

Empirical Research Paper

Linking information systems team resilience to project management success

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ABSTRACT

Team resilience is a critically essential contributor to team effectiveness. However, the impact of team resilience on project management success has been little studied. This article aims to investigate the influence of team resilience on project management success in the context of information system projects. Using a quantitative study, we show that there is a significant positive relationship between project team resilience and project management success. As a result of this finding, we stress the importance of developing actions to promote team resilience to increase the likelihood of project management success, particularly in unstable environments.

1. Introduction

An Information Systems (IS) project is a temporary endeavor undertaken to improve an organization (e.g., a company) through the use of Information Technology (IT) (Varajão, 2018; Varajão et al., 2022). A major attribute of IS projects is their socio-technical nature, and they can take on many forms, such as digital transformation endeavors (Escobar et al., 2023), IT/IS custom development (Cadle and Yeates, 2008), IS consulting (Cadle and Yeates, 2008), or commercial off-the-shelf application deployment (Meneses and Varajão, 2022).

Effective teams are one of the most influential success factors of IS projects (Rehman et al., 2020), and in recent years there has been a growing interest in studying team resilience contributors (Chapman et al., 2020). Team resilience is defined here as a project team's ability to recover from and adapt to shocks and potentially improve performance (Linkov and Trump, 2019).

Different tiers of resilience analysis have been developed based on empirical studies (Aldrich, 2012). For example, recently, Pavez et al. (2021) have shown that affect-based trust and group potency positively relate to project team resilience, and Linkov et al. (2018) propose an approach for resilience assessment that can be integrated into the existing regulatory processes.

Despite the growing interest in studying resilience, there is still a limited understanding regarding project team resilience (Alliger et al., 2015; Chen and Zhang, 2021; Hartmann et al., 2020a,b; Naderpajouh et al., 2020; Thomé et al., 2016); in fact, little attention has been paid to

resilience in teams (Duchek et al., 2021) and, in particular, little is known about the impact of team resilience both on team performance (Naderpajouh et al., 2020) and on project management success. This gap is particularly noticeable in the IS arena.

Moreover, the magnitude and degree of environmental instability affect the likelihood of major disruption events that might affect the projects' lifecycle execution, project management performance, and the attainment of the project's predefined outputs, outcomes, and benefits (Blay, 2017). Disruption can be seen as a large-scale event that can profoundly affect the organization's or endeavor's performance (Fasey et al., 2021). Those events pose increasing challenges to organizations' lasting prosperity and development over time (Chen et al., 2021a,b), and teams are typically charged with creating and enacting organizational responses to them (Kaplan and Waller, 2018). One example of a large-scale global disruptive event was the COVID-19 pandemic in 2020, whose multifaceted impacts we are still experiencing today. Thus, if it is important to understand the relationship between team resilience and project management success under the so-called "normal" or "stable" environmental conditions, it is then critically vital in the context of "high clock speed" environments (Pinsonneault and Choi, 2022) and disruptive times like the one we are currently experiencing, where events such as pandemics are constantly challenging project teams' resilience (Floetgen et al., 2021).

This article aims to fill the literature gap by presenting a study on the influence of team resilience on project management success. The underlying research question is: Does team resilience influence project

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management success in information systems projects? We hypothesize that project team resilience is correlated to project management success (i.e., to the degree of efficiency and effectiveness of the management process), and the effect size varies according to the project's environmental stability.

The research approach is quantitative within a cross-sectional study (Neuman, 2014; Saunders et al., 2019). Three questionnaire-based surveys were administered to collect data for the theoretical model's empirical validation in stable and unstable project environments. Team members from IS projects carried out in an academic setting between February 2019 and May 2021 were contacted (at the end of their projects) to invite them to participate in the survey. Despite the context's specificities, since projects were carried out by teams of students enrolled in a master's program, the projects shared the same characteristics as other professional projects: they have a context and the objective of improving real organizations (i.e., they were not a mere assignment which a professor then marked), with project management success being indexed to stakeholder satisfaction (primarily client satisfaction). The data were analyzed using descriptive and inferential statistics.

