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Team Resilience Model: An Empirical Examination of Information Systems Projects

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ABSTRACT

Organizations need well-prepared teams to perform their projects with efficiency and effectiveness. In such socio-technical systems, project teams' capability to face and surpass difficulties play a critical role for the organizational reliability. Hence the relevance of studying project team resilience, defined here as the team's ability to deal with problems, overcome obstacles, and quickly recover from adverse and possibly harmful situations without collapsing. This paper presents an empirically-tested theoretical model for explaining team resilience. Results show that several factors such as Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embracing conflicts, Work conditions, and Skills & Behaviors are important contributors for team resilience. The findings discussed here contribute both to a better understanding of how project team resilience can be studied theoretically and improved in practice and to determine the triggers to ensure the proper adjustments to improve the overall organizational resilience and consequent reliability and performance.

1. Introduction

There is an increasing prevalence of temporary organizations or projects [1]. However, projects still fail to live up to stakeholders' expectations as they continue to be disappointed by the results [2]. One explanation for this phenomenon is the fact that many organizations are unable to deal with the pressure and problems that frequently arise, which limits their ability to properly manage projects and frequently results in time or cost overruns, and even poor quality [3].

Projects are becoming more and more complex, which gives rise to a context of adversity [4]. This requires adjustment mechanisms to deal with difficult circumstances and stressors, which are environmental stimuli that often require actions from the individuals, the team or even the organization [5]. To maintain progress and achieve project success, the team needs to be able to bounce back from setbacks [6]. Being resilient in such environment entails having the necessary capabilities to deal with the unknown and successfully go through transforming and adjusting processes [7].

Resilience capabilities are, therefore, critical for the system reliability in overall, and human reliability in particular. Human beings play a unique role in social-technical systems [8], and their lack of judgment or failure, have been deeply associated with an increased probability of accidents and major negative impacts [9,10]. Thus, the importance of determining factors to explain the behavior of human beings in the process of improving the overall system reliability [8].

Resilience thinking can help project managers improving reliability and performance through flexible, systemic and context-specific approaches once confronted with disruptive events [11] and also helps to create conditions that enable to solve issues and promote stability [12]. However, there is a limited understanding of resilience in the context of projects or teams.

Recently, Thomé et al. [13] suggested that the lack of coverage of the concept of resilience by the literature deserves more attention by scholars and that is an opportunity for new developments and contributions. As argued by Bhamra et al. [14], there is a need to conduct good quality empirical-based research, particularly focused on case studies and surveys, to fully develop the area and properly recognize the potential of improving the resilient characteristics within organizations. In the specific case of project management and human reliability, resilience is still a very recent field of research that needs to be reinforced by

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qualitative and quantitative studies [11,15].

In this context, team resilience can be described as the team's ability to deal with problems, overcome obstacles, or resist the pressure caused by adverse situations without collapsing [16]. This paper aims to answer to the research question *"what are the key factors for explaining project team resilience?"* and to contribute to the body of knowledge by presenting a new model for project team resilience. The unit of analysis in our study is, therefore, the project team. Team resilience has a distinct nature when compared with resilience at the individual level. Team resilience might be influenced by individual resilience, but two or more resilient individuals might not be a resilient team [17]. Additionally, team characteristics in temporary organizations, such as resilience, are distinct from those in permanent organizations [18], where teams usually work together from a long period, while in projects, team members work together just for a particular endeavor during a short period.

A theoretical model for explaining team resilience was assessed with empirical data resulting from a survey focusing Information Systems (IS) projects, and hypotheses were tested using the Structural Equation Modeling (SEM) approach since it is adequate for complex research models with a large number of indicators [19]. Studying the project team resilience is particularly important in the case of IS projects [20], considering the lower levels of success that these projects have shown in recent decades [21,22] and the important role that these socio-technical projects have in modern organizations [21]: a) they are the backbone of today's organizations [23]; b) they are critical for the productivity and competitiveness of virtually any human organization [24]; and c) they involve significant investments [25].

The paper is organized as follows. The second section presents the study background. The third section describes the theoretical model. The fourth section presents the research methodology. The fifth section presents the analysis and results of a structural equation model for explaining team resilience. Finally, in the last two sections are discussed the results and the main conclusions that emerged from this study, and suggestions are presented for further work.

2. Background

2.1. Reliability, Human Reliability and Resilience

The unprecedented technological progress has been challenging for the convergence of multiple knowledge areas and professionals to deal with a broader spectrum of complexity, especially by pushing them to understand the intricacies of concepts like integrity, reliability, availability, maintainability, and safety to assure system integration and fully operability [26].

Some of these concepts have been frequently used throughout the past decades, namely the concept of reliability applied in the context of engineering, which began in the early 1950s in the fields of communications and transport. The U.S. Military Standard (M1L-STD721B) defines the reliability concept as the probability of an item to perform its intended function for a specified period of time under stated conditions. However, reliability may not be quite as simple to define as previously mentioned, due to the increasing level of system complexity interactions, evolving product quality requirements, safety regulations, "green" legislation, economic and financial pressures, and the increasing amount of stakeholders involved in the decision process, which requires a holistic and systemic approach for properly assessing systems behavior as a whole.

It is widely accepted that human beings play a unique role in social-technical systems, namely those involved in the design, construction, installation, maintenance, and operations [8,27]. One important concept in this context is Human Reliability, which is focused on the interactions between humans and systems, assessing its overall implications and detecting other determining factors to explain the impact of human beings in the process of improving system reliability [8].

New challenging features and requirements arise with the digitalization of industry and the necessity both to include the interactions between humans and Cyber-Physical Systems and measure their implications in terms of system reliability [28]. In this new context brought by the digital revolution, concepts like resilience are critical aspects that should be included in human reliability studies to enhance the system's stability and control behaviors that might affect the system's overall performance [15], which often relies on human capital [29].

Resilience is a concept widely used in many domains, including ecology, psychology, climate change, critical infrastructure, and organization science. The term "resilience" derived from the Latin verb *resilire*, which can be defined as the ability to recover quickly from difficult and possibly harmful situations [30]. However, its definitions can vary depending on the scope under analysis, whether it is a community, an organization, a project, an engineering system or others. From a systematic literature review, Righi et al. [31] identified several possibilities for describing resilience. Two examples are presented here as common definitions: "Resilience is a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" ([32], p. 14); "Resilience is closely related with the capability and ability of an element to return to a stable state after a disruption" ([14], p. 5376). Organizational resilience can also be defined as the organization's ability to recover from shock or disturbance resulting from adverse and unexpected situations [33], by responding to the situations that endanger its organizational survival and prosperity [34].

System resilience is usually linked with the system's ability to rapidly adjust to its proper functioning conditions after suffering disturbances [35]. Therefore, a resilient system must be able to reduce the probability, and consequences of the failures occurred, and be able as well to recover to its proper operating level within an acceptable period of time and at minimum cost [36], without any major degradation of its operational parameters. System resilience should include a clear set of relationships to the main system's metrics regarding the accepted risk level and its corresponding reliability [37]. Therefore, it should include mechanisms of inherent resilience and adaptive resilience to ensure better system adaptability capacity and, in this way, promote a better overall performance [38].

