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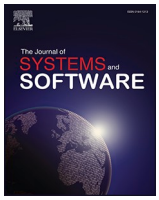

Success with Agile Project Management: Looking back and into the future

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ABSTRACT

We show what the influential factors and practical strategies are that contribute to agile project management success. The research model comprises three people-related factors (personal characteristics, team capability, and customer involvement), three technological factors (gamification, artificial intelligence, and marketing intelligence), and one dependent variable (agile project management success). Based on 143 questionnaire responses, our findings reaffirm the positive impact of personal characteristics and customer involvement while challenging the roles of gamification and team capability, suggesting that their effects are more context-dependent than previously thought. Our findings also highlight that agile project management success depends on the interplay between remote work and team capability, with strong team skills being highly important for agile methodologies, especially in traditional office settings.

1. Introduction

The versatile applicability of agile project management (APM) has been demonstrated across diverse domains including engineering (Wang et al., 2024), software industries (Singh and Simon, 2023), and marketing (Kalaignanam et al., 2021). APM fosters adaptability, collaboration, shorter cycles, quality enhancement, transparency, risk mitigation, and continuous improvement (Badewi, 2016; Noteboom et al., 2021; Tam et al., 2020; Wu, 2022), highlighting its pivotal role in modern project management practices. Despite the growth in its adoption, a gap remains in understanding the key drivers affecting agile project effectiveness. Agbejule and Lehtineva (2022) call for adapting models to include project risk factors and motivational aspects, while Alvarez and Sanchez (2022) emphasize the need for more data-driven studies across organizations. Ciric Lalic et al. (2022) suggest identifying project characteristics influencing management decisions, and Cruz Andrade et al. (2023) propose evaluating critical success factors in agile transformation.

Our research assesses the impact of critical factors on APM success. We identify three people-related factors—personal characteristics, team capability, and customer involvement— with the addition of three technological factors – gamification, artificial intelligence, and marketing intelligence (Kalaignanam et al., 2021) and incorporate them into a validated conceptual model.

Misra et al. (2009) emphasize that people factors, with particular attention given to personal characteristics and team capability, foster an environment conducive to collaboration, innovation, and responsiveness, which are essential elements in Agile methodologies. Additionally, customer involvement enhances adaptability and responsiveness by ensuring active collaboration throughout the project lifecycle, thereby effectively meeting requirements (Chow and Cao, 2008). Gamification addresses motivational challenges that can undermine the effectiveness of initiatives. By applying game mechanics, organizations can increase practitioner engagement and encourage sustained commitment, significantly boosting the likelihood of achieving successful outcomes (Alhammad and Moreno, 2020). Artificial Intelligence (AI) has a transformative impact on organizational capabilities and its ability to enhance organizational agility (Chatterjee et al., 2021). Moreover, marketing intelligence can aid rapid, informed decision-making and is crucial for maintaining agility in today's fast-paced markets (Kalaignanam et al., 2021).

Our analysis addresses the following question:

> "What are the influential factors and practical strategies that contribute to agile project management success?"

We reaffirm the positive impact of personal characteristics (PC) (Misra et al., 2009) and customer involvement (CI) (Chow and Cao, 2008) while questioning the effectiveness of gamification (GAM) (Barradas, 2023) and team capability (TC) (Chow and Cao, 2008), indicating their context-dependent nature. Agile project management success (SUC) requires balancing team capabilities, adapting work practices, and leveraging technology for innovation. Remote work

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arrangements are very important, with high team capability aiding success in traditional settings, while adaptability is critical in remote contexts.

The contributions of this work are fourfold. First, we show how artificial intelligence, marketing intelligence, personal characteristics, and customer involvement influence agile project management success. Extensive research has been undertaken to understand the drivers of agile project management success. In this study we characterize this research stream's development and describe where it stands today. Second, we study the moderation effects of work from home on team capability and customer involvement over agile project management success. Third, through the mediation analysis of team capability, customer involvement, personal characteristics, artificial intelligence, and marketing intelligence we demonstrate the importance of studying indirect effects in addition to direct ones. As we demonstrate through the analysis of mediation and moderation, these analyses are valuable in understanding the conceptual model's relationships. Fourth, we examine how gamification affects team capabilities directly and indirectly through artificial intelligence and marketing intelligence. By studying gamification, we expect to increase our understanding of its influence on team capability.

The study is structured as follows: foundational concepts from the literature are introduced, covering agility, APM, and critical success factors. The research model and hypotheses, methodologies, and a discussion of results, theoretical and managerial implications, research limitations, and future insights follow.

2. Literature review

2.1. Project management vs. Agile project management

Kerzner (2022) defines a project as a unique, temporary endeavor to create a specific product, service, or result defined by clear objectives, timelines, and organizational resources. Each project is distinct and carries inherent risks, impacting the success of the implementing organization as it progresses through a lifecycle with changes in tasks and team members.

Building on this foundation, this research commences by clearly differentiating between project management and agile project management, with Table 1 establishing distinct definitions for both concepts.

