Successes and failures in software development project management: a systematic literature review

Patricia Gerlero

Programa de Maestría en Ingeniería en Sistemas de Información, Grupo de Estudio en Metodologías de Ingeniería en Software (GEMIS), Universidad Tecnológica Nacional Facultad Regional Buenos Aires, Buenos Aires, Argentina

Abstract

Project management is a social construction and must be analyzed from the objective and subjective world. The high failure rate of software development projects, even with the evidence of a thorough knowledge of the factors, require a change of paradigm. Planning, execution and control is only effective in conditions of predictability and certainty and this sequence must give way to experimentation and collaborative learning and a co-creation that allows to make perception and mental models evident. This requires a framework that allows co-creating the content to be adequately represented in the decision-making process. Scripts conform a structure that makes thought visible, allows structuring the subjective and transforming it with a common objective. The nature of risks changes and understanding human behavior is key. Through communication, cognitive processes are put into perspective, modifying individual intelligences and institutionalizing the capabilities needed to achieve success. The black box is opened and project managers must pull back the veil of security based on a risk analysis resulting from lessons learned. They must modify their own mental models and dare to innovate and create successful projects with the knowledge of existing capabilities and co-creating those necessary for action

Keywords

Knowledge Management, Co-creation, Project Management, Software Development

1. Introduction

Project Management Institute [1] defines project as a temporary effort that is undertaken to create unique results. Project management is the framework, functions and processes that guide the activities [2]. Software is an intangible product [3] and, from a management perspective, involves planning, monitoring and control, processes and actions that occur as the software evolves [4]. Avoiding failure involves understanding the crucial factors that lead to good project management and developing a common sense approach [4]. The traditional approach focuses on planning, execution and control which is ineffective due to the instability and unpredictability of system changes [5]. Project management is a social construct that if looked inwardly pretending to deliver on time, within budget and scope, would not be contemplating the delivery of successful projects due to the adaptation deficit to the operational and social context [6]. It should be seen as a temporary organization that is motivated by the need to

ICAIW 2021: Workshops at the Fourth International Conference on Applied Informatics 2021, October 28–30, 2021, Buenos Aires, Argentina

pgerlero@frba.utn.edu.ar (P. Gerlero)

0000-0001-8270-1342 (P. Gerlero)

perform specific actions to achieve immediate goals [7]. It is made up of a group of individuals who temporarily enact a common cause, with expectations it become into action and learning, the great challenge being the preservation of this after the project [8].

Success and failure factors are some of the best indicators of lessons learned, adapted and used by the software industry as a method to help managers determine what information is most relevant to achieve their goals [9] and they represent the probability of increasing or decreasing the result [3]. Criteria are the variables that allow to evaluate and compare projects distinguishing between hard (cost, time, scope/quality) and soft (customer satisfaction) [3]. Three theoretical perspectives are evident when analyzing success and failure in management: rationalist, process and narrative [10].

A rationalist that although it contributes to a better understanding of the nature and management of projects focuses on the failure of the previously specified compliance and the social and narrative construction that as a complement to the previous ones focuses on subjectivity [10]. Its objective is to help managers in practice, it is expected that paying attention to the factors will increase the probability of avoiding failure [10]. McConnell [11, 12] evaluates the practices frequently chosen in the management of software development projects leading to results so predictable and bad that they deserve to be called Classic Mistakes. Nelson [13] takes up this concept and through a retrospective analysis of lessons learned identifies best practices. In the same way, the research industry, represented by the Standish Group, has published since 1994 the Chaos Report [14]. These studies reveal percentages of successful projects and frequent failure factors in software development projects. They are references used in both academic and professional environments. Authors such as [15, 16, 17, 18] take the results as a starting point in their research, even taking into account objections from authors such as [19, 20, 21] who question their results by showing biases and methodological issues. This perspective is criticized for providing a simple and linear cause-effect model causing a lack of understanding of complex and ambiguous phenomena [10], however, they provide the "what" in many research projects.

The process perspective avoids the black box by understanding that projects are shaped by emergent, dynamic, political and social relationships [10]. It suggests adjusting procedures when they become flawed. The Guide [1] accounts for the complicated and describes processes by identifying at the beginning of the project the objectives, required investment, financial and qualitative criteria for success. Progress through the life cycle allows the results to be compared with the specified objectives and criteria, providing the basis for measuring success [1]. This traditional project management perspective predefines the way of doing things and provides tools to resolve conflicts. It identifies the "how" and "when". However, it provides a somewhat biased view from the praxis because it focuses on what should be and often leaves aside what is [22].

There is a very pragmatic desire by project teams to understand the lived experience in order to deal with complexity and uncertainty [23]. Researchers and research subjects will cooperate in interpretation [24, 25]. Verbalization, as the process of data collection, allows important aspects of praxis such as social responsibility, judgment, emotions, the functioning of dominant discourses, the potential relationship between knowledge and practical wisdom to be addressed together. It offers more coherent theoretical concepts of the complexity related to communication processes, power relations and the ambiguity of performance criteria over time.

It evidences the practice of project management as a collaborative learning process.