2.2. Project Team Resilience

The ability to properly deal with unexpected events, focusing on a set of actions to compensate the persistence of damaging circumstances, requires a specific set of competencies, experience and attitudes [39]. Therefore, resilience shortens the individuals' recovery period and guarantees a strengthened will, as well as an increased resourceful repository for future situations [40], which is critical for human functioning and organizational reliability [41].

Resilience can be used to characterize individuals' ability to overcome setbacks and to, somehow, measure their life achievements and career expectations or ambitions [42]. In the end, as mentioned by Coutu [[43] p. 2]: "More than education, more than experience, more than training, a person's level of resilience will determine who succeeds and who fails."

This scenario changes when we start focusing on team resilience and not exclusively on the individual. In general, the mechanisms considered in the resilience of a team are similar to those pointed out in the individual. However, the teamwork dimension and the interactions between its members bring up new aspects that need to be adequately considered to measure its dependencies and impacts on the team performance [44].

The resilience of a team can be defined as the team's ability to deal with problems [45], to overcome obstacles [16], or to resist the pressure of adverse situations (e.g., the early leaving of a team member), without collapsing; this capacity allows the team to positively adjust to successfully perform particular tasks and increase reliability, longevity and the overall performance [46]. This ability translates into a set of

determinants that make the team more or less resilient and can be boosted to protect a group of individuals from the potential adverse effects of the stressors they collectively encounter during a project lifecycle [47].

The ties developed between team members (which equates to the degree of team connectivity) and their openness provide teams with the proper conditions to face and overcome problems that might impact project's goals; these ties also enhance learning possibilities and generates new insights which will increase the adaptability process when experiencing new adversities in the future [47,48].

Team resilience is a key attribute, especially when organizations are confronted with emergencies and need to figure out suitable responses to ensure the desired outcomes before and after a crisis [49], to survive times of extreme difficulty, such as the ones experienced with the COVID–19 pandemic.

Competencies for team resilience can be improved [50] over time and Alliger et al. [17] identified 40 team–level behaviors, categorized within three major strategies: 1) Minimize - behaviors that address conditions prior to a crisis and which act as anticipatory control; 2) Manage - behaviors which are used to handle the crisis as it unfolds, and 3) Mend - behaviors used to regain resources and team health after a crisis. More recently, Morgan et al. [51] studied the psychosocial enablers and strategies to promote the development of team resilience, and found five main themes: 1) inspire, motivate and challenge team members to achieve performance excellence; 2) develop a team-regularity system based on ownership and responsibility; 3) cultivate a team identity and togetherness based on "selfless" culture; 4) expose the team to challenging training and unexpected/difficult situations; and 5) promote the enjoyment and positive outlook during stressors.

While the literature provides several relevant resilience frameworks [52], the operationalization of these frameworks to understand resilience in the project context requires strategies that are dependent on the characteristics of an organization. The organizational capacity to develop a resilient attitude among its members should be anchored on specific competencies, routines, and processes to achieve the proper alignment towards moving forward and creating an adjustable setting to enhance the integration of all the aspects needed to develop a resilient organization [53]. The resilience work integration should focus on three different dimensions: individuals; teams or groups; and organizational context.

In the individual dimension, the typical aspects presented focus on the ability to solve problems, having strong faith and confidence, as well as a combination of resourcefulness and counterintuitive agility gained by practising useful habits and by being prepared for any situation [45]. Team resilience should focus on developing a group structure, shaped by common rules and values, based on shared transformational leadership, thoughtful interactions amongst team members during unexpected situations, and proactive awareness to promote an emphasis on team improvement ([47,48]). The organizational context should foster a positive orientation through the development of strong core values [43] coupled with a sense of purpose [54], a clear vision and communication, a non-hierarchical structure (diffuse power) and accountable environment [55].

3. Theoretical Model

Team resilience is critical for any project; however, to the best of our knowledge, there is no comprehensive and integrated theoretical framework for explaining it. Aiming to help fill this gap in the literature, we developed a new theoretical model based on the previous work of Amaral et al. [56], which assumes that factors Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors are related to team resilience. Furthermore, we hypothesize that team resilience can be explained by these factors. The theoretical model for team resilience is shown in Fig. 1. Each arrow in the figure represents the hypotheses to be tested empirically.

Trust & Solidarity primarily consist of having project team members who are genuinely open to one another about their mistakes and weaknesses, making it possible to build a foundation for trust [46]. Collaboration among project team members is crucial to minimize individualistic behavior in favor of teamwork results, thus promoting solidarity between project team members [57]. Trust and solidarity set the tone for another construct of the model – Embrace conflicts. Thus, the following hypothesis:

H1: Team resilience can be explained by Trust & Solidarity.

Focus on results consists of setting the team members' focus on the project results rather than on their individual needs, such as career development or recognition, or the needs of their departments. Therefore, it is essential to establish specific project result indicators, thus minimizing project ambiguities and promoting systematic feedback on the current project results [58]. Thus, the following hypothesis:

H2: Team resilience can be explained by Focus on Results.

Commitment includes engagement to the project results and plan of action. For enhancing project commitment it is essential, for example, to involve the project team in the project plan development, to encourage team members to put forward their ideas and make them feel that their views are duly taken into account, and to include the systematic dissemination of project results during project team performance reviews [59]. A lack of commitment also leads to lack of accountability, which is another important construct of the model. Thus, the following hypothesis:

H3: Team resilience can be explained by Commitment.

Management & Accountability focus on the management of a plan of action, aiming at minimizing disturbances during the project lifecycle, enabling the communication of each team member's priorities to other members, performing project control close to the project team, and helping the team to manage change [60]. It also involves project team accountability, i.e., there are consequences which might be positive (rewards) or negative (penalties) whether the project staff is delivering the project's planned results or not [61]. Thus, the following hypothesis:

H4: Team resilience can be explained by Management & Accountability.

Embrace conflicts consists of having project teams capable of

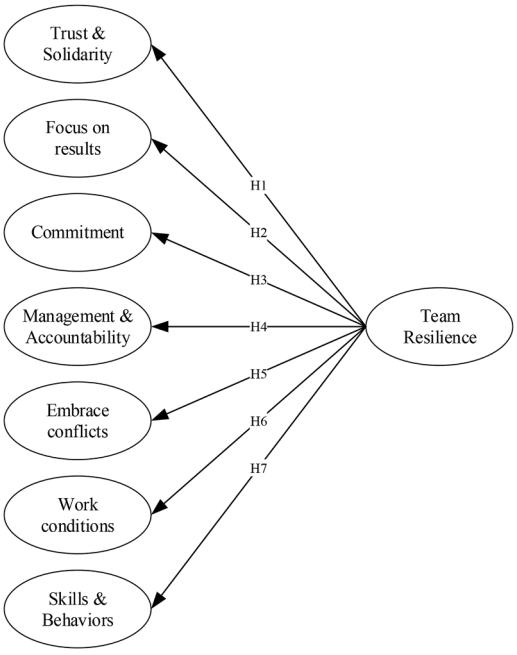

Fig. 1. Theoretical model for team resilience.

engaging in an unfiltered and passionate debate of ideas to overcome disputes. A lack of healthy conflict is a problem because it leads to a lack of commitment, which is another construct of the model under discussion. Essential competencies for embracing conflicts are, for example, active listening from all project team members, the need for team members to always give the benefit of the doubt before drawing negative conclusions, recognition of one's own weaknesses and mistakes, and apologizing and accepting apologies among project team members [62, 63]. Thus, the following hypothesis:

H5: Team resilience can be explained by Embrace conflicts.

