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Human factors that influence the success of Agile Projects

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Dissertation presented as partial requirement for obtaining
the Master's degree in Information Management.

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

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HUMAN FACTORS THAT INFLUENCE THE SUCCESS OF AGILE PROJECTS

by

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Dissertation presented as a partial requirement for obtaining the Master's degree in Information Management, with a specialization in Marketing Intelligence.

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ABSTRACT

Project management, when based on agile methodologies, has brought improvements in the success rate in software development projects in recent years, contributing to the improvement of service quality and boosting motivation and productivity in their teams. Thus, it is important to understand what people face when managing projects, using agile methodologies. This study suggests a revised model for assessing the impact of human variables that affect the success of agile methodology in a project management context based on the DeLone & McLean IS Success Model. Our model combines three human factors including collaboration quality as independent variable and agile mindset and agile coach as moderators between the relationship of user satisfaction and individual performance. The motivation of this research is to gain a better understanding of the factors that can influence the achievement of successful agile project management, taking into consideration the factors related with individual performance. The results of a SEM-PLS analysis of 201 professional respondents indicate that "user satisfaction" and "individual performance" are the two most important elements in the success of agile software development projects. Managers and teams will be able to set priorities and improve project outcomes by recognizing which aspects are crucial for success. We discuss this topic, the limitations of the research, and possible paths for future studies.

KEYWORDS

Project management; agile methodology; success factors; human factors; DeLone and McLean

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1. Introduction

Project management is fundamental to promote the success of a project. It involves not only technical knowledge but also skills and abilities that go beyond technical aspects. Measuring the success of agile project management is very demanding, as it requires that issues and challenges are addressed to enable such measure, and not only the implementation of suitable agile methods (Sithambaram et al., 2021). Several authors have proposed a model with five human elements that affect how well ongoing agile software development projects perform in terms of quality, cost, timeliness, and client satisfaction (Boehm & Turner, 2005; Chow & Cao, 2008; Tam, Moura, et al., 2020). Results unequivocally demonstrate how important it is to choose the appropriate individuals for the right teams in order for agile approaches to succeed (Lalsing, 2012). People have a significant role in project development, according to some authors who have reported on the Agile methodology, because embracing agility enforces change amongst enterprises and all related stakeholders (Loiro et al., 2019). According to Chow and Cao (2008), project managers need to choose well-qualified teams, practice Agile engineering techniques, and apply Agile-style delivery strategies to ensure success on projects. Within this Agile-style we find the dimension of "People" as a fundamental feature. The Agile methodology requires motivated and flexible individuals in a support-based environment (Boehm & Turner, 2005).

Our study focuses on the people dimension as it is a pillar in agile methodologies. We seek to find the factors that must be taken into consideration when the goal is to achieve successful projects in an agile context. We chose collaboration quality, agile mindset, and agile coach (from Cockburn & Highsmith, 2001; Misra et al., 2009; Senapathi & Srinivasan, 2014) as human factors to include because we wish to validate the impact that these characteristics have on whether a project is successful. If the project management is executed correctly and efficiently, it can deliver many benefits to the team and the business in general. The benefits are not for managers only, as all teams involved in the project can understand and apply them toward achieving greater success in managing their agile projects. Furthermore, another motivation is to determine if this study can have an impact on agile projects management. We hope to demonstrate that these human factors can influence the success of agile projects and increase the success probability of future agile software development projects.

We base our theoretical model on the DeLone & McLean Information Systems (IS) Success Model as a framework for measuring the complex dependent variable in IS research (DeLone & McLean, 1992, 2003). We suggest slight changes to the model and adaptations based on Agile context, selecting collaboration quality as an independent variable as in the D&M model's dimension of service quality. This study also explores the significance of agile mindset and agile coach as moderators between the relationship between user satisfaction and individual performance, not only as a direct influence between user satisfaction and individual performance. We expect that this study will provide agile managers with crucial information they can use to implement the best practices to retain current customers and increase the success of agile project management.

The research is structured in three stages as follows: in the first we review the literature about the actual status of Project Management and Agile methodologies, the factors that contribute to the success of the agile projects, and the theoretical foundations to conduct this research. The DeLone & McLean (D&M Model) is the foundation for the theoretical model of the study.

We created a test of the survey with a small group of colleagues who use the Agile methodology to confirm and validate the questions of the final survey that was conducted, thereby ensuring the relevance of the questions proposed. The survey was then presented to a wider audience. Data analysis using structural equation modelling (SEM) is performed, and in the end we discuss the results, contributions to theory and practice, limitations, and suggestions for future research.

2. Literature Review

2.1 Project Management

Development of projects is very common in companies in all business sectors and it is important to concentrate on project management to ensure efficiency and high-quality results. Project management is a fundamental pillar of the entire performance and consists of structured and planned execution to ensure the best use of available resources, in order to achieve the desired result. According to the ISO (ISO 21502:2020), project management is defined as coordinated activities to direct and control the accomplishment of agreed objectives. The definition of project management has been subject to changes since the 1950s and most of the definitions take into account the dimensions of cost, quality, and performance, known as the Iron Triangle (Atkinson, 1999).

However, project management is much more than this simple description. It is a thinking process that exceeds the complexity of a Gantt chart, for example, and other methods. Managing opportunities, conflicts, and issues are significant project management activities. It is not a question of whether to use project management but instead to select and use the best techniques, tools, and methods (Lientz & Rea, 2001). Making this possible involves different skills and abilities as well as technical knowledge and methodologies. If project management is carried out properly and effectively, it can bring several advantages for the team and the business (Clarke, 1999).

Project management can be used in software projects but is also becoming a crucial instrument in the development of projects across many different industries. As a result, there is significant investment in managers' training, equipping them with the skills they need to complete their responsibilities effectively. Choosing a methodology to use for a project is the main objective. However, the methodology adopted is what matters the most because it must satisfy all of the project's needs. In the end, frameworks are a pivotal tool for project management since they enable job management and progress measurement (Matos & Lopes, 2013).

Project Management Body of Knowledge (PMBOK) is an example of a framework that incorporates best practices in project management. PMBOK it is an entire collection of processes, best practices, terminologies, and guidelines that are accepted as standard within the project management industry for both IT and non-IT projects. However, PMBOK is not regarded as a perfect model for project success (Sithambaram et al., 2021). The Prince2 (acronym for Projects IN Controlled Environments) method is also for any type of project, and is based around the creation of a business case. According to Einhorn (2019), creating and maintaining a business case may contribute to project success, but may not necessarily guarantee it (Einhorn et al., 2019).

Traditional project management methods focus on comprehensive planning, without direct contact with the client in each step of the project, and employ a tight control process that allows for minimal deviation from the original plan. On the other hand, the agile methodology assumes and accommodates the inevitability of change, focusing on customer interactions, thereby downplaying rigid planning and detailed documentation (Boehm, 2002; Nerur et al., 2005). This research is intended to go deeper into Agile methodologies.

2.2 Agile methodology

In 2001 the Agile Manifesto was written – a document explaining the four foundational values and the 12 supporting principles for applying the Agile approach to software development (Beck et al., 2001). The four values are: individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. Nevertheless, the implementation of principles, practices, methodologies, tools, and techniques is not enough to guarantee the success of a project. (Sithambaram et al., 2021).

