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Information Management

Team drivers and knowledge sharing in the performance management of agile projects.

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Dissertation

presented as partial requirement for obtaining the Master Degree Program in Information Management

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TEAM DRIVERS AND KNOWLEDGE SHARING IN THE PERFORMANCE MANAGEMENT OF AGILE PROJECTS.

by

Anaëlle Cogen Ribeiro

Master Thesis presented as partial requirement for obtaining the Master's degree in Information Management, specialization in Information Systems and Technologies Management.

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June, 2023

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Anaëlle Cogen Ribeiro

Lisbon, 23rd of June 2023

ABSTRACT

Organizations are adopting agile methodologies to create value, be competitive, and quickly respond to market changes to satisfy customers. As a result of these challenges, projects are increasingly complex, strategic, and must be addressed by efficient teams during a limited amount of time to deliver high value. We study the agile project performance with a mixed methods approach. We surveyed 160 agile practitioners and conducted six interviews with agile experts. Our results indicate that team autonomy, team diversity, and team resilience affect knowledge sharing. We also find that team resilience and risk monitoring influence the agile project performance.

KEYWORDS:

Team diversity; knowledge sharing; team autonomy; team resilience; agile project performance

Sustainable Development Goals (SDGs)

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1. INTRODUCTION

Agility is now a “must have” in transformational processes and business performance. Originally adopted among creative industries dominated by management by project (Hodgson & Briand, 2013), now the strategies in all sectors are progressively characterized by uniqueness, uncertainty, and complexity, thus requiring flexibility, innovation, and intense collaboration (Ajmal et al., 2009). Observations at international agile conferences demonstrate that all companies and all industries are adopting agile methodologies but with differing enthusiasm. Agile practices are also being developed and adjusted according to organizations’ and projects’ needs (Williams, 2012), to adapt constantly to this complex environment. Agile method adoption is a continuous process, going from implementing a particular agile methodology or a more complex one combining various process methodologies according to organization or team needs (Tripp & Armstrong, 2018). Nowadays, scaling agility is a target in most companies. Indeed, agile ways of working have proved to be able to accelerate value creation, time to market, and organizational performance by accelerating new product delivery by 200% to 400%, reducing development project costs by 15% to 25%, improving customer satisfaction, and reaching more than 90% employee engagement (Bodo von Hülsen et al., 2019). This explains why agile teams and agile organizations are now present in 65% of companies (Tripp & Armstrong, 2018).

Projects, especially those in software development, are increasingly strategic, costly, challenging, and complex in all industries. Project management and execution need excellence from the definition to the delivery of value to meet expected performance. In a project, teams work during a specific period to reach a complex, unpredictable, and complex target (Ajmal et al., 2009). As projects are based on social interactions and teamwork, much of the published literature addresses the agile team's dynamics and team role in the project success. Nevertheless, there is still contradiction on team factors level for agile project performance (Hennel & Rosenkranz, 2017). Cohesion is one of the most important factors according to Fruhling and de Vreede (2006), Cao et al. (2009) Imam and Zaheer (2021). Phillips et al. (2006), Lee and Xia (2010), and Bear and Woolley (2011) report that team diversity was key for creativity and problem-solving. In a more recent study Tam, Moura, and Varajão (2020) determined team capability and customer involvement to be the main people factors influencing software development project success. We found no studies that combine agile team factors and knowledge sharing to explain agile project performance. To fill this gap, we propose the following research question (RQ):

RQ: How are agile teams’ factors and knowledge sharing influencing the performance management of agile projects?

By answering this RQ, we expect to make two contributions. First, the aim of this research is to add to the literature and help managers to set up performing project teams, to maximize project value delivery. To our best of our knowledge, this is the first study that combines the dimension of knowledge sharing and performance in agile projects with team factors: team autonomy, team diversity, team capability, and team resilience. Second, our mixed methods approach triangulates quantitative and qualitative results, enabling us to define the relationships between variables accurately (Venkatesh V et al., 2016). The result of combining these dimensions and methods is

expected to provide a new contribution for a better understanding of team factors and knowledge sharing within teams to increase performance of future agile projects.

The work structure is as follows. First agile concepts are introduced, followed by project performance, team's factors, and knowledge sharing. Then the research model is presented with related hypotheses and the methods applied to explain the results. Then we explain the results obtained, and the theorical and managerial implications. Finally, we will conclude with research limitations and future work.

2. LITERATURE REVIEW

2.1 AGILE METHODOLOGIES

Conceptually agile project management is opposed to the traditional vision of project management normally following waterfall methodologies based on extensive planning and documentation. Waterfall methodology follows timelines and task outlines to achieve results, while agile methodology calls for tasks on short timescales to rapidly have outcomes to present to the customers and collect feedback to determine the next steps of the project (Thesing et al., 2021). The flexibility, adaptability, and capacity to respond to change are greater and the agile team as main contributor is empowered to take decisions on projects (Fowler and Highsmith, 2001).

Twelve principles have been described in the agile manifesto to guide organizations' implementation in software development and the principles are now applied in Information Technology (IT) and non-IT projects related to business and operations in all sectors. The performance enablers allowed by agile practices are originally described in the agile manifesto and are founded on four main pillars: (1) Individuals and interactions over processes and tools, (2) working software over comprehensive documentation, (3) customer collaboration over contract negotiation, and (4) responding to change over following a plan. The agile manifesto follows twelve principles fostering teams' interaction, customer satisfaction and high capacity to respond to changes (Fowler and Highsmith, 2001). Technology by itself cannot create value, it must be combined with people working together to implement it efficiently, and that is why individuals are the first pilar of the agile manifesto. Agile methodologies recognized are the following: Extreme Programming (XP), SCRUM, Feature-Driven Development (FDD), Lean Soft Development (LSD), Kanban, Dynamic System Development Method (DSDM), Adaptive Software Development (ASD), Cristal (Tam et al., 2020). SCRUM is today the most practiced agile method, and Safe is the most applied framework currently in the industry (Kadenic et al., 2023).

Most of the project success rate is determined by costs, time, and customer satisfaction – known as the iron triangle, even if additional metrics have been added to access project success (Pollack et al., 2018). Agile interest is based on performance outcomes that adopters deliver comparing to those applying traditional methods. For Tripp and Armstrong (2018), the companies adapt agile method to leverage organizational performance with three main drivers (1) improve software quality, (2) improve efficiency, and (3) improve effectiveness. Adoption of agile principles and agile practices combinations differ from one company to another according to project complexity, and the internal and external context. Tripp and Armstrong (2018) found that to reach the expected outcome it is important to have adequate initial motivation for Agile methodology adoption together with the performance outcomes metrics expected for a perfect fit.

Project success is also achieved by mitigating and avoiding risks and failures, two words of high operational impact for projects. According to the Project Management Institute, in 2021 35% of projects failed (Pulse of the Profession Flex to the Future, 2021.). Indeed, projects are exposed to technology changes, customer demand, environment, or methods and agile is one way to monitor the risk to adjust with

flexibility and speed. With short sprints it reduces the risks and failures. Explicit risk management is not one of the agile principles but can be integrated in some practices such as *daily stand up* and *iteration planning meeting* to have a sharp vision on project goals and associated risks (Garcia et al., 2022).