By adding the discursive layer, the subjective is emphasized, providing a constructive and social narrative perspective on failure. The discursive interpretive and political nature of project evaluation is centered among the daily interactions constructing reality [10]. Through this perspective, a deeper understanding of how meaning-making and interpretive processes in different social and political contexts contribute to the success and failure of projects is built by adding the why to the research.

All these perspectives imply a productive management paradigm based on planning, execution and control. The "what" is identified, the "how" is analyzed, the "when" is analyzed, and the "why" is constructed, reflecting the conclusions in lessons learned. However, constructing a post-mortem reality can be valid for complicated projects with predictable outcomes. Proper planning and risk analysis based on past experience may contribute to success, but may be evidence of a high failure rate. This clear limitation could be justified in the unique and changing reality of software development projects where the social process, value creation and the importance of understanding lived experiences form in itself complex systems understood as the inability to predict behavior [26]. Most complex projects consist of ambiguity and uncertainty, interdependence, nonlinearity, unique local conditions, autonomy, emergent behaviors, and unfixed boundaries [27]. All interrelated parts can change and evolve with respect to the objectives leaving success associated with the complexity paradigm [28]. Managers applying models based on the execution of practical guidelines should verify the stability conditions of the production systems because they could be inappropriate preventing the management model from detecting an error in the production systems [28].

Knowledge is a dynamic process of personal justification of beliefs towards truth [29]. If it is explicit, it has a universal character, supporting the ability to act in different contexts, it is accessible through consciousness [30]. The tacit is related to the senses, skills, intuition, unarticulated mental models and is rooted in action, routines, ideals, values and emotions [31]. Thus, the different knowledge interacts with each other within the spiral of creation [29]. This interaction motivates action, requiring the integration of knowledge management into management so that positive feedback occurs during the project and not after its completion [32].

The Standish Group [14, 33], McConnell [11, 12] and literature reviews [34] based on the identification and grouping of factors in several dimensional axes, form the starting point. But projects are crossed by the ambiguity of human relationships, the dynamics of the environment that influences in a complex way and the limitation in the availability of resources [35]. There is a need to broaden the understanding of complexity as a subjective notion, reflecting the lived experiences of the people involved [36]. To create knowledge, skills shared with others need to be internalized, reformulated, enriched, and translated to fit the new identity [37]. Perception, intuition and hunches as a subjective part have to be incorporated into the hierarchy and as a fundamental link in predicting the possible outcome in the inter-exchange of ideas about the problem at hand. The key to achieve the institutionalization of knowledge is to change the project management paradigm and couple it to the knowledge management system. Creating new knowledge literally means recreating the organization [37] or creating it in the case of temporary organizations. Opening the black box [38] and showing success or failure as an antagonistic construction process of interrelated factors is the complex path to follow, putting

the narrative at the center of the scene.

2. Method

Evidence-based software engineering [39] provides the means by which research can be integrated with practical experience and human values in the decision making process [21]. Systematic literature review (SLR) not only succeeds in identifying all existing evidence on a question, but also provides software engineering solutions [39]. If during the examination of a domain, it is discovered that the problem is broader then systematic mapping is the most appropriate by broadening the search to a not so narrow focus [40]. Systematic mapping is proposed to identify evidence of factors conditioning success and failure in a domain at a high level of granularity [40]. The proposed procedure includes tasks associated with planning (generation of research questions, definition of the search string, period, specification of the engines, inclusion, exclusion, quality, data extraction and accounting strategies), execution (search, selection according to established criteria and extraction of data in templates) and presentation of results once a significant sample has been obtained.

In order to determine the factors that condition success and failure in software development projects and to identify emerging elements that allow institutionalizing knowledge for decision making, the following questions are proposed:

- **Q1.** What criteria do the authors identify as indicators of success and failure in software development projects and what factors condition them?
- **Q2.** What differences or similarities exist between the success and failure criteria and factors identified in the literature in the last four years (2017-2020) and those specified by McConnell (1996-2008) or the Chaos Report published annually (1994-2015) by Standish Group?
- **Q3.** What are the emerging elements that emerge from relevant research for the approach of a software development project management framework?

It specifies the search strings, the engines to be used in a period between January 2017 and June 2020.

- **Search string:** "Success factors in software development projects". "Failure factors in software development projects". "Factores de fracaso en proyectos de desarrollo de software". "Factores de éxito en proyectos de desarrollo de software".
  `Success+factors+failure+project+software`
  `Exito+fracaso+factores+proyecto+software`
  `Success+failure+Projects+management+software+development`
  `Exito+fracaso+proyecto+administración+software+desarrollo`
- **Search engines:** ACM Digital Library, Emeral, GoogleScholar, IEEE Xplore, IGI-Global, Redalyc, Scielo, ScienceDirect and Taylor&Francis. The following inclusion, exclusion and quality criteria are specified:

- **Inclusion:** Primary and secondary studies written in Spanish or English, reported in national or international congresses and scientific journals available in any of the specified sources and that include any key words Success+failure+project+software/SI in the abstract or in the text, in the specified search period 2017-2020.
- **Exclusion:** Repeated articles, studies that do not meet the inclusion criteria or not having access to the entire content.
- **Quality:** Objectives clearly defined and aimed at achieving them and variables clearly measured.