In Table 1, we can confirm that in comparison between the agile and waterfall methods (2015 CHAOS Report, released by the Standish Group), there is greater success in projects that use the Agile methodology. The findings for all projects indicate that waterfall initiatives have a three times higher failure rate than agile projects, and that agile programs have a nearly four times higher success rate than waterfall projects. The results are divided into three categories, large, medium, and small projects. The aggregate findings undeniably demonstrate that agile programs scale significantly better than waterfall projects. However, note that there is a less significant difference between the agile and waterfall processes for smaller projects (Hastie & Wojewod, n.d.). This report has been published every year since 1994 and is a snapshot of the state of the software development industry. In our study, we can confirm that there is still work to be done around achieving successful outcomes from software development projects.

Table 1 – Chaos resolution by agile versus waterfall (Chaos Report, The Standish Group, 2015)

SIZE	Method	Successful	Challenged	Failed
ALL SIZE PROJECTS	Agile	39%	52%	9%
	Waterfall	11%	60%	29%
LARGE SIZE PROJECTS	Agile	18%	59%	23%
	Waterfall	3%	55%	42%
MEDIUM SIZE PROJECTS	Agile	27%	62%	11%
	Waterfall	7%	68%	25%
SMALL SIZE PROJECTS	Agile	58%	38%	4%
	Waterfall	44%	45%	11%

The resolution of all software projects from fy2011-2015 in the Chaos database, segmented by the agile process and waterfall method. The total number of software projects is over 10,000.

Agile project management (APM) or "agile methodologies" is a team management strategy and productivity paradigm that promotes ongoing, incremental progress on work priorities even in the face of changes. APM derives from agile software development techniques which are programming methodologies focused on adaptation to any change to increase the likelihood that a project will succeed (Cohen et al., 2004). Most agile methodologies create software in

iterations, which typically span one to four weeks, to reduce risks during the execution of a project. All the tasks required to create new capabilities are included in each iteration, which is like a smaller version of the overall project and comprises planning, requirements analysis, design, coding, testing, and documentation. A project using agile programming undertakes to release new software at the conclusion of each iteration, and the team analyses its priorities between iterations (Senabre Hidalgo, 2019).

There are variously typed Agile methodologies, such as Scrum and Kanban as well as Extreme Programming (XP), Feature Driven Development (FDD), Lean Software Development, Agile Unified Process (AUP), Crystal, and Dynamic Systems Development Method (DSDM), among others. In the months after introducing the Agile Manifesto, the authors extended it, based on the ideas of the document. After the publication of the Manifesto, teams started to adopt Agile and gradually managers also started to incorporate this methodology in their organizations. However, Agile is much more than these examples of frameworks. It is the umbrella term for a set of frameworks and practices based on the Manifesto for Agile Software Development and the 12 principles behind it. The main difference between this approach from others is the focus on the people doing the work and how they work together. “The demand for success in agile projects requires serious attention while addressing its issues and challenges, besides merely implementing suitable agile methods” (Sithambaram et al., 2021). Table 2 shows some examples of agile frameworks and respective practices that differ between them (Nikitina et al., 2012):

Table 2 - Differences between Scrum, Kanban, and Scrumban (Source: Nikitina et al., 2012)

	Scrum	Kanban	Scrumban
INSTRUMENTS	Scrum board with prioritized tasks	Kanban board	Working board for visualizing the workflow and progress
ROLES	Different roles (Product Owner, Scrum Master, Developer Team)	No defined roles	Team and other needed roles
PLANNING MEETING	Planning sprint, mandatory	If the team wants and the flow is improved	If the team wants and the flow is improved
DAILY MEETING	Every day (duration 15min), mandatory	No meetings	Recommended for continuous improvement of work

REVIEW / RETROSPECTIVE MEETING	Predefined meetings, activities, and durations defined by the framework	Not prescribed	Can be done when needed for process improvement and feedback
PROGRESS	Sprint content	Task limit for each step (WIP)	Controlled by workflow state
PRODUCT BACKLOG	List of prioritized and estimated stories	Tasklist, each task containing a signal card	Time or signal card
ITERATIONS	Between 2-4 weeks (sprint)	Continuous flow	Continuous flow

The agile principles state that communication and responsiveness to changes are essential for the team to continuously create functional software. Despite having different working techniques, commonalities might be seen between the frameworks such as: a shared goal of removing waste and impediments; teams that self-organize and allocate tasks without a team leader; using Scrum/Kanban boards to visualize the task in progress; regular software delivery that is usable and transparent, and better procedures and methods (Elena, 2019).

2.3 The success of project management

Success in project management has been traditionally associated with the “Iron Triangle” that points out the delivery of projects in time, cost, and quality. Nevertheless, we know that other challenges exist besides this “measurable” scope, time, cost, and quality. Most project management problems – poor communication between stakeholders, schedule delays, differing priorities, poor client interface – occur due to behavioural problems rather than technique. Therefore, it has been recognized that good management along with the understanding of human behaviour and the organizational dimensions of project management are the keys to managing projects effectively. As James W. Walker stated, “through human resource planning, management prepares to have the right people at the right places at the right times to fulfil both organizational and individual objectives” (Verma Vijay K., 1996).

At the same time, the culture, mission, vision, and the way the team collaborates play critical roles in the success of a project. It is not only the technical knowledge but the combination of the right methodology and leadership skills that leads to the successful implementation of a project (Collazo, 2020). Most project managers are well trained in terms of technical knowledge but they forget the importance of the culture and the team. It is very important to get to know all members of the team, from the CEO to the business analysts and developers, as it is an essential step to avoid project failure.

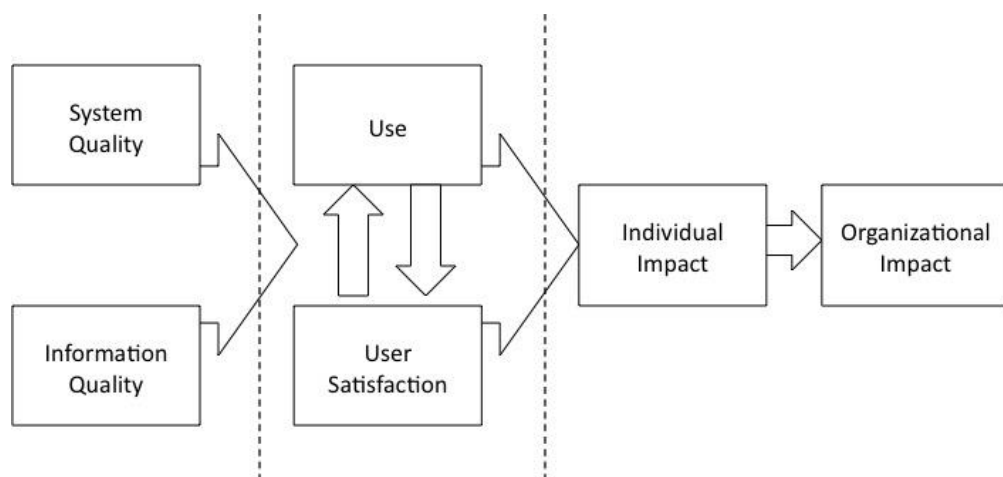
The teams need to be motivated and engaged with the vision and mission of the project. What makes a successful project at the end of the day are people, so we need to go deeper into detail

about where to focus attention to achieve the maximum success possible. Research has addressed the factors that can influence the success of projects, and systematized them into “Organizational, People, Process, Technical, and Project dimensions” (Chow & Cao, 2008; Tam, Moura, et al., 2020). Critical success factor (CSF) is defined by Bullen & Rockart (1981) as “(...) the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department, or organization. CSFs are the few key areas where “things must go right” for the business to flourish and for the manager’s goals to be attained.” It is very important to never stop looking for new ways of contributing to the improvement of constructing management success. For this reason we intend to go further in detail on the “people” dimension that influences the success of project management.