Organizations are increasingly geared toward implementing their strategic objectives through projects. However, the incidence of disruptive events limits organizations' ability to implement their projects. In fact, these events can profoundly affect project technical feasibility, budget execution, planned time to market, and even, in some cases, the need to abort the project. The absence of a resilience-oriented organizational culture for the project team can greatly hamper the organization's ability to achieve success and, at the same time, constrain the project's contribution to creating value and generating benefits (Rahi, 2019). Therefore, it is of utmost importance to understand the influence of team resilience on project management success in both stable and disruptive contexts. Our results contribute to a better understanding of this phenomenon.

The remaining content of the paper proceeds as follows. We first review the relevant literature and develop the hypotheses of the impact of team resilience on project management success. After outlining the research method, we describe and discuss the empirical findings from the statistical tests performed. Finally, the article concludes by presenting the main implications of these findings on theory and practice, its limitations, and future work.

2. Background

2.1. Team resilience

The personal ability to properly overcome setbacks and deal with unexpected events by focusing on a set of actions to compensate for the effects of damaging circumstances requires a specific set of competencies, experience, and attitudes (Furniss et al., 2011), which can be designated as individual resilience (Zautra et al., 2010). Resilience shortens the recovery period for individuals and ensures a strengthened will, as well as an increased repository of resources for future situations (Carmeli et al., 2013).

Individual resilience is related to team resilience (Hartwig et al., 2020), and some mechanisms of team resilience are similar to those pointed out at the individual level. To successfully overcome disruptive situations, teams need to develop resilience capabilities (Duchek et al., 2019). However, the dimension of teamwork and the interactions among its members raise new aspects that need to be adequately considered to measure their dependency and impact on the team performance (Mathieu et al., 2008; Varajão et al., 2021).

Resilience has been recognized as an important phenomenon for understanding how individuals and teams overcome difficult situations (Bowers et al., 2017). Team resilience can be defined as the team's intrinsic ability to deal with problems (Carmeli and Markman, 2011), overcome obstacles, or resist excessive pressure caused by adverse

situations (e.g., the loss of a team member) without collapsing (Lengnick-Hall and Beck, 2009); this capacity allows the team to successfully adjust to a new set of tasks and increase reliability, longevity, and overall performance (Bandura, 1997). Resilience can be improved through a set of actions that make the team more or less resilient (Amaral et al., 2015), protecting it from the potential adverse effects of stressors or disruptive events it may encounter throughout the project lifecycle (Morgan et al., 2015).

Team resilience can also be defined as an emergent state reflecting a team's capacity to bounce back from adversities or setbacks (Brykman and King, 2021; Stoverink et al., 2020). Bowers et al. (2017) conclude that resilience is the result of a dynamic process that affects and is affected by other salient team variables. The level of team bonding can empower teams to overcome issues that might impact the project's goals; these bonds can also improve learning possibilities and provide insights to boost adaptability when experiencing disruptions or setbacks (Morgan et al., 2015; van der Beek and Schraagen, 2015).

Some authors propose theoretical models and scales suitable for measuring team resilience. van der Beek and Schraagen (2015) present ADAPTER, a questionnaire driven by four essential abilities of resilience (responding, monitoring, anticipating, and learning). Stoverink et al. (2020) propose a theoretical model of team resilience that aims to clarify the meaning of the work team resilience construct and illustrates how it emerges in an interdependent fashion via critical team-level resources and how it unfolds over time through team processes. Sharma and Sharma (2016) present a scale to assess the team resilience capacity via four major constructs: mastery approaches, group structure, social capital, and collective efficacy. Varajão et al. (2021) propose a theoretical model for explaining team resilience and a scale that includes the factors of trust and solidarity, focus on results, commitment, management and accountability, embracing conflicts, work conditions, and skills and behaviors. In our study, we adopted the scale by Varajão et al. (2021) since it was empirically tested with IS projects data, as is the case of our research.

2.2. Project success and project management success

Dvir et al. (2003) emphasize three main points for measuring a project's success (or failure): the implementation process, the project's perceived value, and the client/customer satisfaction level with the project's outputs. Moreover, according to Shenhar et al. (1997), there are four dimensions of success: project efficiency, impact on client/customer, business success, and preparation for the future.

The project efficiency dimension is a short-term metric that focuses on how efficiently each project process was managed. It highlights projects that were completed on time and within budget. While this is a mark of quality in project management, it does not ensure enhanced benefits, which are vital to achieving long-term project success (Slevin and Pinto, 1987; Varajão et al., 2022).

