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IT projects success factors: a literature review

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Abstract:
Information Technology (IT) projects are enablers of organizational transformation and business growth. Despite the contribution of methodologies and frameworks for project management, the ratio of failed IT projects remains high; then, studying critical success factors of IT projects persist as an essential issue for researches and practitioners. This paper presents a systematic literature review focused on compiling and synthesizing project success factors in IT projects. The literature search was conducted using primary journal articles until 2017. All studies agree on the relevance of studying the critical success factors in IT projects given their particular characteristics. The results indicate there is no clear definition of project success concept; our review consolidates the IT success criteria into time, budget, project management, system quality, user satisfaction, and economic value. Also, there a vast and overlapped list of factors; so, this research proposes a structure that synthesizes the most referenced critical factors that have in common soft attributes as involvement, support, communication, and commitment. Findings reinforce the relevance of soft skills in IT project teams.

Keywords:
project success; IT project; systematic review; success factors.

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1. Introduction

Information technology (IT) projects serve as vehicles of transformation and business growth. It has been observed that annual global investment in information technology is permanently increasing. Gartner-Inc estimates that in 2019, it will reach 3.79 trillion dollars [1]. These investments are made to contribute to the achievement of organizational aims and objectives [2]. IT enables multidimensional IT-based change in organizations, and they are increasingly configured oriented or based on projects [3, 4].

Even though progress has been made in project management practices and methodologies, the high ratio of failure in IT projects continues. Project methodologies and frameworks have contributed to better project achievements and to help address low success rates using project-related knowledge [5, 6]. However, over time, the IT failure rate is still high. Standish Group reports that 31.1% of the projects are classified as failed, which means they were abandoned or canceled, and 52.7% are completed over cost, over time, and/or lacking promised functionality [6]. So, it is therefore vital to find out what makes the difference in project results and what are the critical factors.

Critical success factors have been studied extensively with specific approaches, and the lists of critical success factors that have resulted are also vast. Some authors focused on a specific methodology [e.g., 7, 8], technology [e.g., 9, 10], stakeholder perspective [e.g., 11, 12, 13], specific group of factors [e.g. 9, 14], or others. To a large extent, this long list is since each project is unique. Although project methodologies seek to be general for all types of projects, there is a coincidence in the authors in pointing out that the different particularities of the projects influence success. Belassi presented the variation in the criticality of factors among the industry sectors; the author demonstrated that there are sectors in which some factor is very critical while in another sector it is not relevant [15]. This idea, more recently reinforced by project studies, has adopted a contingency approach that indicates that project performance increases if the contextual factors are aligned with the structural factors of the organization [16-18]. It has been pointed out that the context, type, history, and nature of the projects are elements that should be considered [18, 19].

Project success is intensely studied in general project management literature, and these studies have contributed to our understanding of the phenomenon. However, it is convenient to explore the success in the context of IT projects, given the particularities of high complexity, uncertainty, and high risk of the more significant number of information technology projects. There are no studies that summarize, evaluate, and interpret the relevant literature on these factors transversally. While there are literature review studies about project success [20, 21], there are not literature reviews in the IT project field. In IT literature, studies are found [e.g., 22, 23] who make contributions through literature review with a focus on software development rather than projects; therefore, they present a technical approach more than a management one.

To help fill this gap, a Systematic Literature Review (SLR) of IT project success was performed focusing on critical success factors expressed as attributes (e.g., involvement, commitment, expertise, quality) that apply on project objects (e.g., users, sponsor, schedule, methodology). Based on a rigorous systematic review methodology, 39 articles were identified and analyzed, summarizing the criteria to define success and its factors, as well as synthesizing the main categories of factors.

This research contributes to the literature by identifying opportunities for future research in the field of critical factors. This study is also useful for managers since it can guide them in their decision-making processes, project organizing, resource assignment, monitoring, and control. Finally, it is helpful for project managers to identify critical success factors and act according to them.

This paper is structured as follows. Section 2 summarizes the previous literature on the subject. Then, the research question and methodology are presented in section 3. The results and discussion are developed in sections 4 and 5, respectively. Finally, section 6 presents the conclusions.

2. Background

2.1 Project success

No clear definition of the concept "project success" was found. It has been defined in a range of different ways [24-26]. Many authors conceptualize success grounded in the criteria of success, criteria in which there is no consensus, the most traditional is the so-called "iron triangle" comprising cost, time, and quality [24, 25, 27-29]. Baccarini [30] presents project success as a core concept in project management, identifies two components that define a successful project: successful project management and successful product of the project. In another stream, "success" is corresponding to the efficiency and the effectiveness of the project. The efficiency understood as the maximization of output for a given level of resources; the effectiveness directed to the achievement of goals or objectives [31].

Project Success concept is often based on the different perceptions of each stakeholder depending on the moment the project is found; it is usual to find that the same project is considered successful by some and a failure by others. Lim and Mohamed [32, 33] explain that a project impacts a different way to each element of society, and each stakeholder such as the individual owner, developer, contractor, user, the general public, each of them has a different perspective. The perception of the stakeholders rather than being a global perspective is due to a perception of the achievement of their own objectives [34-36].

The existing theory of project success is mainly relying on the work done by Pinto and Slevin. The study aimed to construct a more general and more widely accessible measure of project success applicable to a variety of organizational projects. Success comes from criteria linked to the project (e.g., time, cost, and the performance of the project); as well as criteria related to the client (e.g., such as use, satisfaction, and effectiveness) [37].

In contrast to the search for a general measure of success, more recently, the project contingency theory (PCT) has emerged linking project management methods and the project context [16]. Contingency theory suggests that the structural factors in organizations should suit the contextual factors to increase performance [17]. Based on contingency theory, Shenhar, who has conducted several studies based on contingency theory, proposes four bases to analyze projects (NTCP): "Novelty", how intensely new are crucial aspects of the project?; "Technology", where does the project exist on the scale from low-tech to superhigh-tech?; "Complexity", how complicated are the product, the process, and the project?; and, "Pace", how urgent is the work? Is the timing "normal, fast, time-critical or blitz"? [38].

The project success criteria are the conditions that a project must meet to determine if it is acceptable; this list of criteria varies from project to project. In literature we found the concept of the "iron triangle", "triple constraint" or "golden triangle" as a representation of the essential criteria for assessing project performance; it means the project is delivered by the due date, within budget and with quality, performance or scope [25, 27, 39]. At the same time, as the use of the triangle, other less used concepts are found, such as "virtuous square of criteria" or "quadruple constraint" (which include customer satisfaction). Recently, Pollack indicated the iron triangle concept is still valid; there is an agreement in two vertices of the triangle: time and cost; and for the third vertex, the most common use is quality following by scope, performance, or requirements [40]. Satisfaction is a perception criterion also included in the literature. For example, Westerveld, under the term "appreciation" shows the relevance of it by defining six categories, five related to satisfaction: project results (Budget, Schedule, Quality), appreciation by the client, by project personnel, by users, by contracting partners and by stakeholders [41]. Is becoming constant the inclusion of benefit concepts, such as benefit to the client, to the organization, to the stakeholders, support to the strategy, and business outcomes, such as information-processing benefits, effects on business operations, or impact on business performance [e.g., 42, 43].

In conclusion, project success is a multi-dimensional concept depending on criteria, stakeholder perception, the context, and the phase the project is found.

2.2 Project success factors

The literature on success factors is ample. The most cited author regarding success factors is Cooke-Davies who presents twelve factors to project management success, to a successful individual project and consistently successful projects [28]. Another facet of project success that is important to establish is time frame [44]. Pinto & Slevin give fourteen critical success factors and analyzes the most relevant for each stage of the project [45]. Sudhakar collects eighty factors [46] and presents a model explaining interaction among groups of them. To avoid problems associated with critical success factors that give rise to the criticisms, Fortune & White present twenty-seven critical factors collected from literature and map them onto components of the formal system model used as a framing device to deliver the benefits of taking account of critical success factors [47].