2.4 Delone & McLean Information System Model

Our conceptual model is based on the Delone & McLean Information System (IS) Success Model (Figure 1) (DeLone & McLean, 1992) . The model was published in 1992 to create a framework that would conceptualize and operationalize IS success. The D&M Model suggests some factors such as information quality (measuring semantic success), system quality (measuring the technical success), use, user satisfaction, individual impact, and organizational impact, that measure the effectiveness success (Urbach & Müller, 2012).

Figure 1 - Information Systems Success Model (Delone & Mclean, 1992)

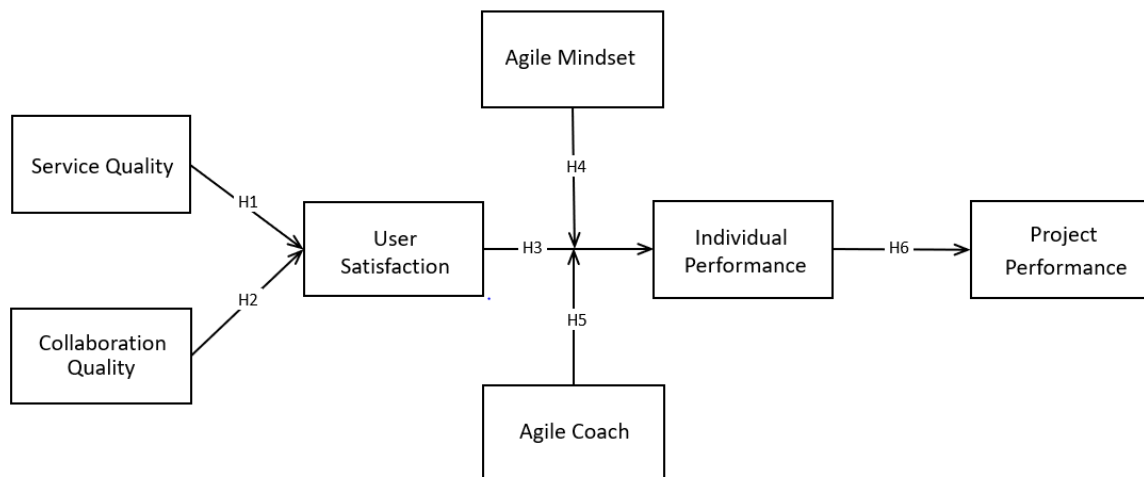


Ten years after the first publication and based on the contributions that extended or adapted the first model, Delone & McLean published the updated IS Success model taking into consideration the measurement challenges that had emerged. The updated model is grouped into six interrelated dimensions: Information quality, system quality, service quality, (intention to) use, user satisfaction, and net benefits. A system can be evaluated by the quality of the system, quality of service, and quality of information. The set of these characteristics affects the intention for use/subsequent use and user satisfaction. As a consequence of using the system, some benefits will be achieved (these may influence either positively or negatively) the user's satisfaction and the further use of the information system (Urbach et al., 2010). All these factors are used for the evaluation of IS components that contributes to the system’s success (DeLone & McLean, 2003).

3. Research Model

Based on the IS Success Model, this research proposes a revised model for evaluating the effect of human factors that influence the success of agile methodology in a project management context. Although previous literature reviews use this model to measure IS success, to our knowledge, the Delone & McLean IS Success Model has not been used to determine agile project management success. In research made by Sithambaram, Nasir, and Ahmad (2021), the issues and challenges were grouped and simplified as factors into the organization, people, process, and technical categories. Furthermore, these categories were mapped into a new framework in which we confirm that most factors are related with the process and people categories. The most important problems identified were about misalignment of agile methods with the business objectives, insufficient understanding of agile principles, lack of teamwork, and inadequate skill sets of the project stakeholders, which also matches with the following metrics that we analyse.

Figure 2 - Research Model



As shown in Figure 2, our proposed model preserves some of the dimensions from the original model with the causal relationships that make more sense in the context of project management. We use as independent variables: service quality, user satisfaction (in this case of the employee that uses the agile methodology rather than the satisfaction of the end customer), and individual performance to analyse the success of agile teams and organizations when working with this methodology. Regarding the dependent dimension, we investigate if individual performance can improve organizational performance overall, which is related to the success and performance of an agile project. We added the dimensions related to the most important “umbrella” in agile methodologies, i.e., the people. We choose the following dimensions: collaboration quality as independent variable and agile mindset and agile coach as the moderators between the relationship of user satisfaction and individual performance for the following reasons:

- Collaboration is essential in an agile environment, promoting the workflow between all agents (Cockburn & Highsmith, 2001).

- The agile mindset, as a personal characteristic, is an important factor to promote communication, respond to change, and reinforce a constant improvement inside the team (Misra et al., 2009).
- The agile coach is crucial for better performance on software development teams as well as maintaining continuous improvement in the adoption of agile practices (Senapathi & Srinivasan, 2014).

We intend to go deeper into the interactions and communications between the agile team, so we choose these human factors that can be more likely to favour the success of Agile projects.

Service quality

The service quality represents the quality of working with agile methodologies. According to Urbach (2010), this success dimension covers aspects such as responsiveness, reliability, empathy, and competence. Senapathi and Srinivasan (2014) refer to quality of the development process as decreasing the number of errors and improving quality of systems/software built. Hence, we formulate the following hypothesis:

H1: Service quality has a positive influence on user satisfaction.

Collaboration quality

Collaboration quality is expected to be an important dimension in an agile context, as people can work together with good communication and interaction, which will increase the levels of working. Agile teams focus on increasing both individual competencies and intense collaboration (Cockburn & Highsmith, 2001). It is intended to evaluate if working with this methodology enables easy and comfortable communication, effectiveness and efficiency sharing of information, and effective networking between the members of the organization – overall, to evaluate the relationship between the collaboration quality of an agile team and the user satisfaction itself. Hence, we formulate the following hypothesis, adapted from Urbach (2010):

H2: Collaboration quality has a positive influence on user satisfaction.

User satisfaction

According to Oliver (1980), satisfaction is the result of multiple interactions that reflect the feelings that arise from it. This success dimension is one of the most important to take into consideration that covers adequacy, efficiency, effectiveness, and overall satisfaction with the use of agile methodology when managing projects. Additionally, user satisfaction is an excellent method for evaluating the performance since it is difficult to contradict the success of a project that users claim to like (Wu & Wang, 2006). In consequence, we formulate the following hypothesis adapted from Wu and Wang (2006):

H3: User satisfaction has a positive influence on individual performance.

Agile mindset

The agile methodology takes into consideration “an attitude that equates failure and problems with opportunities for learning, a belief that we can all improve over time, that our abilities are not fixed but evolve with effort” (Rising, 2011). Since the agile methodology considers continuous improvement with a positive attitude, willingness to learn more and team spirit, all

these characteristics have been categorized as an agile mindset. This mindset has been identified as one of the critical factors of success in agile development software (Misra et al., 2009). In this sense, we formulate the following hypothesis adapted from Senapathi and Srinivasan (2014):

H4: Agile mindset moderates the relationship between user satisfaction and individual performance.