Work conditions include, for example, the opportunities for the project team's continuous learning [64], the existence of a positive and loyal project team environment [65], or a flexible work schedule. Thus, the following hypothesis:

H6: Team resilience can be explained by Work conditions.

Skills & Behaviors consist mainly in having project teams with the necessary competencies to perform the project activities, as well as with the adequate behavioral characteristics to execute the project; for example, assertiveness among team members, recognition and appreciation of each other's talents and competencies [49]. Thus, the following hypothesis:

H7: Team resilience can be explained by Skills & Behaviors.

4. Research Methodology

The research approach adopted here is quantitative within a single cross-sectional study [66]. A questionnaire-based survey was administered to collect data for the theoretical model's empirical validation.

4.1. Construct Operationalization

To operationalize the conceptual model's constructs, we followed the study by Amaral et al. [56] and developed a research instrument (a questionnaire) based on the items presented in Table 1. To ensure content validity, the choice of items was discussed in a group of three researchers with extensive experience in IS and project management areas. A seven-point Likert scale was used to measure each item, ranging from 1 ("without influence") to 7 ("total influence").

The questionnaire was pre-tested with five team members to evaluate the ease of understanding and time required to complete. Only minor revisions were required; for example, minor re-wordings of questions to remove ambiguities and slight changes to the layout of the questionnaire to improve readability.

4.2. Data Collection

The project managers of 28 IS projects in development in an academic setting were contacted to invite their team to participate in the survey. Each project team ranged from three to six members (in a total of 131 members). The participants were asked to fill out the survey and return it on-site to the researchers. Strict confidentiality has been stated in the survey cover.

The questionnaire took about 15 minutes to complete. Questionnaires were received from 118 participants. Three of those questionnaires were not used in the analysis due to incomplete responses, yielding a final response rate of 88% (corresponding to 115 complete questionnaires). Sample characteristics are presented in Table 2.

Most of the respondents were male (83.5%). The majority is above 25 years old. The respondents were participating in projects classified into four types: custom development (32.1%); IS analysis (25%); IS consulting (25%); other, including business intelligence, workflow, etc. (17.9%). The average duration of the projects was three months.

The data was screened for univariate and multivariate outliers using the protocol described by Tabachnick and Fidell (2007). Standardized z-scores were inspected, and those larger than 3.29 ($p < 0.001$) were removed. Cases with a Mahalanobis distance greater than $\chi 2$ (10 df) =

Table 1
Research instrument description.

Construct/Code		Item
Trust & Solidarity	TS1	Minimize individualistic behavior in favor of teamwork results
	TS2	Empower project team (give decision-making power to team members)
	TS3	Promote solidarity between project team members during work development
	TS4	Encourage project team members' autonomy and versatility
	TS5	Promote collaboration among project team members
	TS6	Develop project team-building
Focus on results	FR1	Establish specific indicators concerning project results
	FR2	Assure systematic feedback of project results
	FR3	Focus team effort on project results
	FR4	Seek to minimize project ambiguities
Commitment	CO1	Help each team member to perceive the usefulness of her/his work
	CO2	Ensure that low-performing team members feel the need to improve
	CO3	Involve project team in project plan development
	CO4	Promote that all project team members put forward their ideas and that they feel their ideas are taken into account
	CO5	Align all project team members with the project objectives
	CO6	Implement a participative project management philosophy
	CO7	Implement suitable motivation systems
Management & Accountability	MA1	Minimize disturbances during project lifecycle (e.g., lack of information, rumors, etc.)
	MA2	Report priority activities to each team member
	MA3	Control project progress and highlight any default by the team
	MA4	Perform project control close to project team
	MA5	Avoid bureaucracy in project management
	MA6	Identify the best strategy for project execution
	MA7	Implement project risk management processes
	MA8	Help the team to manage change
	MA9	Implement effective communication processes
Embrace conflicts	EC1	Identify and clarify acceptable and unacceptable behaviors of team members (e.g., sarcasm, etc.)
	EC2	Identify and eliminate barriers to project execution (e.g., physical environment conditions such as temperature, level of noise; interpersonal relationships; unsolved issues from the past; antisocial behavior, etc.)
	EC3	Promote active listening of all project team members
	EC4	Place team interest always before personal interest
	EC5	Encourage project team members to recognize their weaknesses and mistakes
	EC6	Promote the request and acceptance of excuses among project team members
	EC7	Reinforce the need for team members to always give the benefit of the doubt before drawing negative conclusions
Work conditions	WO1	Assure the redundancy of non-human resources (e.g., equipment)
	WO2	Establish a flexible work schedule in order to address the needs of each team member
	WO3	Provide opportunities for the continuous learning of the project team
	WO4	Stimulate a positive and loyal project team environment
	WO5	Ensure adequate working conditions
Skills & Behaviors	SB1	Set up teams with the necessary competencies to perform project activities
	SB2	Provide training to develop the necessary competencies for the project
	SB3	Develop individual resilience of project team members
	SB4	

(*continued on next page*)

Table 1 (*continued*)

Construct/Code		Item
		Identify the most important behavioral characteristics of each team member that can "strengthen" the project team
	SB5	Identify the most important behavioral characteristics of each team member that can "weaken" the project team
	SB6	Promote the ability of project team members to learn from mistakes
	SB7	Encourage assertiveness among team members (e.g., "talk about what should be spoken")
	SB8	Promote recognition, appreciation, and use of talents and competencies of each team member

Table 2
Demographics of participants and projects.

	Number	Percentage
Participant		
Gender		
Male	96	83.5%
Female	19	16.5%
Age		
[21 to 22]	25	21.7%
[23 to 24]	31	27.0%
[25 to 30]	34	29.6%
>30	25	21.7%
Project Type		
Custom development	9	32.1%
IS analysis	7	25.0%
IS consulting	7	25.0%
Other	5	17.9%

29.59 ($p < .001$) were also removed [67]. This led to the removal of two participants, and so, after data screening, a total of 113 responses were included in the analysis.

Although developed in an academic setting, the projects share the same characteristics of professional projects, and their success is indexed to the benefits obtained by the project's customers (entities that are internal or external to the university where the projects were developed). In nine of the 28 project teams (32%), at least one 'crisis' situation occurred (for example, one team member leaving the team prematurely, or having internal conflicts).