The impact on clients/customers and/or end-users is deeply related to the perceived value obtained by ensuring fulfillment of the needs and requirements defined by them (Pereira et al., 2022). Client/customer satisfaction can also be related to follow-up approaches to facilitate feedback on projects or even new versions of the same product or outputs that can improve the organization's success.

According to the Project Management Methodology (EU, 2018), the success of a project is achieved when objectives are realized, and all deliverables are produced and accepted by the project client. Turner and Xue (2018) consider that a project is successful when there are relevant benefits, based on deliverables and schedule and budget compliance. Other authors include the quality (in addition to schedule and budget) to measure project success (Collins and Baccarini, 2004; Yeong and Lim, 2010).

Baccarini (1999) bases success on two components: product success and project management success. On the one hand, project management success focuses on the management process and mainly on the successful

execution of the project in the three dimensions of scope, time, and cost, which indicates its degree of efficiency and effectiveness. On the other hand, product success mainly focuses on the effects of the project results in the post-project stage. This article focuses on project management success following [Baccarini \(1999\)](#)'s perspective by considering the triple constraint and stakeholder satisfaction in evaluating success.

3. Research model and hypotheses

Our research addresses the influence of team resilience on the success of IS project management. As shown in [Fig. 1](#), the conceptual model is composed of two main variables: Project Management Success – the dependent variable – regards scope, time, and cost compliance, as well as deliverables quality and stakeholder satisfaction (mainly client satisfaction) ([Baccarini, 1999](#); [Pereira et al., 2022](#)); the independent variable, Team Resilience, relates to team resilience in relation to trust and solidarity, focus on results, commitment, management and accountability, embracing conflicts, work conditions, and skills and behaviors ([Varajão et al., 2021](#)). In [Fig. 1](#), the effect of environmental stability on the relationship between team resilience and project management success is also considered. The arrows in the figure represent the hypotheses to be tested empirically.

Projects are becoming more complex, which gives rise to a context of adversity ([Morcov et al., 2020](#)). Being resilient in such an environment entails having the necessary skills to deal with the unknown transformation and adjust processes ([Klein et al., 2015](#)). To maintain progress and achieve success in project management, project teams must be able to recover from setbacks, i.e., they need to be resilient ([Karlsen and Berg, 2020](#)). Hence the following hypothesis:

H1. Team Resilience is positively related to Project Management Success.

Problems in a project are common and often affect performance, primarily due to unforeseen scenarios and situations that increase uncertainty ([Huemann and Martinsuo, 2016](#)). Thus, the influence of team resilience on project management success is expected to be positive even in the case of projects carried out in (more) stable environments, such as the pre-pandemic context. On the other hand, considering that team resilience is a key attribute when organizations are faced with emergencies and need to implement suitable responses to ensure desired

outcomes before and after a crisis ([Trijp et al., 2018](#)), we hypothesize that the effect of the positive influence of team resilience on project management success is greater in such unstable contexts (e.g., projects carried out in person, forced to move to remote work due to a disruptive event such as COVID-19 that brings uncertainty to the project execution). Thus, the following hypotheses:

H2a. The relationship between Team Resilience and Project Management Success is stronger when working in unstable environments.

H2b. The relationship between Team Resilience and Project Management Success is weaker when working in stable environments.

4. Method

4.1. Measurement

The measurement items used in our research are based on relevant literature. We adopted items identified in previous studies to enhance validity (by using tested and proven measures). Team resilience was measured using the scale proposed by [Varajão et al. \(2021\)](#) to calculate a Team Resilience index for each surveyed project. A Project Management success index was also calculated, taking as criteria scope, time, and cost compliance, as well as the quality of deliverables and stakeholder satisfaction (including sponsor and client satisfaction), following the work of [Baccarini \(1999\)](#) and [Pereira et al. \(2022\)](#). The measuring items presented in [Table 1](#) were taken and adapted from the original sources to create the research instrument (questionnaire). For instance, the item “Ensuring adequate working conditions” was presented in the questionnaire as “Adequate working conditions were ensured in your project.” The items used in this study were measured using a seven-point Likert-type scale (1 = “I strongly disagree” to 7 = “I strongly agree”).