2.2 TEAM PERFORMANCE IN AGILE CONTEXTS AND KNOWLEDGE SHARING

The team is the central contributor to projects and, as mentioned above, despite the great amount of research reported in the literature, there are still contradictions in determining the most important agile team factor from amongst team diversity, team cohesion, team capability, and customer involvement. Also, team's challenges are growing along with the complexity of projects, multi-sites, and multiple country locations (Dingsoyr et al., 2016). According to Mayer et al. (2023), since Covid-19, virtual teams have become a normality at work, and companies have begun to embrace hybrid models (16th State of Agile Report, 2022). Understanding current trends and team performance is important to ensure organizational performance and project performance by transforming and adjusting the team context. To maximize the chances of project success, team capability is particularly important and customer involvement is a second key factor (Tam et al., 2020). Indeed, teams' factors are highly important as team satisfaction promotes higher productivity at work and lower absenteeism. This influences satisfaction of stakeholders and facilitates new opportunities and development options (Trzeciak & Banasik, 2022).

For that reason, human factors are increasingly observed in organizations and projects. Imam and Zaheer (2021) identified shared leadership as a project success driver because it enhances perceived cohesion, knowledge sharing, and trust. In agile teams, the expertise is not only based on technical skills, but also teamwork and process knowledge, domain knowledge, and product knowledge (Šmite et al., 2017). The author emphasizes the importance of social capital in addressing coordination challenges to manage internal and external knowledge for project performance. Fostering innovation is also one of the main goals when implementing agile, as teams play a vital role in achieving and maintaining competitive advantage. In agile methodologies informal communication is preferred with daily stand-up meetings and ceremonies at which members can receive information and share current topics and challenges (Hess et al., 2019). The agile setting leads to a psychological empowerment of the team due to autonomy and communication as described in the principles facilitating innovation (Malik et al., 2021). This innovative behaviour is highly positive for project performance.

Knowledge sharing relates to the action of sharing and transferring information and know–how among individuals necessary to accomplish a task and deliveries in project milestones (Deng et al., 2023). Agile requires collective responses to complex problems in the absence of prior knowledge about how to achieve the outcome (Malik et al., 2021). Projects, and more specifically software development projects, are knowledge intensive exercises (Gregory et al., 2022). Intense collaboration is needed, and knowledge sharing is key within the project teams to find solutions and address project challenges. Knowledge management reveals the importance of efficiently managing the knowledge exchanged amongst people according to knowledge type: tacit and explicit (Nonaka, 1994). Tacit knowledge is defined as personal, context-specific,

and difficult to formalize as it is in people's brains. The challenge is to make tacit knowledge become explicit, codified, and documented, to be available for all within the organization. Tacit knowledge created in an agile context is a challenge. Indeed, agile methodology is based on informal communication and face to face interactions between individuals. Hess et al., (2019) demonstrated that less detailed documentation can lead to problems such as communication lapses, work duplication, and product inconsistencies. There are negative factors that can impact agile projects. Seven different barriers to knowledge sharing have been identified by Ghobadi and Mathiassen (2016) and must be considered in managing knowledge within the project.

3. RESEARCH FRAMEWORK AND HYPOTHESES

The research model (Figure 1) identifies how agile team factors and knowledge sharing influence the performance management of agile projects to settle priorities at the team level to positively influence project outcome. Agile project success is the dependent variable of this study and is defined according to the iron triangle and in terms of quality improvement, productivity, and customer and market satisfaction (Tripp & Armstrong, 2018). As independent variables we investigate team autonomy, team diversity, team resilience, knowledge sharing, and risk monitoring to explain agile project performance.

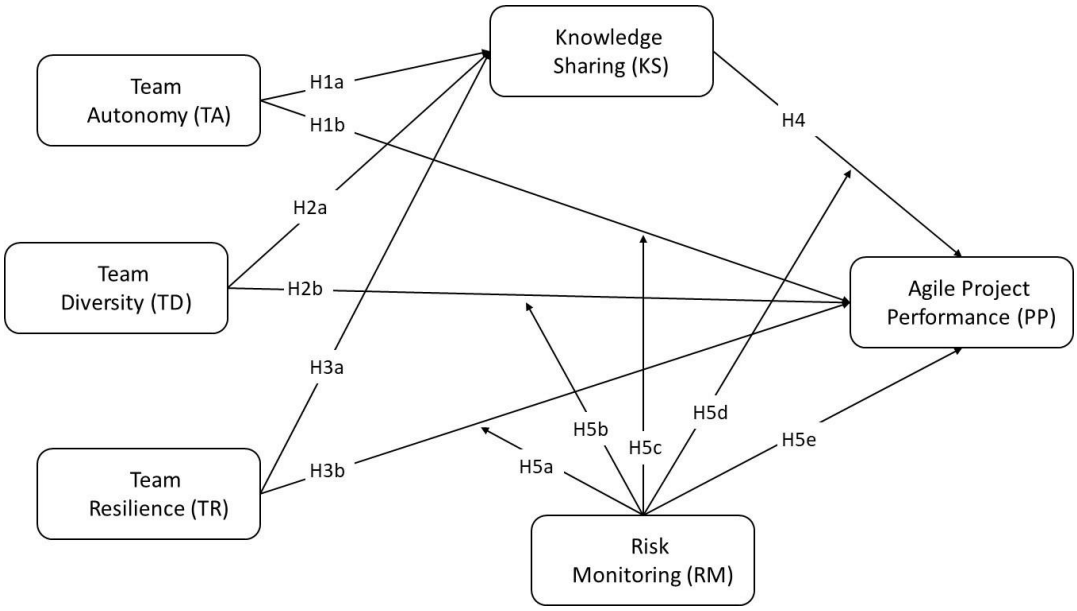

Figure 1- Research model

3.1 TEAM AUTONOMY

Agile principles are based on self-organization and self-discipline. Trzeciak and Banasik (2022) showed that employees are more efficient and committed in this type of team and it is an important motivator for employees to engender efficiency and commitment, especially in software projects where innovation is important. Agile methodologies are often adopted for delivering better results through their flexibility and commitment. In the 16th Annual State of Agile (2022) the best practices highlighted for high-performance Agile teams were elevated levels of cross-collaboration and communication, best practices facilitating knowledge transfer, and knowledge sharing. Autonomy combined with efficient communication contribute to the psychological empowerment of the team and boost the innovation behaviour important for agile projects to deliver expected outcomes in challenging environments (Malik et al., 2021). Based on the above, we posit the following hypotheses:

H1a: Team autonomy influences knowledge sharing.

H1b: Team autonomy influences positively agile project performance.

3.2 TEAM DIVERSITY

Projects involve a diversity of people in terms of skills, nationalities, organization, and professional cultural backgrounds (Ajmal et al., 2009). Many researchers have found diversity to be an improver of team performance; and this finding has also been verified in agile software development. Phillips et al. (2006), Lee and Xia (2010), and Bear and Woolley (2011) found that team diversity was key for creativity and problem-solving. Indeed, diversity allows more perspectives on problem solving and potential solutions and has a positive impact on project performance (Verwijs & Russo, 2023). Team diversity intensifies creativity and communication, essential for complex projects to deliver value added and maximize success (Hennel & Rosenkranz, 2017). Based on the above, we posit the following hypotheses:

H2a: Diversity in teams fosters knowledge sharing due to interactions to collaborate on problem solving and on potential solutions.

H2b: Diversity in agile teams contributes positively to project performance.