5. Analysis and Results

The measurement properties were assessed using the empirical data from the survey, and hypotheses were tested using the Structural Equation Modeling (SEM) approach (a second-order factor model employing structural equation modeling). We chose SEM for the data analysis since our research model is relatively complex and has a large number of indicators [19] and because SEM allows testing both a measurement model and a structural model (substantive model), affording as well an assessment of model fit [68]. We used the software package IBM SPSS Statistics 23 (with AMOS) for the statistical calculations.

5.1. Data Analysis

Before conducting the analysis presented here, the structure factor of each of the scales was subjected to exploratory and confirmatory factor analysis to derive the most robust measures for the resilience model.

For each scale, total scores were obtained by summing item response and dividing by the number of items on the scale. Therefore, high scores on each scale indicate a higher level of influence of the items (e.g., higher Trust & Solidarity) on team resilience.

The relationships were first examined using Pearson's correlations. The strength of the correlations was determined by the criteria of Cohen [69]: large correlations are described as being greater than 0.50; medium correlations ranging from 0.30 to 0.49; and small correlations ranging from 0.10 to 0.29.

Due to indications of indexes and regressions weights, two items originally identified in the study by Amaral et al. [56] were removed: one linked to factor Work conditions ("Assure the redundancy of human resources") and the other to factor Focus on results ("Manage project stakeholders' expectations").

The reliability analysis was conducted using Cronbach's alpha coefficients, which indicate the internal consistency of the items used for calculating the final structures of each instrument (scale) [70]. The Cronbach's alpha values (α in Table 3) were analyzed for each scale, with acceptable values observed for all the scales; internal consistency for all factors ranged between 0.72 (Work conditions) and 0.87 (Management & Accountability) [71]. As argued by Nunnally [72], above 0.7 is the desired threshold.

Using confirmatory factor analysis (CFA), we tested the expected underlying factor structure of all the scales, and we assessed the discriminant validity (the degree to which measures of different latent variables are unique enough to be easily differentiated from other constructs [73]).

We conducted a second-order factor model of team resilience, explained by seven-order factors (Focus on results, Management & Accountability, Skills & Behaviors, Work conditions, Embrace conflicts, Commitment, and Trust & Solidarity). All analyses were conducted in AMOS 23 software package using maximum likelihood estimation methods to establish the relationships between the study variables.

To assess model fit, we used the Chi-square statistics and its associated level of probability: the root mean square error of approximation (RMSEA) [74], the Tucker-Lewis index (TLI) [75], and the comparative fit index (CFI) [76]. A Chi-square value of no more than twice the degrees of freedom indicates a well-fitting model [77]. Values ≥ 0.80 for the CFI and the TLI are considered to indicate acceptable fit values [78], values ≥ 0.90 are interpreted as good and close to 0.95 are considered excellent fit values [79]. For RMSEA, values below 0.05 are considered to indicate excellent fit. However, the RMSEA depends on model complexity and values of RMSEA ≤ 0.08 indicate a reasonable fit between the model and the data [80]. Therefore, the p-value for the test of close fit is also given, which tests the alternative hypothesis that the RMSEA is larger than 0.05. To indicate close fit, p-values should be larger than 0.05 [81].

5.2. Results

The means, standard deviations, internal consistency reliability α values, and Spearman correlations among the scales are displayed in Table 3. All the correlations are significant and in the expected direction.

Before evaluating the second-order factor model, the fit of the subscales (Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors) was tested with a CFA to measure their hypothesized constructs. All latent variables were allowed to correlate with each other, and their variances were fixed at a value of one. Therefore, a measurement model with seven first-order correlated factors was tested. The confirmatory factor analysis revealed that the hypothesized correlated seven-factor structure showed an acceptable fit ($\chi^2(962\ df) = 1569.41$, $p < 0.001$; RMSEA = 0.07, 90% C.I. [0.068; 0.082]; CFI = 0.80; TLI = 0.80) [76]. This model specifies that all 46 items are reflective of one latent variable. All of the factor loadings were significant (at the 0.001 level), ranging from 0.44 to 0.79 (Costello and Osborne [73] recommended that the factor loadings should be higher than the cutoff value in the magnitude from 0.40 to 0.70), providing evidence that each of the indicators (i.e., subscales) is an important contributor to its respective latent construct. We can then conclude that the degree to which measures of different latent variables are unique enough to be easily

Table 3
Means, standard deviations, correlations, and internal consistency estimates.

Variable	1	2	3	4	5	6	7	M	SD	α
1. Focus on results	–							5.86	.68	.74
2. Management & Accountability	.74**	–						5.98	.63	.87
3. Skills & Behaviors	.66**	.77**	–					5.95	.62	.81
4. Work conditions	.68**	.72**	.74**	–				5.71	.64	.72
5. Embrace conflicts	.56**	.70**	.77**	.70**	–			5.82	.79	.86
6. Commitment	.68**	.76**	.72**	.70**	.66**	–		6.06	.60	.80
7. Trust & Solidarity	.72**	.80**	.75**	.73**	.70**	.81**	–	6.08	.62	.77
** $p < .01$ (all correlations significant)										

differentiated from other constructs and the observed loading paths were methodologically rigorous and relevant. Moreover, each of the correlations among the latent constructs was significant ($p < 0.01$). These results support the validity of our specified measurement model.

In Fig. 2 are presented the results of the structural analysis. All variables predicted the respective specified factor: they explained 98% of variance of Focus on results ($R^2 = 0.98$); 91% of the variance of Management & Accountability ($R^2 = 0.91$); 93% of variance of Skills & Behaviors ($R^2 = 0.93$); 99% of variance of Work conditions ($R^2 = 0.99$); 72% of variance of Embrace conflicts ($R^2 = 0.72$); 89% of variance of Commitment ($R^2 = 0.89$); and 99% of variance of Trust & Solidarity ($R^2 = 0.99$).

The second-order factor model of team resilience is fitted. The second-order factor model fitted the data adequately ($\chi^2(978) = 1596.447$, $p < 0.01$; RMSEA = 0.07 (90% C.I. [0.068; 0.082]); CFI = 0.80; TLI = 0.80). All seven components loaded strongly on the second-order factor. In all predictions, the standardized coefficients presented the same signal (positive). All standardized factor loadings were significant (all $p < .001$), ranging from 0.84 to 0.99 (Fig. 2). These results confirmed the validity of the specified 7-factor measurement model. The results clearly emphasize that all seven latent constructs (Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors) loaded strongly (and positively) on team resilience.

6. Discussion

6.1. Team Resilience Model

The frequently changing boundary conditions in today's industries – commonly referred to as VUCA (Volatile, Uncertain, Complex and Ambiguous) environments [82] – requires realiable organizations, and resilience is crucial in this context since it is a cornerstone of a social system [7]. One of the main drivers of this research was to identify the main variables that explain the team's resilience in temporary organizations, i.e. during the execution of a project, and to increase the awareness of the research and professional project management community regarding it.

Problems in a project are common and often affect its performance, especially due to unforeseen scenarios and situations that increase the level of uncertainty [83]. Thus, the existence of a model that enhances the understanding of the project team's resilience during the project lifecycle is essential as it points out essential dimensions that may affect the overall reliability and success.