In order to data extraction and accounting strategies, a template is prepared for the extraction of general data, context of the studies (circumstance of software development), purpose (objectives that the researchers intend to achieve), contribution (contribution made) and relevant characteristics (criteria and success and failure factors grouped by dimensions or axes on which they have an impact).

3. Systematic Literature Review

In accordance with the process formalized in the planning, the selection of articles and continuous iteration is carried out until a significant sample of 179 (147 primary and 32 secondary) is obtained. The sample of secondary studies is maintained as background and validation of the data collected. Hereafter, the results are expressed by indicating characteristic (X1, X2), where X1 is the number corresponding to primary studies and X2 is the number corresponding to secondary studies.

The following articles were found in GoogleScholar (40,13), ScienceDirect (38,7), IEEEXplore (30,7), Taylor&Francis (11,0), Emeral (3,2), IGI-Global (8,1), ACM Digital Library (5,1), Scielo (4,1) and Redalyc (2,0). The distribution by year is uniform 2017 (45,14), 2018 (34.4), 2019 (47,10) and up to June 2020 (11,4). The strategies used by the authors are mainly mixed (76,15), qualitative (38,17) and quantitative (0,38).

Many of the studies are developed in the context of a specific methodology, others base their research on any methodological context, extending their conclusions. From the sample were obtained in agile contexts (24,1) identifying as characteristics the free flow of communication, organic structure [41], continuous progress and interaction [42], coordination with direct influence on productivity [43], use of tacit knowledge avoiding heavy documentation [44], savings and elimination of bureaucracy [45]. In traditional contexts (1,0) identifying the plan-based approach, clearly specified requirements, satisfaction or not of the final product [46]. Most of the articles are not developed in a specific context, also contemplating hybrid contexts, indistinct (80,17). Open-source development (1.0) with its collaborative nature, available source code [47] low cost of construction and deployment and global software context (5,3) with lower cost of skilled resources, fast delivery with its challenges in communication, coordination, control by geographical, socio-cultural, temporal and organizational distances [48], technological and process [49] and trust as a critical factor [50] starts to emerge among the researches. Project portfolios (6,1) with their individual characteristics of interdependencies and massive consequences of failure [51] as well as their complex, unique, temporal and uncertain components [52] require

alignment and efficiency [53] with small, focused and less dispersed teams [16] recognizing agile capabilities as emerging strategies in uncertain environments [54]. Complex contexts (3,5) are difficult to understand, foresee and keep under control behavior [55] however, there is great difficulty in distinguishing complex from complicated projects [56], the authors identify interacting components of uncertainty, ambiguity and interdependence [57]. Developments in process improvement contexts (4.1) contemplate developments including a series of tasks such as process scoping, evaluation, design, realization and continuous improvement [58], seek to contribute and increase the performance and usefulness of processes [59] emerging through agility new models that contemplate continuous learning [58]. Large-scale developments (9,3) are characteristic of a high cost and the intervention of many people with a long duration, this implies a high collective effort made by multiple developers [50]. Not many studies were identified in the context of SMEs (1.0) even though they continue to be the driving force of the economy of many countries. Among the characteristics observed, they identify the need to focus on requirements, customer expectations, progressive planning, monitoring, control through a clear definition of scope and the use of management methodologies [60]. App development (1,0) is mentioned for a particular characteristic of interaction with users which allows them to implement changes that are then rewarded [61]. The public sector is a particular context (4.1) due to its complexity and the need for efficient and effective management [62]. And the academic environment (8,0) corresponds to a controlled environment [63] with students using scrum methodology or [64] with survey identifying best practices and management support are important for the success of the project.

Among the different purposes it was identified:

- Report an experience (80,0);[65] show how is the agile process in the current software industry.
- Synthesize the available evidence (0, 22) as [66] that review the literature of the last 25 years identifying 142 success factors in technology projects triangulating with a survey to determine the impact that each one has on the success of the project.
- Propose (28, 9) such as [67] suggesting a new parameter favoring a holistic approach to measure projects in contrast to the traditional view or [68] proposing a hybrid approach.
- Validate (30,1) giving firmness to a statement as [69] that identify emotional intelligence as the main contributor to the challenges of management under agile methodologies.
- Evaluate (5,0) as [70] that determine the correlation between quality, time and cost and give an opinion (4.0).

The main contribution is to the knowledge of factors conditioning success and failure and their possible correlations and is justified by the specified search string. Knowledge of determinants (109,23) [71, 72, 73], some frameworks (18,6) [74], metrics (3,0) [67, 75], models (9,1) [41, 49], methods (4,0) and tools (4,2) [76, 77].

There are several looks at defining success and failure criteria, most agree cost, time and quality as hard and stakeholder expectations as soft [3, 17] considering the subjective way of evaluating the project from the narrative [78] leaving perception in evidence [79]. Stakeholder theory contemplates a holistic approach [79] and conditions the starting point for embedding learning in the system. Performance looks at project performance [80] and within the hierarchy.