3.3 TEAM RESILIENCE

Projects are unique and project teams often must face unpredictable events and problems that they need to solve. Team resilience can be defined as the team capability that members can jointly recover from setbacks without collapsing and maintain the continuation of operational activities (Cheng et al., 2023). Indeed, teamwork progress can be negatively impacted if the team is affected, and as a result both team and project performance will deteriorate. On the contrary, the capacity to quickly recover team capacity will positively influence project performance. Team resilience is harder to obtain in temporary organizations as projects rely on diverse skills and knowledge interactions during a limited period. This interaction is important to improve performance through appropriate decisions and actions (Varajão et al., 2021). Based on the above, we posit the following hypotheses:

H3a: Team resilience positively contributes to knowledge sharing in the team.

H3b: Team resilience is a contributing factor of project performance.

3.4 KNOWLEDGE SHARING

Projects, and more specifically software development projects, are knowledge intensive exercises (Gregory et al., 2022). Knowledge is people based and to perform a project with higher quality and more quickly, the use and re-use of knowledge is needed (Ajmal et al., 2009). According to Das et al. (2022), employees who are open to learning, skilled, and knowledgeable enhance agility at the firm level through flexibility and innovative approaches. At project level the same occurs and it is a challenge for all team members, especially for newcomers, as they need to integrate knowledge at distinct levels: at organizational, project, product, domain, and technical environment (Gregory et al., 2022). All team members are needed to share, create, capture, and transfer this knowledge efficiently, as the reuse of knowledge to perform projects is a competitive

advantage (Ajmal et al., 2009). In agile product customization design, knowledge-based activities are also identified as a main competitive advantage to provide products with optimized costs and higher quality in a shorter period. Interactions within designer teams and experience need to be capitalized with technology support to represent, capture, share, and reuse knowledge efficiently to find innovative solutions (Yang & Li, 2008). As knowledge is a driver of project performance, it is important that knowledge process flows are ensured by building and monitoring the knowledge management capabilities (Alghail et al., 2017). Based on the above, we posit the following hypothesis:

H4: Knowledge sharing within the team during the project contributes to project performance.

3.5 RISK MONITORING

Risk monitoring is important to prevent and avoid failures and secure the project performance. Failures in projects are still underexplored in project management literature. Chow and Cao (2008) summarized four categories of failure factors: organizational risks, people risk factors, process risks factors, technical risks. Risk monitoring is inherent to project management and is part of a software development life cycle and is also an important contributor for project success. Proactive methods allowed in agile help to identify and avoid risk (Shehzad et al., 2023). As agile projects are knowledge intensive and require elevated levels of collaboration and resilience throughout project implementation, we posit the following hypotheses:

H5a: Risk monitoring moderates the impacts of knowledge sharing on project performance.

H5b: Risk monitoring moderates the impact of team autonomy on project performance.

H5c: Risk monitoring moderates the impact of team diversity on project performance.

H5d: Risk monitoring moderates the impact of team resilience on project performance.

H5e: Risk monitoring is a contributing factor of project performance.

4. METHODS

4.1 CONSTRUCT OPERATIONALIZATION

The items included in the model have been adopted from the agile literature, and more specifically from Trzeciak and Banasik (2022), Varajão, Fernandes, Amaral, and Gonçalves (2020), Tam, Moura, Oliveira, and Varajão (2020), Cheng, Hsu, and Li (2023), and Imam and Zaheer (2021). All the items are included and detailed in Appendix A.

The study gathered data through a questionnaire. The target population consisted of professionals working in projects, more specifically with agile methodologies as agile team members.

4.2 DATA COLLECTION

This study used an online survey to create the questionnaire, to contact the sample population, to store the response, and visualize the data. The advantage is to collect quickly and at low cost the necessary information to conduct the investigation (Siva et al., 2019.). The investigation questionnaire was developed in two languages: Portuguese and English and no restriction in terms of regions or sectors was made in sending the surveys. The main tool used to find expert respondents in the research field, was the social network LinkedIn, as it provides an abundance of job-related information such as education, professional experience, and projects important to obtain contacts of agile professionals in the selected countries (Roulin & Levashina, 2019). We used key words such as “agile,” “agile methodologies,” and “agile project management” to find agile experts. A total of 600 invitations were sent between March and April 2023 in a southern European country. 250 responses were received, 160 responses were considered as complete and were analysed, resulting in a response rate of 27% considering complete responses.

The 7-point Likert scale was used in the investigation to understand respondents’ agreement with (1) meaning “totally disagree” and (7) meaning “totally agree” to assess each item described in Table 1 (Joshi et al., 2015). A pilot test was performed to validate the quality and validity of then questionnaire’s items with a group of 30 agile professionals. The necessary feedback was collected to pre-validate results of the sample with a structural equation model tool SmartPLS. As a result of the pilot, minor wording adjustments were made to start with final data collection.

The data were screened using a common method bias test using Harman’s single factor test (Podsakoff et al., 2003). This detected no significant common bias as the first eigenvalue, the larger one, corresponds to 44%, which is below the threshold of 50% for the sum of all eigenvalues, representing item total variance. The marker variable has a low variance corresponding to 0.009216 (Johnson et al., 2011). These indicators confirmed the absence of common bias in our data. Concerning validated responses, Table 1 shows that the most our respondents have higher education degrees (89%), the majority having a master's degree. Experience on projects (all methodologies) is 12 years

on average and concerning agile project the average experience is 5 years. The main sector represented is Finance and Insurance (48%), followed by software and hardware industry (26%), and Consulting (9%).

Table 1 - Sample characteristics.

Education	N	%	Project Experience	N	%	Agile Project Experience	N	%
12th grade	18	11%	Less than 1 year	1	1%	Less than 1 year	8	5%
Bachelor's deg.	57	36%	1-2 years	11	7%	1-2 years	33	21%
Master's deg.	83	52%	3-5 years	33	21%	3-5 years	80	50%
PhD	2	1%	5-10 years	38	24%	5-10 years	24	15%
			10-15 years	32	20%	10-15 years	12	8%
			Greater than 15 years	45	28%	Greater than 15 years	3	2%
Methodology	**N**	**%**	**Agile roles**	**N**	**%**	**Industry**	**N**	**%**
Scrum	120	75%	Agile Coach	15	9%	Finance, Insurance	76	48%
Kanban	17	11%	Customer / End User	18	12%	Software / Hardware	42	26%
Lean	6	4%	Developer	31	19%	Consulting	14	9%
TDD	1	1%	Product Owner	24	15%	Transport and Logisitics	4	3%
Others	14	9%	Project manager	46	29%	Retail	4	3%
			Scrum Master	9	6%	Telecommunications	3	2%
			Tester	2	1%	Public administration	2	1%
			Other	15	9%	Health	2	1%
						Education	1	1%
						Publishing	1	1%
						Engineering	1	1%
						Entertainment	1	1%
						Others	9	6%

Table 1 shows that Scrum is the most used methodology (75%), followed by Kanban (11%) and Lean (4%). Most of the respondents were from Portugal (74%).

4.3 QUALITATIVE APPROACH

Aiming to complete our investigation and to understand more deeply our findings, we conducted structured interviews (Alsaawi, 2014). Six agile practitioner experts were interviewed, three in person and three remotely. For anonymity and confidential purposes, the experts were assigned numbers – Expert 1 (E1) to Expert 6 (E6).

Table 2 – Interviews' sample characteristics.