Regarding the project success factors categories in literature, there are several lists of them; one of the most referenced readings in terms of factor grouping is Belassi & Tukel [15]. They studied success factor collected from literature, described the impact of these factors on project performance and grouped the factors into four areas: factors related to the project, factors related to the project managers and the team members, factors related to the organization and factors associated with the external environment [15]. Later, Yeo presents three groups: two related to the managerial and organizational context and one related to the development of the project [48]. Westerveld categorizes the factors in seven areas: leadership and team, policy and strategy, stakeholder management, resources, contracting, project management and external factors [41].

2.3 IT Project

PMI defines a project as "a temporary endeavor undertaken to create a unique product, service, or result" [49]. Information Technology (IT) is the technology used to acquire and process information in support of individual and social purposes. It is typically instantiated as IT systems - complex organizations of hardware, software, procedures, data, and people, developed to address tasks faced by individuals and groups, typically within some organizational setting [50].

Another relevant term is "Information System" (IS) can be defined as a working system whose processes and activities are devoted to processing information, that is, capturing and transmitting, storing, retrieving, manipulating, and displaying information. Thus, an IS is a system in which human participants or machines perform work (processes and activities) using information, technology, and other resources to produce informational products or services for internal or external customers [51].

Combining project characteristics and IT objectives, Bannerman presents an "IT project" definition, IT projects are discrete and unique activities that serve as vehicles of multidimensional IT-based change [52].

The International Council on Systems Engineering (INCOSE) points out a factor that characterizes technology projects: Complexity. Complexity is a characteristic of more than just a technical system being developed. It is often created by the interaction of people, organizations, and the environment that are part of the complex system surrounding the technical system [53]. IT projects are different from and potentially more difficult than other engineering projects as they are characterized by high complexity and high chances of project failure. Some characteristics make them different from other engineering projects and increase the chances of their failure [54].

Most of the IT project characteristics are related to the fact that IT projects involve software. IT projects are often poorly defined, market pressures demand delivery in the shortest time. The rapid pace of technological progress in IT hinders expertise. The tendency to write new software code to perform well-established functions decreases reliability. IT projects involve numerous iterations and continuous interaction and their work are highly interdependent [54]. In addition to complexity, The Royal Academy of Engineering and the British Computer Society mentions lack of constraints due to the immateriality of the software, the software is effectively invisible, there is a visualization problem source of many potential IT project failures, the uncertainty that is generated because many IT systems seek to undertake or increase tasks previously performed by people; the majority of IT projects are undertaken to deliver some business or process change and require an understanding of the company and the processes concerned [55]. IT projects

contain a higher degree of novelty than other engineering projects. In particular, IT projects related to product innovation development are extremely complex, risky, and expensive endeavors [56].

In this study, IT projects include infrastructure, outsourcing, information systems (IS), and related projects as Enterprise Resource Planning (ERP) and Customer Relation Management (CRM). It is noticed that researches use the terms IS (for development or implementation) projects, IT projects, software (development) projects indistinctly.

2.4 IT Project success

In the IT project world, success studies were based on information systems success studies; Thus, several authors use TAM and TAM2 [57, 58] as their basis, these models explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. Another group of studies related to the measurement of information system success are based on DeLone & McLean IS Success Model; authors suggest an interactive and taxonomy model as a framework for information system success model [59, 60]. These information system studies have an orientation that links success to the product and user satisfaction.

The approach that includes project management success and information system success, is presented by studies that were based on the sum of the project theory and the theory of success of information systems [43, 61, 62].

Some authors, based on critical success factors (CSF) concept, define the few critical areas of activity in which favorable results are absolutely necessary for a particular manager to reach his or her goals [63].

A smaller number of authors have been based on other theories. Based on attribution theory, which represents an extensive examination of the perceived causes that many apply to events involving themselves or others [64]. Based on analytic hierarchy process (AHP), a method that uses a hierarchic structure to present a complex decision problem by decomposing it into several smaller sub problems, used to reflect the importance, or weights, of the factors associated to priorities [65]. Based on fuzzy cognitive maps (FCM) a modeling methodology for complex decision systems, which has originated from the combination of fuzzy logic and neural networks, describes the behavior of a system in terms of concepts such as entities, states, variables or characteristics of the system [66]. Based on grounded theory, theory in which insights emerge from the data rather than from researchers' preexisting theoretical concerns [26].

In the IT field, project success studies are carried out under the contingency approach. Critical success factors have been studied extensively with specific approaches. Some authors focused on a specific methodology [e.g. 7, 8], technology [e.g., 9, 10], stakeholder perspective [e.g., 11, 13, 26], specific group of factors [e.g., 9, 14], or others. It is noteworthy that the most studied type of project corresponds to ERP implementation projects, and more recently, there is a significant number of studies in projects that apply an agile methodology.

3. Methodology

To identify as much of the relevant literature as possible and to aim to present a fair evaluation of a research topic by using a trustworthy, rigorous, and auditable methodology, a systematic literature review appropriate for software engineering researchers were followed [67]. This study comprises three stages: planning, conducting, and reporting.

3.1 Research questions

The research questions are:

- RQ1: What is the definition of "IT Project Success" given by authors?
- RQ2: What are the critical factors for project success most referenced in IT project literature?
- RQ3: Which are the categories in which the critical factors for IT project success have been grouped?

3.2 Search process

The electronic databases searched in this review included those identified as relevant to Information Technology (IT): IEEE (Institute of Electrical and Electronics Engineers), ACM (Association for Computing Machinery); also, because IT is an interdisciplinary field, we looked in transversals databases: Scopus and Web of Science.

The search terms were constructed in four steps: 1) identification of key terms from the research question identifying the most appropriate terms, 2) identification of synonyms and acronyms, 3) terms combination using the "and" and "or" operators, and 4) adjust the search terms according to the terminology for each database.

Terms according to the research questions were included: "project success" and "project failure", since some authors study what must be done and others what should not be done, both looking at the success of the projects. To focus the scope in technology projects, "Information Technology" and "Information System" terms were used, followed by acronyms and synonyms like "IS", "IT", "ERP", "CRM", "HIS". Finally, finding answers to research questions, "factors" and "models" terms were introduced in the search. The final search strings used are shown in table 1.

Table 1. Search Strings

Source	Search string
IEEE Institute of Electrical and Electronics Engineers	("project success" OR "project failure") AND ("factors" OR ("Author Keywords": "models")) AND (("Author Keywords":"IT") OR ("Information Technology") OR ("Information System") OR ("software") OR ("ERP") OR ("CRM") OR ("HIS"))
ACM Association for Computing Machinery	((acmdlTitle:(+"project success") OR recordAbstract:(+"project success")) OR (acmdlTitle:(+"project failure") OR recordAbstract:(+"project failure"))) AND ((acmdlTitle:(+"factors") OR recordAbstract:(+"factors") OR (acmdlTitle:(+"models") OR recordAbstract:(+"models"))) AND(Title:(+"IT") OR recordAbstract:(+"Information Technology") OR recordAbstract:(+"Information System") OR recordAbstract:(+"software") OR recordAbstract:(+"ERP") OR recordAbstract:(+"CRM") OR recordAbstract:(+"HIS"))
Web of Science	(TI="project success" OR TS="project success" OR TI="project failure" OR TS="project failure") AND (TI=factors OR TS=factors OR TI=models OR TS=models) AND (TS="Information Technology" OR TS="Information System" OR TS=software OR TS=ERP OR TS=CRM OR TS=HIS)
Scopus	(TITLE-ABS-KEY ("project success") OR TITLE-ABS-KEY ("project failure")) AND (TITLE-ABS-KEY ("factors") OR KEY ("models")) AND (KEY ("IT") OR TITLE-ABS-KEY ("Information Technology") OR TITLE-ABS-KEY ("Information System") OR TITLE-ABS-KEY ("software") OR TITLE-ABS-KEY ("ERP") OR TITLE-ABS-KEY ("CRM") OR TITLE-ABS-KEY ("HIS"))

Several criteria were specified to select appropriate studies. These criteria are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Only journals will be included (books, doctoral papers, conferences are excluded). • Papers contain terms that match those defined in the search string. • Papers include the title, abstract, or content related to the topic. • Papers that included the study of factors. • Papers published in journals rated Q1, Q2, or Q3 in Scimago Journal Rank.	• Duplicated articles. • Papers in a language other than English. • Papers related to sectors other than IT. • Title and abstract review exclude articles that correspond to some specific success factors. • Exclude systematic reviews and meta-analysis. • Lessons learned reports based on expert opinion.