Substantial growth in Agile Project Management (APM) research since 2013 has occurred, with critical contributions from influential journals (Pacagnella and da Silva, 2023). Agility in the literature embodies flexibility, speed, adaptability to change, and a focus on delivering high-quality customized products and fostering innovation (Goldeman et al., 1995).

Agile organizations are characterized by limited hierarchy, informal communication, distributed decision-making, and fluid role definitions. Ganguly et al. (2009) emphasize that agility combines response-ability and knowledge management, enabling swift and precise adaptation to unforeseen changes without compromising cost or quality. APM emphasizes adaptability through an iterative and lean approach, simplifying project management processes to be flexible and high performing in cost, time, quality, innovation, and customer value. APM promotes facilitation, collaboration, goal setting, and flexibility in uncertain projects with evolving requirements. The success measurement paradigm in agile organizations shifts from the traditional iron triangle to an agile triangle, focusing on value, quality, and constraints (Jackson, 2012).

Emphasizing authentic learning experiences through real-life projects underscores the practical knowledge gained in project management, particularly with an agile approach (Marnewick, 2023). This work highlights APM research's evolving nature and critical dimensions (Raharjo and Purwandari, 2020). These insights, combined with the emphasis on requirement management, the link between APM and behavioral outcomes, and authentic learning experiences, provide contemporary perspectives and valuable lessons for researchers and practitioners alike.

Table 1
Differences between project management and agile project management (Dong et al., 2024; Kerzner, 2022).

Basis for comparison	Project Management	Agile Project Management
Nature	Traditional, structured, focused on linear, sequential project phases.	Adaptive, flexible, customer-focused, iterative.
Characteristics	1. The project manager independently manages outcomes. 2. Coordination of efforts to meet objectives; 3. Project team from diverse functions or external to the organization; 4. The project manager integrates and directs the teams; 5. Project staffing involves negotiation with functional managers; 6. Focus on deliverables may cause conflict with functional managers; 7. Shared accountability for outcomes among team members. 8. Reallocation of resources as necessary.	1. Close customer collaboration and continuous refinement of objectives; 2. Projects divided into sprints, each with feedback loops; 3. Evolving requirements even late in development; 4. Teams manage tasks independently and are empowered to make decisions; 5. Regular delivery of functional components for incremental value; 6. Regular adaptation of project goals based on feedback and needs; 7. Collaboration and interactions are prioritized over rigid processes; 8. Teams regularly review and improve performance.
Definition	Managing projects by using tools and techniques to meet objectives without disrupting routine operations.	Managing projects through iterative work, collaboration, and incremental delivery of value.
Essence	Focus on achieving the set goals of the project, managing tasks, resources, and personnel.	Emphasizes adaptability, collaboration, continuous learning, and customer satisfaction.
Lifecycle	Short-term focus on project deliverables with a potential long-term lifecycle beyond project team delivery.	Iterative approach with sprints, continuous feedback, adaptive planning, and ongoing refinement of goals.

2.2. Critical success factors

Critical success factors (CSFs) greatly influence a project's success (Milosevic and Patanakul, 2005). Despite much research, consensus on project success criteria remains elusive (Fortune and White, 2006). Pinto (1988) lists top management support, client consultation, personnel, and communication as critical. Studies highlight diverse CSFs such as senior management support, skilled personnel, effective planning, and communication (Alias et al., 2014).

Cooke-Davies (2002) distinguishes project management success and project success, with the former defined by traditional performance metrics such as cost, time, and quality, focusing on the efficiency of project management processes. His analysis identified 12 critical success factors centered around risk management, mature change control processes, learning factors, and the human element in project delivery, collectively enhancing schedule and budget performance. Conversely, project success encompasses the broader objectives of delivering stakeholder benefits and requires a cooperative approach between project management and operations management. A key factor for project success is an effective benefits delivery and management process, emphasizing that achieving the envisioned benefits calls for collaboration beyond the project manager in order to ensure tangible outcomes aligned with organizational goals.

Merhi (2023) emphasizes the importance of factors related to security, confidentiality, data governance, and data quality. Yontar (2023)

broadens the scope of CSFs by incorporating economic, social, and environmental dimensions. Debnath et al. (2023) present a holistic framework for CSFs in lean manufacturing, emphasizing sustainable resource utilization, lead time reduction, and top management support. Zaman et al. (2022) underline the significance of organizational, communication, and technical factors, with supportive leadership as a positive mediator. Additionally, Mohsen Alawag et al. (2023) stress the importance of leadership and customer satisfaction in project success.

3. Research model and hypotheses

The study addresses human and technology aspects to help agile projects prioritize and succeed. Fig. 1 shows a research model with seven well-grounded variables. The dependent variable, agile project management success, is defined by time (on-time delivery), cost (effective cost control), and customer satisfaction (best outcome). In the realm of agile software development, three human aspects play a pivotal role: personal characteristics (Misra et al., 2009), team capability (TC), and customer involvement (CI) (Chow and Cao, 2008). These factors are not only significant but also have a direct impact on the success of the project. Gamification, for instance, is a tool that can enhance user engagement and address challenges (Alhammad and Moreno, 2020). Marketing intelligence (MI), as a mediator, plays a crucial role in the relationship between leadership, proactive personality, and business performance, contributing to market orientation and value creation (Mandhachitara and Allapach, 2017). With its focus on techniques such as reinforcement learning, AI is also becoming increasingly prevalent (Riahi et al., 2021). The model integrates these six factors to depict people and technological dimensions, hypothesizing their significant contribution to agile software development success. Age, gender, education, and team size are the control variables (Bernerth and Aguinis, 2016).