Experts	Experience and Agile background	Sector
E1	20 y mainly as agile coach	Software / Hardware
E2	10 y mainly as product owner	Transport and Logistics
E3	10 y mainly as project manager	Finance, Insurance
E4	5 y mainly as project manager	Finance, Insurance
E5	10 y mainly as scrum master	Finance, Insurance
E6	20 y mainly as developer and product owner	Software / Hardware

5. DATA ANALYSIS AND RESULTS

After collecting all of the data, the analysis was carried out with structural equation modelling (SEM) based on Partial Least Squares (PLS). The software used for analysis purposes was SmartPLS 4.0.9.0.

5.1 MEASUREMENT MODEL

The measurement model should demonstrate a good consistency and solid reliability, indicator convergent validity, and discriminant validity.

For the internal consistency we used the composite reliability (CR) and Cronbach's alpha. According to normal standards, constructs have a good consistency when scored above 0.7 and should be discarded when scored below 0.4, as presented in Table 3 (Hair et al., 2017). The assessment of convergent validity was based on average variance extracted (AVE), according to standards, the minimum should be 0.5, indicating that more than half of the latent variables' variance is explained by the indicator (Fornell & Larcker, 1981). To assess the discriminant validity, we apply three criteria. First, the loading should be greater than cross-loadings (Table 4). To meet that criterion, three items (TD3, TA3, and KS1) were removed. Second, the diagonal values (AVEs' square roots) are greater than the correlations between the constructs amongst each pair of constructs, as reported in Table 3. Third, the Heterotrait-Monotrait ratio (HTMT) of correlations criteria should be lower than 0.9 (Henseler et al., 2015). In conclusion, the measurement model meets all the criteria, permitting structural model testing.

Table 3 - Means, standard deviations, correlations, and reliability and validity measures (CR, CA, and AVE) of latent variables.

Constructs	Mean	SD	CA	CR	TeamAut	TeamDiv	TeamRes	KShar	RiskM	AgileP
TeamAut	5.358	1.094	.856	.898	**.800**					
TeamDiv	5.133	1.010	.715	.820	.622	**.730**				
TeamRes	5.509	1.055	.896	.923	.706	.649	**.841**			
KShar	5.434	1.177	.901	.931	.734	.620	.739	**.879**		
RiskM	4.832	1.200	.808	.874	.609	.588	.611	.545	**.796**	
AgileP	5.274	1.041	.902	.924	.579	.533	.698	.606	.676	**.819**

Table 4 - PLS loadings and cross-loadings.

Constructs		TeamAut	TeamDiv	TeamRes	KShar	RiskM	AgileP
Team autonomy (TA)	TA1	**.710**	.389	.378	.472	.434	.414
	TA2	**.887**	.533	.601	.669	.512	.491
	TA4	**.833**	.597	.704	.676	.548	.518
	TA5	**.696**	.468	.483	.462	.444	.445
	TA6	**.853**	.476	.608	.618	.486	.441
Team Diversity (TD)	TD1	.428	**.670**	.382	.395	.365	.257
	TD2	.418	**.762**	.405	.395	.428	.362
	TD4	.431	**.710**	.449	.372	.445	.354
	TD5	.519	**.774**	.602	.589	.469	.518
Team Resilience (TR)	TR1	.518	.550	**.842**	.520	.484	.607
	TR2	.632	.495	**.859**	.621	.536	.545
	TR3	.633	.595	**.847**	.641	.532	.619
	TR4	.540	.519	**.835**	.624	.443	.584
	TR5	.636	.563	**.820**	.688	.567	.578
Knowledge Sharing (KS)	KS2	.619	.414	.548	**.804**	.445	.454
	KS3	.666	.587	.708	**.922**	.447	.549
	KS4	.651	.569	.664	**.922**	.460	.559
	KS5	.646	.592	.666	**.861**	.562	.560
Risk Monitoring (RM)	RM1	.498	.456	.483	.408	**.820**	.562
	RM2	.429	.486	.413	.408	**.785**	.450
	RM3	.520	.475	.564	.487	**.823**	.612
	RM4	.482	.463	.465	.425	**.754**	.505
Project Performance (PP)	PP1	.511	.458	.567	.521	.587	**.834**
	PP2	.541	.505	.605	.554	.665	**.850**
	PP3	.518	.453	.622	.512	.597	**.870**
	PP4	.412	.343	.497	.429	.422	**.792**
	PP5	.327	.335	.452	.346	.455	**.792**
	PP6	.486	.480	.644	.566	.540	**.771**

Table 5 - Heterotrait-Monotrait Ratio of correlations (HTMT).

Constructs	TeamAut	TeamDiv	TeamRes	KShar	RiskM	AgilePP
TeamAut						
TeamDiv	.777					
TeamRes	.792	.780				
KShar	.829	.738	.817			
RiskM	.727	.767	.709	.636		
AgilePP	.648	.620	.766	.659	.769	

5.2 STRUCTURAL MODEL

To estimate the structural model, R^2 measures and path coefficients' level of significance were used. The variance inflation factor (VIF) is lower than 5, revealing no

multicollinearity problems. The study's dependent variable "agile project performance" scored an R^2 of 63.4% as shown in Figure 2. The significance of path coefficients was evaluated with bootstrapping process based on 5,000 resamples (Hair et al., 2017).

The model explains 64.6% of the variation in the knowledge sharing. Team autonomy ($\hat{\beta}$=0.380; p<.01), team diversity ($\hat{\beta}$=0.135; p<.10), team resilience ($\hat{\beta}$=0.383; p<.01) are statistically significant in explaining knowledge sharing, confirming the hypotheses H1a, H2a, H3a. The model explains 63.4% of variation in agile project performance, with the following items having statistical significance: team resilience ($\hat{\beta}$=0.308; p<.01) and risk monitoring ($\hat{\beta}$=0.354; p<.01). As a result, hypotheses H3b and H5e are confirmed. On the other hand, team autonomy, team diversity, and knowledge sharing items are not statistically significant, excluding confirmation of the hypotheses H1b, H2b, and H4. Risk monitoring was appraised as a moderating variable in the relationship between team resilience (H5a), team diversity (H5b), team autonomy (H5c), knowledge sharing (H5d), and agile project performance. According to our results, two of the four hypotheses are supported, H5a (β=-0.239; p<.01) and H5d (β=0.198; p<.01).