4.2. Measurement assessment

Although our study used identical items to those in [Varajão et al. \(2021\)](#), [Baccarini \(1999\)](#), and [Pereira et al. \(2022\)](#), thus taking advantage of previous validation, we examined the context validity of the questionnaire before the survey was conducted. Four IS and project management professors and five IS project managers pilot-tested the surveys. Considering the feedback obtained, we concluded that no

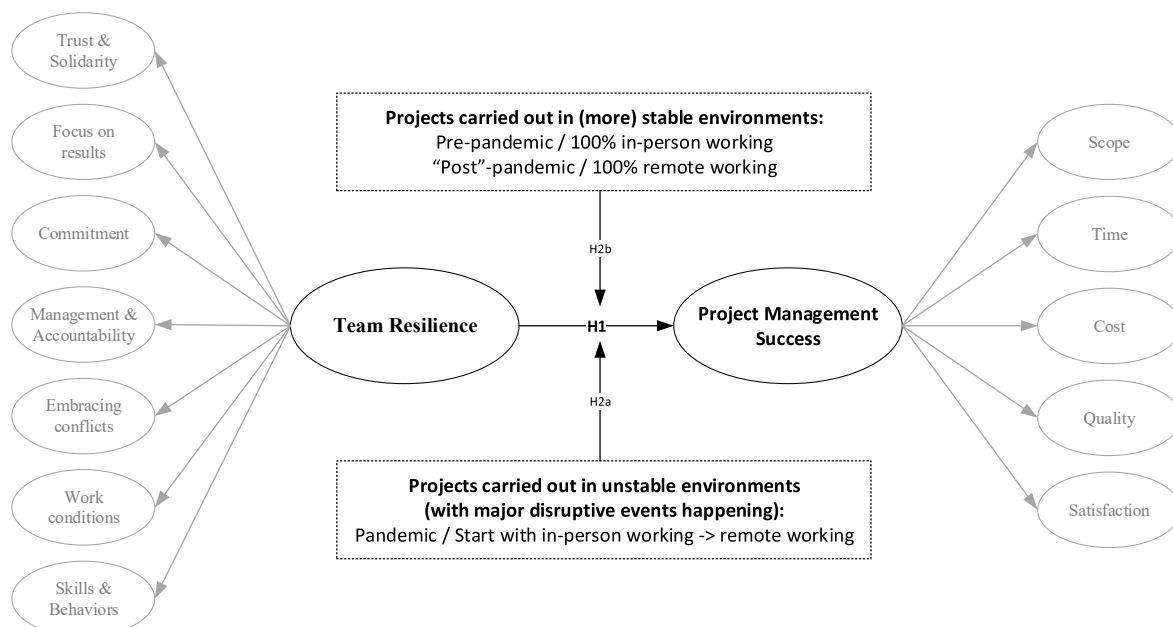


Fig. 1. Conceptual model.

Table 1
Measuring items.

Constructs	Items	Adapted from
Team Resilience Trust & Solidarity	<i>Team Resilience index</i> (calculated) Minimizing individualistic behavior in favor of teamwork results Empowering project team (give decision-making power to team members) Promoting solidarity between project team members during work development Encouraging project team members' autonomy and versatility Promoting collaboration among project team members Developing project team building	Varajão et al. (2021)
Focus on results	Establishing specific indicators regarding project results Ensuring systematic feedback on project results Focusing team effort on project results Seeking to minimize project ambiguities	
Commitment	Helping each team member to perceive the usefulness of their work Ensuring that low-performing team members feel the need to improve Involving the project team in project plan development Encouraging all project team members to put forward their ideas and making them feel that their ideas are taken into account Aligning all project team members with the project's objectives Implementing a philosophy of participatory project management Implementing proper motivation systems	
Management & Accountability	Minimizing disturbances during the project lifecycle (e.g., lack of information, rumors, etc.) Reporting priority activities to each team member Controlling project progress and highlighting any default by the team Performing project control in close proximity to the project team Avoiding bureaucracy in project management Identifying the best strategy for project execution Implementing project risk management processes Helping the team to manage change properly Implementing effective communication processes	
Embracing conflicts	Identifying and clarifying acceptable and unacceptable behaviors of team members (e.g., sarcasm, bias, etc.) Identifying and eliminating barriers to project execution (e.g., physical environment conditions such as temperature, noise level; interpersonal relationships; unsolved issues from the past; antisocial behavior, etc.) Promoting active listening by all project team members Placing team interest always before personal interest Encouraging project team members to recognize their weaknesses and mistakes Promoting requests and acceptance of excuses among project team members	