3.1. Gamification

Gamification incorporates gaming elements into various settings to enhance experiences and drive engagement. Deterding et al. (2011) define it as including game design in non-game environments. Interpretation is important for effectiveness, as noted by Werbach and Hunter (2020) and Staller and Koerner (2021). Vos and Perreault (2020) emphasize its role in audience engagement, while Ekici (2021) highlights its positive impact on motivation and learning. Neffati and Sallam (2021) see potential in personnel management, aligning with learner and instructor preferences. Alhammad and Moreno (2020) underscore its role in motivation and awareness, and highlight its broad applicability. Considering the above statements and the context of our research, we state the following hypotheses:

H1: Gamification has a positive influence on AI.
H2: Gamification has a positive influence on TC.
H3: Gamification has a positive influence on MI.
H4: Gamification has a positive influence on SUC.

3.2. Artificial intelligence

Sadeghi et al. (2024) emphasize the critical role of AI in enhancing agile decision-making across multiple industries, including supply chain management. Salehi (2022) also advocates integrating AI with Agile methodologies, highlighting its potential to improve understanding and increase productivity. Similarly, Tosic (2023) underscores the impact of AI on refining decision-making processes. Dubey et al. (2022) further discuss AI's role in advancing big data analytics, particularly in humanitarian contexts, while Chatterjee et al. (2021) explore its contributions to organizational agility, skills development, and competitiveness. Adding to this perspective, Wang et al. (2022) add that AI significantly enhances customer service performance within organizations. Sakirin and Kusuma (2023) suggest that generative AI can optimize workflows, foster innovation, and automate routine tasks, and

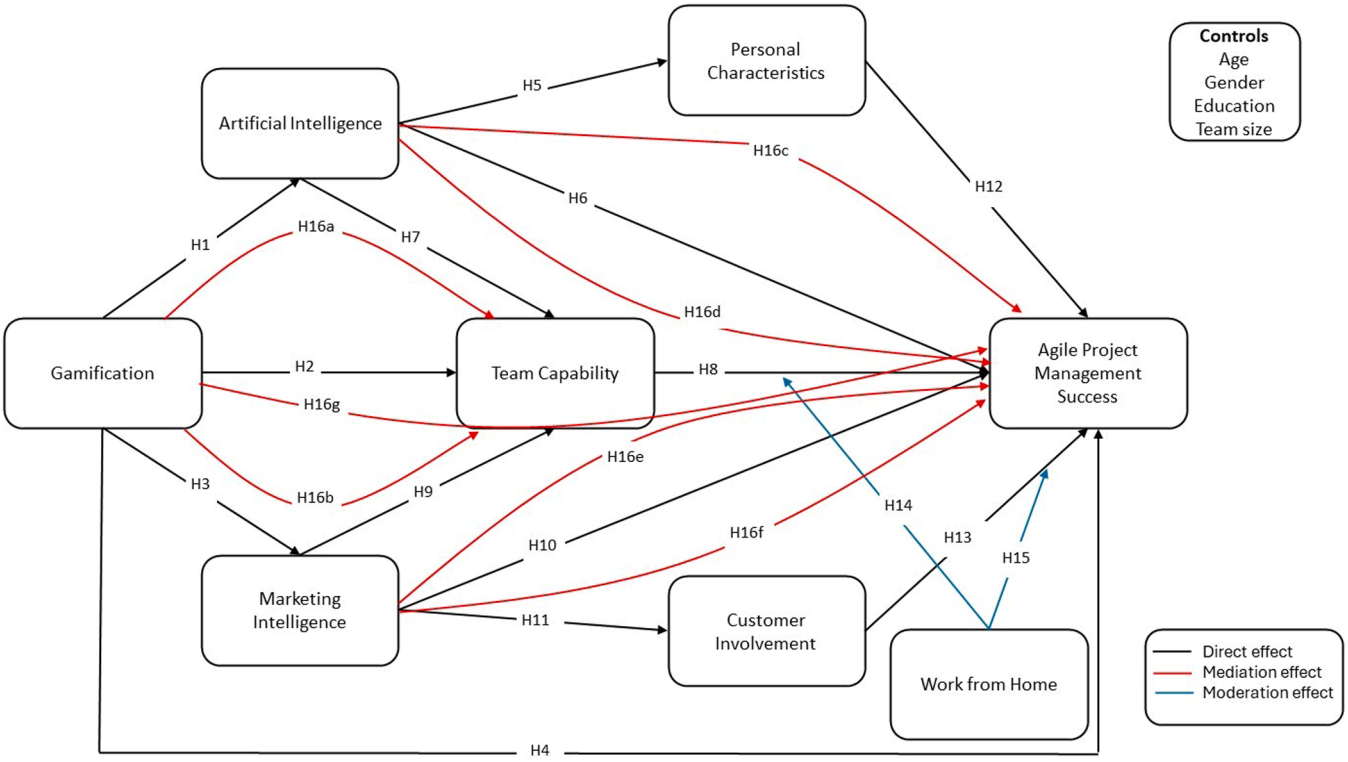

Fig. 1. Research model.