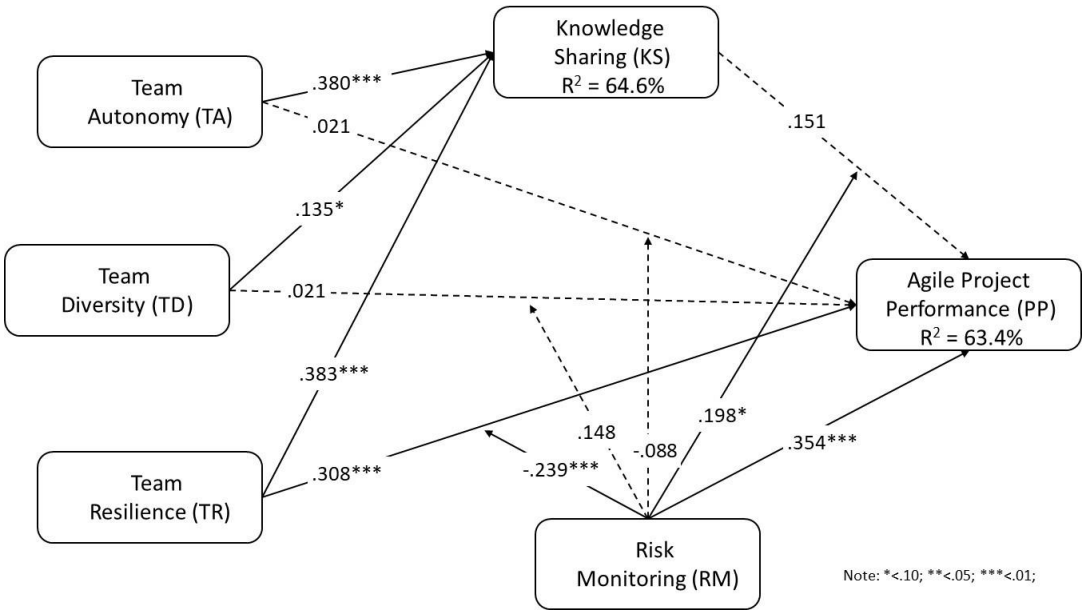

Figure 2 - Structural model results

5.3 QUALITATIVE APPROACH

The main objective was to provide a deeper understanding of the results and how the variables studied are perceived by practitioners in professional contexts.

5.3.1 Team autonomy

The first interview question addressed team autonomy. In a nutshell, autonomy is key to be successful in agile according to all of our experts and is in line with Agile Manifesto principles. For E3,

> With autonomy teams reach a level of optimization which triggers a virtuous cycle of autonomy, optimization, self-organization.

E2 added that,

> Autonomy allows empowerment and brings more motivation to team members,

and E6 explained,

> What is required is a safe and healthy environment where people can foster their skills! Passionate, talented, and highly educated people do not need a boss to tell them what to do, they want a context to show their strengths and expertise. The result: better decision-making, problem-solving and productivity. That means the employees are happy and motivated in their jobs, they experiment and innovate, they exchange experience and knowledge, and the direct impact is in quality improvement and productivity.

However, E1 mitigated that point,

> Being self-organized and autonomous needs discipline and responsibility and it is a long journey. The self-organization requires to have the right people, the right culture, and have the requested various experience and appropriate training. The same formula cannot be use in all teams even in the same company.

E4 mentioned that,

> Agile coaches are very important to spread agile culture. However, autonomy has some limits as moments with management are important to valorise the job done and collect feedback on the team outcomes.

E5 - added that,

> Team maturity is very important for a perfect autonomy to understand what and how to deliver value higher with more accurate estimations.

5.3.2 Team diversity

Diversity was the main point discussed in the second question and is important for all experts by bringing diverse perspectives seen as an added value. The diversity according E2 in terms of

> …genders, cultures, and backgrounds to have different experiences in terms of project and in doing things to improve team dynamics and review how to work more efficiently. Also, diverse perspectives provide added value to the project contribution and delivery with a technical, business, market, analytical, customer point of view.

For E3,

> Diversity is necessary to think outside the box, to leverage on multiple ways of thinking which take its sources from multiple experiences. We always say that sometimes a team needs fresh blood to indeed break the routine and get challenged.

E1 added that,

> Diversity facilitates the openness necessary to have a complete diverge and after do the converge, to achieve product double diamond.

E4 mentioned that,

> Ecosystems helps to have this diversity with experts from all areas are important.

E5 highlighted that,

> Diversity is important in terms of business, technical, soft skills.

E6 remarked,

> I work with people from various places around the world, with diverse cultures, skills, and perspectives. We can observe that teams with high diversity are more innovative, creating and testing their ideas and different perspectives. The result is a combination of better decisions, a productive work environment, and, in the end, a set of new features that bring more value to customers, reaching the next product level.

5.3.3 Team resilience

The third question had to do with team resilience. All experts mentioned trust as a key element for team resilience as communication and empathy. E1 said that,

> Work is a marathon. Mutual trust takes time to be built. It requires to treat persons as growing up and have the courage to have difficult conversations and capacity to listen negative feedback to produce the right solution to the problem. For those soft skills are essential: collaboration, flexibility in thinking different, mutual help but also the capacity to listen, to communicate, to change and be creative.

E3 added,

> Resilience is built through habits and trust. Be able to provide honest feedback with the right words so that nobody's feelings are hurt.

E6 explains how to build resilience.

> By keeping strong relationships and team spirit, communication and trust, teams can keep efficiency in difficult times and also turn potential errors or failures into new opportunities to grow.

5.3.4 Knowledge sharing

Knowledge sharing was the fourth topic. According to E1 Knowledge sharing is always a complex topic must be collaborative, and that visual cues and gamification is a good option to make work more fun. For E3,

> The quantity of information is so huge that there is no perfect knowledge sharing system. The daily stand up remains the best way to share information or the regular weekly call.

For E4,

> Co-development workshop with agile coaches to solve problematics and to share experiences are interesting: 5 minutes to present the problems, 5 minutes for questions and feedback, everybody needs to actively listen in that exercise. Dedicated time to receive and give training during one day per trimester was planned.

For E5,

> Sessions to upgrade on skills and technology: retrospectives are the moment of knowledge sharing - lessons learned.

E6 mentioned,

> We use several tools and events to transfer information and skills, product benefits and features, use cases, testimonials, and customer stories. For an organization to be agile it needs to have a collective understanding of the services and products, so teams can easily move in the same direction. Knowledge is not just about technology, it is about people and communication, team meetings and onsite events are perfect occasions for knowledge sharing and organizational alignment.

The practical tools helping in knowledge sharing mentioned by our experts are the following: Wikis, Miros, Gherkin sintax, JIRA, Confluence, Concept Boards, Figma, and training paths leveraging videos. Events to foster knowledge sharing are: Collaboration trails to evaluate rollout options and best practices., pairing in IT and non-IT topics, community of practices, gamification, speakers corners, town halls, and hackathons.

5.3.5 Risk monitoring

The last point was about risk management. On those points experts have different approaches and feedback. E1 observes,

> Risk monitoring is like in waterfall methods and classical risk management however it must be visual and visible to fit in agile mindset, short term oriented and reviewed frequently. It is important to note that a risk can turn to opportunity as we see with some companies during Covid. Key performance indicators (KPI) and health metrics can be measured and can monitor risk when a level have been reached.

E2 comments that there was no proactive approach on risk monitoring in past projects, and was sometimes neglected, but was mitigated by code review. In another context it was mandatory beginning with a check list depending on risk profile of the project, but it was seen as a bureaucratic point and was not fully integrated in the team routine, based on back-up plans due to lessons learned on previous projects. E3, E4, E5, and E6 integrates risk monitoring in agile practices: through daily stand-up meetings, during program increment planning, and the prioritization process where dependencies and risks are identified.

6. DISCUSSION

6.1 THEORICAL IMPLICATIONS

The present research combined agile team's factors and knowledge sharing to explain the performance management of agile projects. After gathering all data and performing a PLS-SEM analysis we have all the information needed to provide answers to the research question. The results support seven of the twelve hypotheses of the model.

About dependant variable, our research model validates that risk monitoring and team resilience are main contributors of agile project performance. The research model explains 63.4% of agile project performance. Risk monitoring should be a priority according to our study, as a lack of risk monitoring is one of the main causes of project failure in software development (Tavares et al., 2021). Concerning team success factors, our findings demonstrate than team resilience should be addressed throughout the project lifecycle to enhance performance. Trust is the main driver for building team resilience according to the qualitative approach.