Table 1 (continued)

Constructs	Items	Adapted from
	Reinforcing the need for team members to always give the benefit of the doubt before drawing negative conclusions	
Work conditions	Ensuring redundancy of non-human resources (e.g., equipment) Establishing a flexible work schedule to address the needs of each team member Providing opportunities for project team continuous learning Stimulating a positive and loyal project team environment Ensuring adequate working conditions	
Skills & Behaviors	Setting up teams with the necessary competencies to perform project activities Providing training to develop the necessary competencies for the project Developing individual resilience of project team members Identifying the most important behavioral characteristics of each team member to "strengthen" the project team Identifying the most important behavioral characteristics of each team member that can "weaken" the project team Promoting the ability of project team members to learn from mistakes Encouraging assertiveness among team members (e.g., "talk about what should be said") Promoting recognition, appreciation, and use of the talents and competencies of each team member	
Project Management Success	<i>Project Management Success index</i> (calculated) Scope Time Cost Quality Satisfaction (stakeholders)	(Baccarini, 1999; Pereira et al., 2022)

refinements to the questionnaire were needed.

Cronbach's Alpha was computed to test the reliability and internal consistency of the responses. Cronbach's Alpha ranged from 0.756 (Team Resilience – Focus on results) to 0.930 (Team Resilience – Commitment), which is considered a good value since all constructs scored above 0.7 (Cohen, 1988), indicating a high degree of internal consistency of responses.

4.3. Data

Hypotheses testing is based on a cross-sectional sample of information systems projects. This data was collected at three different points in time over three years. The project teams of 71 IS projects developed in an academic setting were contacted to participate in the survey in 2019 (dataset 1: pre-pandemic projects carried out 100% in-person), 2020 (dataset 2: projects carried out in-person in the first month during the pandemic, and then conducted via remote working due to the Coronavirus outbreak, facing high uncertainty in the wake of this disruptive event), and 2021 (dataset 3: "post"-pandemic projects carried out 100% via remote working).

Despite the context's specificities, since projects were carried out by teams of students enrolled in the project management course of a master's program on information systems engineering and management, the projects shared the same characteristics as other professional projects,

with project management success being indexed to stakeholder satisfaction (primarily client satisfaction). Projects were carried out in a “real” environment: all the projects had a client, which could be internal (from the university) or external (e.g., a company); and the main objective was to contribute to improving an organization. In each team, one student assumed the role of project manager, following project management best practices (including classical, agile, and hybrid approaches, depending on the project characteristics). The project teams ranged from five to six members (for a total of 376 members), all having a degree in IS engineering and IT proficiency.

The completion of this project management course in the master’s program not only facilitates student mobility beyond the university but also exposes them to an environment conducive to honing skills that extend beyond academia (Benson and Chau, 2019). Moreover, it enhances the likelihood of students securing employment as project managers upon course completion (Hurn, 2016).

Participants were asked to fill out an online questionnaire regarding team resilience in their projects, and strict confidentiality of individual responses was assured. As in many other studies, this data-gathering method can be a source of bias, mainly response bias (in this case). This occurs when participants do not answer the questionnaire accurately due to factors such as social desirability. For instance, respondents may lie or omit information to avoid judgment. This was minimized by clearly communicating the research objective and clarifying that it does not influence the project evaluation.

The project management success index for all projects was reported by the project evaluators (two professors responsible for the projects), who were the same for all the projects. Note also that the used criteria and evaluation procedures were the same in all reported years (including listening to the client).

A total of 373 team members completed the questionnaire. Thirteen of these questionnaires were not used in the analysis due to incomplete responses or outliers (resulting in removing three projects), thus yielding a final response rate of 95.75% (corresponding to 360 valid questionnaires and 68 projects). Table 2 presents the demographics of participants and projects.

Most of the respondents are male (68.9%). The respondents participated in projects classified into three types: IT/IS custom development (50.0%); IS analysis (27.9%); IS consulting (22.1%). The project’s average duration was three months.

4.4. Data analysis

The unit of analysis in our study is the project team. After collecting data, the team resilience index was calculated for each project as an average of all project team members’ responses (to improve reliability). Correlations were computed to investigate if there was any statistically significant association between team resilience and project management success. Since the assumption of normality of the variables was violated, the nonparametric Spearman rho statistic was calculated (Cohen, 1988). The Spearman rho was first calculated using all the data (from the three

Table 2 Demographics of participants and projects.