Agile coach

After implementing the agile methodologies, it is necessary to have a tool that guarantees the continuous development of this methodology. This is where the fundamental role of coaching comes in, which guarantees both technical and business knowledge, capable of challenging teams to become better (Senapathi & Srinivasan, 2014). Learning how to use the system can also raise usage and increase familiarity (Ruivo et al., 2014). We therefore postulate that people with a higher degree of training tend to enjoy the use of agile methodologies. The agile coach was considered one of the main factors in the effectiveness of the creation and development of these methodologies, which allows us to significantly influence the use of these methodologies and embrace a better performance of software development teams (Senapathi & Srinivasan, 2014). Hence, we formulate the following hypothesis:

H5: Agile coach moderates the relationship between user satisfaction and individual performance.

Individual / organizational performance

Individual performance refers to efficiency and productivity, in this case of each element of the agile team. If each person on the team performs their work with high performance, then the entire organization will also benefit from the overall performance of the team. In our research, we chose to individualize the dimensions of individual impact and organizational impact to better understand the importance of moderating effects in a more individual perspective, at the level of performing individual tasks (Tam & Oliveira, 2016). In this sense, the individual performance will cover factors such as task performance, job efficiency, and overall usefulness. In our context, we adapt the organizational performance dimension from the original D&M Model to project performance as it is more related to our context of research. We include this dimension as it is important to determine if individual performance can positively affect project performance and increase the success of an agile project. Measures like quality improvement, cost reduction, and competitive advantage were included in this success dimension (Urbach et al., 2010). We aim to identify the people facilitators that have more impact on the individual performance. Individual performance can also influence the success of projects in general, including the success of the organization that uses an agile methodology. Not only managers but all teams involved in the project can understand and consider these factors, achieving greater success in managing their agile projects. Hence, we formulate the following hypothesis:

H6: Individual performance has a positive influence on organizational performance in an agile project management context.

4. Methodology

4.1 Measurement

The study was conducted in a European country (Portugal). We did not restrict the survey to professionals from this specific methodology or region in Portugal, but the target were the people involved in agile methodology or with at least good knowledge about the topic. All measurement items are presented in the construct table in Appendix, which were adapted from Urbach et al., (2010), Wu & Wang, (2006), Senapathi & Srinivasan (2014), and Ruivo et al. (2014) with slight modifications. From the literature, collaboration quality, individual performance, and project performance came from Urbach et al. (2010), user satisfaction from Wu & Wang (2006), and service quality, agile mindset, and agile coach from Senapathi & Srinivasan (2014). Agile coach was also adapted from Ruivo et al. (2014).

4.2 Data

This research used an online survey to collect the data. A first questionnaire was conducted in English and Portuguese to perform a test of the proposed measurements with approximately 30 responses. After formulating and improving this first survey, the main questionnaire was made and distributed to departments that use these methodologies in their work. All items were measured using seven-point Likert scales, mostly ranging from totally disagree (1) to totally agree (7). It was also intended to find people on social networks (such as LinkedIn) that had a role in an agile environment (for example, scrum master, product owner) to boost the number of people answering the questionnaire.

The final survey was online from March to June 2022. Two hundred and one responses were received, which corresponds to a 50.25% response rate. Our demographic analysis (Table 3) indicated that of the 201 respondents, 66% are male. Concerning age, 67 (45%) are younger than 30. Regarding the education, 50% have a bachelor's degree. Regarding occupation, 94% are employees. In terms of industry, 40% are from technology.

Table 3 - Sample characteristics

Distribution (n=201)					
Gender	N	%	Education	N	%
Male	133	66	Less than bachelor's degree	10	5
Female	68	34	Bachelor's degree	101	50
			Master's degree or higher	90	45
Age	N	%	Occupation	N	%
<=25	25	12	Employee	189	94
26-30	67	33	Self-employed	8	4

31-35	25	12	Student	1	0
36-40	19	9	Other	3	1
41-50	47	23			
>50	18	9			

Industry	N	%
Technology	80	40
Consultancy	50	25
Bank	45	22
Telecommunications	16	8
Insurance	6	3
Other	4	2

5. Results

The objective of this study is to analyse the human factors that favour success of agile projects. To allow estimation of complex cause-effect relationships in path models with latent variables (factors) (Sarstedt et al., 2017), we used partial least squares structural equation modelling (PLS-SEM). In terms of analytical tools, we chose Smart PLS (v. 3.2.8) to look at the associations formed in our model (Ringle, Wende, & Becker, 2015). We applied PLS, a method that is often used in information systems research, to evaluate our model assumptions, ensuring that the results of the established structural relationships are acquired from a set of measurement instruments with psychometric attributes (Chin et al., 2003). The fundamental element of PLS is a collection of alternating least squares algorithms, which imitate and expand canonical correlation analysis and principal component analysis. Herman Wold (1974) created the technique for the analysis of high-dimensional data in a low-structure setting, and it has since undergone several changes and additions (Henseler et al., 2016). When it comes to examining the cause-and-effect relationships between latent components, SEM has almost become a standard in marketing and management research (J. F. Hair et al., 2011). These authors concluded that PLS-SEM route modelling, when used properly, can be a "silver bullet" for estimating causal models in a variety of theoretical models and empirical data scenarios.

5.1 Measurement model

Regarding measurement model, it is important to consider the internal consistency, convergent validity, and discriminant validity of data. The findings of the measurement model are shown in Table 4, 5 and 6. The three components of internal and convergent validity are the reliability of the questions, the composite reliability (CR) of the constructs, and the average variance extracted (AVE) by the constructs (Fornell & Larcker, 1981).

Internal consistency and reliability are typically assessed using "Cronbach's alpha" in social science research, but it typically provides a conservative assessment in PLS-SEM (Bonett & Wright, 2015). The CR values (composite reliability) are greater than 0.9, which reveals that the model's internal consistency is adequate (Table 4). Each latent variable's average variance extracted (AVE) is assessed to ensure convergent validity. The AVE value must be greater than 0.50 to ensure that the latent variables account for more than half of the variance in their indicators (J. Hair et al., 2022). Table 4 shows that all AVE values are greater than the threshold of 0.5, confirming convergent validity. The last step is to evaluate the discriminant validity of reflectively measured constructs after reliability and convergent validity have been effectively established. This analysis shows the degree to which a construct differs empirically from other constructs, in terms of how much it correlates with other constructs and the degree to which the indicators represent only this one construct (Sarstedt et al., 2017).

Three techniques were used to investigate the measures' discriminant validity in more detail. First, the square roots of AVEs (diagonal elements) in each latent variable are greater than the correlation between each pair of constructs (off-diagonal elements) (Fornell & Larcker, 1981) (Table 4). The square root of AVE (in bold) is greater than the correlation between constructs in all latent variables and as a result, discriminant validity appears to be well established (Wong, 2013). Second, the loadings should be greater than the cross loadings to guarantee the discriminant validity (Henseler et al., 2015), as we see in Table 5. The requirement that the

loadings should be more than 0.70 served as the basis for evaluating the good indication of PLS loadings and cross-loading. In the end, it is important to analyse the heterotrait-monotrait ratio (HTMT) of correlations. As we see in Table 6, the values are lower than 0.90, thereby confirming discriminant validity.

Results from the measurement model show that it has good indicator reliability, convergent validity, and discriminant validity. As a result, the constructs in our model can be used to test the structural model because they are statistically distinct (Roldán & Sánchez-Franco, 2012).