The research model also validates the significant effects of team autonomy, team diversity, and team resilience on the knowledge sharing within the agile team, but knowledge sharing was not considered significant to explain directly agile project performance. Concerning team diversity, in our study this item was not significant to explain agile project performance, not supporting, with our sample, what was previously demonstrated by Phillips et al. (2006), Lee and Xia (2010), and Bear and Woolley (2011). The team autonomy hypothesis also was not supported despite self-organization and self-discipline being pillars in the Agile Manifesto (Fowler & Highsmith, 2001). However, in our qualitative research experts considered all of these points as important, with recent changes due to Covid 19 and remote work, we can conclude that knowledge sharing, autonomy, and diversity are prerequisites for all teams even if they are not working in agile contexts. To achieve agile success these dimensions must be considered to achieve the desired performance.

We obtained interesting findings in the moderator effect of risk monitoring of the influence of team resilience over the agile project performance, and between knowledge sharing over the agile project performance (Figure 3). On the left side of the figure, the moderator effect of risk monitoring between team resilience on agile project performance (due to the negative beta value) in the context of low-risk monitoring, the importance of team resilience is greater; for high-risk monitoring context, the impact of team resilience in explaining agile project performance is lower. On the right side of the figure, in the circumstance of high-risk monitoring, the influence of knowledge sharing over agile project performance is equally high. To manage agile project performance, it is important to consider that high knowledge sharing leverages positively and significantly the risk monitoring effect on project performance. Looking at the main risk factors highlighted by Chow and Cao (2008) to minimize project failure, and from our

quantitative data, one interpretation is than team resilience mitigates organizational risks and people-risk factors within the project, while knowledge sharing mitigates process risks factors and technical risks.

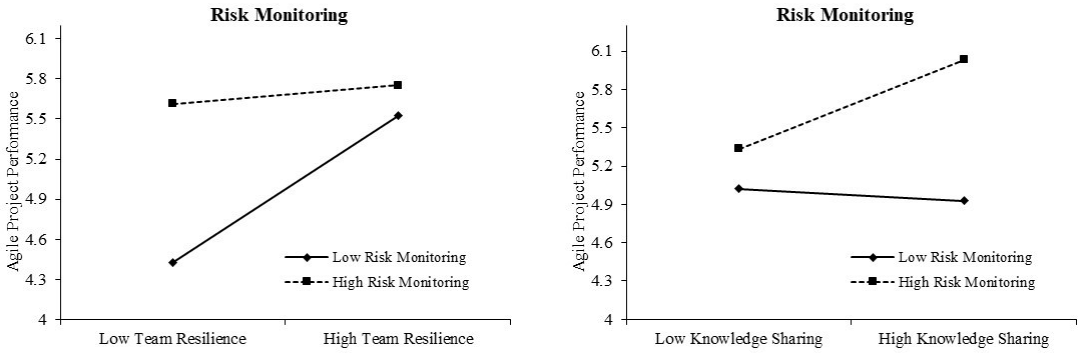

Figure 3 - Moderator effets

6.2 MANAGERIAL IMPLICATIONS

Interpreting the results, we are now able to disclose managerial and practical implications based on our findings to improve agile project performance. As risk monitoring is a critical factor for agile project performance, it is important to include a systematic and proactive way to identify and monitor risks on a daily basis at operational and at strategic project level (Shehzad et al., 2023). Management risk is not explicitly described in Agile principles but multiple iterations are said to reduce risks, so we invite managers to integrate risk monitoring in agile ceremonies and events, starting with daily meetings (Tavares et al., 2021). Risk management must also be included at the technical level, for example in the code review, as mentioned by our experts, and at a more strategic level of the project using the adequate frameworks. These would include minimum documentation and working with lessons learned to maximize efficiency in future projects. The risk monitoring approach must identify and follow up the four categories identified by Chow and Cao (2008) : organizational, people, process, and technical risks. To follow agile mindset, the team should identify risks and make them easily visible and review them regularly. Collaborative tools are helpful in that regard. Depending on the nature of the project, a hybrid approach can be an alternative solution to mitigate some risks, using traditional risk management approaches and frameworks, depending on the type of project (Elkhatib et al., 2022). As failure in software development is still frequent, risk monitoring needs to be managed in all projects with special attention.

According to our results, we also conclude that team resilience is the most important people factor to increase project performance. Based on that, we invite management to reflect and design action plans to create a resilient and efficient team with concrete approaches. In the model developed by Varajão et al. (2021) team resilience was explained by seven factors: trust and solidarity, focus on result, commitment, management and accountability, embrace conflicts, work conditions, and skills and behaviours. Managers should work on these seven factors, starting with trust,

which is fundamental and confirmed in our qualitative research, throughout the entire project duration with the team and to embed it in agile project practices routines.

Moreover, we have demonstrated that high knowledge sharing within the team has the capacity to increase project performance by positively moderating the risk. As a result, we strongly recommend creating the conditions to facilitate this sharing to become a natural process within the team. The tools proposed by our experts can be used in accordance with project typology and organization reality and culture. As demonstrated, team autonomy already described in agile principles by Fowler and Highsmith (2001), team resilience, and team diversity facilitate the knowledge sharing and must be a continuous focus.

6.3 LIMITATIONS AND FUTURE RESEARCH

We acknowledge the disadvantages of the research process and sample, resulting from the methodological approach, as quantitative data samples are not equally balanced in terms of industries. The research was conducted in Portugal. Moreover, our sample is dominated by the insurance and finance industries, in which risk management is the core business. In future research it would be interesting to develop this model in other types of industry where innovation and creativity is extremely critical for business success, such as entertainment and games.

Accordingly, it is recommended to conduct more extensive research in more countries and industries to have a reliable comparison basis to adopt the model, covering the team factors including resilience, risk monitoring, and knowledge sharing effects in agile performance. Another limitation is that in our data no distinction is made regarding project type or between small and large-scale projects, for which process and dynamics may differ considerably, adding project management complexity (Beulen and Eric, 2011). According to Kobitzschet et al. (2001) distributed software development is more complex because of knowledge transfer, legal project management, quality management, language, time, and infrastructure issues. We invite future researchers to apply our model according to type of projects, as the problems to be solved involve challenges of different natures.

Team resilience in a project is key, and trust is the strongest pilar according to our experts. As future work, our study has the potential to invite understanding team resilience foundations and contingencies, as the literature about resilience is lacking (Varajão et al., 2021). Indeed, building trust is a prolonged process. As mentioned in the interviews, trust is also linked to team maturity, and we invite adding this dimension to the model (Kadenic et al., 2023). To confirm the model and understand if team maturity could be a relevant aspect, a longitudinal study could in the future help to validate the sequence.

In addition, as a team is composed of individuals, the personal characteristics necessary to build an resilient agile team could be investigated, as soft skills were mentioned as key in our interviews. Moreover, a team is an ecosystem interacting with other ecosystems. Beh et al. (2022) proposed different dimensions to measure

performance, as the dimensions are interdependent and invited a comprehensive approach. Indeed, a team can be efficient in terms of agile outcomes but processes and organizational culture contexts can still be barriers. Future research can study a more complex model including organization culture, process, and individuals' contexts.