	Dataset 1 (2019)		Dataset 2 (2020)		Dataset 3 (2021)		Total data	
	Number	%	Number	%	Number	%	Number	%
Projects								
Number of projects/teams	25	36.8	19	27.9	24	35.3	68	-
Team elements	129	35.8	97	26.9	134	37.2	360	-
Participant gender								
Male	91	70.5	69	71.1	88	65.7	248	68.9
Female	38	29.5	28	28.9	46	34.3	112	31.1
Project type								
IT/IS custom development	12	48.0	10	52.6	12	50.0	34	50.0
IS analysis	7	28.0	5	26.3	7	29.2	19	27.9
IS consulting	6	24.0	4	21.1	5	29.8	15	22.1

years) to test hypothesis H1. Then, it was calculated using each year’s project data separately to verify if environmental stability influences the effect size of the correlation (to test hypotheses H2a and H2b). The data collected were analyzed using the IBM SPSS Statistics software package.

5. Results

5.1. Descriptive findings

Descriptive statistics were computed to summarize and describe the data collected. The most relevant statistics used included the mean, median, mode, and standard deviation. For a given variable, the mean is the average score assigned by respondents (the sum of responses/scores given divided by the number of responses), which can be affected by extremely high and low values. So, in general, this is complemented by other measures of central tendency, such as the median. The median is not sensitive to outlying or abnormal values and represents the score for a variable above and below which half of the responses fall. The mode represents the score for a variable’s most frequently occurring score (when multiple modes exist, the SPSS software package only reports the smallest mode). Data analysis is enriched if all three measures are used. Finally, standard deviation measures dispersion around the mean (Varajão et al., 2020). Table 3 presents the descriptive statistics of the surveyed projects.

The mean values of the team resilience index vary between 5.8945 (2019) and 6.3253 (2021). The standard deviations show values ranging between 0.32094 (2021) and 0.46496 (2020), indicating the answers’ variability. Overall, it is noted that the project teams seem more resilient after the pandemic. Regarding the project management success

Table 3 Projects – descriptive statistics.

	Dataset 1 (2019)	Dataset 2 (2020)	Dataset 3 (2021)	Total data
Valid	25	19	24	68
Team Resilience index				
Minimum	4.90	4.90	5.63	4.90
Maximum	6.73	6.80	6.85	6.85
Mean	5.8945	5.9674	6.3253	6.0669
Median	5.8667	6.0083	6.4083	6.0646
Mode	4.90a	4.90a	5.63a	4.90a
Std. deviation	0.44012	0.46496	0.32094	0.44795
Project Management Success index				
Minimum	13.27	16.49	12.35	12.35
Maximum	18.89	18.75	18.98	18.98
Mean	16.0508	17.6482	17.0850	16.8621
Median	16.2100	17.8100	17.5300	17.2100
Mode	16.33	16.49a	12.35a	16.33a
Std. deviation	1.61029	0.73568	1.53777	1.52468

a. Multiple modes exist. The smallest value is shown.

normalized index, the mean values range from 16.0508 (2019) to 17.6482 (2020). The standard deviations range from 0.73568 (2020) to 1.61029 (2019). It is worth mentioning that project management success reached slightly higher levels in the 2020 projects, which were impacted by a major disruption (the coronavirus outbreak). However, it should also be noted that in 2020 the number of projects was also lower than the other years surveyed.

5.2. Hypotheses testing

To find if there is a significant association between team resilience and project management success in information systems projects, as well as any effect on the relationship with environmental stability, the Spearman rho statistic was computed. The results are presented in Table 4.

The results indicate a statistically significant positive correlation between the team resilience index and the project management success index $r(68) = 0.510, p < 0.01$. According to the guidelines by Cohen (1988), the effect size is large. Moreover, as expected, the effect size of team resilience is larger when disruptive events occur, such as the Coronavirus outbreak, which mainly affected the surveyed 2020's projects. The correlation coefficient during this period has a large effect size $r(19) = 0.591, p < 0.01$, while in the surveyed 2019's projects (the first dataset), the correlation coefficient has a medium effect size $r(25) = 0.400, p < 0.01$. According to Cohen (1988), the r coefficient between 0.3 and 0.5 is a medium or typical correlation, while the r coefficient between 0.5 and 0.7 is large or larger than typical. Therefore, we can conclude that developing team resilience in IS projects is even more important in unstable environments, such as the COVID-19 pandemic.