significantly enhance APM. Similarly, Jovanovic and Campbell (2022) highlight how generative AI can boost efficiency, creativity, and decision-making throughout project phases. Liu et al. (2023) further stress that harnessing the capabilities of generative AI, such as data generation, augmentation, and predictive analysis, can significantly improve multiple stages of project development. Considering the above statements and the context of our research, we state the following hypotheses:

H5: AI has a positive influence on PC.
H6: AI positively influences the success of SUC.
H7: AI has a positive influence on Team Capability.

3.3. Team capability

This aspect pertains to the practical application of knowledge and the conducive conditions that enable teams to fulfil their tasks (Haas, 2006). According to Misra et al. (2009), a highly proficient team facilitates the swift delivery of functional software that meets customer requirements. Beyond technical competence, Chow and Cao (2008) highlighted additional factors such as team members' motivation and commitment, agile-savvy managers employing an adaptive management style, and providing adequate technical training to the project team. Attributes such as commitment and technical expertise are recognized as drivers that enhance a team's ability to address risks, thereby increasing the likelihood of project management success (Ndlela and Tanner, 2022; Pargaonkar, 2023). Considering these insights and the context of our research, we propose the following hypothesis:

H8: TC is a factor that contributes to the success of SUC.

3.4. Marketing intelligence

Over the years MI has seen substantial growth due to increased collaboration among researchers (Gebhardt et al., 2019). MI advancements have led to shifts in marketing, such as leveraging big data for personalized campaigns and promoting a data-driven corporate culture (Lies, 2019). Lies (2022) highlights the impact of digitization on service marketing, emphasizing advancements in customer satisfaction. Al-Hashem (2020) concludes that MI significantly impacts product innovation within companies, with technology-based knowledge sharing playing a pivotal role. MI enhances competitiveness, facilitates comprehensive customer sentiment analysis, and drives data-driven choices (Salhab et al., 2023; P. Singh et al., 2023). It is recognized as critical for organizational success, correlating with customer satisfaction (Mahdi AL-shammari et al., 2023). Moreover, effective management of MI contributes to creating value for buyers and mediating relationships between leadership styles, personality traits, and business performance (Mandhachitara and Allapach, 2017). Considering the above statements and the context of our research, we state the following hypotheses:

H9: MI has a positive influence on TC.
H10: MI is a factor that contributes to the success of SUC.
H11: MI has a positive influence on CI.

3.5. Personal characteristics

Cinque et al. (2021) pointed out that individual traits include qualities beyond cognitive abilities, such as communication skills, empathy, and resilience. Herein we define and assess this aspect based on the characteristics outlined by Misra et al. (2009). These attributes extend beyond communication and interpersonal skills and encompass honesty, motivation, a collaborative mindset, a sense of responsibility, and an eagerness to learn. Regarding projects, effective performance is contingent on possessing communication and interpersonal skills, honesty, and a collaborative attitude (Annosi and Lanzolla, 2023; da Cruz Andrade et al., 2023). Additionally, Yang et al. (2011) discovered that teamwork, involving communication, cohesiveness, and collaboration among team members significantly influences project performance. Considering these insights and the context of our research, we propose the following hypothesis:

H12: PC is a factor that contributes to the success of SUC.

3.6. Customer involvement

As outlined by Saldanha et al. (2017), CI refers to the interactions between customer representatives and the company throughout the project's duration. Kaur et al. (2023) and Sheffield et al. (2013) revealed a close correlation between the level of customer participation and the success of a software development project, indicating that projects tend to achieve higher success rates with increased CI. Dewnarain et al. (2021) also posit that involving customers can enhance project outcomes regarding customer satisfaction. This factor will be characterized by customer commitment, authority within the project, and a positive relationship with the project organization (Chow and Cao, 2008). Given these observations and the context of our research, we propose the following hypothesis:

H13: CI is a factor that contributes to the success of SUC.

3.7. Work from home

Remote work, also known as work from home (WFH), offers numerous benefits for individuals and organizations such as improved work-life balance, flexibility, and productivity while reducing costs. It promotes inclusivity, digital skill development, and health benefits (Gorenc et al., 2023; Kučera et al., 2023). Flexible schedules enabled by remote work leads to higher job satisfaction and productivity. For organizations, telecommuting enhances productivity, minimizes interruptions, reduces overhead costs, broadens the talent pool, and improves employee retention. Heidt et al. (2023) stress the importance of agile work in remote work success, emphasizing adaptability and flexibility. Additionally, WFH facilitates agile work, project management success, and talent retention, presenting opportunities for the future of work (Pillai and Prasad, 2023; Schmidtner et al., 2021). Considering the above statements and the context of our research, we state the following hypotheses:

H14: WFH positively moderates the impact of TC on SUC.
H15: WFH positively moderates the impact of CI on SUC.