Many organizations are attempting to improve projects' performance [84] by rethinking the *modus operandi* and introducing new management approaches and practices [85]. The structural model proposed in Fig. 2 might be used to assess the team's level of resilience in a project context, based on the factors previously described, namely: Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors.

All the identified hypotheses were supported, with different degrees of correlations, as shown in Fig. 2. Each of the correlations among the latent constructs was significant ($p < 0.01$), which supports the validity of the measurement model.

For instance, Trust & Solidarity are closely related and are both relational mechanisms by which individuals may be encouraged to engage in work tasks within the team, and therefore become a more resilient team, able to resist the pressure of adverse situations. Trust manifests the degree of one's own vulnerability in relation to another member [1]. As argued by Carmeli and Spreitzer [86], when individuals develop trust in their team, their level of vitality to engage in project work is likely to increase, thus contributing to the team resilience to successfully perform particular tasks and improving the project's overall performance [46].

The factor Focus on results also leads the project team to become more resilient; as Forrester [[58], p. 78] argued: "getting crystal clear about the result to be produced, as well as the shape of the current reality, creates a tension that is extremely energizing (…)". When the envisioned project results are precise, not only is energy created, but less is wasted in conflicts and scattered activities. Therefore, the final result is more effective, and the project team can then more easily resist the pressure of adverse situations [46].

The level of commitment among team members is crucial to maintain focus on the project's results [59] and to be able to create a suitable atmosphere that enhances the work conditions throughout the project lifecycle.

Proper management stimuli will favor the accountability of all team's members through a robust and assertive leadership style. Therefore, the leader is central in embracing and embedding the "right" premises towards ensuring team's performance and being consistently focused on the individuals in a continuous improvement approach to strengthen the team through the development of a set of skills and behaviors that promote the success of the project. It is also important to foster a culture toward embracing conflicts [62].

Skills & Behaviors are of vital importance for resilience, namely the adaptive learning capabilities embedded in strong network relationships [49], and the project team's adaptive capacity in responding to changes in its external environment by changing its internal organization and thus recover from any damage incurred [87]. Carpenter et al. [88] identified that the adaptive capacity of a system also reflects the learning aspect of system behavior in response to a disruption.

6.2. Implications: Guidelines for an Effective Use of the Team Resilience Model in Practice

Reliability engineering professionals face growing challenges in their systems' design activities. On the one hand, due to the gradual complexity of systems over time and the multiple skills required from a project's team to guarantee system integrity, reliability, availability, maintenance, and security. On the other hand, market changes exert pressure on teams to embed new skills and behaviors that are more aligned with these requirements and more suitable to maintain the expected performance within transition or in adjusting periods. This fosters the acquisition of new management approaches and shared transformational leadership, a different type of commitment, a higher level of accountability and focus on results, cooperation with other teams, proactive awareness of envisioned unexpected situations, and

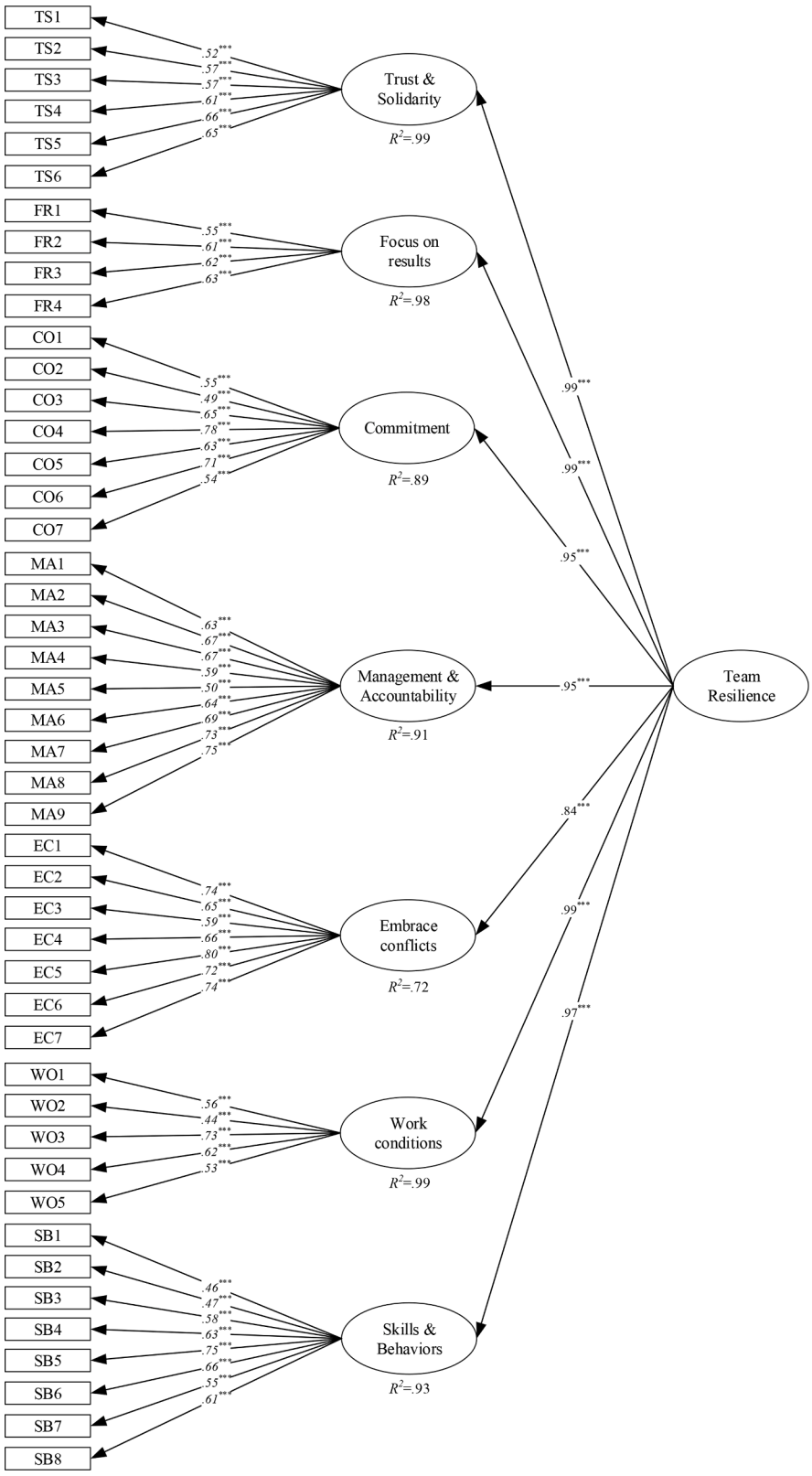

Fig. 2. Results of the structural analysis (standardized components). ***all significant at $p < 0.001$.

heedful interrelating amongst team members during unexpected situations, thus contributing to the flourishing of trust among teams' fellows [48]. All these determinants, properly combined, will have a positive impact on team resilience.