Table 4 - Means, standard deviations, correlations, and reliability and validity measures (CR, CA, and AVE) of latent variables

Constructs	Mean	SD	CA	CR	ServQ	CollQ	USatis	AgMind	AgCoach	IndP	PerfP
ServQ	5.203	1.151	.883	.920	.861						
CollQ	5.574	1.085	.918	.942	.566	.896					
USatis	5.426	1.146	.940	.957	.707	.652	.921				
AgileMind	5.658	.974	.921	.940	.415	.479	.485	.872			
AgileCoach	3.030	1.339	.903	.932	-.350	-.396	-.521	-.414	.880		
IndP	5.426	1.134	.955	.965	.698	.676	.790	.408	-.412	.921	
PerfP	5.160	1.190	.954	.963	.697	.622	.725	.486	-.547	.695	.902

Table 5 - PLS loadings and cross-loading

Constructs		ServQ	CollQ	USatis	AgMind	AgCoach	IndP	PerfP
Service Quality	SQ1	.888	.494	.648	.353	-.315	.621	.658
	SQ2	.834	.456	.538	.368	-.326	.529	.581
	SQ3	.910	.548	.626	.343	-.262	.636	.631
	SQ4	.809	.447	.613	.368	-.307	.608	.526
Collaboration Quality	CQ1	.458	.880	.605	.367	-.310	.564	.483
	CQ2	.545	.920	.629	.431	-.359	.648	.561
	CQ3	.498	.886	.512	.416	-.341	.576	.573
	CQ4	.525	.898	.578	.505	-.409	.631	.620
User Satisfaction	US1	.635	.588	.881	.425	-.493	.711	.617
	US2	.609	.602	.939	.462	-.490	.731	.636
	US3	.698	.631	.927	.450	-.442	.742	.729
	US4	.659	.577	.936	.451	-.495	.727	.684
Agile Mindset	AM1	.431	.475	.492	.884	-.467	.413	.476
	AM2	.342	.455	.419	.888	-.403	.392	.431
	AM3	.401	.427	.403	.883	-.335	.336	.449
	AM4	.291	.354	.378	.844	-.294	.307	.371
	AM5	.323	.349	.406	.858	-.261	.305	.372
Agile Coach	AC1	-.242	-.303	-.399	-.287	.854	-.282	-.417
	AC2	-.376	-.370	-.507	-.390	.911	-.399	-.559
	AC3	-.242	-.362	-.428	-.394	.863	-.338	-.458
	AC4	-.344	-.349	-.481	-.371	.891	-.407	-.475
Individual Performance	IP1	.650	.640	.679	.340	-.335	.936	.608
	IP2	.632	.646	.677	.338	-.360	.936	.600
	IP3	.677	.558	.753	.371	-.407	.917	.661
	IP4	.626	.686	.721	.381	-.329	.919	.614
	IP5	.625	.588	.791	.436	-.452	.896	.704
Project Performance	PRP1	.674	.591	.705	.425	-.492	.674	.918
	PRP2	.679	.607	.712	.454	-.498	.642	.914
	PRP3	.657	.559	.659	.443	-.492	.668	.919
	PRP4	.608	.612	.686	.442	-.491	.644	.916
	PRP5	.552	.484	.562	.423	-.507	.563	.869

PRP6 .592 .501 .582 .448 -.486 .557 .876

Table 6 - Heterotrait-Monotrait Ratio of correlations (HTMT)

	ServQ	CollQ	USatis	AgMind	AgCoach	IndP	PerfP
ServQ							
CollQ	.627						
USatis	.772	.697					
AgileMind	.456	.514	.517				
AgileCoach	.385	.432	.560	.438			
IndP	.757	.722	.830	.426	.433		
PerfP	.756	.664	.761	.514	.585	.722	

5.2 Structural model

Figure 3 - Structural model results

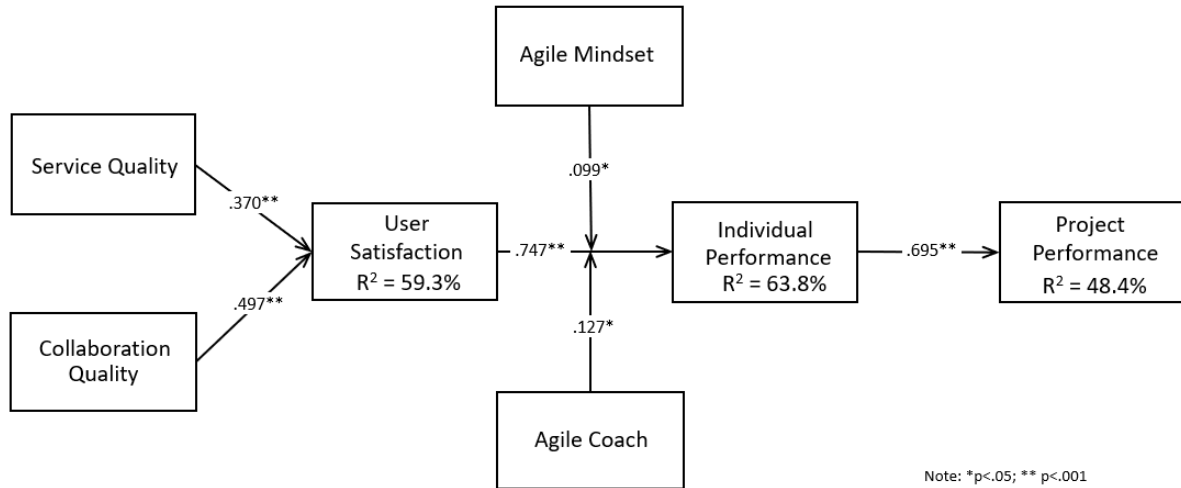


Figure 3 shows the outcomes of the tests conducted on the structural models. Using a technique known as *bootstrapping*, *SmartPLS* can produce t-statistics for significance testing of both the inner and outer model. In this method, a sizable subsample is chosen from the original sample with replacement to produce bootstrap standard errors, which in turn produces approximative t-values for the structural path's significance test. The bootstrap outcome comes close to representing data normalcy (Wong, 2013). In our case, we use the technique of bootstrapping based on 5,000 resamples. The path coefficients, t-statistics, and R² values are in Figure 3. The latent variable scores can be used as input for multiple regression to obtain the tolerance or

variance inflation factor (VIF) values, which can be used to evaluate collinearity issues of the inner model. To prevent the collinearity issue, we need to have a VIF of 5 or lower (i.e., a tolerance level of 0.2 or greater) (Wong, 2013; Hair et al., 2011). In our case the VIF is lower than 5, thereby indicating that there is no collinearity problem.

Following is a summary of the findings. The model explains 59.3% of variations in user satisfaction. The service quality ($\beta = .370$, $p < .001$) and collaboration quality ($\beta = .497$, $p < .001$) are statically significant in explaining user satisfaction, supporting hypotheses H1 and H2. The model accounts for 63.8% of the variances in individual performance. The user satisfaction has a relationship with individual performance ($\beta = .747$, $p < .001$), thus confirming H3. Finally, 48.4% of variation in project performance is explained by the model. Hypothesis H6 is supported by the finding that individual performance explains project performance ($\beta = .695$, $p < .001$), which means that individual performance has a positive influence on organizational performance in an agile project management context (H6). Regarding agile moderators, our findings show that both hypotheses are supported (H4 and H5). Agile mindset has statistical significance in the relationship between user satisfaction and individual performance ($\beta = .099$, $p < .01$), which implies that agile mindset moderates the relationship between user satisfaction and individual performance (H4). Ultimately, agile coach also explains the same relationship ($\beta = .127$, $p < .01$), which confirms that agile coach moderates the relationship between user satisfaction and individual performance (H5).