3.8. Mediating role of artificial intelligence, team capability, marketing intelligence, personal characteristics, and customer involvement

Project management success often hinges on its closing outcome. Yang et al. (2023) suggest that AI facilitates the interaction between GAM and TC, employing algorithms and data analytics to enhance feedback mechanisms, customize learning experiences, adapt challenges, provide insights, and promote collaboration among team members. MI positively impacts the intersection of gamification and team capability by offering insights, supporting decision-making, fostering collaboration, and promoting ongoing learning (Abou-Shouk and Soliman, 2021). Tominc et al. (2023) highlight the role of PC traits such as adaptability, innovative thinking, problem-solving, collaboration, and continuous learning in mediating AI integration's correlation with agile project management success. Mikalef and Gupta (2021) stress that TC mediates AI and agile project management success by facilitating efficient integration and utilization of AI tools within the team's workflow. Fostering TC and integrating MI into agile development involves nurturing a culture of learning, collaboration, and skill development within teams (Arslan Haider, 2019). Haider and Kayani (2021) assert

that CI mediates the relationship between MI and agile project management success by enhancing customer understanding, minimizing delays, promoting agility, encouraging innovation, and providing empirical support for frameworks. TC conclusively impacts the moderation of GAM and SUC by enhancing collective engagement and fostering adaptive behaviors. Socially driven game dynamics, such as dynamic interactions and collaborative competition, encourage teamwork and collaboration (Nivedhitha, 2023). These factors could serve as mediators, and we propose the following hypotheses:

H16a: AI positively mediates the relationship between GAM and TC.
H16b: MI positively mediates the relationship between GAM and TC.
H16c: PC positively mediates the relationship between AI and SUC.
H16d: TC positively mediates the relationship between AI and SUC.
H16e: TC positively mediates the relationship between MI and SUC.
H16f: CI positively mediates the relationship between MI and SUC.
H16g: TC positively mediates the relationship between GAM and SUC.

4. Methodology

4.1. Measurement

The study measured constructs drawn from various sources: Gamification (GAM) from Suh et al. (2017), AI from B. Wang et al. (2023), MI from Falahat et al. (2020) and Weng (2020), TC and CI were adapted from Stankovic et al. (2013), PC from Misra et al. (2009), WFH from Chatterjee et al. (2022), and agile project management success from Serrador and Pinto (2015), Stankovic et al. (2013), and Tam et al. (2020). Control variables included age, gender, education, and team size. The target population comprised individuals involved in agile software development projects or agile project management.

4.2. Data

Two surveys were conducted on Qualtrics to validate the proposed research model. The first was a pilot test aimed at assessing the construct validity of the questionnaire, followed by distribution of the questionnaire to agile project management professionals. Participants used a 7-point Likert scale to indicate their agreement with the questionnaire items, which were available in both Portuguese and English. The target population, predominantly international individuals interested in agile project management, was reached via LinkedIn and Facebook (>95 % of participants) through targeted searches using keywords such as "project management" and "agile". The finalized questionnaire items can be found in Appendix A.

The survey was active from 12 March 2024 to 4 April 2024. Over 500 invitations were sent out during this time, but only 244 individuals initiated the questionnaire, and 143 of those (58.6 %) completed it. According to Harman's single factor test, the data were shown to be free of common method bias. The result (29 %) is below the 50 % cut-off (Podsakoff et al., 2003), and the marker variable test result (3.6481 %) is considered low (Johnson et al., 2011; Lindell and Whitney, 2001).

The sample demonstrates near gender balance, with 77 female respondents (54 %), the ages 45 % being 29 years old or younger. 95 % of the sample had at least an undergraduate degree. As to employment status, 75 % of respondents worked full-time, while 20 % were student workers. Additionally, 87 % of the teams consisted of 3 to 15 members. Further details are provided in Table 2.

Table 2
Sample characteristics.

Distribution (n = 143)					
Gender	N	%	Education	N	%
Male	66	46 %	Lower than bachelor's degree	5	3 %
Female	77	54 %	Bachelor's degree	68	48 %
			Master's degree or higher	70	49%
Age	N	%	Employment Status	N	%
<30	65	45 %	Employed	107	75 %
30–39	32	22 %	Self-employed	3	2 %
40–49	20	14 %	Student	1	1 %
>49	26	18 %	Student worker	28	20 %
			Unemployed	4	3 %
Team Size	N	%			
<7	47	33 %			
7–11	56	39 %			
12–15	21	15 %			
>15	19	13 %			

5. Results

Following data collection we employed structural equation modelling (SEM), a statistical approach for evaluating impact relationships through a blend of statistical data and qualitative influence presumptions. As Chin et al. (2003) suggested, partial least squares (PLS) is a favored method in IS/IT research. Therefore, we used it to assess our model hypotheses, ensuring that the structural relationships' outcomes stem from a suite of measurement tools with psychometric properties. For software to scrutinize the established relationships in our research model, we opted for Smart PLS 4.1.0.2 (Ringle et al., 2024).