A failed project does not necessarily indicate poor performance of its managers [81]. Economic profitability identifies that it may be promising during start-up and not be accepted in the market [3][3]. The criteria mentioned by the researchers cost (73,20), scope (66,14), time (73,91) continue to be the hard criteria for evaluating projects. To the same extent customer/user acceptance (70,11) as soft criteria. Performance (40,7) emerges as a criterion that seeks to establish both objective and subjective concepts when evaluating projects, with the economic and commercial proposal (3,1) being the least considered.

There is no agreement among researchers on the important and relevant dimensions when grouping factors that condition success and. The authors propose organization, environment, processes and people [74], teams and customers [9], technique [46], users and stakeholders considering communication at all levels as predictors of success [66], external environment [80] and financial [82].

It was decided to group the sample into 9 dimensions with their associated factors:

- Organization (102,20): clear role definition (13,2), conflict resolution (27,4), coordination (37,7), change management/flexibility (45,12), open/mature communication (40,11), rewards (15,2), recognition (11,2), transparency (12,2), structural, organizational policies, alignment (12.2), ability to learn (30,7), ability to translate learning/give meaning (24,4), knowledge management (3,0), and good working environment (25,3).
- Team (93,14): good relationship (11,1), trust (34,3), compatibility (4,1), adequate expertise (41,6), good communication (40,3), cooperation (38,6), commitment (24,2), shared vision, shared experiences, exchange (20,1), autonomy/empowerment (16,0) and motivation (33,6).
- Processes (78,20): planning (45,11), estimation (9,3), risk assessment (24,10), communication (25,6), follow-up (14,2), monitoring and control (25,9), documentation (11,7), choice of processes, development and training (34,8).
- Technical (37,10): use of techniques and tools (9,1), incomplete/ambiguous requirements (20,7), experience and knowledge in the use of tools (7,3).
- Personal (77, 20): management intelligence/management skills (52.10), social skills (4.4), emotional intelligence/self-control (11,5), business skills (12,2), political skills (3,1), decision making and leadership (16,7), technical knowledge (17,1), soft and cognitive skills (38,6).
- Political/legal (39,13): lack of management commitment and support (33,12), lack of coordination with governments (7,4), underestimation of changing requirements (4,3), lack of communication with project management (2,0).
- Financial (14,7): lack of money/financial/resources (16,7).
- Third parties (67,12): perception of product quality (41,7), participation (29,5), collaboration (10,0), communication (10,1), trust (18,1), flexibility (2,0) and commitment (17,3).
- Internal/external environments (48.14): complexity (37.14), uncertainty (26.7), ambiguity (11.5), independence/nonlinearity (8.2).

4. Result

Q1: What criteria do the authors identify as indicators of success and failure in software development projects and what factors condition them? A combination of hard and soft concepts is observed in equal proportion, giving rise to the performance criterion. The factors associated with the organizational dimension and the team are evidenced over the processes, emerging the personal dimension.

Q2: What differences or similarities exist between the success and failure criteria and factors identified in the literature over the past four years (2017-2020) and those specified by McConnell (1996-2008) or the Chaos Report published annually (1994-2015) by Standish Group? Standish Group specifies user involvement, resource, planning and management support [14], includes emotional maturity and qualified resources as relevant [33][33]. These are still present in the research. Forty-two percent of the classic errors found by McConnell [12] correspond to those arising in systematic mapping. Planning, risk management, insufficient estimation, user involvement is at the top of the list. A very process-oriented focus evidencing the importance of user involvement and the conflicts associated with the same involvement. However, there is a clear tendency to study organizations as a complex system, focusing on communication that crosses all dimensions as the true causal link. Coordination and flexibility at the organizational level and management and emotional intelligence, giving importance to social and political skills as an emerging element, begin to have relevance not only in the relationship with the client or in the teams, but also as an element of the organization. The ability to learn from the organizations, the exchange and shared experiences of the teams raise the need to translate this learning into a shared vision.

Q3: What are the emerging elements that emerge from the research that are relevant to a framework for managing software development projects? Researchers have a much more complex view of software development projects than simple causal relationships. Analyzing the problem through dimensions highlights the interrelationship of factors. Authors such as [38] strive to highlight the complexity of the mechanisms involved by showing the importance of revealing the reality through integrated subjective and objective strategies. The dynamics of relationships and the visualization of systems as a complex interrelation of dimensions begins to be the objective of researchers with a common goal, productivity, but not anchored in a strict planning generated in the past, but with enough flexibility to visualize the living present. They begin to work on the perception of reality, reflected through discourse [43]. Others [44] model contingent proposals to solve a reality that always existed but seeing the factors as causal relationships only made the decision maker rest on structural biases created in the past without positioning himself in the present and analyzing the true context, ambiguous, uncertain and non-linear. Knowledge acquisition and transformation into meaningful learning through collaboration and social interaction seem to be the key. The co-creation of knowledge proposes to go beyond the exchange by creating processes that allow the evaluation and modification of collective ideas that lead to improve one's own [83]. Allowing active participation in knowledge co-creation activities can lead to high quality learning outcomes [84]. One way to promote productive collaborative learning is the use of scripts that explicitly guide participants during their learning [84]. An intelligent collaborative system allows for improved learning and decision-making processes [85]. Content representation [86] is a key dimension of

knowledge management [87]. The productive process changes the paradigm to make way for the modeling-experimentation-learning trinomial. Reality over prescription guides the way towards transformation, but it requires multiple views that allow the integration of objective, subjective and social worlds. This can be achieved through communicative action that allows confronting these worlds by adopting logical reasoning instead of domination to resolve disagreements [88]. Communicative action is the basis for change aimed at achieving, sustaining and revising consensus through human potential rooted in language and discourse analysis [89].