3.3 Search execution

Our search resulted in 920 potentially relevant articles (Fig. 1). Of these, 39 publications met our criteria.

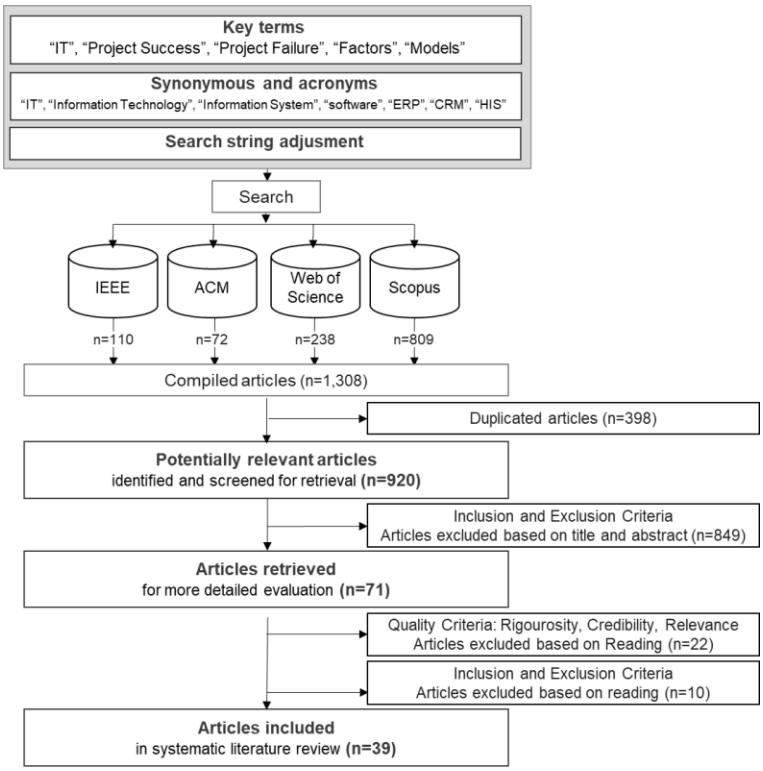

Fig. 1. Search Process. The process followed during articles selection and quantities found

The thirty-nine selected papers are listed in appendix A. In addition to the Scimago journal rank, as quality selection criteria, a quality assessment question list was defined to ensure alignment with the objective of this research. Each selected article will be evaluated according to (1) Rigor (quality of research methodology), (2) credibility (findings and conclusions are correctly presented and with a complete meaning), and (3) relevance (usefulness for the subject of our study). Eight questions cover the three criteria. The quality score ranged from 0 to 8. The scoring system used to determine the individual question score was: Yes (Y) = 1 point, Partial (P) = 0.5 points, No (N) = 0 points. The overall quality score was obtained, summing the eight individual question scores. Thus, the total quality score for each paper ranged between 0 (very poor) and 8 (very good). The quality questions and scores obtained from the included papers are listed in appendix B.

4. Results

All kinds of IT projects were found in the selected papers. Table 3 shows ERP is the most studied IT project type, followed by agile projects.

Table 3. Project Types Studied in IT Project Success Factor Literature

IT Project Type	Frequency	%
General	21	54%
ERP	12	31%
Agile	3	8%
CRM	1	3%
EIS	1	3%
Open-source	1	3%

The research approach used by authors is shown in table 4. The most significant number of studies is quantitative. The high number of studies are descriptive and explanatory. The analysis technique most used in the studies is the correlation analysis (24.4%) followed by the structural equation model with 14.3%. Other techniques are used, such as bayesian model, factor analysis, frequency analysis, among others.

Table 4. Types of Studies

Approach	No.	%	Type	N°	%
Quantitative	31	79%	Correlational	15	38%
			Descriptive	12	31%
			Explanatory	4	10%
Qualitative	5	13%	Case study	3	8%
			Interviews	2	5%
Quantitative & Qualitative	2	5%	Correlational & Interviews	2	5%
Conceptual	1	3%	Conceptual	1	3%

4.1 RQ1: What is the definition of "IT Project success" given by authors?

The types of definitions found are shown in figure 2; 30 of 39 authors did not specify a definition, and only 9 of 39 did a specific definition. Three authors did an intensional definition, providing a statement that establishes the essence of the concept, and six authors did an extensional definition (explaining the concept from a list of success criteria).

Three authors explicitly defined the 'Project Success' concept. "We define ERP project success as the use of such a project to promote effective deployment and enhance organizational effectiveness to which the project management efforts of the steering committee are crucial" [P10]. "The concept of 'success' was derived from a pilot study of practitioners and was 'defined' as (a) there is a project plan, (b) the project is well planned, (c) practitioners have a sense of achievement while working on a project, (d) practitioners have a sense of doing a good job (i.e., delivered quality) while working on a project, and (e) requirements are accepted by the development team as realistic achievable" [P13]. "Ensure successful competitive performance for the organization" [P36].

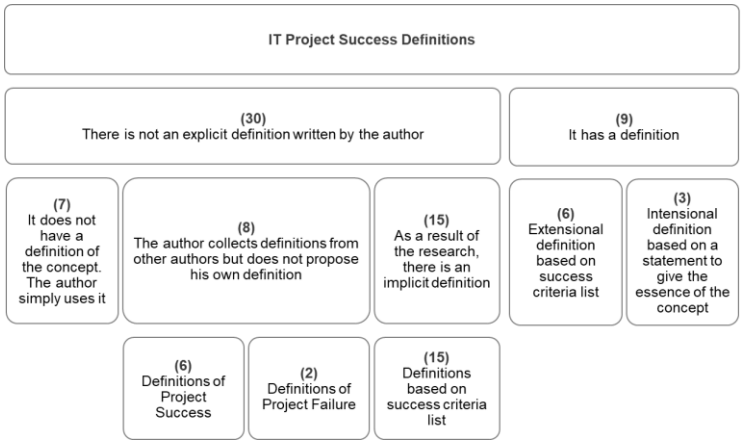

Fig. 2. Types of IT Project Success Definitions.

Several authors who defined extensionally based on success criteria included benefit and impact for the organization. "The success of project introduction is a multifaceted concept and, therefore, can be measured in various categories. These categories include introduction speed, visible and measurable business benefits, as well as the fast return of investments [P16]; "Our study defined success related to the extent that potential benefits were achieved, the costs associated with achieving those benefits, and the duration since going live [P27]. "Project success is defined as organizational impact and on time and on/under budget project completion" [P28]. "Success in ERP projects may be evaluated on traditional project-management metrics, such as on-time or on-budget performance, or based on business outcomes, such as information-processing benefits, effects on business operations, or impact on the business" [P30].

The authors do not agree on the same single definition of project success. Even thirteen authors who keep definitions linked to the iron triangle present some variant for the vertices; for the time vertex: time, schedule, adherence to schedule, within time, duration; for the cost vertex: cost, budget, adherence to budget, financial budget, within budget; for the third vertex there is a much more varied list. The list of criteria used in extensional definitions is shown in table 5.