5.1. Measurement model

To evaluate internal consistency, composite reliability (CR) and Cronbach's alpha (CA) were used. According to Hair et al. (2017), and as demonstrated in Table 3, all constructs exceed the 0.7 threshold, indicating that our model exhibits robust internal consistency. Convergent validity was assessed using the average variance extracted (AVE), with a minimum threshold of 0.50, indicating that latent variables explain over half of their indicators' variance (Fornell and Larcker, 1981). AVE values in Table 3 exceed the minimum 0.5 threshold for each construct, ensuring convergence. Three aspects were considered when evaluating discriminant validity. First, regarding the cross-loadings criterion, item loadings must exceed all cross-loadings (Götz et al., 2009). Appendix B illustrates that loading values are greater than cross-loadings, satisfying the criterion. However, TC1, PC1, PC2, and PC5 exhibited low loadings and were consequently excluded by the cross-loading criterion. Second, as Appendix C reports, all HTMT values are less than 0.9 (Henseler et al., 2015). Last, the square root of the AVE must exceed the correlations between constructs (Fornell and Larcker, 1981). In Table 3, the diagonal values (representing AVEs' square roots) hold greater significance than the correlations observed between pairs of constructs (values in off-diagonal). Therefore, it may be concluded that the measurement model has discriminant validity. In addition to strong internal consistency, the measurement model's results indicate favorable indicator reliability, convergent validity, and discriminant validity, enabling the use of all constructs to test the structural model.

5.2. Structural model

Fig. 2 shows our conceptual model results. Although our sample comprises fewer than 160 respondents, Hair et al. (2017) argue that such a sample size limitation may be manageable. He suggests that a rule of thumb for sample size adequacy is that the sample should be at least ten times the maximum number of arrows pointing at a latent variable within the PLS path model. Our sample size meets this criterion.

Gamification (GAM) demonstrates significant explanatory power in two key areas: GAM ($\beta = 0.423$; $p < 0.01$) explains 17.9 of the variation in AI and GAM ($\beta = 0.507$; $p < 0.05$) 25.7 in MI. These findings support hypotheses H1 and H3, respectively. Interestingly, while AI ($\beta = 0.342$; $p < 0.01$) and MI ($\beta = 0.336$; $p < 0.01$) significantly explain 31.7 of the variation of TC variance, Gamification's influence on TC is not statistically significant, contrary to H2.

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

Constructs	Mean	SD	CA	CR	GAM	AI	MI	TC	PC	CI	WFH	SUC
Gamification (GAM)	4.818	1.252	.895	.920	**.812**							
Artificial Intelligence (AI)	5.246	1.200	.829	.876	.423	**.739**						
Marketing Intelligence (MI)	5.245	1.062	.911	.931	.507	.339	**.833**					
Team Capability (TC)	5.232	1.087	.784	.861	.330	.462	.460	**.781**				
Personal Characteristics (PC)	5.379	1.185	.828	.895	.207	.331	.348	.685	**.860**			
Customer Involvement (CI)	5.261	1.100	.780	.874	.328	.291	.457	.541	.476	**.836**		
Work from Home (WFH)	5.847	1.072	.895	.920	.247	.144	.141	.333	.437	.277	**.813**	
Agile Project Management Success (SUC)	5.214	1.045	.827	.882	.328	.407	.467	.537	.512	.531	.387	**.808**