5. Conclusions and future lines of research

There is no common definition of complexity among researchers, but many agree on characteristics such as multiple interacting parts, uncertainty and social interactions that produce systemic risks that must be managed with a holistic view [90]. Changes in one component of the system can cause unforeseen events in others, making the project evolve, making it dynamic and unpredictable [91]. The institutionalized absorption capacity through the use of scripts allows the necessary competences to use the new knowledge [92].

Understanding human behavior in projects is the key to predicting the triggering effects of decision making. This requires institutionalizing emergent capabilities to absorb real complexity, adapt and recover quickly. It is key to understand the links between projects and institutions and how they trigger change and establish stabilizing mechanisms for long-term social interaction [93]. The theory of practicality can be useful in understanding aspects of human behavior [90] allowing for meaningful predictive tools [94]. It is important to view the social world as an emergent product of decisions, actions and cognitions. Cognitive operations depend on supporting processes in that reasoning and decision making depend on the availability of knowledge about situations, options for action, and outcomes [95]. Knowledge can be used to read and interpret the world [78] but its nature, value and perceived view of power in conjunction with different mindsets form key barriers to exchange not occurring [96]. Any team participation in projects is highly dependent on the quality of communication [88]. Communication barriers are an important part of human perception, thus shared social construction can offer a way to address complexity as a whole by redefining the dimensions that are interrelated through decision making and co-creation of content to modify the mental models of the teams during the project and not after its completion.

The toolbox of reflexive sociology [94], the critique in terms of communicative action proposed by [88] and the spiral of knowledge creation [29] provide a solid structure that makes clear the social dynamics in the field of management. The choices we make are not inherent to the situations we are presented with but complex exchanges between the properties of the context and our properties, our doubts and our history [97]. The theory of multiple intelligences [98] proposes a framework for cognitive growth because we must go beyond the ability to see the world through mental representations, we must work with them, manipulate them and transform them. With the elements provided, a model could be formalized that contemplates the different scripts integrated in the spiraling of knowledge, promoting practices that allow co-creating and representing the content at key moments of the execution, creating intelligent temporal organizations. The construction implies training people who learn to see as systemic

thinkers, who develop their own personal domain and who learn to reveal mental models in collaboration.

References

[1] P. M. Institute, Guía de fundamentos para la dirección de proyectos (guía pmbok) sexta edición, 2017.

[2] C. Biesenthal, R. Wilden, Multi-level project governance: Trends and opportunities, International journal of project management 32 (2014) 1291–1308.

[3] M. Albert, P. Balve, K. Spang, Evaluation of project success: a structured literature review, International Journal of Managing Projects in Business (2017).

[4] R. S. Pressman, C. Ruckaüer, L. Hernández Yáñez, et al., Ingeniería del Software: Un enfoque práctico, 1993.

[5] R. Picciotto, Towards a 'new project management'movement? an international development perspective, International Journal of Project Management 38 (2020) 474–485.

[6] P. Morris, Reconstructing project management reprised: A knowledge perspective, Project Management Journal 44 (2013) 6–23.

[7] R. A. Lundin, A. Söderholm, A theory of the temporary organization, Scandinavian Journal of management 11 (1995) 437–455.

[8] J. Packendorff, Inquiring into the temporary organization: New directions for project management research, Scandinavian journal of management 11 (1995) 319–333.

[9] V. Garousi, A. Tarhan, D. Pfahl, A. Coşkunçay, O. Demirörs, Correlation of critical success factors with success of software projects: an empirical investigation, Software Quality Journal 27 (2019) 429–493.

[10] Z. Baghizadeh, D. Cecez-Kecmanovic, D. Schlagwein, Review and critique of the information systems development project failure literature: An argument for exploring information systems development project distress, Journal of Information Technology 35 (2020) 123–142.

[11] S. McConnell, I. M. Águila Cano, A. Bosch, et al., Desarrollo y gestión de proyectos informáticos, 1997.

[12] S. McConnell, Software development's classic mistakes 2008, 2008.

[13] R. R. Nelson, It project management: Infamous failures, classic mistakes, and best practices., MIS Quarterly executive 6 (2007).

[14] G. Standish, The chaos report, The Standish Group (1994) 1–16.

[15] K. Davis, An empirical investigation into different stakeholder groups perception of project success, International Journal of Project Management 35 (2017) 604–617.

[16] O. P. Sanchez, M. A. Terlizzi, et al., Cost and time project management success factors for information systems development projects, International Journal of Project Management 35 (2017) 1608–1626.

[17] D. L. Hughes, N. P. Rana, A. C. Simintiras, The changing landscape of is project failure: an examination of the key factors, Journal of Enterprise Information Management (2017).