Table 5. Project Success Criteria in Extensional Project Success Definitions

Process Performance	**Product Performance**	**Satisfaction**	**Benefits and Impact**
Time [P15], [P6], [P23], [P20]	Quality [P6], [P11], [P20]	User satisfaction [P1], [P15], [P26]	Benefits [P34]
On-time [P30]	Quality product [P1]	Customer satisfaction [P9]	Business perspective [P26]
On-time completion [P28]	Features [P23]		Economic value [P15]
Timelines [P11]	Functionality [P23]		Financial terms [P18], [P19]
Duration [P27]	Performance [P22]		Information-processing benefits [P30]
Cost [P6], [P27], [P11], [P20]	Product performance [P24]		Effect on business operations [P30]
Budget [P15], [P23]	System quality [P15]		Impact on business performance [P30]
On budget [P30]	Future needs [P19]		Business benefits [P16]
On budget completion [P28]			Return on investments [P16]
Under budget completion [P28]			Organizational impact [P28]
Scope [P11], [P20]			Potential benefits [P27]

Process Performance	Product Performance	Satisfaction	Benefits and Impact
Process efficiency [P9]			Process improvement [P19]
Process performance [P24]			
Project management [P15], [P22]			
Project metrics [P26]			
Project performance [P29], [P12]			

In the articles reviewed, we found ten authors who focus their study on determining success criteria. These studies take some initial relationship of success criteria and, by some method, establish the validity of them. Papers that consider success as a global variable or papers that use success variables without developing any validation on these variables were not included.

Table 6. Project Success Criteria Variables

No.	Success criteria	[P14]	[P7]	[P9]	[P10]	[P29]	[P15]	[P26]	[P13]	[P17]	[P12]	Times criteria
1	Customer satisfaction	X		X						X		3
2	User satisfaction				X		X				X	3
3	Adherence to budget	X				X						2
4	Adherence to schedule	X				X						2
5	Information quality				X		X					2
6	Process efficiency	X		X								2
7	System quality				X		X					2
8	Addresses a need		X									1
9	Budget		X									1
10	Business value							X				1
11	Competitive advantage									X		1
12	Contractor satisfaction	X										1
13	Customer is satisfied		X									1
14	Duration										X	1
15	Efficient task operations					X						1
16	Financial budget										X	1
17	Functionality		X									1
18	Goals achievement										X	1
19	Individual impact				X							1
20	Managerial effectiveness									X		1
21	Meeting functional requirements	X										1
22	Meeting non-functional requirements	X										1
23	Net benefits						X					1
24	Operational quality			X								1
25	Organizational impact				X							1
26	Practitioners have a sense of achievement while working on a project								X			1
27	Practitioners have a sense of doing a good job								X			1
28	Product is used		X									1
29	Productivity improvement									X		1

No.	Success criteria	[P14]	[P7]	[P9]	[P10]	[P29]	[P15]	[P26]	[P13]	[P17]	[P12]	Times criteria
30	Project stakeholder satisfaction						X					1
31	Quality		X									1
32	Quality of Project management process						X					1
33	Requirements are accepted by the development team as realistic/achievable								X			1
34	Resources savings									X		1
35	Scope										X	1
36	Service Quality						X					1
37	System is used by end-users	X										1
38	System Use				X							1
39	Team is satisfied		X									1
40	The ability to meet project goals					X						1
41	The expected amount of work completed					X						1
42	The project is well planned								X			1
43	The quality of work completed					X						1
44	There is a project plan,								X			1
45	Time		X									1
46	Use / Intention to Use						X					1
47	Use level of satisfaction							X				1
48	Within budget						X					1
49	Within specifications						X					1
50	Within time						X					1

The list of criteria determined by the authors is shown in table 6, this list is extensive, although there is a similarity among them. As an example, about the budget: ‘Adherence to budget’, ‘Budget’, ‘Financial budget’, ‘Within Budget’; in other cases, the similarity is found reading the description of the criteria consigned by the authors, as an example, Pankratz and Basten [P14] list as criterion ‘Process Efficiency’ and defines it as ‘Ratio of objective achievement to expended effort (budget, particularly human resources)’, whereas Subiyakto et al. [P17] in simple form list as criterion ‘Resources savings’. Besides, based on the variable name and description indicated by the authors, a single variable description has been compiled. This information is showed in table 7.

Based on the identification of similar definitions, fourteen criteria were synthesized (see table 7). Each of these fourteen criteria has been related to one of the five categories established by Gollner and Baumane [P15]. Four criteria were found that were not part of the initial list of criteria: process efficiency, goals achievement, the team is satisfied, and business impact; these criteria were included in the list in their corresponding category. An additional note, in the ‘economic value’ category, Gollner and Baumane included the criterion 'net benefits'; however, the description corresponds to what other authors called 'individual impact' or 'impact on users.'.

Table 7. Project Success Criteria and Category (Synthesized Variables)

Times Category	Success Criteria Category	No.	Success Criteria	[P14]	[P7]	[P9]	[P10]	[P29]	[P15]	[P26]	[P13]	[P17]	[P12]	Times Criteria	Criteria Definition
19	Project management	1	Scope / Specifications	X	X			X	X				X	5	[P14] Conformance between specified functional and non-functional requirements and their actual realization. [P15] Within specifications is testing whether the predefined specifications were achieved for go-live, goals of project were reached, and scope of project was kept. [P12] The actual scope of an implementation with respect to the planned implementation.
		2	Process Efficiency	X		X		X				X		4	[P14] Ratio of objective achievement to expended effort (budget, particularly human resources). [P29] efficient task operations. [P17] Resource savings.
		3	Goals Achievement					X			X		X	3	[P29] The ability to meet project goals. [P13] Practitioners have a sense of achievement while working on a project. [P12] The existence and achievement of project goals.
		4	Quality of Project Management						X		X	X		3	[P13] The project is well planned. [P17] Managerial effectiveness.
		5	Project Stakeholder Satisfaction	X					X					2	[P14] The contractor organization's stakeholders are satisfied with the project. [P15] For Project Stakeholder Satisfaction, the narrower definition of the term stakeholder is applied, focusing on the influencers and decision-makers of business or technological change, adopting the stakeholder approach to management.
		6	Team is Satisfied		X						X			2	[P13] Requirements are accepted by the development team as realistic/achievable. Practitioners have a sense of doing a good job.
12	User Satisfaction	7	User / Customer Satisfaction	X	X	X	X		X			X	X	7	[P14] Customer organization's stakeholders are satisfied with the project. [P10] User satisfaction records the satisfaction level as reported by system users, including information, software, interface, overall satisfaction, ERP project satisfaction, etc. [P15] User Satisfaction describes the user's level of satisfaction when utilizing an ERP system. [P12] Users' level of satisfaction from the system introduced.
		8	Use / Intention to Use	X	X		X		X	X				5	[P14] The developed system is deployed at the customer organization and is used by end-users after project completion. [P10] Use of ERP system refers to the frequency at which an information system is used. Items like the rate of using ERP to assist in making decision, charge for ERP system use, and amount of connecting time are examined. [P15] The success dimension Use/Intention to Use represents the degree and manner in which an ERP system is utilized by its users.
10	Time & Budget	9	On Budget	X	X			X	X				X	5	[P14] Conformance between planned and actual development cost. [P15] Within the budget is controlling whether the project budget within predefined specifications is not exceeded, the budget was used effectively and evaluates expenses for extra requirements. [P12] Financial budget with regard to the planned budget.

