project (adequate sponsorship, adequate resources and the link to (strategic) business objectives) are important in causing project failure. Research by Cerpa and Verner (2009) finds that fundamental in the chain of causality are project managerial factors, being unrealistic delivery date, project resource underestimation, inadequate risk management and overburdening of project staff. Additionally, Lehtinen *et al.* (2014) found that a lack of cooperation, weak task backlog and lack of software testing resources were most influential for project failure. Hughes *et al.* (2016) discussed how driving project failure factors are in the project managerial domain, being executive support and project sponsorship, size and complexity and whether a pilot and initial project evaluation was performed.

Reviewing the above literature for interdependency of project failure factors shows a pattern of initially project managerial failure factors and causes for failure in predominantly the earlier project phases (e.g. definition of objectives, ensuring sufficient resources and sponsorship, application of project management methodology). Research by Ahonen and Savolainen (2010) corroborate the likeliness of serious mistakes before a project has started as sales, negotiations and project start-up processes are "full of opportunities for project failure". Hence, there is agreement on the existence of interdependency between project failure factors, though there is ambiguity on the origins of the independent (the causing) project failure factors. Reviewing the literature reveals a pattern of predominantly project managerial failure factors that originate in early project phases, which leads to the following proposition:

P2. Project managerial failure factors in early phases of the project lifecycle have a stronger positive influence on the likeliness for PI project failure than project managerial failure factors in later phases of the project lifecycle have.

4.3 Mitigation strategies for project failure factors

Knowing what project failure factors are likely to disturb project execution is raising the need for project failure mitigation strategies. Research into project failure has identified mechanisms that allow for before-, during- and after- the project failure mitigation.

Before the project failure mitigation strategies: Known preventive factors for project failure are skill gap identification and training programs for project sponsors, -managers, -members and -stakeholders to ensure technical competency (Kilkelly, 2011) and intercultural competency (Kealey *et al.*, 2005).

For preventing project failure due to suppliers Chen *et al.* (2010) propose to use contracts wherein suppliers agree on the costs *and* penalties (calculated based on the probability of failure) when they fail to deliver as promised. Jorgensen (2014) proposes that project failure can be predicted by the failure rate of previous projects by the provider and suggests that increased emphasis on low price and project size increases the risk for failure. Clear and shared understanding of the project scope must be in place through transparent and effective communication in the early stages to reduce the chances for project failure (Gray and Anantatmula, 2009).

During the project failure mitigation strategies: While the project is in execution mode, close monitoring of progress allows for learning at regular intervals or following significant events (Robertson and Williams, 2006). To do so, Dalcher (2003) proposes a five step feedback loop and Matta and Ashkenas (2003) propose small projects that quickly deliver mini versions of the bigger projects' end result to ensure fast feedback. In a typical project execution stage, a reporting system is designed to meet the needs of the organization (Snee and Hoerl, 2003). Abdul-Rahman *et al.* (2012) suggest that strategies related to user involvement and project- planning and communication are most influential in preventing failure and Janssen and Klievink (2012) advocate the guiding use of enterprise architecture structures. Research by Vit (2011) suggests that project failure is hard to detect and prevent as different mechanisms such as the rules, cognitive routines and ideological pressures of an institutional environment can override technical and economic rationality. Chen (2015) proposes that occurring project failure can be detected by monitoring seven performance factors.

When project failure is imminent and commitment to project success is failing, Keil and Robey (1999) have showed that actions to turn troubled projects around are redefinition of the project and its objectives, improvement of the project management methods applied and a change in project leadership. For project leadership, Jani (2008) found that when project managers believe the failing project is under their control it is unlikely they recommend alternative courses of action other than continuation. Jani (2011) found that project managers are likely to underestimate endogenous (within the project) risk factors and point to a "self-efficacy" bias, where project managers with a higher self-efficacy underestimate the risks of a troubled project. Additional research by Ivory and Alderman (2005) has proposed implications for management in complex-project failure situations, being multi-nodality (design intervention at differing hierarchical levels), top-down and bottom-up intervention (allow for flexibility of local response to emerging problems) and the requirement for organizational slack (ensure availability of time and resources).

After the project failure mitigation strategies: The element of learning and the execution of retrospectives is named often as after the project failure mitigation strategy (Pinto and

Kharbanda, 1996; Bierwolf, 2016), such as cognitive- and causal mapping (Robertson and Williams, 2006) and decomposition of a project in a complex set of linear and non-linear interactions (Bolin, 2012). Learning at the individual, team and organizational levels is essential for the sustainable deployment of PI projects (Antony and Gupta, 2018).

Shepherd and Cardon (2009) suggest that the ability to learn from failed projects is negatively influenced by the intensity of the emotional reactions and Shepherd *et al.* (2014) conclude that delayed termination causes negative emotions towards project failure. Delayed termination does provide the time needed for learning from failure, but a negative side effect is that negative emotions have more time to grow. Sauser *et al.* (2009) suggest that adopting contingency theory will enhance project failure understanding. The researchers advocate that what works well in one situation may not work in another, and therefore, engagement in after the project learning should be characterized by a contingency perspective.

Reviewing the literature on project failure mitigation reveals a predominant focus on learning and adaption, before the project (training) while the project is in execution (feedback mechanisms) or after the project (evaluations and retained learnings) which leads to the following proposition for future research:

P3. Presence and use of mechanisms that allow for frequent evaluation, learning and adaption will negatively influence the likeliness of PI project failure.