The six hypotheses that were derived from the D&M model are all fully supported by our study. A multicollinearity study would often be part of a PLS-SEM analysis. In other words, every combination of exogenous latent variables in the inner model is examined for potential collinearity issues to see whether any variables should be dropped, combined, or simply have a higher-order latent variable constructed (Wong, 2013).

6. Discussion

6.1 Theoretical implications

The main objective of our study is to provide an explanation of the influence of human factors related with agile methodology in successful agile projects. The success of ongoing agile software development projects was examined using a combination of human factors. Following the PLS-SEM analysis, the circumstances are now favourable to offer a succinct response to the research question.

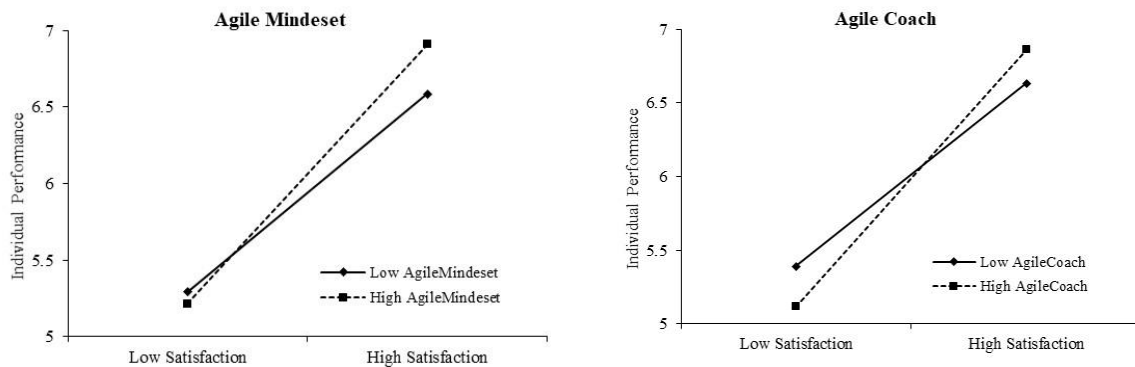
All the hypotheses are supported according to our findings. We also offer new perspectives on the ways in which agile mindset and agile coach may affect the success of an agile software development project. The results of the moderation analysis support the relationship between user satisfaction and the individual performance that is necessary for project success. To the best of our knowledge, this is the first empirical study that focuses on user satisfaction while considering agile mindset and agile coach as moderators over individual performance.

As revealed in Figure 3, our research model accounts for 59.3% of the variation in user satisfaction, thus supporting H1 and H2. These findings show that user satisfaction is significantly influenced by both service quality and collaboration quality variables. This is in accordance with previous studies on the effects of user satisfaction (Akter et al., 2010; Homburg & Stock, 2004). Hypothesis H3 is supported by the model's explanation of 63.8% of the variance in individual performance. Our findings imply that user satisfaction has the most significant direct and advantageous effects on individual performance. This result is in line with past conclusions from related studies (Tam, Loureiro, et al., 2020). The research model also explains 48.4% of the variance in project performance. Project performance was found to be significantly and favourably influenced by individual performance, supporting H6. The results of individual performance to explain project performance are consistent with those reported in similar studies (e.g., Tam et al., 2020). We chose to evaluate agile coach because such persons have been identified as a critical sociological component in establishing and maintaining well-balanced, high-performing software development teams that have a substantial impact on the adoption of agile methodologies (Senapathi & Srinivasan, 2014).

Figure 4 demonstrates how agile mindset and agile coach over different levels of satisfaction have a statistically significant moderating effect on the individual performance, i.e., how agile mindset and agile coach moderate the relationship between user satisfaction and individual performance. Regarding the moderator of agile coach, when people are affected by high levels of agile coaching, it also shows a larger impact of high satisfaction on individual performance. According to our findings, agile coach with high scores has a greater impact on the relationship between satisfaction and individual performance. As a result, for those with high agile coach context, the value of individual performance is greater, whereas for those with low agile coach context, the value of satisfaction in elucidating individual achievement is lower. The moderator of agile mindset suggests a major impact of high satisfaction on individual performance when people are affected with high levels of agile mindset. In a context of low levels of agile mindset, nevertheless, there remains a positive impact of higher satisfaction on individual as the difference is not overly substantial. A statistically significant relationship exists between the path satisfaction and individual performance and the agile mindset moderator. The benefits of

satisfaction and individual performance will be larger for users with high agile mindset propensity than for users with low agile mindset propensity, as we can see from the positive beta value for user satisfaction. The results show that agile mindset and agile coach can fully moderate the relationship between user satisfaction and individual performance. Furthermore, when high satisfaction is moderated by agile mindset and agile coach, it is observed that individual performance increases. Therefore, hypotheses H4 and H5 are confirmed.

Figure 4 - Moderator effects



In conclusion, our research model supports the connection between collaboration quality and service quality and how it affects user satisfaction, which leads to improved individual performance and ultimately better project performance. In brief, to maximize the chances of project success, individual performance should be the priority, followed closely by user satisfaction.

6.2 Practical implications

Following an explanation of the human elements affecting the success of agile software development projects, some real-world applications will be discussed to support managers in making conscious choices. Our research indicates that the adoption of agile techniques has reduced the number of errors in the systems and software products, increased the quality of the systems and software we develop, and increased team awareness of software quality (Senapathi & Srinivasan, 2014). In general, it is important to facilitate effective and efficient information exchange while using agile approaches. This includes making it simple and pleasant for employees to communicate with one another. Additionally, it makes it possible for colleagues to save and share papers in comfort, and using an agile methodology helps the organization's members effectively network (Urbach et al., 2010). According to our research, service quality and collaboration quality may enhance user satisfaction. In this situation, agile techniques satisfy the requirement for informational understanding while agile teams are pleased with the methodology's efficiency (Wu & Wang, 2006).

Maintaining an agile mindset is essential to achieving happiness when team members have a strong feeling of identification and commitment to the team, the desire to adapt and change, excellent interpersonal and communication skills, technical competence, and, generally, a collaborative attitude (Senapathi & Srinivasan, 2014). Moreover, it is necessary that the business employ an agile coach to facilitate the efficient application of agile methodologies through

trainings that employees may utilize in their everyday work (Ruivo et al., 2014; Senapathi & Srinivasan, 2014). Working with an agile methodology raises team productivity and job effectiveness, makes it simpler to complete tasks, and is valuable for the job (Urbach et al., 2010). Working with an agile methodology has thereby aided organizations to boost the effectiveness of internal operations, the integrity of work products, coordination within the company, and collaboration inside the organization. Additionally, it aids the organization's success overall and helps it stand out from other organizations of a similar nature (Urbach et al., 2010). In conclusion, an environment for agile software development should be established around agile methodologies through specialized trainings, without forgetting the agile coach to lead all teams through the software development process. With this knowledge in mind, managers and teams will be better able to set priorities and take appropriate action when determining which aspects they should be focusing on to increase the probability for a project to succeed.

7. Conclusions and recommendations for future works

The purpose of our research is to analyse the agile factors that influence successful project management.