Times Category	Success Criteria Category	No.	Success Criteria	[P14]	[P7]	[P9]	[P10]	[P29]	[P15]	[P26]	[P13]	[P17]	[P12]	Times Criteria	Criteria Definition
		10	On-Time	X	X			X	X				X	5	[P15] Within Time is checking whether main milestones and go-live were reached in time with predefined specifications. It also includes the time span of the ERP project. [P12] The actual duration with respect to the assumed duration;
6	System Quality	11	System Quality		X	X	X		X					4	[P10] System quality denotes system performance like data accuracy, database contents, data currency, system accuracy, responses, etc. [P15] System Quality measures the information processing system itself / The success dimension Service Quality represents the quality of the support that the users receive from the IT department like training and consulting. It also measures the goodness of hotline or helpdesk provided by IT support personnel.
		12	Information Quality				X		X					2	[P10] Information quality refers to the quality of the IS product, such as believability of output, timeliness of output, the usefulness of output, understandability of output, and relevance of output. [P15] Information Quality measures the information system output.
6	Economic Value	13	Business Impact				X			X		X		3	[P10] Organizational impact requires the evaluation of changes caused by the information system to the organization, such as a decrease in operating cost, savings in labor costs, and growth in profits. [P26] The business improvements the system has introduced.
		14	Impact on Users				X		X			X		3	[P10] Individual impact refers to measuring the impact of the information system on individual users, reflected by job performance, individual productivity, decision quality, information awareness, inventory etc. [P15] Net Benefits, which roughly consist of Individual Impact, describing the measure of the effect of information on the recipient or user.

4.2 RQ2: What are the critical factors for project success most referenced in IT project literature?

In IT literature, there is not a single agreement among authors about what are the critical success factors. Thirty-four authors worked on the analysis of the critical factors for project success. Regarding the meaning and use of the factor term, there is no similarity among authors. There are coincidences in the detail of lists that some authors called characteristics, other cues, factors, or items.

There were 263 factors collected from the researches of these authors. The most cited factors: top management support (five times), change management (three times), internal communication and user involvement. However, since the number of factors is so high; it is necessary to find a mechanism that allows us to synthesize and better understand this large number of factors.

In this study, factors were worked as variables that can be defined conceptually and operationalized to be measured. In each factor, an attribute (characteristic, quality, or property) was identified that applies to an object (person, activity, artifact, or event). The sequence of steps followed to obtain the synthesized factors is detailed below.

a) Identification of articles that analyze success factors and present conclusive studies about the incidence of these factors in project success: 34 articles studied success factors ([P14], [P2], [P19], [P7], [P10], [P29], [P27], [P34], [P30], [P38], [P1], [P16], [P5], [P6], [P20], [P8], [P21], [P26], [P28], [P11], [P35], [P31], [P13], [P37], [P22], [P3], [P17], [P18], [P4], [P12], [P26], [P32], [P23], [P24]) and 5 articles studied failure factors ([P25], [P33], [P27], [P38], [P22]).

b) Factors that correspond to papers that study a specific group of factors were discarded. For example, the analysis is concentrated in a single factor project related motivation [P14], only technical factors linked to quality product [P8], only factors linked to project management methodology [P21], only factors related to staff [P26], only factors related to people [P3]. In addition, paper [P29] that studies four factors as categories and does not analyze factors in detail was discarded.

c) Success factors that, in their definition, are found that correspond to failure factors were discarded. For example, 'Business Case, estimating and financial management' defined as 'Poor business case definition; project benefits are not clearly defined or properly estimated and poor financial management'; 'Requirement and scope management' defined as 'Failings as a direct result of inadequate requirements definition or poorly managed scope creep during the project life cycle' [P2].

d) Factors that, in fact, are criteria of success and not factors were discarded. For instance: 'Fulfilling business' and 'Implementation goal'.

e) 'Factors' that were not variables that can be measured were discarded. For example, 'Project environment' without a definition It is not clear which is the attribute to measure; 'Project management and control', 'Project planning', 'Project definition process', 'Risk analysis', 'interface management', 'IT infrastructure', they are activities or resources and not factors.

At this point, the number of factors that result was 187.

f) Each factor was discomposed in an attribute and an object, identifying the attribute that is measured on the object. For instance, the factor 'maturity of the organization' is discomposed as attribute 'maturity' and object 'organization; 'experienced participants' is discomposed as attribute 'experience' and object 'participant'.

g) Attributes and objects with the same meaning have been synthesized. For example, 'Use of planning' factor, whose description indicates effective use of planning, is synthesized with the 'effective planning' factor, leaving a single attribute 'Effective/use of'; in the case of factors 'a clear project goal', 'clear responsibilities', 'clarity of the project', a single attribute has been synthesized as 'clarity'; also factors that have this implicit attribute have been added to 'clarity' attribute.

The number of attributes resulted in thirty-seven, while the number of objects in thirty-three. A double-entry consolidated matrix (attribute vs. object) was created, and each cell shows the number of times that attribute associated with that object is found. The final matrix is shown in table 8.

The most referenced attributes: 'involvement', 'support', 'communication',' knowledge and technical expertise', 'commitment' and so on are shown in upper rows (from top to bottom); while in left columns (from left to right) the most referenced objects are shown: team members, users, top management, consultants, organization, internal members, participants or stakeholders, project manager and more.

Regarding the most cited attributes, 'Involvement' is defined as playing a significant role, incorporation of point of view, the influence, and participation in important decisions. 'Involvement' means active participation throughout the project. Whose 'involvement' is expected? From users: "User involvement means that the end-user of the project outcome should be consulted throughout the project" [P6], 'the incorporation of the user's viewpoint into project management" [P22], from top management: "Top management awareness regarding the project goals and complexity, labor required, existing limitations, required capital investment and project inevitability" [P12], "The use of a champion in a significant role is important to project success. Projects reporting a significant role of a champion were more successful than those without champions or where the champion did not play a significant role." [P28]; from the team and participants: "The project manager and members of the implementation team are strongly involved in the implementation duties" [P12], "Coworker influence means that the project manager does not make important decisions without consulting with the team" [P6].

Table 8. Project Success Factors Expressed as Attributes That Impact Objects

Attributes	Team-members	Users	Top Management	Consultants	Organization	In-house/Internal/Intercompany	Participants or Stakeholders	Project Manager	Contractors/Suppliers/Providers	Techonology and IS	Project Organization	Planning	Project Management	Scope and Requirements	Changes and Deviations	Sponsor	Operational Processes	Tools e Infraestructure	Customers	Plan	Financial Resources	Agility Methodology	Implementation	IT area	Expectation Management	Crisis and Conflicts	Size and Complexity	Business case	Project Objectives	Schedule	Metrics	Software Selection	Control	Times
	Objects																																	
Involvement	1	7	2				2									2			1					1										16
Support		1	11	1																		1												14
Communication	1	1				6	1		1										1	1								1						13
Knowledge and Technical Expertise				5			1		1					1				1				1	1											11
Commitment			2		1	1						2				2																	1	9
Ability to Handle								1							3										1	2					1			8
Effective / use of												5	2					1																8
Capability	3	2		1																			1											7
Training	1	4				1											1																	7
Clarity / Definitions										1	2			1															1	1	1			7
Managerial Skills								1							2									2	1									6
Skills	3						1	1																										5
Availability							1											1			3													5
Adherence													1				2			1											1			5
Alignment and suitability										1	1																	1	1	1				5
Trust and Confidence				2				1	1																									4
Experience					1		1			1							1																	4
Maturity					3					1																								4
Environment quality	2				2																													4
Leadership								3																										3
Professionalism and Integrity	1						1																1											3
Competencies	2												1																					3
Politics and norms	1				1		1																											3
Culture					3																													3
Capacity	1																	1					1											3
Dedication Time	1							1						1																				3
Agreement or consensus														2						1														3
Structure and Responsibilities											3																							3
Soft Skills				2																														2
Emphaty				1					1																									2
Responsiveness				1					1																									2
Cooperation									1										1															2
Empowerment	1										1																							2
Quality									1													1												2
Compatibility										2																								2
Documentation and Methodology													2																					2
Reliabiity									1	1																								2
Times	18	15	15	13	11	8	9	8	8	7	7	7	6	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	1	1	187
	10%	8%	8%	7%	6%	4%	5%	4%	4%	4%	4%	4%	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	100%
	the most referenced objects for success factor (pareto 80%)															the less referenced objects (20%)																	

'Support' defined as to assist to; to give approval, comfort, or encouragement to; be actively interested in and concerned for the success of. Whose 'support' is expected? from top management: "Support from management, managerial experience, Position of the Board of Directors in the corporate organizational chart" [P1], "Top management support means that the project sponsor is actively involved in the project." [P6], "Top management adherence to project execution goals, participation in project trends formation, readiness to allocate resources and authority necessary for project execution." [P18], "In the close-knit SME work environment, management leads by example. Encouraging employees positively towards the project is just as important as providing sufficient resources" [P27], "Top management support for the project, and the management members' involvement in implementation duties" [P12].