[18] J. U. Kim, R. Kishore, Do we fully understand information systems failure? an exploratory

study of the cognitive schema of is professionals, Information Systems Frontiers 21 (2019) 1385–1419.
[19] M. Jørgensen, Forecasting of software development work effort: Evidence on expert judgement and formal models, International Journal of Forecasting 23 (2007) 449–462.
[20] M. Jørgensen, K. Moløkken-Østvold, How large are software cost overruns? a review of the 1994 chaos report, Information and Software Technology 48 (2006) 297–301.
[21] T. Dyba, B. A. Kitchenham, M. Jorgensen, Evidence-based software engineering for practitioners, IEEE software 22 (2005) 58–65.
[22] J. Z. Ruiz, ¿ por qué fracasan los proyectos de software? un enfoque organizacional, in: Congreso Nacional de Software Libre, volume 2, 2004, pp. 20–42.
[23] P. Buckle, J. Thomas, Deconstructing project management: a gender analysis of project management guidelines, International Journal of Project Management 21 (2003) 433–441.
[24] S. Cicmil, T. Williams, J. Thomas, D. Hodgson, Rethinking project management: researching the actuality of projects, International journal of project management 24 (2006) 675–686.
[25] S. Cicmil, Understanding project management practice through interpretative and critical research perspectives, Project management journal 37 (2006) 27–37.
[26] S. A. Sheard, Assessing the impact of complexity attributes on system development project outcomes, Stevens Institute of Technology, 2012.
[27] J. Bakhshi, V. Ireland, A. Gorod, Clarifying the project complexity construct: Past, present and future, International journal of project management 34 (2016) 1199–1213.
[28] P. A. Daniel, C. Daniel, Complexity, uncertainty and mental models: From a paradigm of regulation to a paradigm of emergence in project management, International journal of project management 36 (2018) 184–197.
[29] I. Nonaka, H. Takeuchi, The knowledge-creating company: How Japanese companies create the dynamics of innovation, Oxford university press, 1995.
[30] I. Nonaka, G. Von Krogh, Perspective—tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory, Organization science 20 (2009) 635–652.
[31] I. Nonaka, K. Umemoto, D. Senoo, From information processing to knowledge creation: a paradigm shift in business management, Technology in society 18 (1996) 203–218.
[32] A. Aurum, F. Daneshgar, J. Ward, Investigating knowledge management practices in software development organisations–an australian experience, Information and Software Technology 50 (2008) 511–533.
[33] G. Standish, Chaos report 2015, 2015.
[34] A. Rezvani, P. Khosravi, Identification of failure factors in large scale complex projects: an integrative framework and review of emerging themes, International Journal of Project Organisation and Management 11 (2019) 1–21.
[35] S. Cicmil, T. Cooke-Davies, L. Crawford, K. Richardson, Exploring the complexity of projects: Implications of complexity theory for project management practice, 2017.
[36] M. F. Mikkelsen, Perceived project complexity: a survey among practitioners of project management, International Journal of Managing Projects in Business (2020).
[37] l. Nonaka, H. Takeuchi, K. Umemoto, A theory of organizational knowledge creation, International journal of technology management 11 (1996) 833–845.
[38] O. Pankratz, D. Basten, Opening the black box: Managers' perceptions of is project success

mechanisms, Information & Management 55 (2018) 381–395.
[39] B. Kitchenham, O. P. Brereton, D. Budgen, M. Turner, J. Bailey, S. Linkman, Systematic literature reviews in software engineering–a systematic literature review, Information and software technology 51 (2009) 7–15.
[40] S. Keele, et al., Guidelines for performing systematic literature reviews in software engineering, Technical Report, Citeseer, 2007.
[41] C. Tam, E. J. da Costa Moura, T. Oliveira, J. Varajão, The factors influencing the success of on-going agile software development projects, International Journal of Project Management 38 (2020) 165–176.
[42] D. Ciric, B. Lalic, D. Gracanin, N. Tasic, M. Delic, N. Medic, Agile vs. traditional approach in project management: Strategies, challenges and reasons to introduce agile, Procedia Manufacturing 39 (2019) 1407–1414.
[43] I. Fatema, K. Sakib, Factors influencing productivity of agile software development teamwork: A qualitative system dynamics approach, in: 2017 24th Asia-Pacific Software Engineering Conference (APSEC), IEEE, 2017, pp. 737–742.
[44] A. Ahimbisibwe, U. Daellenbach, R. Y. Cavana, Empirical comparison of traditional plan-based and agile methodologies: Critical success factors for outsourced software development projects from vendors' perspective, Journal of Enterprise Information Management (2017).
[45] M. Pace, A correlational study on project management methodology and project success., Journal of Engineering, Project & Production Management 9 (2019).
[46] S. Dhir, D. Kumar, V. Singh, Success and failure factors that impact on project implementation using agile software development methodology, in: Software engineering, Springer, 2019, pp. 647–654.
[47] J. Maqsood, I. Eshraghi, S. S. Ali, Success or failure identification for github's open source projects, in: Proceedings of the 2017 International Conference on Management Engineering, Software Engineering and Service Sciences, 2017, pp. 145–150.
[48] N. Saleem, Empirical analysis of critical success factors for project management in global software development, in: 2019 ACM/IEEE 14th International Conference on Global Software Engineering (ICGSE), IEEE, 2019, pp. 68–71.
[49] C. Arumugam, S. Kameswaran, B. Kaliamourthy, Global software development: A design framework to measure the risk of the global practitioners, in: Proceedings of the 7th International Conference on Computer and Communication Technology, 2017, pp. 1–8.
[50] F. Calefato, G. Iaffaldano, F. Lanubile, B. Vasilescu, On developers' personality in large-scale distributed projects: the case of the apache ecosystem, in: 2018 IEEE/ACM 13th International Conference on Global Software Engineering (ICGSE), IEEE, 2018, pp. 87–96.
[51] A. Neumeier, S. Radszuwill, T. Z. Garizy, Modeling project criticality in it project portfolios, International Journal of Project Management 36 (2018) 833–844.
[52] M. Martinsuo, J. Geraldi, Management of project portfolios: Relationships of project portfolios with their contexts, International Journal of Project Management 38 (2020) 441–453.
[53] D. Hoffmann, F. Ahlemann, S. Reining, Reconciling alignment, efficiency, and agility in it project portfolio management: Recommendations based on a revelatory case study, International journal of project management 38 (2020) 124–136.