Throughout the analysis of how teams and their members adapt to adversity or to undesirable events, team resilience works as a predictor of its capacity to find out solutions. It is also a good predictor of how well teams are able to adapt, embrace sacrifices, re-prioritize plans and operational methods, and evaluate the right trade-offs of any situation [62,63].

Given this, it is useful to consider how our research's results can influence current understanding and how the new team resilience model can be used in practice. Although not an extensive list, below are presented some best practices to be followed:

1 *Identify and make widely known the measures by which project team resilience will be measured*, i.e., inform project team members about all the variables in the resilience model (Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors), which would improve team resilience and enhance the probability of success.
2 *Measure team resilience early in the project lifecycle*, by scoring the key team resilience variables, to get an overall insight of the actual team resilience. As argued by Morgan et al. [89], resilience measures might reflect resilience as a process, and so a project team's resilience is a dynamic phenomenon, which can be improved along the project lifecycle.
3 *Make an honest assessment of your project team's strengths and weaknesses*. For example, by providing answers to the questions: "Are the team interests always before personal interests?", "Have opportunities been provided for the project team's continuous learning?", "Have effective communication processes been implemented?" If in some areas there is a recurrent bad performance, it is particularly important to take corrective actions (the sooner, the better). By identifying the project team's strengths and recognizing those that result in poor project performance, it is possible to develop strategies for improvement. The literature on resilience provides some guidance on strategies to improve team resilience (e.g., [17,51]).
4 *Select the key team resilience variables that the team aims to improve and prioritize.* It should be noted that a gradual implementation of changes is critical to better manage the expectations and benefits of each change [90].
5 *Define the main actions for improving the selected team resilience variables in the project team*. The identified variables in the team resilience model should be viewed as a guide to what it takes to achieve higher project team resilience; however, other works in literature might also be used (e.g., Alliger et al. [17]; Morgan et al. [51]).
6 *Develop means to continually monitor and update the status of project team resilience*. As mentioned above, project team resilience is a dynamic phenomenon, and therefore it should be monitored along the project lifecycle. For example, re-score each team resilience variable, depending on the established assessment period (3, 6 or 12 months) until the project closure phase, i.e., go back to the 2nd step. The project team may stop this process when perceiving that its target team resilience level has been reached.

7. Conclusion

This research brings both theoretical and practical contributions. Firstly, it builds knowledge in the area of project team resilience, for which there is limited understanding [13,17]. As argued by Bhamra et al. [14], the literature is lacking in empirically proving the theories. In other words, there is little on how organizations, particularly project teams, can achieve higher degrees of resilience.

This study validates that team resilience can be explained by seven factors: Trust & Solidarity, Focus on results, Commitment, Management & Accountability, Embrace conflicts, Work conditions, and Skills & Behaviors. Secondly, by examining the variables identified in this study, researchers, organizations and practitioners can use the model to deepen their knowledge on the factors to take into consideration to strengthen project teams' resilience, which is a significant practical contribution, namely to increase organizational reliability.

An important theoretical contribution of this paper is that the variables that affect team resilience in temporary organizations (projects) are different from those of permanent organizations (e.g., Alliger et al. [17]; Morgan et al. [51]). For example, in temporary organizations, issues of vulnerability, uncertainty and risk are resolved through swift trust rather than the regular trust found in permanent organizations [91]. Temporary organizations rely on an interdependent set of diverse skills and knowledge sets. Yet, project teams lack time to engage in the common forms of confidence-building found in permanent organizations [18]. One the other hand, social structure and institutional safeguards provided by permanent organizations allow to more easily solving issues of coordination and uncertainty than in temporary organizations that lack social and structural embeddedness [92].

This research has limitations mainly concerning the research sample. The data has been gathered only from the context of IS projects. For this reason, the generalization of these results is limited. Further work should involve the collection of data from other contexts to identify if any dependency on the project context can be acknowledged (e.g., type of industry, project duration, geographic location, complexity, team dimension, etc.). This question deals with the identification of some particularities that could differ according to the type of contexts (e.g., measuring variables).

Future research should also address the process for assessing and developing resilience, using as a basis the proposed model, since methods for resilience management are still a relatively unexplored area [35]. As pointed out at the beginning of this paper, the promotion of resilience in the organizational context and among project teams enables firms to take the appropriate actions to address unanticipated events that potentially may threaten their existence. The ability to be resilient is not an attribute of just some organizations or type of projects, but can be adequately developed and managed to ensure the embeddedness of its key factors and dimensions, and thus guarantee its adoption and experience the benefits gained over time.

Additionally, it is recognized that interactions between team members are an essential lens/perspective through which the resilient performance of social systems can be analyzed. Therefore, suitable methods are needed to allow that analysis, since these are also lacking in the resilience literature [35,93].

To sum up, there is great potential for future research within the area of resilience, being our ambition to apply the proposed model to different contexts to disseminate its usage, as well as to link resilience to performance and success.

Author Statement

João Varajão: Conceptualization, Methodology, Validation, Investigation, Discussion, Writing; Gabriela Fernandes: Conceptualization, Methodology, Validation, Discussion, Writing; António Amaral: Conceptualization, Methodology, Validation, Discussion, Writing; Manuela Gonçalves: Formal Analysis, Writing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

[1] Müller R, Turner R, Andersen ES, Shao J, Kvalnes Ø. Ethics, Trust, and Governance in Temporary Organisations. Project Management Journal 2014;45(4):39–54.
[2] Musawir A, Serra C, Zwikael O, Ali I. Project governance, benefit management, and project success: Towards a framework for supporting organisational strategy implementation. International Journal of Project Management 2017;35(8):1658–72.