'Communication' defined in the dictionary as the imparting or exchanging of information by speaking, writing, or using some other medium. Communication between whom? Mainly Internal-In house, team members, users, stakeholders, and suppliers are also indicated. 'In house communications' [P18], 'user-customer-contractor dialogue' [P22], "Internal communication means the communication within the project team" [P6], "Triggering effective communication" [P10]. Communication of what? Plan "working routines should be standardized and communicated to relevant personnel" [P6], 'communicating the case' [P34].

'Team members' is the most referenced object. This object is also often referenced with the name of participants, or internal or in-house members. What are the attributes that the literature points out that the team should have? These attributes are quite diverse; Capabilities and skills: "The implementation team consists of various people having high qualifications and knowledge about the enterprise" [P12], "The own staff company having necessary skills, knowledge, and experience regarding implementation project" [P18], "Skill level of the team remaining on the project through test/transition" [P22], "Skilled team refers not only to competent personnel in general but requires that the team as a whole covers relevant knowledge perform all tasks in the project." [P6], 'Team Capability (in terms of Timeliness and Cost)' [P11], "Integrity" [P17], "Skills and competencies of project members" [P16]; Time-dedication: "The work time assured for the implementation team members (work time schedule)" [P12]; Empowerment: "The empowerment of the project team members to make decisions and their high position in the enterprise hierarchy" [P12]; Environment (quality): "Team Environment (in terms of Quality)" [P6].

The results can also be read following the intersection between attributes and objects. The most referenced factor with eleven times frequency is 'support of top management' composed by attribute 'support' and object 'top management'; then 'user's involvement' with seven times; followed by 'internal communication' (six times) and 'knowledge and technical expertise of the consultants' and 'effective of planning' (five times).

4.3 RQ3: Which are the categories in which the critical factors for IT project success have been grouped?

Therteen authors worked on categories of success factors, mostly taking previous studies as a reference. Paper from Stankovic et al. [P20] was not included because they used the categorization of Chow and Cao [P11]. Paper from Karlsen et al. [P31] was included even though it takes categories proposed before by Belassi and Tukel [15].

The list of 41 different categories found in the literature is shown in table 9. Each author grouped factors following different criteria. In some cases, criteria names are similar and, in other cases, are quite similar to a word that accompanies it, and that introduces some specificity to the category.

Curcio et al. [P1] classify in three categories, factors related to individuals, technology, and organization. Some particularities: the support of top management is included in the category of organizational factors, not in factors related to individuals. It does not include factors related to project management and is very extensive in terms of factors related to technology; this is because its study focuses on factors related to software quality as an element of success in a software development project.

Two authors propose a more atomized grouping that includes seven categories, each group with an extensive list of factors. Amid et al. [P25] based on a list of forty-seven factors study the categorization of thirty-five factors, while Sudhakar [P39] based on a review of the literature studies categories and proposes a model that relates these categories. Both include the categories: organization, technical, and project management; besides, the first author includes: human resources, processes, managerial and vendors, and consultants, while the second also considers: communication, environment, product, and team.

Pecherskaya et al. [P18] present a double categorization of factors, first grouping them into key participants and key activities, and at the same time, classifies them as hard or soft categories. He is the only author who proposes a second grouping. This study emphasizes the relevance of soft factors.

A peculiar grouping is presented by Saadé, Dong, and Wan [P5]; the proposed categories are different from all other authors: engagement traits, education, and experience. These three categories seem to correspond to the grouping of attributes that impact on the different objects that are referenced in the factors.

Samuel and Kumar [P19] propose three categories: user group, internal support, and external support. Internal support category includes top management and project team, while external support includes vendors and consultants. In general, these categories refer only to crucial project participants.

The most uncomplicated grouping is of two categories. Sheffield and Lemétaver [P7] present project factors and project environment factors. Project environment factors category includes factors related to the organization and top management, while the project factors category includes factors related to management, the team, and the nature of the project (size, complexity, etc.).

Chow and Cao [P11] propose grouping through five categories and conclude with four relevant categories: organizational, technical, process, and people. There is a coincidence with other authors in the first three with the same category name and not in the fourth that authors call people; although the name of the 'people' category does not coincide precisely with other authors, it is similar to 'human resources', 'individual factors', 'team', 'key project participants' or 'related to implementation participants'. It should be noted that in the 'process' category it brings together factors related to project management as well as factors related to the development methodology; 'technical' category includes factors related to the technical activities for product development; the project category that was dismissed included factors related to the nature of the project.

Salmeron and Herrero [P36] raise three categories: human resources, information & technology, and system interaction, and authors propose a model of the relationship between these categories. As a result, it suggests that technical elements are less critical than information and human factors. The relevance of the information in this study may be due to the nature of an EIS type project.

Authors Subiyakto et al. propose three categories: project contents that gather factors related to the nature of the project (size, complexity, etc.), people and actions that include mainly soft skills as well as organization and culture of the team, finally, institutional context category includes organization-related factors.

Karlsen et al. [P31] propose four categories: related to the project, related to the project manager and the team, related to the organization and factors related to external stakeholders; in this last category, factors as environment and resources and provision of an appropriate network are included.

Other authors who worked categories are Procaccino et al. [P13]. Authors list seven categories and focus on three categories: sponsor or management support and participation, customer or user support and participation, and requirements management. These three categories are identified as a critical chain of events for success in the model presented authors.

Given that the list of categories is vast and overlapped, it is necessary to synthesize in a parsimonious list. Based on the categorization made by Chow and Cao: organizational, technical, processes, and people, categories of each author were transferred in the related category of the original based category list, either by similarity or by being included within. In addition, the category named 'processes' was renamed by 'processes and project management', this in order to make explicit that factors related to project management processes are included in that category.

Taking the relation of objects worked in question 3, these have been grouped following the categories proposed by Chow and Cao, getting the summary that is shown in table 10.

People category is the most referenced group of critical success objects and factors, followed by processes and project management factors.

To group the attributes list, hard and soft categories proposed by Pecherskaya et al. were used. "Soft" ones are difficult to measure and tend to be nonmaterial, ambiguous, related to the areas of human psychology and organizational behavior. "Hard" ones are more easily measured and are usually associated with uniquely interpreted phenomena [P18]. Table 11 shows the list grouped by hard and soft categories.