6. Discussion

6.1. Theoretical contributions

In an increasingly dynamic and unexpected business environment, studying resilience is fundamental to understanding how individuals and teams successfully handle adversity (Hartmann et al., 2020a,b). However, despite the vital role of teamwork in organizations, the conceptual development of team resilience is still in its infancy (Hartmann et al., 2020a,b; Hartmann et al., 2020a,b). Our research brings important theoretical contributions to the body of knowledge. On the one hand, it contributes to increasing the knowledge of resilience and project management by showing a positive correlation between project team resilience and the success of project management in IS projects; on the other hand, it shows that the effect size of team resilience is larger in unstable environments when major disruptive events impact projects.

Some previous studies have linked resilience with performance. For instance, Meneghel et al. (2016)a,b investigated the relationship between collective positive emotions at work, team resilience, and in-role and extra-role team performance. The results emphasize the importance of developing positive emotions within teams to support their evolution

Table 4
Hypotheses testing.

	Dataset 1 (2019)	Dataset 2 (2020)	Dataset 3 (2021)	All data
Correlation Coefficient	$r = 0.400^*$	$r = 0.591^{**}$	$r = 0.455^*$	$r = 0.510^{**}$
Sig. (2-tailed)	$p = 0.048$ (< 0.05)	$p = 0.008$ (< 0.01)	$p = 0.026$ (< 0.05)	$P < 0.001$
N (projects/ teams)	25	19	24	68
Hypotheses Effect size	Supported Medium	Supported Large	Supported Medium	Supported Large

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

towards enhancing resilience and thus improving performance. Another study by Meneghel et al. (2016)a,b shows that job social resources are related to team performance, and team resilience is a significant mediator. The results suggest that organizations should develop social resources of work to enhance team resilience and, consequently, team performance. Chen and Zhang (2021)' research also shows a strong link between team resilience and team performance in the context of new venture teams. Qamari et al. (2020) present a conceptual model of transformative interaction capability. Along with the quality of work life and transformative interaction capability constructs, the conceptual model links team resilience to teamwork performance; it was found a positive relation between team resilience and teamwork performance. Duchek et al. (2021)' research shows that training focused on team building and resilience achieves the best results concerning group dynamics and resilience behavior. Oh and Teo (2006) also conclude that more resilient organizations exhibited better organizational performance.

Although none of the mentioned studies directly address the relationship between team resilience and project management success or are focused on the context of IS projects, the overall results align with our findings since, in all cases, resilience directly or indirectly influences performance. Our study expands previous research by discussing team resilience as an influencer of project management success and proposing and examining a conceptual model tested under different conditions (stable and unstable environments) within the context of IS projects.

Note that projects carried out in a more stable environment occurred in teams working 100% in-person (2019 projects) and working 100% remotely (2021 projects). In both cases, the effect size is medium, which shows that the work regime may not significantly affect the influence of team resilience on project management success. Our results are aligned with Neirotti et al. (2012)' study since they did not find differences in labor productivity in the case of home-based telework practices. On the one hand, the COVID-19 pandemic brought new challenges and demands to individuals and organizations since it was necessary to adapt quickly to unique circumstances, such as intensively carrying out work from home using IT/IS (Soares et al., 2021). On the other hand, Schoch (2023) states that remote working self-efficacy generally increases performance for remote work. This may explain our results (at least partially) since all the surveyed team members have a degree in IS engineering and IT proficiency.

6.2. Managerial implications

The research has practical management implications relevant to temporary organizations, highlighting the need to focus more on projects' social and human elements rather than technical ones, which aligns with Hernes (2014). This research also provides new evidence to practitioners on the importance of developing systematic actions to promote project team resilience, as other authors advocate (e.g., Varajão et al. (2021); Zemba et al. (2019).

Team resilience is a multilevel phenomenon (Linkov and Trump, 2019) that requires clear identification of key factors and appropriate stimulus to enable its emergence and systemic development in individuals, teams, and organizational culture (Gucciardi et al., 2018). Therefore, organizations should promote a better work-life balance quality to enhance project team members' transformative interaction capabilities, thus positively affecting team resilience and overall performance (Qamari et al., 2020). Dimas et al. (2018) highlight the importance of adopting transformative leadership behaviors to increase the viability and overall effectiveness of the team. Leaders need to know their signature strengths and use them wisely and assertively to increase the resilience level of teams (Karlsen and Berg, 2020).