7. CONCLUSION

Through survey data this research explored drivers of agile project performance using mixed methods. The data collected from 160 Agile practitioners from several industries in Portugal provided empirical information from a SEM_PLS analysis completed by structured interviews. The study revealed the important effect of risk monitoring as main success factor for agile projects and at team level, resilience appeared as key driver. The study results failed to find direct evidence that knowledge sharing is critical for agile project performance, however it demonstrates that high knowledge sharing increases risk monitoring, which allows a positive effect on performance. The key contribution of this research is to identify two critical success factors based on survey data obtained completed with qualitative interviews. It provides a clear focus for management to systematically include risk monitoring in agile practices and to work on strengthening team resilience starting with trust to maximize agile project performance.

REFERENCES

16th State of Agile Report. (2022).

Ajmal, M. M., Kekäle, T., & Takala, J. (2009). Cultural impacts on knowledge management and learning in project-based firms. *VINE*, *39*(4), 339–352. https://doi.org/10.1108/03055720911013634

Alghail, A. A., Yao, L., Kie, C. J., & Alkawsi, J. (2017). The Effect of Knowledge Management Capabilities on Project Management Success. *International Journal of Business Management (IJBM*, *2*.

Alsaawi, A. (2014). A critical review of qualitative interviews. *European Journal of Business and Social Sciences*, *3*(4), 149–156. http://ssrn.com/abstract=2819536

Bear, J. B., & Woolley, A. W. (2011). The role of gender in team collaboration and performance. *Interdisciplinary Science Reviews*, *36*(2), 146–153. https://doi.org/10.1179/030801811X13013181961473

Beh, H. C., Jusoh, Y. Y., Abdullah, R., & Hassan, S. (2022). Dimensions in Measuring Performance of Agile Software Development Projects: A Literature Review. *Proceedings - AiIC 2022: 2022 Applied Informatics International Conference: Digital Innovation in Applied Informatics during the Pandemic*, 83–87. https://doi.org/10.1109/AiIC54368.2022.9914025

Bodo von Hülsen, James Sattler, Michael Schachtner, László Juhász, Sara Codella, Simone Schwemer, & Rob Koentopp. (2019). *When Will Insurers Go Agile?* https://www.bcg.com/publications/2019/when-will-insurers-go-agile

Cao, L., Mohan, K., Xu, P., & Ramesh, B. (2009). A framework for adapting agile development methodologies. *European Journal of Information Systems*, *18*(4), 332–343. https://doi.org/10.1057/ejis.2009.26

Cheng, K. T., Hsu, J. S. C., Li, Y., & Brading, R. (2023). Intellectual capital and team resilience capability of information system development project teams. *Information and Management*, *60*(1). https://doi.org/10.1016/j.im.2022.103722

Chow, T., & Cao, D. B. (2008). A survey study of critical success factors in agile software projects. *Journal of Systems and Software*, *81*(6), 961–971. https://doi.org/10.1016/j.jss.2007.08.020

Das, K. P., Mukhopadhyay, S., & Suar, D. (2022). Enablers of workforce agility, firm performance, and corporate reputation. *Asia Pacific Management Review*. https://doi.org/10.1016/j.apmrv.2022.01.006

Deng, H., Duan, S. X., & Wibowo, S. (2023). Digital technology driven knowledge sharing for job performance. *Journal of Knowledge Management*, *27*(2), 404–425. https://doi.org/10.1108/JKM-08-2021-0637

Dingsoyr, T., Faegri, T. E., Dyba, T., Haugset, B., & Lindsjorn, Y. (2016). Team performance in software development: Research results versus agile principles. *IEEE Software*, *33*(4), 106–110. https://doi.org/10.1109/MS.2016.100

Elkhatib, M., al Hosani, A., al Hosani, I., & Albuflasa, K. (2022). Agile Project Management and Project Risks Improvements: Pros and Cons. *Modern Economy*, *13*(09), 1157–1176. https://doi.org/10.4236/me.2022.139061

Tripp, J. F., & Armstrong, D. J. (2018). Agile Methodologies: Organizational Adoption Motives, Tailoring, and Performance. *Journal of Computer Information Systems*, *58*(2), 170–179. https://doi.org/10.1080/08874417.2016.1220240

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Fowler, M., & Highsmith, J. (2001). *The Agile Manifesto*. www.martinfowler.com/articles/newMethodology.html

Fruhling, A., & de Vreede, G. J. (2006). Field experiences with eXtreme Programming: Developing an emergency response system. *Journal of Management Information Systems* , 22(4), 39–68. https://doi.org/10.2753/MIS0742-1222220403

Garcia, F. V., Hauck, J. C. R., & Rizzo Hahn, F. N. (2022). Managing Risks in Agile Methods: a Systematic Literature Mapping. *Proceedings of the International Conference on Software Engineering and Knowledge Engineering, SEKE*, 394–399. https://doi.org/10.18293/SEKE2022-123

Ghobadi, S., & Mathiassen, L. (2016). Perceived barriers to effective knowledge sharing in agile software teams. *Information Systems Journal*, *26*(2), 95–125. https://doi.org/10.1111/isj.12053

Gregory, P., Strode, D. E., Sharp, H., & Barroca, L. (2022). An onboarding model for integrating newcomers into agile project teams. *Information and Software Technology*, *143*. https://doi.org/10.1016/j.infsof.2021.106792

Hair, J. F., Hult, G., Ringle, C., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). Sage.

Hennel, P., & Rosenkranz, C. (2017). *Team Diversity and Performance – How Agile Practices and Psychological Safety Interact*. https://www.researchgate.net/publication/321997357

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*, 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hess, A., Diebold, P., & Seyff, N. (2019). Understanding information needs of agile teams to improve requirements communication. *Journal of Industrial Information Integration*, *14*, 3–15. https://doi.org/10.1016/j.jii.2018.04.002

Hodgson, D., & Briand, L. (2013). Controlling the uncontrollable: "Agile" teams and illusions of autonomy in creative work. *Work, Employment and Society*, *27*(2), 308–325. https://doi.org/10.1177/0950017012460315

Imam, H., & Zaheer, M. K. (2021). Shared leadership and project success: The roles of knowledge sharing, cohesion and trust in the team. *International Journal of Project Management*, *39*(5), 463–473. https://doi.org/10.1016/j.ijproman.2021.02.006

Johnson, R. E., Rosen, C. C., & Djurdjevic, E. (2011). Assessing the impact of common method variance on higher order multidimensional constructs. *Journal of Applied Psychology*, *96*(4), 744–761.

Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology*, *7*(4), 396–403. https://doi.org/10.9734/bjast/2015/14975

Kadenic, M. D., Koumaditis, K., & Junker-Jensen, L. (2023). Mastering scrum with a focus on team maturity and key components of scrum. *Information and Software Technology*, *153*. https://doi.org/10.1016/j.infsof.2022.107079

Lee, G., & Xia, W. (2010). Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data on Software Development Agility. *MIS Quarterly*, *34*(1), 87–114. https://www.jstor.org/stable/20721416

Malik, M., Sarwar, S., & Orr, S. (2021). Agile practices and performance: Examining the role of psychological empowerment. *International Journal of Project Management*, *39*(1), 10–20. https://doi.org/10.1016/j.ijproman.2020.09.002

Mayer, C., Sivatheerthan, T., Mütze-Niewöhner, S., & Nitsch, V. (2023). Sharing leadership behaviors in virtual teams: effects of shared leadership behaviors on team member satisfaction and productivity. *Team Performance Management*. https://doi.org/10.1108/TPM-07-2022-0054

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, *5(1),* 14–37.