After a comprehensive analysis of the literature, we developed a model of variables that had been shown to be important for the success of agile software development projects, and their applicability in the Portuguese context was therefore confirmed. The conceptual model based on the Delone & McLean model, provided a succinct summary of the human dimension. We invite other researchers to confirm and extend our findings to improve the model's accuracy.

A total of 201 professionals from various business sectors participated in the study. The success of agile software development projects can be substantially explained by user satisfaction and individual performance, according to the PLS-SEM results. The effect of agile mindset and agile coach are also important factors that contribute to the success on moderation of the relationship between user satisfaction and individual performance. According to our findings, guaranteeing the service quality and collaboration quality is more likely to result in the success of an agile software development project. Additionally, managers are advised to hire an agile coach to ensure that agile teams are appropriately monitored with the help of methods that team members can use in their daily work. Achieving satisfaction requires team members to have a strong sense of identification with and dedication to the team, which can be attained by maintaining an agile attitude. Therefore, it is important to adopt an agile mindset. Agile practitioners who are presently working on or will be working on agile software development projects can find this work to be a helpful contribution.

We need to be aware of some limitations. First, we acknowledge the intrinsic complexity of our variables, indicating that there are undoubtedly other variables that could have been included to characterize each component relating more accurately to agile methodologies or even project success. The study was conducted in only one nation (Portugal), which limits its generalizability. Future studies should collect information from different countries while combining different perspectives. It is impossible for this study's sample to be fully representative of the public, and a sizeable portion of the sample may lack a sufficient understanding of project success. Nevertheless, this group is very important in the context of agile methodologies. For future research, we advise analysing other variables connected to agile methodology to confirm their influence on achieving a successful project management, or even investigating these variables when they are incorporated in other models. We invite future researchers to include interviews before choosing the variables that could help to understand the factors with more importance during an agile project management. Future study can thus incorporate both qualitative and quantitative techniques. Even though our study was able to examine only four of the McLean & Delone Model dimensions, we still think the findings will be helpful to other academics and professionals who may wish to investigate some of the other dimensions.

Additionally, our findings emphasize the significance of investigating not only direct effects but also indirect effects via the moderation effect. Our findings suggest that agile mindset and agile coach can directly influence individual performance and therefore influence the success of agile software development projects. In our study we sought to use factors that could have a positive impact, but it can also be interesting to analyse the factors that could have a negative impact and compare the results.

Bibliographical References

- Akter, S., D'Ambra, J., & Ray, P. (2010). Service quality of mHealth platforms: Development and validation of a hierarchical model using PLS. *Electronic Markets*, 20(3–4), 209–227. <https://doi.org/10.1007/S12525-010-0043-X/TABLES/8>
- Atkinson, R. (1999). Project management: Cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management*, 17(6), 337–342. [https://doi.org/10.1016/S0263-7863\(98\)00069-6](https://doi.org/10.1016/S0263-7863(98)00069-6)
- Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., & Thomas, D. (2001). *Manifesto for Agile Software Development Twelve Principles of Agile Software*. <http://www.agilemanifesto.org>
- Boehm, B. (2002). Get ready for agile methods, with care. *Computer*, 35(1), 64–69. <https://doi.org/10.1109/2.976920>
- Boehm, B., & Turner, R. (2005). Management challenges to implementing agile processes in traditional development organizations. *IEEE Software*, 22(5), 30–39. <https://doi.org/10.1109/MS.2005.129>
- Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, 36(1), 3–15. <https://doi.org/10.1002/JOB.1960>
- Bullen, C. V., & Rockart, J. F. (1981). *A Primer on critical success factors*. Massachusetts Institute of Technology, Sloan School of Management.
- Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. *Information Systems Research*, 14(2), 189–217. <https://doi.org/10.1287/ISRE.14.2.189.16018>
- 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>
- Clarke, A. (1999). A practical use of key success factors to improve the effectiveness of project management. *International Journal of Project Management*, 17(3), 139–145. [https://doi.org/10.1016/S0263-7863\(98\)00031-3](https://doi.org/10.1016/S0263-7863(98)00031-3)
- Cockburn, A., & Highsmith, J. (2001). Agile software development: The people factor. *Computer*, 34(11), 131–133. <https://doi.org/10.1109/2.963450>
- Cohen, D., Lindvall, M., & Costa, P. (2004). An Introduction to Agile Methods. *Advances in Computers*, 62(C), 1–66. [https://doi.org/10.1016/S0065-2458\(03\)62001-2](https://doi.org/10.1016/S0065-2458(03)62001-2)
- Collazo, J. (2020). *Four Steps To Ensure Your Company's Next Project Is A Success*. Forbes. <https://www.forbes.com/sites/forbesbusinesscouncil/2020/06/24/four-steps-to-ensure-your-companys-next-project-is-a-success/?sh=4bd441bd893e>
- DeLone, W. H., & McLean, E. R. (1992). Information Systems Success: The Quest for the

- Dependent Variable. *Information Systems Research*, 3(1), 60–95. <https://doi.org/10.1287/ISRE.3.1.60>
- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30. <https://doi.org/10.1080/07421222.2003.11045748>
- Einhorn, F., Marnewick, C., & Meredith, J. (2019). Achieving strategic benefits from business IT projects: The critical importance of using the business case across the entire project lifetime. *International Journal of Project Management*, 37(8), 989–1002. <https://doi.org/10.1016/J.IJPROMAN.2019.09.001>
- Elena, M. (2019). Project Management using Agile Frameworks. *Economy Informatics Journal*, 19(1/2019), 34–43. <https://doi.org/10.12948/EI2019.01.04>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error: *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.1177/002224378101800104>
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), 139–152. <https://doi.org/10.2753/MTP1069-6679190202>
- Hair, J., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. <https://doi.org/10.1007/978-3-030-80519-7>
- Hastie, S., & Wojewod, S. (n.d.). *Standish Group 2015 Chaos Report - Q&A with Jennifer Lynch*. Retrieved September 17, 2022, from <https://www.infoq.com/articles/standish-chaos-2015/>
- Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management and Data Systems*, 116(1), 2–20. <https://doi.org/10.1108/IMDS-09-2015-0382/FULL/PDF>
- 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(1), 115–135. <https://doi.org/10.1007/S11747-014-0403-8>
- Homburg, C., & Stock, R. M. (2004). The link between salespeople’s job satisfaction and customer satisfaction in a business-to-business context: A dyadic analysis. *Journal of the Academy of Marketing Science* 2004 32:2, 32(2), 144–158. <https://doi.org/10.1177/0092070303261415>
- Lalsing, V. (2012). People Factors in Agile Software Development and Project Management. *International Journal of Software Engineering & Applications*, 3(1), 117–137. <https://doi.org/10.5121/IJSEA.2012.3109>
- Lientz, B., & Rea, K. (2001). *Project Management for the 21st Century (3rd ed.)*. Routledge. <https://doi.org/10.4324/9780080480497>
- Loiro, C., Castro, H., Ávila, P., Cruz-Cunha, M. M., Putnik, G. D., & Ferreira, L. (2019). Agile Project Management: A Communicational Workflow Proposal. *Procedia Computer Science*, 164, 485–490. <https://doi.org/10.1016/J.PROCS.2019.12.210>