5. Conclusions, future research agenda, implications and limitations

The objective of this paper is to extend the understanding of PI project failure by contextualizing existing PI-specific insights into the broader literature on generic project failure through a systematic literature review. Three categories in project failure research that each lead to propositions for future research are presented. Dominant topics that appeared in the research to date are mainly revolving around the causes for project failure and their relative importance, causality and relatedness between project failure factors and project failure mitigation strategies. From the review several academic and practical implications emerge.

5.1 Understanding process improvement project failure prevention and mitigation

The review identified predominantly cross-sectional and case study research methods that have yielded a list of project failure factors. Conclusively we see a growing need in explaining project failure while it is happening, and future research methods should focus on better understanding project failure as it unfolds, by for instance process study- (Langley, 1999) or design science (van Aken and Romme, 2009) research methods. Such insights allow for more effective project failure mitigation strategies and provide opportunities to understand project failure as it unfolds. Thereby our understanding of identifying and terminating infeasible PI projects can be developed. Existing research on the decision to prematurely terminate PI projects is scarce and centres around its impact on the organization and project team members (Shepherd *et al.*, 2014). With a better delineation between failure and termination, the act of termination can become more natural (Boehm, 2000).

5.2 Understanding process improvement project failure from a theoretical perspective

Contingency factors that are identified in research to date are organizational culture, politics, organizational structure and other external factors such as regulatory requirements and the influence of external parties. Also, stakeholders are identified as having a large influence on project failure. Hence, although both contingency and stakeholder related project failure

factors are recognized, project failure has not been studied through these respective theories to date. Explanation of PI project failure through the research lenses of contingency- (Hofer, 1975) or stakeholder theory (Freeman, 1994) is especially valuable for creating a better understanding of effective project leadership behaviours in different organization context where for instance differences in strategy, technology and size are expected to affect PI project outcome.

Theoretical streams of research can further enhance the understanding of PI project failure. The organizational behaviour literature provides insights in the internal dynamics and functioning of project teams (Hackman and Wageman, 2005) and can contribute to a better understanding of project failure. Research that presumes more fundamental management theories such as the resource-based view (Wernerfelt, 1984) or dynamic capabilities (Teece *et al.*, 1997) will be particularly valuable in exploring the interrelatedness of the project organization with the broader organization and how this is affecting PI project failure (Sinha and Van de Ven, 2005; Chandrasekaran *et al.*, 2016). Such research can establish new and different conceptions of project failure beyond the traditional failure factors and develop more refined contingency frameworks.

5.3 Understanding the antecedents of process improvement project failure

Additional future research lays in several directions, being the research methodologies applied and the types of PI projects for which failure factors are being studied. For one, the authors recognize that different improvement methodologies have fundamental differences in how PI projects are to be executed. For instance, Lean management dictates bottom-up participation, whereas Six Sigma is more driven as top-down initiative in a parallel project organization. The impact of failure of these projects is not the same and hence further empirical studies to critically evaluate the impact of such project failures are needed. Furthermore, most of the studies that have been conducted on project failure factors have a limited cross-cultural perspective and are based mainly on data from the USA and Europe, have focused mainly on the public- or professional services sector or have focused predominantly on IT and IS types of projects. Hence, more studies in non-Western countries, comparing project failure in different types of industry (Varajão *et al.*, 2014) and comparisons of project failure in different types of projects is promising future research.

5.4 Practical implications

Comprehensive review and structured presentation make the knowledge on project failure readily available and provide a basis for improving the design and management of PI projects in organizations. Reviewing the literature on process failure resulted in three propositions for future research, each holding implications for practice. First, existing reconstructions and researches elaborately explored the effects of failure factors on project outcome, revealing a predominant focus on failure factors that originated from within the project management organizations. This finding signals the importance of correct project managerial methodology application for PI practitioners and details the aspects especially in need of attention (Table 3: failure factor categories 1-11; Figure 7: failure factors 1-11). Second, exploration of failure factor interdependencies revealed a pattern of initially project managerial failure factors in predominantly earlier project phases: i.e. many failures appeared to be rooted in factors that are to be influenced by the project manager or the project team (Table 4). This finding corroborates the importance of meticulous application of project managerial methodology for PI practitioners, especially in preparatory project phases. Finally, research on project failure revealed the importance of learning and adaption

to prevent (future) project failure: PI practitioners are advised to follow the identified before-, during- and after the project failure mitigation strategies (Figure 7: project failure mitigation strategies 1-15).

Managers and practitioners that are confronted with the task of managing projects may find direction in the typology of project failure factors and the consecutive strategies for project failure mitigation, that we have conceptually placed in Figure 7. Certainly, many idiosyncratic causes for project failure will exist; however, PI project management is better served when managers and practitioners have a grasp of the known mechanisms underlying project failure.

5.5 Limitations

This systematic literature review has limitations. Discussions and conclusions on project failure research are based upon our sample, which is a product of the research methodology applied and journal databases wherein the search is performed, and is therefore limiting the generalizability of our findings. Also, we acknowledge that project failure is a label we have chosen after extensive exploratory research. Publications that apply different labels to similar concepts may thereby be missed and not included in our sample.

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