Phillips, K. W., Northcraft, G. B., & Neale, M. A. (2006). Surface-level diversity and decision-making in groups: When does deep-level similarity help? *Group Processes and Intergroup Relations*, *9*(4), 467–482. https://doi.org/10.1177/1368430206067557

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, Vol 88(5)*, *879*(5), 879–879.

Pollack, J., Helm, J., & Adler, D. (2018). What is the Iron Triangle, and how has it changed? *International Journal of Managing Projects in Business*, *11*(2), 527–547. https://doi.org/10.1108/IJMPB-09-2017-0107

Pulse of the Profession ® 2021 Flex to the Future. (n.d.). Retrieved June 5, 2023, from https://www.pmi.org/

Roulin, N., & Levashina, J. (2019). LinkedIn as a new selection method: Psychometric properties and assessment approach. *Personnel Psychology*, *72*(2), 187–211. https://doi.org/10.1111/peps.12296

Shehzad, N., Iqbal, M. A., & Amjad, M. (2023). *A Review of Risk Management in Agile Development*. 63–68. https://doi.org/10.1109/icdi57181.2022.10007239

Siva, M., Nayak, D. P., & Narayan, K. A. (2019). Strengths and Weakness of Online Surveys. *IOSR Journal of Humanities and Social Sciences (IOSR-JHSS*, *24*(5). https://doi.org/10.9790/0837-2405053138

State of Agile. (2022). *16th Annual State of Agile Report*. https://stateofagile.com/

Tam, C., Moura, E. J. da C., Oliveira, T., & Varajão, J. (2020). The factors influencing the success of on-going agile software development projects. *International Journal of Project Management*, *38*(3), 165–176. https://doi.org/10.1016/j.ijproman.2020.02.001

Tavares, B. G., Keil, M., Sanches da Silva, C. E., & de Souza, A. D. (2021). A Risk Management Tool for Agile Software Development. *Journal of Computer Information Systems*, *61*(6), 561–570. https://doi.org/10.1080/08874417.2020.1839813

Thesing, T., Feldmann, C., & Burchardt, M. (2021). Agile versus Waterfall Project Management: Decision model for selecting the appropriate approach to a project. *Procedia Computer Science*, *181*, 746–756. https://doi.org/10.1016/j.procs.2021.01.227

Trzeciak, M., & Banasik, P. (2022). Motivators Influencing the Efficiency and Commitment of Employees of Agile Teams. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(4), 176. https://doi.org/10.3390/joitmc8040176

Varajão, J., Fernandes, G., Amaral, A., & Gonçalves, A. M. (2021). Team Resilience Model: An Empirical Examination of Information Systems Projects. *Reliability Engineering and System Safety*, *206*. https://doi.org/10.1016/j.ress.2020.107303

Venkatesh V, Brown, S. A., & Sullivan, Y. W. (2016). Guidelines for conducting mixed methods research: An extension and illustration. *Journal of the Association for Information Systems*, *17(7), 2.*

Verwijs, C., & Russo, D. (2023). *The Double-Edged Sword of Diversity: How Diversity, Conflict, and Psychological Safety Impact Agile Software Teams*. http://arxiv.org/abs/2301.12954

Williams, L. (2012). What agile teams think of agile principles. *Communications of the ACM*, *55*(4), 71–76. https://doi.org/10.1145/2133806.2133823

Yang, C., & Li, H. (2008). A framework of product knowledge management supporting product agile customization design. *Proceedings of 2008 IEEE International Conference on Service Operations and Logistics, and Informatics, IEEE/SOLI 2008*, *1*, 308–313. https://doi.org/10.1109/SOLI.2008.4686411

APPENDIX

APPENDIX A - ITEMS

Construct		Item	Adapted from
Team autonomy (TA)	TA1	Team members are asked to participate in project execution strategy in an early stage.	Trzeciak & Banasik (2022), Varajão, Fernandes, Amaral, & Gonçalves (2020); Tam, Moura, Oliveira, & Varajão (2020)
	TA2	Team members are encouraged to share new ideas and new ways of doing things.	
	TA3	Project team was trained on Agile principles.	
	TA4	Communication within the team is continuous and transparent.	
	TA5	Team members are empowered by management to take decisions about the project.	
	TA6	Team members are encouraged to be creative, imaginative, and innovative.	
Team Diversity (TD)	TD1	People in the team were from different professional backgrounds.	Varajão, Fernandes, Amaral, & Gonçalves (2020) Tam, Moura, Oliveira, & Varajão (2020)
	TD2	People in the team have complementary competencies.	
	TD3	People in the team are from different countries / regions.	
	TD4	People's level of seniority in the team is equally balanced.	
	TD5	The social culture in the team was similar despite the origin and background of team members.	
Team Resilience (TR)	TR1	Team members have a clear understanding of priorities, the project progress, and difficulties.	Varajão, Fernandes, Amaral, & Gonçalves (2020) Cheng, Hsu, & Li (2023)
	TR2	Team members are aware of expected results and have regular feedback about achievement.	
	TR3	Team members are highly involved in problem solving and are committed to the solution.	
	TR4	Conflicts are managed in a proper way with respect and tolerance to each other.	
	TR5	The team works in a safe and positive environment allowing it to maintain a positive attitude.	
Knowledge Sharing (KS)	KS1	Team members onboarding is done with a training and all materials (manuals, meeting minutes) are shared.	Ajmal, M. M., Kekäle, T., & Takala, J. (2009) Fedor, Ghosh, Caldwell, Maurer, & Singhal (2003)
	KS2	Team members are encouraged to share knowledge and know-how on a regular basis.	
	KS3	Team members welcome questions and discussions.	
	KS4	Team members are open minded about mistakes, share project difficulties and previous failures.	
	KS5	My team's members reflect on lessons learned to improve future projects and processes.	
Risk Monitoring (RM)	RM1	Organizational management, structure, and culture are favourable to agile project performance.	Cao (2008) A.Hess, et al- (2019)
	RM2	People are trained on agile processes and have the necessary competence, and skills-sets are contributing to successful project achievement.	
	RM3	Process about projects' scope, requirements, and planning are clearly communicated within the team and with the customer.	
	RM4	Technical practices on agile process, tools, and technology available is contributing to project success.	
Project Performance (PP)	PP1	Project is delivered with a better quality.	Tripp & Armstrong, 2018
	PP2	Project is delivered with higher productivity due to agile practices.	
	PP3	Project is in line with customer expectations.	
	PP4	Project is on time.	
	PP5	Project is on budget.	
	PP6	Project team is achieving a predefined goal.	

APPENDIX B- ETHICS COMMITTEE

De: Qualtrics Survey Software <noreply@qemailserver.com>
Enviado: 18 de fevereiro de 2023 19:03
Para: Anaelle <m20210377@novaims.unl.pt>
Assunto: NOVA IMS | Ethics Committee - APPROVED

This is to certify that
Project No.: **INFSYS2023-2-182317**
Project Title: **Team drivers and Knowledge Sharing in the performance management of Agile projects**
Principal Researcher: **Anaëlle Ribeiro**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 2/18/2023.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of
- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 2/18/2023

NOVA IMS Ethics Committee
ethicscommittee@novaims.unl.pt