- Matos, S., & Lopes, E. (2013). Prince2 or PMBOK – A Question of Choice. *Procedia Technology*, 9, 787–794. <https://doi.org/10.1016/J.PROTCY.2013.12.087>
- Misra, S. C., Kumar, V., & Kumar, U. (2009). Identifying some important success factors in adopting agile software development practices. *Journal of Systems and Software*, 82(11), 1869–1890. <https://doi.org/10.1016/J.JSS.2009.05.052>
- Nerur, S., Mahapatra, R., & Mangalaraj, G. (2005). Challenges of migrating to agile methodologies. *Communications of the ACM*, 48(5), 72–78. <https://doi.org/10.1145/1060710.1060712>
- Nikitina, N., Kajko-Mattsson, M., & Stråle, M. (2012). From scrum to scrumban: A case study of a process transition. *2012 International Conference on Software and System Process, ICSSP 2012 - Proceedings*, 140–149. <https://doi.org/10.1109/ICSSP.2012.6225959>
- Oliver, R. L. (1980). A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions: <https://doi.org/10.1177/002224378001700405>, 17(4), 460–469. <https://doi.org/10.1177/002224378001700405>
- Ringle, C.M., Wende, S., & Becker, J.-M. (2015). *SmartPLS 3. Bonningstedt: SmartPLS*. <https://www.smartpls.com>
- Rising, L. (2011). *The Power of an Agile Mindset*. <http://turkuagileday.fi/topics/slides/power-of-agile-mindset.pdf>
- Roldán, J. L., & Sánchez-Franco, M. J. (2012). Variance-based structural equation modeling: Guidelines for using partial least squares in information systems research. *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems*, 193–221. <https://doi.org/10.4018/978-1-4666-0179-6.CH010>
- Ruivo, P., Oliveira, T., & Neto, M. (2014). Examine ERP post-implementation stages of use and value: Empirical evidence from Portuguese SMEs. *International Journal of Accounting Information Systems*, 15(2), 166–184. <https://doi.org/10.1016/J.ACCINF.2014.01.002>
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research* (pp. 1–40). Springer International Publishing. https://doi.org/10.1007/978-3-319-05542-8_15-1
- Senabre Hidalgo, E. (2019). *Adapting the scrum framework for agile project management in science: case study of a distributed research initiative*. <https://doi.org/10.1016/j.heliyon.2019>
- Senapathi, M., & Srinivasan, A. (2014). An empirical investigation of the factors affecting agile usage. *ACM International Conference Proceeding Series*. <https://doi.org/10.1145/2601248.2601253>
- Sithambaram, J., Nasir, M. H. N. B. M., & Ahmad, R. (2021). Issues and challenges impacting the successful management of agile-hybrid projects: A grounded theory approach. *International Journal of Project Management*, 39(5), 474–495. <https://doi.org/10.1016/j.ijproman.2021.03.002>
- Tam, C., Loureiro, A., & Oliveira, T. (2020). The individual performance outcome behind e-commerce: Integrating information systems success and overall trust. *Internet Research*,

30(2), 439–462. <https://doi.org/10.1108/INTR-06-2018-0262/FULL/XML>

- 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>
- Tam, C., & Oliveira, T. (2016). Understanding the impact of m-banking on individual performance: DeLone & McLean and TTF perspective. *Computers in Human Behavior*, 61, 233–244. <https://doi.org/10.1016/J.CHB.2016.03.016>
- Urbach, N., & Müller, B. (2012). *The Updated DeLone and McLean Model of Information Systems Success*. 1–18. https://doi.org/10.1007/978-1-4419-6108-2_1
- Urbach, N., Smolnik, S., & Riempp, G. (2010). An empirical investigation of employee portal success. *The Journal of Strategic Information Systems*, 19(3), 184–206. <https://doi.org/10.1016/J.JSIS.2010.06.002>
- Verma Vijay K. (1996). Human resource management and project management | PMI. *PM Network*, 10(4), 34–40. <https://www.pmi.org/learning/library/human-resource-management-project-management-4772>
- Wold, H. (1974). Causal flows with latent variables: Partings of the ways in the light of NIPALS modelling. *European Economic Review*, 5(1), 67–86. [https://doi.org/10.1016/0014-2921\(74\)90008-7](https://doi.org/10.1016/0014-2921(74)90008-7)
- Wong, K. (2013). Partial least square structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 1–32. https://www.researchgate.net/publication/268449353_Partial_least_square_structural_equation_modeling_PLS-SEM_techniques_using_SmartPLS
- Wu, J. H., & Wang, Y. M. (2006). Measuring KMS success: A respecification of the DeLone and McLean's model. *Information and Management*, 43(6), 728–739. <https://doi.org/10.1016/J.IM.2006.05.002>

8. Appendix

APPENDIX - ITEMS

CONSTRUCTS	Items	Adapted from
SERVICE QUALITY	SQ1 Use of agile methods/practices has enhanced the functionality of applications that we build.	Senapathi & Srinivasan (2014)
	SQ2 Use of agile methods/practices has decreased the number of errors in the systems/software products we build.	
	SQ3 Use of agile methods/practices has improved the quality of the systems/software products we build.	
	SQ4 Use of agile methods/practices has made me (us) more conscious of software quality.	
COLLABORATION QUALITY	CQ1 Working with agile methodology enables an easy and comfortable communication with my colleagues.	Urbach et al. (2010)
	CQ2 Working with agile methodology supports an effective and efficient sharing of information with my colleagues.	
	CQ3 Working with agile methodology enables a comfortable storing and sharing of documents with my colleagues.	
	CQ4 Working with agile methodology supports an effective networking between the members of my organization.	
USER SATISFACTION	US1 I am satisfied that agile methodologies meets my knowledge or information processing needs.	Wu & Wang (2006)
	US2 I am satisfied with working with agile methodology.	
	US3 I am satisfied with agile methodology effectiveness.	
	US4 Overall, I am satisfied with working with agile methodology.	
AGILE MINDSET	AM1 My team members have a strong sense of identification and commitment to the team.	Senapathi & Srinivasan (2014)
	AM2 My team members have the willingness to learn and change.	
	AM3 My team members have strong interpersonal and communication skills.	
	AM4 My team members are technically competent.	
	AM5 My team members have a collaborative attitude.	
AGILE COACH	AC1 There is a coach on agile methodologies at the company where I work.	Senapathi & Srinivasan (2014); (Ruivo et al., 2014)
	AC2 The agile coach is enabling effective use of agile methods.	
	AC3 According to users' program training, please rate the degree of their understanding of the content training material.	
	AC4 According to users' program training, please rate the degree of worth in navigating through the topics after training and applied in daily tasks.	

INDIVIDUAL PERFORMANCE	IP1	Working with an agile methodology improves my job performance.	Urbach et al. (2010)
	IP2	Working with an agile methodology increases my productivity.	
	IP3	Working with an agile methodology enhances my job effectiveness.	
	IP4	Working with an agile methodology makes it easier to accomplish tasks.	
	IP5	Working with an agile methodology is useful for my job.	
PROJECT PERFORMANCE	PRP1	Working with an agile methodology has helped my organization improve the efficiency of internal operations.	Urbach et al. (2010)
	PRP2	Working with an agile methodology has helped my organization improve the quality of working results.	
	PRP3	Working with an agile methodology has helped my organization enhance and improve coordination within the organization.	
	PRP4	Working with an agile methodology has helped my organization enhance and improve collaboration within the organization.	
	PRP5	Working with an agile methodology has helped distinguish my organization from similar organizations.	
	PRP6	Working with an agile methodology has helped my organization make itself an overall success.	

Appendix A - Measurement items