[3] Jani A. Escalation of commitment in troubled IT projects: Influence of project risk factors and self-efficacy on the perception of risk and the commitment to a failing project. International Journal of Project Management 2011;29(7):934–45.
[4] Morcov S, Pintelon L, Kusters R. Definitions, characteristics and measures of IT project complexity - a systematic literature review. International Journal of Information Systems and Project Management 2020;8(2):5–21. Morgan, P. B., Fletcher, D., & Sarkar, M. (2015). Understanding team resilience in the world's best athletes: A case study of a rugby union World Cup winning team. Psychology of Sport and Exercise, 16(1), 91–100.
[5] Fletcher D, Hanton S, Mellalieu SD. In: Hanton S, Mellalieu SD, editors. eds. New Nova Science: York Editors: Literature reviews in sport psychology; 2006. p. 321–74.
[6] Karlsen JT, Berg ME. A study of the influence of project managers' signature strengths on project team resilience. Team Performance Management 2020;26(3/4):247–62.
[7] Klein L, Biesenthal C, Dehlin E. Improvisation in project management: A praxeology. International Journal of Project Management 2015;33(2):267–77.
[8] Tao J, Qiu D, Yang F, Duan Z. A bibliometric analysis of human reliability research. Journal of Cleaner Production 2020;260:121041.
[9] Chen C, Reniers G, Khakzad N. Integrating safety and security resources to protect chemical industrial parks from man-made domino effects: A dynamic graph approach. Reliability Engineering & System Safety 2019;191:106470.
[10] Chen C, Reniers G, Khakzad N. A thorough classification and discussion of approaches for modeling and managing domino effects in the process industries. Safety Science 2020;125:104618.
[11] Rahi K. Project resilience: a conceptual framework. International Journal of Information Systems and Project Management 2019;7(1):69–83.
[12] Crawford L, Nahmias AH. Competencies for managing change. International Journal of Project Management 2010;28(4):405–12.
[13] Thomé AMT, Scavarda LF, Scavarda A, Thomé FS. Similarities and contrasts of complexity, uncertainty, risks, and resilience in supply chains and temporary multi-organisation projects. International Journal of Project Management 2016;34(7):328–1346.
[14] Bhamra R, Dani D, Burnard K. Resilience: the concept, a literature review and future directions. International Journal of Production Research 2011;49(18):5375–93.
[15] Vanderhaegen F. Towards increased systems resilience: New challenges based on dissonance control for human reliability in Cyber-Physical&Human Systems. Annual Reviews in Control 2017;44:316–22.
[16] Lengnick-Hall CA, Beck TE, Lengnick-Hall ML. Developing a capacity for organisational resilience through strategic human resource management. Human Resource Management Review 2011;21(3):243–55.
[17] Alliger GM, Cerasoli CP, Tannenbaum SI, Vessey WB. Team resilience: How teams flourish under pressure. Organisational Dynamics 2015;44(3):176–84.
[18] Bakker RM. Taking Stock of Temporary Organisational Forms: A Systematic Review and Research Agenda. International Journal of Management Reviews 2010;12(4):466–86.
[19] Arbuckle JL. In: Amos 5.0 Update to the Amos User's Guide. SPSS; 2003.
[20] Edson MC. A Complex Adaptive Systems View of Resilience in a Project Team. Systems Research and Behavioral Science 2012;29(5):499–516.
[21] Iriarte C, Bayona S. IT projects success factors: a literature review. International Journal of Information Systems and Project Management 2020;8(2):49–78.
[22] Varajão J. A new process for success management – bringing order to a typically ad-hoc area. Journal of Modern Project Management 2018;5(3):94–9.
[23] Muhic M, Johansson B. Sourcing motives behind sourcing decisions exposed through the Sourcing Decision Framework. International Journal of Information Systems and Project Management 2014;2(1):5–17.
[24] Varajão J. The many facets of information systems (+projects) success. International Journal of Information Systems and Project Management 2018;6(4):5–13.
[25] Kappelman L, Torres R, McLean E, Maurer C, Johnson V, Kim K. The 2018 SIM IT Issues and Trends Study. MIS Quarterly Executive 2019;18(1):51–84.
[26] Amin MT, Khan F, Zuo MJ. A bibliometric analysis of process system failure and reliability literature. Engineering Failure Analysis 2019;106:104152.
[27] Olivares C, Rivera RD, Núñez SS, Mc Leod JE. A novel qualitative prospective methodology to assess human error during accident sequences. Safety Science 2018;103:137–52.
[28] Bolbot V, Theotokatos G, Bujorianu LM, Boulougouris E, Vassalos D. Vulnerabilities and safety assurance methods in Cyber-Physical Systems: A comprehensive review. Reliability Engineering & System Safety 2019;182:179–93.
[29] Tam C, Moura EJC, Oliveira T, Varajão J. The factors influencing the success of on-going agile software development projects. International Journal of Project Management 2020;38(2020):165–76.
[30] Xue X, Wang L, Yang RJ. Exploring the science of resilience: critical review and bibliometric analysis. Natural Hazards 2018;90(1):477–510.
[31] Righi AW, Saurin TA, Wachs P. A systematic literature review of resilience engineering: Research areas and a research agenda proposal. Reliability Engineering & System Safety 2015;141:142–52.
[32] Holling CS. Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics 1973;4(1):1–23.
[33] Gittell JH, Cameron K, Lim S, Rivas V. Relationships, Layoffs, and Organisational Resilience: Airline Industry Responses to September 11. The Journal of Applied Behavioral Science 2006;42(3):300–29.
[34] Lengnick-Hall C, Beck T. Resilience Capacity and Strategic Agility: Prerequisites for Thriving in a Dynamic Environment. In: Nemeth C, Hollnagel E, Dekker S, editors. Resilience engineering perspectives. eds.2nd ed. Aldershot, UK: Ashgate Publishing; 2009.
[35] Hosseini S, Barker K, Ramirez–Marquez JE. A review of definitions and measures of system resilience. Reliability Engineering & System Safety 2016;145:47–61.
[36] Haimes YY. On the Definition of Resilience in Systems. Risk Analysis 2009;29(4):498–501.
[37] Ayyub BM. Systems Resilience for Multihazard Environments: Definition, Metrics, and Valuation for Decision Making. Risk Analysis 2014;34(2):340–55.
[38] Rose A. Economic resilience to natural and man-made disasters: Multidisciplinary origins and contextual dimensions. Environmental Hazards 2007;7(4):383–98.
[39] Furniss D, Back J, Blandford A, Hildebrandt M, Broberg H. A resilience markers framework for small teams. Reliability Engineering & System Safety 2011;96(1):2–10.
[40] Carmeli A, Friedman Y, Tishler A. Cultivating a resilient top management team: The importance of relational connections and strategic decision comprehensiveness. Safety Science 2013;51(1):148–59.
[41] Ayala JC, Manzano G. The resilience of the entrepreneur. Influence on the success of the business. A longitudinal analysis. Journal of Economic Psychology 2014;42:126–35.
[42] Zautra AJ, Hall JS, Murray KE. Resilience: A new definition of health for people and communities. In: Reich JW, Zautra AJ, Hall JS, editors. Handbook of adult resilience. eds. New York: The Guildford Press; 2010. p. 3–30.
[43] Coutu, D. (2002). How Resilience Works. Harvard Business Review, May, Retrieved from https://hbr.org/2002/05/how-resilience-works.
[44] Mathieu J, Maynard MT, Rapp T, Gilson L. Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse into the Future. Journal of Management 2008;34(3):410–76.
[45] Carmeli A, Markman GD. Capture, governance, and resilience: strategy implications from the history of Rome. Strategic Management Journal 2011;32(3):322–41.
[46] Bandura A. Self-Efficacy: The Exercise of Control. Worth Publishers; 1997.
[47] Morgan PB, Fletcher D, Sarkar M. Understanding team resilience in the worldâ€™s best athletes: A case study of a rugby union World Cup winning team. Psychology of Sport and Exercise 2015;16(1):91–100.
[48] van der Beek D, Schraagen JM. ADAPTER: Analysing and developing adaptability and performance in teams to enhance resilience. Reliability Engineering & System Safety 2015;141:33–44.
[49] Trijp JV, Boersma K, Groenewegen P. Resilience from the real world towards specific organisational resilience in emergency response organisations. International Journal of Emergency Management 2018;14(4):303–21.
[50] Čavrak I, Bosnić I, Ciccozzi F, Mirandola R. Resilience of distributed student teams to stress factors: A longitudinal case–study. Information and Software Technology 2019;114:258–74.
[51] Morgan PB, Fletcher D, Sarkar M. Developing team resilience: A season–long study of psychosocial enablers and strategies in a high–level sports team. Psychology of Sport and Exercise 2019;45:101543.
[52] Son C, Sasangohar F, Neville TJ, Peres, S. C. Moon J. Evaluation of work-as-done in information management of multidisciplinary incident management teams via Interaction Episode Analysis. Applied Ergonomics 2020;84:103031.
[53] Keegan A, Ringhofer C, Huemann M. Human resource management and project based organising: Fertile ground, missed opportunities and prospects for closer connections. International Journal of Project Management 2018;36(1):121–33.
[54] Freeman SF, Hirschhorn L, Maltz M. The Power of Moral Purpose: Sandler O'Neill & Partners in the Aftermath of September 11, 2001. Organisation Development Journal 2004;22(4):69–81.
[55] Lengnick-Hall CA, Beck TE. Adaptive Fit Versus Robust Transformation: How Organisations Respond to Environmental Change. Journal of Management 2005;31(5):738–57.
[56] Amaral A, Fernandes G, Varajão J. Identifying useful actions to improve team resilience in information systems projects. Procedia Computer Science 2015;64:1182–9.
[57] Sudhakar G, Farooq A, Patnaik S. Soft factors affecting the performance of software development teams. Team Performance Management 2011;17(3/4):187–205.
[58] Forrester R. Empowerment: Rejuvenating a Potent Idea. The Academy of Management Executive 2000;14(3):67–80.
[59] Cho I, Park H, Dahlgaard-Park S. The impacts of organisational justice and psychological resilience on employee commitment to change in an M&A context. Total Quality Management & Business Excellence 2017;28(9-10):989–1002.
[60] Moura I, Dominguez C, Varajão J. Information systems project teams: factors for high performance. Team Performance Management: An International Journal 2018;25(1/2):69–83.
[61] Moura I, Dias P, Dominguez C, Varajão J. What team members perceive as important to achieve high performance: an exploratory case study. Procedia Technology 2014;16:1010–6.
[62] Provan DJ, Woods DD, Dekker SWA, Rae AJ. Safety II professionals: How resilience engineering can transform safety practice. Reliability Engineering & System Safety 2020;195:106740.
[63] Zemba V, Wells EM, Wood MD, Trump BD, Boyle B, Blue S, Cato C, Linkov I. Defining, measuring, and enhancing resilience for small groups. Safety Science 2019;120:603–16.
[64] Sun W, Xu A, &Shang Y. Transformational leadership, team climate, and team performance within the NPD team: evidence from China. Asia Pacific Journal of Management 2014;31(1):127–47.
[65] Leonard A, van Zyl D. Social relationships in IT project teams: its role, complexity and the management thereof. International Journal of Information Systems and Project Management 2014;2(1):21–39.