Table 9. Project Success Factors Categories in IT Literature

Categories	[P13]	[P36]	[P31]	[P12]	[P11]	[P25]	[P39]	[P7]	[P19]	[P18]	[P5]	[P17]	[P1]	Times
Organizational			X		X	X	X						X	5
Technical					X	X	X							3
Human Resources		X				X								2
Processes					X	X								2
Project			X					X						2
Project management						X	X							2
Communication							X							1
Customer/users	X													1
Education											X			1
Engagement traits											X			1
Environmental							X							1
Experience											X			1
External stakeholders			X											1
External support									X					1
Hard										X				1
Individual Factors													X	1
Information & Technology		X												1
Institutional context												X		1
Internal support									X					1
Key business activities										X				1
Key project participants										X				1
Managerial						X								1
People					X									1
People and actions												X		1
Product							X							1
Project contents												X		1
Project environment								X						1
Project manager and team			X											1
Related to implementation participants				X										1
Related to information systems				X										1
Related to the project definition and organization				X										1
Related to the project status				X										1
Related to top management involvement				X										1
Requirements management	X													1
Soft										X				1
Sponsor/management	X													1
System Interaction		X												1
Team							X							1
Technological													X	1
User group									X					1
Vendors and consultants						X								1

Table 10. Project Success Factors Categories and Objects

People									Organizational				Technical			Processes and Project Management																			Times
[P13], [P36], [P31], [P12], [P11], [P25], [P39], [P19], [P18], [P17], [P1]									[P31], [P12], [P11], [P25], [P39], [P7], [P17], [P1]				[P36], [P12], [P11], [P25], [P39], [P1]			[P13], [P12], [P11], [P25], [P39],[P1]																			
Team-members	In-house/Internal/Intercompany	IT area	Participants or Stakeholders	Project Manager	Users	Customers	Consultants	Contractors/Suppliers/Providers	Top Management	Sponsor	Organization	Size and Complexity	Agility Methodology	Tools e Infraestructure	Techonology and IS	Plan	Business case	Financial Resources	Project Objectives	Operational Processes	Scope and Requirements	Schedule	Metrics	Project Organization	Planning	Software Selection	Control	Implementation	Expectation Management	Project Management	Crisis and Conflicts	Changes and Deviations			
Objects																																		
84									32				14			57																		187

Table 11. Project Success Factors Categories and Attributes

			Times	
Soft	Involvement	**Attributes**	16	116
	Support		14	
	Communication		13	
	Commitment		9	
	Ability to handle		8	
	Effective / use of		8	
	Managerial skills		6	
	Trust and confidence		4	
	Experience		4	
	Environment quality		4	
	Leadership		3	
	Professionalism and integrity		3	
	Culture		3	
	Agreement or consensus		3	
	Soft skills		2	
	Empathy		2	
	Responsiveness		2	
	Cooperation		2	
	Empowerment		2	
	Skills		5	
	Competencies		3	
Hard	Knowledge and technical expertise		11	71
	Capability		7	
	Training		7	
	Clarity / Definitions		7	
	Availability		5	

		Times	
	Adherence	5	
	Alignment and suitability	5	
	Maturity	4	
	Politics and norms	3	
	Capacity	3	
	Dedication Time	3	
	Structure and responsibilities	3	
	Quality	2	
	Compatibility	2	
	Documentation and methodology	2	
	Reliability	2	
		187	187

Attributes related to the areas of human psychology and organizational behavior are the most referenced by the literature.

5. Discussion

Regarding question RQ1, the results reaffirm what is indicated by the literature regarding the lack of a consensual definition on the concept of project success. It is difficult to make a definition of project success, so the higher number of authors recourse to a list of criteria of success with which they try to explain the project success concept.

The criteria list that defines the success of a project is much broader than the traditional list: scope, time, and cost. In the definition of success, the authors include variables related to quality, functionality and product performance; they also include variables related to the satisfaction of the stakeholders, mainly user satisfaction; likewise, they include a broad extent criterion related to the benefit and impact produced by the project to the organization, mainly economic benefit.

It is to notice that, in the definition of project success through criteria, the list of criteria mentioned is even broader than the list of criteria that have been worked as variables part of a study. This difference may be because some criteria are difficult to measure; there are objective variables that are easier to quantify respect to other subjective variables such as satisfaction. In another case, the transcendence of the project is more challenging to measure with respect to the criteria that can be measured immediately after finishing a project; this is the case of all variables related to project impact and benefits.

No two authors have coincided in the same list of success criteria. This variety of definitions and criteria reinforces the idea that the qualification of a successful project by each stakeholder depends on perception. Stakeholders have a different perception of the achievement, of the objectives, of their interest; and this is the reason why various studies have been carried out of the success linked to perception from the point of view of each stakeholder, linked to the cultural perspective, linked to the stages of the project, etc. The grouping of criteria of success through five categories that Gollner [P15] makes is a quite complete categorization since the full and varied list of criteria of all the authors easily fit into the five groups: Project management, Time & budget, user satisfaction, system quality, and economic value. This grouping goes well with the grouping made by other authors who distinguish process management success and product success. In this case, IT project management author includes Project management and Time & Budget as part of Project management success, user satisfaction, and economic value as part of the product success, and finally, the system quality group as part of project and product success. Figure 3 shows a summary of the criteria and their categorization.

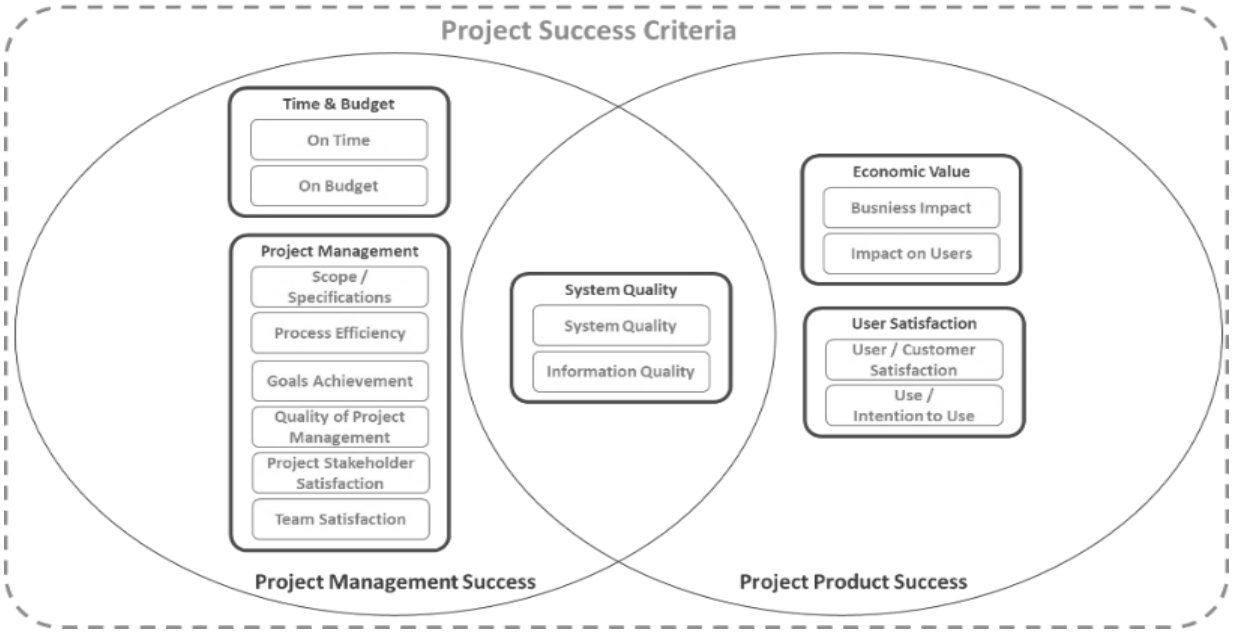

Fig. 3. Project Success Criteria. Variables and Categories.

This synthesis of IT project success criteria can be used to construct a scale of measurement of success specific to information technology projects.

As seen in the theoretical foundation, project success is a multi-dimensional concept depending on criteria, stakeholder perception, the context, and the moment the project is found.

This measurement scale could be developed considering as context the four bases to analyze projects proposed by Shenhar Novelty, Technology, Complexity and Pace (NTCP), since these four elements fit the described characteristics of IT projects, which are often innovative, highly complex and generally urgent. This aligned with the contingency theory that suggests considering contextual factors.