[54] C. Kaufmann, A. Kock, H. G. Gemünden, Emerging strategy recognition in agile portfolios, International Journal of Project Management 38 (2020) 429–440.
[55] T. S. Nguyen, S. Mohamed, Interactive effects of agile response-to-change and project complexity on project performance, in: 10th International Conference on Engineering, Project, and Production Management, Springer Singapore, 2020, pp. 311–320.
[56] V. Damasiotis, P. Fitsilis, Project management guidelines/frameworks in the era of agility and complexity, in: Smart City Emergence, Elsevier, 2019, pp. 1–20.
[57] M. Mohseni, A. Tabassi, E. Kamal, D. Bryde, R. Michaelides, Complexity factors in mega projects: a literature review, European Proceedings of Multidisciplinary Sciences 2 (2019) 54–67.
[58] M. Kuhrmann, J. Müench, Spi is dead, isn't it? clear the stage for continuous learning!, in: 2019 IEEE/ACM International Conference on Software and System Processes (ICSSP), IEEE, 2019, pp. 9–13.
[59] A. M. Garcia Rodríguez, Y. Milanés Zamora, Y. Trujillo Casañola, J. P. Febles Rodríguez, I. J. Sánchez González, Asociación entre buenas prácticas y factores críticos para el éxito en la mps, Revista Cubana de Ciencias Informáticas 12 (2018) 89–103.
[60] J. A. G. Correa, S. L. S. Castañeda, D. A. V. Quintero, G. E. Giraldo, Identification and analysis of project management success factors in information technology smes, International Journal of Information Technology Project Management (IJITPM) 9 (2018) 73–90.
[61] F. Palomba, M. Linares-Vásquez, G. Bavota, R. Oliveto, M. Di Penta, D. Poshyvanyk, A. De Lucia, Crowdsourcing user reviews to support the evolution of mobile apps, Journal of Systems and Software 137 (2018) 143–162.
[62] T. Lappi, K. Aaltonen, Project governance in public sector agile software projects, International Journal of Managing Projects in Business (2017).
[63] L. F. Santana, L. F. C. d. Santos, T. S. C. Silva, V. B. Villar, F. G. Rocha, V. Gonçalves, Scrum as a platform to manage students in projects of technological development and scientific initiation: a study case realized at unit/se, Journal of Information Systems Engineering & Management 2 (2017).
[64] T. Jitpaiboon, S. M. Smith, Q. Gu, Critical success factors affecting project performance: An analysis of tools, practices, and managerial support, Project Management Journal 50 (2019) 271–287.
[65] M. M. Sharma, A. Agrawal, H. Deore, S. Kumar, R. Kumari, Revisiting agile software development process based on latest software industry trends, Journal of Information and Optimization Sciences 41 (2020) 533–541.
[66] D. Stevenson, J. A. Starkweather, It project success: The evaluation of 142 success factors by it pm professionals, International Journal of Information Technology Project Management (IJITPM) 8 (2017) 1–21.
[67] J. Rajagopalan, P. K. Srivastava, Introduction of a new metric "project health index"(phi) to successfully manage it projects, Journal of Organizational Change Management (2018).
[68] P. R. Cristaldo, L. C. Ballejos, M. A. Ale, Propuesta metodológica de enfoque "híbrido" para la gestión de proyectos de tics en la administración pública: Implementación y verificación, Revista Tecnología y Ciencia (2019) 16–36.
[69] T. T. Luong, U. Sivarajah, V. Weerakkody, Do agile managed information systems projects fail due to a lack of emotional intelligence?, Information Systems Frontiers 23 (2021)