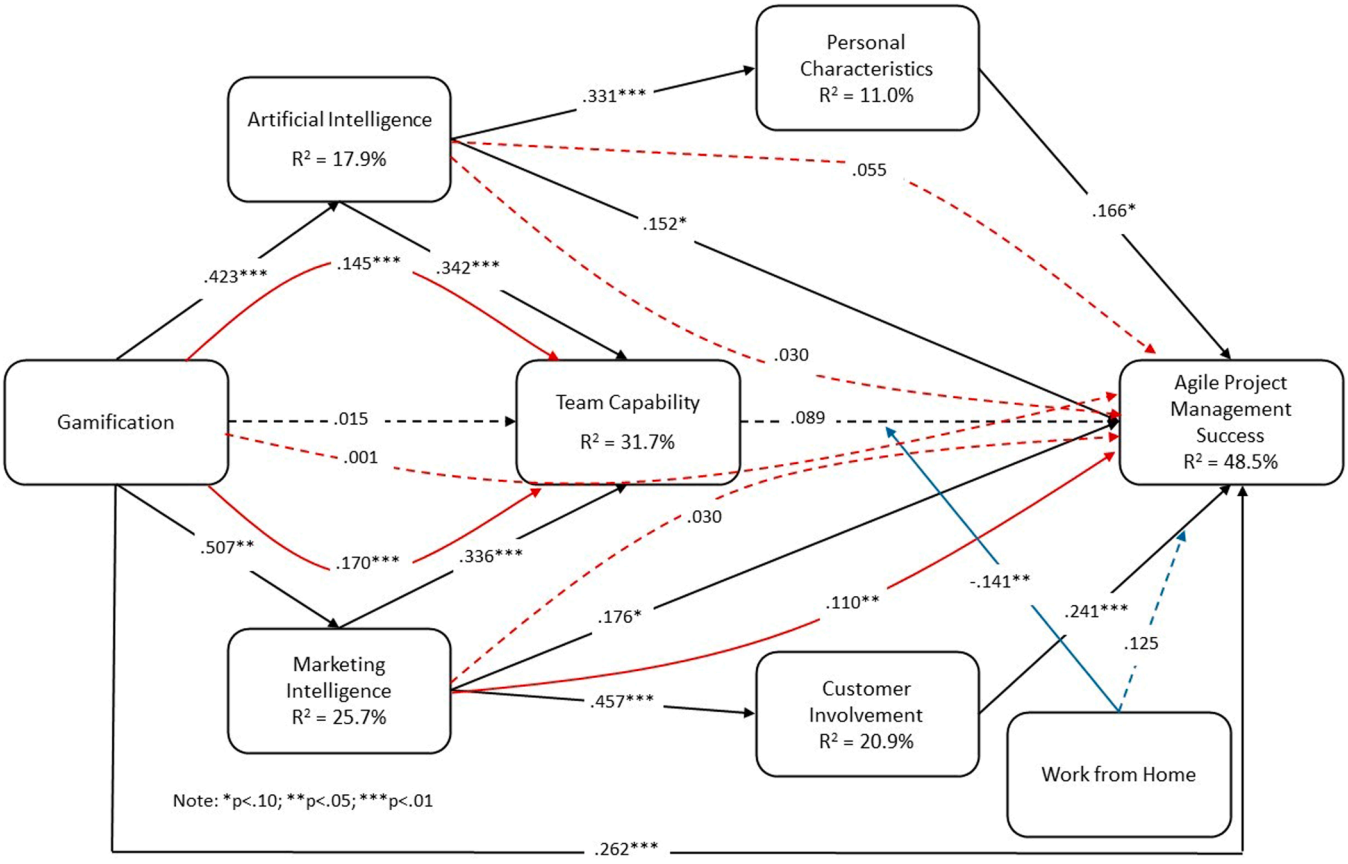

Fig. 2. Structural model results.

Furthermore, the study validates the hypotheses with AI ($\beta = 0.342$; $p < 0.01$) significantly explaining 11.0 of the variation in PC, affirming H5, and MI ($\beta = 0.452$; $p < 0.01$) significantly explaining 20.9 of the variation of CI, validating H11. This underscores the credibility of the research and its findings.

This study does not overlook the current context of remote work. The role of WFH ($\beta = -0.141$; $p > 0.05$) emerges as a significant moderator, influencing the relationship between TC and SUC (supporting H14) but not significantly affecting the relationship between CI and SUC (not supporting H15). This finding underscores the relevance of the research to the current work environment.

Furthermore, AI ($\beta = 0.152$; $p < 0.10$), MI ($\beta = 0.176$; $p < 0.10$), PC ($\beta = 0.166$; $p < 0.10$), GAM ($\beta = 0.262$; $p < 0.01$), and CI ($\beta = 0.241$; $p < 0.01$) collectively explain 48.5 of the variation of SUC, confirming hypotheses H4, H6, H10, H12, and H13. However, contrary to H8, TC does not significantly contribute to SUC.

Last, control variables such as gender ($\beta = -0.076$; $p > 0.10$), age ($\beta = -0.017$; $p > 0.10$), education ($\beta = -0.024$; $p > 0.10$), and team size ($\beta = -0.006$; $p > 0.10$) did not exhibit statistically significant relationships with the variables studied.

5.3. Results of the mediating role of confirmation and perceived usefulness

While the direct impact of GAM on project management success was not confirmed, findings in Table 4 suggest that GAM indirectly affects performance only through the mediation effects of AI ($\beta = 0.1445$; $p < 0.01$) and MI ($\beta = 0.1704$; $p < 0.01$), thus supporting both H16a and H16b. AI's direct influence on project management success was validated as per the results in Table 4, showing its impact on PC ($\beta = 0.1523$; $p < 0.10$) and TC ($\beta = 0.1523$; $p < 0.10$), thereby not supporting H16c or H16d. MI's and GAM's direct contribution to agile project management success was affirmed by the results in Table 4, demonstrating their influence on TC ($\beta = 0.1759$; $p < 0.10$) and TC ($\beta = 0.262$; $p < 0.01$), respectively, thereby not supporting H16e or H16g. MI's role as a complementary factor in project management success was evidenced by its direct impact on SUC ($\beta = 0.1759$; $p < 0.10$) and its indirect effect through the mediation effects of CI ($\beta = 0.1104$; $p < 0.05$), thus

Table 4
. Mediation analysis.