A measurement scale as an instrument will allow the project manager or project management office to more accurately assess the success or relative failure of their projects.

The significant number of factors existing in the literature and the little coincidence in some of them, has led to continuing searching for new ways to understand the problem. The most referenced factors were the support of top management, user involvement, and internal communication. These critical factors are quite similar to the factors identified by the widely cited authors Pinto and Slevin [68]; they include top management support, client consultation, and communication.

About questions RQ2 and RQ3, factors are numerous and overlapped. To solve this concern, this paper synthesized these factors through the decomposition of variables into attributes and objects to find which are the most relevant objects and which are the most referenced attributes to achieve success.

As a result of this classification (see tables 10 and 11), a crossed summary is shown in table 12. The most referenced factors are the soft attributes of people. This finding is not new, Belout [31] already in 1998 said that projects should not be seen only as technical systems but also as behavioral systems highlighting the importance of human resources factors. People's aspects have the most substantial impact on success or failure result.

The soft attributes (behavioral) are seen as general in the participants and the organization (e.g., skills of team members, user's involvement), as well as applied to specific management processes (e.g., the ability to manage change and

deviations, commitment to planning). The importance of the study of human behavior in IT projects for the achievement of success was already expressed in some researches; For example, in one study, 19 behaviors are grouped from 127 initially collected behaviors [69], other studies point out the relevance of the behavior and soft skills of the project manager [70, 71]. The identification of human factors as critical factors for the success of information technology projects is aligned with the characteristics of the technology projects that were described in the background.

In relation to complexity as the main characteristic of IT projects, it is often created by the interaction of people, organizations, and the environment. IT projects involve numerous iterations and continuous interaction, and their work is highly interdependent. It is this strong interaction of people, which implies the need for excellent people management, leadership, gain trust between them, excellent communication, involvement, commitment, and participation.

The uncertainty generated because of a poorly defined and lack of constraints. Due to the immateriality of the software, the software is effectively invisible, and there is a visualization problem source of many potential IT project failures. The abstract nature of the projects leads to different perceptions of each stakeholder, and these make understanding and communication difficult. Uncertainty is also generated because many IT systems seek to undertake or increase tasks previously performed by people. Again, given this characteristic, it is necessary to achieve excellent communication, trust, and involvement of the team with the needs of the client to understand the business and the processes in question.

The high degree of novelty of IT projects, the rapid pace of technological progress, and the urgency with which technology projects are worked, because generally market pressure demands delivery in the shortest time, leads to requiring an additional commitment of the team, cooperation, and support.

Table 12. Grouping of Objects and Attributes.

		People	Organizational	Technical	Process and Project Management	
		Objects				
Soft	Attributes	57	28	3	28	116
Hard		27	4	11	29	71
		84	32	14	57	187

An unexpected result is a low reference to technical factors. This could be since, in some instances, the interviews are directed to the project managers and sponsors, who may have a bias towards the elements closest to them.

6. Conclusions and future work

This paper presents a systematic literature review of IT Project studies on success factors and analyzes 39 papers studying success definition, success criteria, success factors, and success factors categories.

There is no single definition of project success. Authors define project success based on criteria related to the project management, product quality, stakeholder's satisfaction, and benefits of the project; the business impact criteria have been less studied; this may be due to the greater difficulty of measuring this variable.

While the criteria related to management can be similar in all types of projects, in the IT literature; the criteria related to the product have particular relevance: the quality of the system and the quality of the information that the system generates, the satisfaction of the user and the intention of using the system; as well as the impact that the product brings

to the organization and users, this aligned to the majority of IT projects involve software and are undertaken to deliver some kind of business or process change.

The IT project success literature shows no convergence in terms of the factors and their definitions, for example, participants or team members are used indistinctly; likewise, it shows overlap in its scope, for example, skills or soft skills or competencies.

In the most traditional list, the factors that receive the most mentions are top management support, user involvement, internal communication, knowledge and technical expertise of the consultants, and effective planning.

In a new way of view this list, the analysis of factors as variables composed of attributes that apply on objects, the most mentioned attributes are involvement, support, communication, knowledge, and technical expertise, and commitment. The most mentioned objects are the team members, users, top management, consultants, organization, participants, Project manager, and providers. This proposal of a structure (attributes vs. objects) to synthesize the information of factors constitutes a contribution of this investigation; previous works mainly present the factors as lists.

After grouping these factors, soft attributes take particular relevance, since they apply to people, organizations, and to project management processes. Soft skills or people skills are the most important critical factor for IT projects. The characteristics of IT projects lead to the need to manage human resources as a critical factor in achieving success in information technology projects. This research contributes to reinforcing the need to develop soft skills in technological project teams.

As future research topics, it is suggested work in studying a model for IT project success and explain how soft skills can influence in most essential objects to achieve desired project success. Similar way, it is suggested work in studying a model to explain which and how each soft skill can influence in each IT project characteristic. This will allow a better selection of the work team, involving professionals with skills better aligned to the nature and context of the project.

Although the search for articles was intended to cover all types of technology projects, the most significant number of articles were indeed found related to development projects or information systems implementation. This is a limitation of this study since very little or no literature was found on certain types of projects.

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Appendix A. Systematic Review Selected Papers

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Appendix B. Quality of studies

	1 Is the paper based on empirical research?	2 Is there a clear statement of the aims of the research?	3 Is there an adequate basis for the hypotheses?	4 Was the research design appropriate to address the aims of the research?	5 Was the data collection appropriate to the aims of the research?	6 Was the data analysis sufficiently rigorous?	7 Is there a clear statement of findings?	8 Is the study of value for research or practice?	Total Score
[P1]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P2]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P3]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P4]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P5]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P6]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P7]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P8]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P9]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P10]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P11]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P12]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P13]	Y	Y	Y	Y	Y	Y	Y	Y	8.0
[P14]	Y	Y	Y	Y	P	Y	Y	Y	7.5
[P15]	Y	Y	Y	Y	Y	P	Y	Y	7.5
[P16]	Y	Y	Y	Y	Y	P	Y	Y	7.5
[P17]	Y	Y	Y	Y	P	Y	Y	Y	7.5
[P18]	Y	Y	Y	Y	Y	P	Y	Y	7.5
[P19]	Y	Y	P	Y	Y	Y	Y	Y	7.5
[P20]	Y	Y	Y	Y	P	Y	Y	Y	7.5
[P21]	Y	Y	Y	Y	P	Y	Y	Y	7.5
[P22]	Y	Y	P	Y	Y	Y	Y	Y	7.5
[P23]	Y	Y	Y	Y	Y	Y	Y	Y	7.0
[P24]	Y	Y	N	Y	Y	Y	Y	Y	7.0
[P25]	Y	Y	N	Y	Y	Y	Y	Y	7.0
[P26]	Y	Y	P	Y	P	Y	Y	Y	7.0
[P27]	Y	Y	Y	N	Y	Y	Y	Y	7.0
[P28]	Y	Y	Y	Y	P	P	Y	Y	7.0
[P29]	Y	Y	N	Y	Y	P	Y	Y	6.5
[P30]	Y	P	P	P	Y	Y	Y	Y	6.5
[P31]	Y	Y	N	Y	Y	P	Y	Y	6.5
[P32]	Y	Y	N	Y	Y	Y	P	Y	6.0
[P33]	Y	Y	N	Y	P	P	Y	Y	6.0
[P34]	P	Y	P	Y	P	P	Y	Y	6.0
[P35]	Y	Y	N	Y	Y	Y	N	Y	6.0
[P36]	Y	Y	N	Y	P	Y	Y	P	6.0
[P37]	Y	Y	P	P	P	P	Y	Y	6.0
[P38]	Y	Y	N	P	P	P	Y	Y	5.5
[P39]	Y	Y	N	Y	N	N	Y	Y	5.0

Biographical notes

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