[66] Saunders M, Lewis P, Thornhill A. Research Methods for Business Students. 8th ed. Edinburgh: Pearson Education Limited; 2019.
[67] Gomes AR, Faria S, Vilela C. Anxiety and burnout in young athletes: The mediating role of cognitive appraisal. Scandinavian Journal of Medicine & Science in Sports 2017;27(12):2116–26.
[68] Koufteros X, Babbar S, Kaighobadi M. A paradigm for examining second-order factor models employing structural equation modelling. International Journal of Production Economics 2009;120(2):633–52.
[69] Cohen J. A power primer. Psychological Bulletin 1992;112(1):155–9.
[70] Feldt LS, Kim S. A Comparison of Tests for Equality of Two or More Independent Alpha Coefficients. Journal of Eucational Measurement 2008;45(2):179–93.
[71] Cohen J. Statistical Power and Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Erlbaum; 1988.
[72] Nunnally JC. Psychometric theory. New York: McGraw-Hill; 1978.
[73] Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Practical Assessment research & Evaluation 2005;10(7):1–9.
[74] Steiger JH. Structural Model Evaluation and Modification: An Interval Estimation Approach. Multivariate Behavioral Research 1990;25(2):173–80.
[75] Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. Psychometrika 1973;38(1):1–10.
[76] Bentler PM. On tests and indices for evaluating structural models. Personality and Individual Differences 2007;42(5):825–9.
[77] Bollen KA. A new incremental fit index for general structural equations models. Sociological Methods & Research 1989;17(3):303–16.
[78] Byrne B. In: Structural equation modelling with Amos. Erlbaum; 2001.
[79] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal 1999;6(1):1–55.
[80] Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, editors. Testing structural equations models. Eds. Newbury: Park: Sage; 1993. p. 136–62.
[81] Jöreskog KG, Sörbom D. LISREL VIII: Analysis of linear structural equations. Mooresville: Scientific Software; 1992.
[82] Bennett N, Lemoine GJ. What a difference a word makes: Understanding threats to performance in a VUCA world. Business Horizons 2014;57(3):311–7.
[83] Huemann M, Martinsuo M. In project management, uncertainty is a great opportunity. International Journal of Project Management 2016;34(6):1026–7.
[84] Hernaus T, Vuksic V, Bach MP. Influence of strategic approach to BPM on financial and non-financial performance. Baltic Journal of Management 2012;7(4):376–96.
[85] Fernandes, Ward S, Araújo M. Improving and embedding project management practice in organisations - A qualitative study. International Journal of Project Management 2015;33(5):1052–67.
[86] Carmeli A, Spreitzer GM. Trust, Connectivity, and Thriving: Implications for Innovative Behaviors at Work. The Journal of Creative Behavior 2009;43(3):169–91.
[87] Dalziell EP, McManus ST. In: Resilience, vulnerability and adaptive capacity: implications for system performance. Proceedings of International Forum for Engineering Decision Making (IFED); 2004.
[88] Carpenter S, Walker B, Anderies J, Abel N. From Metaphor to Measurement: Resilience of What to What? Ecosystems 2001;4(8):765–81.
[89] Morgan PB, Fletcher D, Sarkar M. Recent developments in team resilience research in elite sport. Current Opinion in Psychology 2017;16:159–64.
[90] Glegg SMN, Ryce A, Brownlee K. A visual management tool for program planning, project management and evaluation in paediatric health care. Evaluation and Program Planning 2019;72:16–23.
[91] Germain M–L, McGuire D. The Role of Swift Trust in Virtual Teams and Implications for Human Resource Development. Advances in Developing Human Resources 2014;16(3):356–70.
[92] Jones C, Lichtenstein BB. Temporary Inter-organisational Projects: How Temporal and Social Embeddedness Enhance Coordination and Manage Uncertainty. In: Cropper Huxham, Ebers, Ring, editors. The Oxford Handbook of Inter–Organisational Relations. eds. Oxford, UK: Oxford University Press; 2008.
[93] Patriarca R, Bergström J, Di Gravio G, Costantino F. Resilience engineering: Current status of the research and future challenges. Safety Science 2018;102:79–100.