415–433.
[70] J. L. Cantú-Mata, F. Torres-Castillo, S. Alcaraz-Corona, F. Banda-Muñoz, Calidad, tiempo y costo en proyectos de desarrollo de software, Interciencia 43 (2018) 707–710.
[71] S. M. A. Suliman, G. Kadoda, Factors that influence software project cost and schedule estimation, in: 2017 Sudan Conference on Computer Science and Information Technology (SCCSIT), IEEE, 2017, pp. 1–9.
[72] A. E. Akgün, Team wisdom in software development projects and its impact on project performance, International Journal of Information Management 50 (2020) 228–243.
[73] A. Y. Gheni, Y. Y. Jusoh, M. A. Jabar, N. M. Ali, The critical success factors (csfs) for it projects, Journal of Telecommunication, Electronic and Computer Engineering (JTEC) 9 (2017) 13–17.
[74] A. A. M. Alsunki, M. A. Ali, A. A. Jaharadak, N. M. Tahir, Framework of software developers engagement antecedents and productivity-a review, in: 2020 16th IEEE International Colloquium on Signal Processing & Its Applications (CSPA), IEEE, 2020, pp. 302–307.
[75] P. Ram, P. Rodriguez, M. Oivo, S. Martínez-Fernández, Success factors for effective process metrics operationalization in agile software development: a multiple case study, in: 2019 IEEE/ACM International Conference on Software and System Processes (ICSSP), IEEE, 2019, pp. 14–23.
[76] D. Monticolo, I. Lahoud, An agent approach to manage heterogeneous and distributed knowledge, International Journal of Knowledge-Based Organizations (IJKBO) 10 (2020) 27–48.
[77] V. Stingl, J. Geraldi, Toolbox for uncertainty; introduction of adaptive heuristics as strategies for project decision making, International Research network on Organizing by projects, IRNOP (2017).
[78] S. R. Bhuiyan, P. Setia, The individual narrative of is project success, in: Proceedings of the 2018 ACM SIGMIS Conference on Computers and People Research, 2018, pp. 164–165.
[79] S. K. Gupta, A. Gunasekaran, J. Antony, S. Gupta, S. Bag, D. Roubaud, Systematic literature review of project failures: Current trends and scope for future research, Computers & Industrial Engineering 127 (2019) 274–285.
[80] R. Octavianus, P. Mursanto, The analysis of critical success factor ranking for software development and implementation project using ahp, in: 2018 International Conference on Advanced Computer Science and Information Systems (ICACSIS), IEEE, 2018, pp. 313–318.
[81] O. Zwikael, J. Meredith, Evaluating the success of a project and the performance of its leaders, IEEE transactions on engineering management (2019).
[82] A. Abbas, A. Faiz, A. Fatima, A. Avdic, Reasons for the failure of government it projects in pakistan: A contemporary study, in: 2017 International Conference on Service Systems and Service Management, IEEE, 2017, pp. 1–6.
[83] I. Dubovi, I. Tabak, An empirical analysis of knowledge co-construction in youtube comments, Computers & Education 156 (2020) 103939.
[84] E. Vuopala, P. Näykki, J. Isohätälä, S. Järvelä, Knowledge co-construction activities and task-related monitoring in scripted collaborative learning, Learning, Culture and Social Interaction 21 (2019) 234–249.
[85] S. Katalnikova, L. Novickis, N. Prokofyeva, V. Uskov, C. Heinemann, Intelligent collaborative educational systems and knowledge representation, Procedia Computer Science 104

(2017) 166–173.
[86] A. Patel, S. Jain, Formalisms of representing knowledge, Procedia Computer Science 125 (2018) 542–549.
[87] P. Gerlero, L. Straccia, M. F. Pollo Cattaneo, Marco de trabajo para la gestión del conocimiento en la administración de proyectos de desarrollo del software, 2021.
[88] M. Sarhadi, S. Yousefi, A. Zamani, Participative project management as a comprehensive response to postmodernism criticisms: The role of communication, International Journal of Managing Projects in Business (2018).
[89] J. Geraldi, J. Söderlund, Project studies: What it is, where it is going, International journal of project management 36 (2018) 55–70.
[90] T. Williams, The nature of risk in complex projects, Project management journal 48 (2017) 55–66.
[91] J. Zhu, A. Mostafavi, Discovering complexity and emergent properties in project systems: A new approach to understanding project performance, International journal of project management 35 (2017) 1–12.
[92] T. Bjorvatn, A. Wald, Project complexity and team-level absorptive capacity as drivers of project management performance, International Journal of Project Management 36 (2018) 876–888.
[93] J. Söderlund, J. Sydow, Projects and institutions: towards understanding their mutual constitution and dynamics, International Journal of Project Management 37 (2019) 259–268.
[94] T. Kalogeropoulos, V. Leopoulos, K. Kirytopoulos, Z. Ventoura, Project-as-practice: Applying bourdieu's theory of practice on project managers, Project Management Journal 51 (2020) 599–616.
[95] J. P. Balladares, D. C. Vera, G. L. Valdez, Aproximación teórica de la acción comunicativa y su relación con la neurociencia cognitiva, Universidad Ciencia y Tecnología 1 (2019) 134–139.
[96] A. E. Akgün, H. Keskin, H. Ayar, Z. Okunakol, Knowledge sharing barriers in software development teams: a multiple case study in turkey, Kybernetes (2017).
[97] E. Goldberg, Cerebro ejecutivo, Crítica, 2004.
[98] H. Gardner, La inteligencia reformulada: las inteligencias múltiples en el siglo XXI, 159.955 G171i Ej. 1 020338, Paidos„ 2001.