Organizations should develop strong values (Coutu, 2003), a strong sense of purpose, a clear vision, and assertive and strategic communication (Lengnick-Hall and Beck, 2009). Increasing team resilience involves strengthening the group structure, supporting the incorporation

of common rules and values, adopting shared transformational leadership, and creating meaningful interactions amongst team members, particularly during unexpected events, as well as promoting proactive awareness focused on team improvement (Morgan et al., 2015; van der Beek and Schraagen, 2015).

7. Conclusion

Instability and uncertainty in business environments are rising, forcing organizations to adopt new working strategies to sustain their ability to thrive and compete globally and enhance their resilience to deal with sudden disruptions that may affect their strategic efforts (Fridgeirsson et al., 2021). According to Chen et al. (2021)a,b, empirical studies suggest that resilient organizations are much more flexible and able to adapt to change, even if the business environment is complex and disruptive (Sakurai and Chughtai, 2020).

Project teams are fundamental in this context. However, work teams frequently face various adverse conditions and, as a result, can experience process breakdowns and performance declines, even leading to team failure (Stoverink et al., 2020). Our research shows that project team resilience has an important role as a main contributor to the success of project management in IS projects. This is even more evident in the case of major disruptive events that impact projects.

The main limitation of this research concerns the data sample. The data was collected in the context of IS projects carried out by teams of master's students. For this reason, the generalizability of these results to other project contexts is somewhat limited. Gordon et al. (1986) discuss this limitation, mentioning the "controversy over using students as subjects in research" since there are risks of the sample not being representative of a general population. However, the same authors suggest some ideas that may improve external validity, including relying on trained experimental subjects and involving subjects with demographic and interest profiles similar to the nonstudents to whom researchers wish to generalize, which was the case of our research. The authors also mention several studies in which MBA students and nonstudents were used as subjects in identical experiments with similar results. Furthermore, to reduce the risk of bias, our results are grounded in projects carried out in different years under different environmental conditions. Nevertheless, future work could involve collecting data from other contexts to identify potential project context dependency. At the same time, other important aspects could be considered by studying the influence of some personality types on team resilience or even collaboration or motivation mechanisms promoted by team leadership.

Another limitation is related to the measurement items used. We adopted well-known measures from the literature to take advantage of previous validation and enhance validity. However, alternative scales could be used, such as the one proposed by Sharma and Sharma (2016) for team resilience or additional measures for project management success, as described by Pereira et al. (2022). Therefore, it is necessary to investigate further the diverse interpretations of team resilience and project management success.

Additionally, the ability to be resilient is not just an attribute inherent to project teams – it can be developed and managed (Amaral et al., 2015; Naderpajouh et al., 2018; Varajão et al., 2021) to ensure that its key dimensions are incorporated and thus improve the resilience of project teams and organizations experience the benefits gained over time. In our study, the results of team resilience after the critical year of pandemics (2021) are higher when compared to the pre-pandemics results (2019). This may be due to the learning effects; this assumption is supported by Stoverink et al. (2020, p. 395) work, as they theorize "that work team resilience strengthens over time through mastery experiences, functioning as a self-reinforcing gain spiral."

Therefore, there is great potential for future research on how to develop resilient project teams to increase the likelihood of project success (for instance, by exposing teams to disruptive events in simulated situations). The ability to assess and monitor the frequency and

extent of disruptions experienced, combined with the maturity of project management and the expertise level of team members, will allow early detection of potential risks and enhance the capability to create adjustments rapidly, thus avoiding impacting project execution and value creation.

Finally, digital transformation and the tendency to adopt IT towards increasing the data available to support decision-making will continue influencing project management in the future. Creating augmented and virtual reality simulations (supported by artificial intelligence) may help prepare teams to overcome unpleasant situations and their impacts. This can be combined with the adoption of transformational leadership and team engagement to gain greater awareness and accelerate quality response time to unstable events or situations. Being prepared to deal with challenging scenarios and prepare responses in advance could enhance team resilience and the ability to overcome difficulties, thus achieving higher success levels.

Declaration of competing interest

The authors have no interests to declare.

Data availability

The data that has been used is confidential.

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