	Beta	SD	t-Test	p-value
H16a - Indirect-only (full mediation)				
(P1*P2) GAM > AI > TC	0.144	0.050	2.896	<0.01
(P3) GAM > TC	0.015	0.087	0.168	NS
H16b - Indirect-only (full mediation)				
(P1*P2) GAM > MI > TC	0.170	0.051	3.341	<0.01
(P3) GAM > TC	0.015	0.087	0.168	NS
H16c – Direct-only (no mediation)				
(P1*P2) AI > PC > SUC	0.055	0.036	1.532	NS
(P3) AI > SUC	0.152	0.091	1.676	<0.10
H16d – Direct-only (no mediation)				
(P1*P2) AI > TC > SUC	0.030	0.037	0.810	NS
(P3) AI > SUC	0.152	0.091	1.676	<0.10
H16e – Direct-only (no mediation)				
(P1*P2) MI > TC > SUC	0.030	0.038	0.789	NS
(P3) MI > SUC	0.176	0.091	1.929	<0.10
H16f - Complementary (partial mediation)				
(P1*P2) MI > CI > SUC	0.110	0.044	2.514	<0.05
(P3) MI > SUC	0.176	0.091	1.929	<0.10
H16 g - Direct-only (no mediation)				
(P1*P2) GAM > TC > SUC	0.001	0.012	0.108	NS
(P3) GAM > SUC	0.262	0.049	5.364	<0.01

Gamification (GAM); Artificial Intelligence (AI); Marketing Intelligence (MI); Team Capability (TC); Personal Characteristics (PC); Customer Involvement (CI); Work from Home (WFH); Agile Project Management Success (SUC).

supporting H16f.

6. Discussion

This study combined seven factors and performed a PLS-SEM analysis to better understand the influencers of agile project management success. The primary objective was to reevaluate the impact of AI, MI, PC, and CI on agile project management success while also examining the mediating role of WFH, the correlation between TC and agile performance success, and the potential influence of GAM on the other variables. The survey targeted agile project management professionals, and supported 15 of the 22 hypotheses.

The results of our study not only confirmed the beneficial influence of PC and CI on SUC, in line with the findings of Chow and Cao (2008) and Misra et al. (2009), but also verified the positive effects of GAM on AI and MI, as reported by Santy and Iffan (2023) and Jain et al. (2023), respectively. However, despite prior reports by Dugnol-Menéndez et al. (2021), the impact on TC was not statistically significant. Despite the contrasting findings on TC's impact, our research reaffirmed the positive correlation of AI with PC (Hu et al., 2021), SUC (Chatterjee et al., 2021) and TC (Mikalef and Gupta, 2021). It also underscored the constructive relationship between MI and TC (Falahat et al., 2020), SUC (Salhab et al., 2023) and CI (Donthu et al., 2021). Furthermore, our study supported PC's contribution to SUC (Misra et al., 2009) and CI's positive impact on SUC (Tam et al., 2020). Lastly, it highlighted the favorable impact of WFH on SUC and CI, consistent with Heidt et al. (2023) and Tabassum et al. (2023), respectively.

6.1. Theoretical implications

Although Mueller (2024) and O'brien et al. (2023) suggest that gamification positively influences TC, our structural model analysis contradicts this. Rahayu et al. (2022) argue that shifting from learning to point collection poses a significant challenge, diverting attention from learning objectives to point accumulation. This shift can diminish motivation over time due to evolving rules, point disparities, leaderboard standings, repetitive tasks, and perceived goal attainment. Additionally, the time-consuming nature of activities can lead to boredom and scheduling conflicts, especially for those with limited time. The initial novelty of gamification tends to wane, emphasizing the need for sustained engagement strategies.

Our study also examined the impact of TC on SUC and the results were unexpected. Contrary to the findings of Barros et al. (2024) and Misra et al. (2009), our research did not find a significant influence of TC on SUC. This lack of significance could be attributed to the limited sample size of our study or the inclusion of additional variables like AI and MI, which might have diluted the statistical relevance of TC. Including multiple variables can make it challenging to isolate the impact of each variable, especially if they interact in complex ways. It is important to note that our findings do not completely invalidate the literature on TC and SUC, as research outcomes can vary based on context, methodologies, and other factors.

The dynamics of agile project management success are complex and influenced by remote work arrangements and team capabilities. Fig. 3 illustrates how these elements interact to shape agile outcomes. When both remote work and team capabilities are low, agile project management success is compromised, indicating a need for support in delivering desired results. It becomes imperative to address both remote work practices and team skills to enhance the effectiveness of agile practices. Conversely, agile project management success is significant when remote work is low, but team capabilities are high. This emphasizes the importance of team expertise in driving successful agile implementation, even in traditional office setups. Interestingly, even with low team capabilities, agile project management success can be significantly high with substantial increases in remote work. This not only underscores the challenges of remote work but also presents a positive outlook, suggesting that organizations can achieve success if teams possess the necessary skills and adaptability. Furthermore, in scenarios with high remote work and team capabilities, agile project management success matches that of low remote work settings with high team capabilities. Balancing effective remote work practices and strong team capabilities can mitigate challenges posed by remote environments, ensuring consistent agile project management success across different work arrangements.

6.2. Practical implications

While initially promising to enhance TC, gamification may not have the expected long-term impact. Corporate leaders should evaluate its use critically, aligning it with specific learning objectives and company culture to ensure its integration into growth strategies. Sustainable engagement strategies are essential to counter potential reductions in motivation, complementing gamification with recognition, feedback, and skill advancement opportunities. Balancing gamification activities is essential to prevent overwhelming employees and promote enjoyable and manageable experiences conducive to learning and collaboration.

Companies have the power to reevaluate TC assessment, customizing

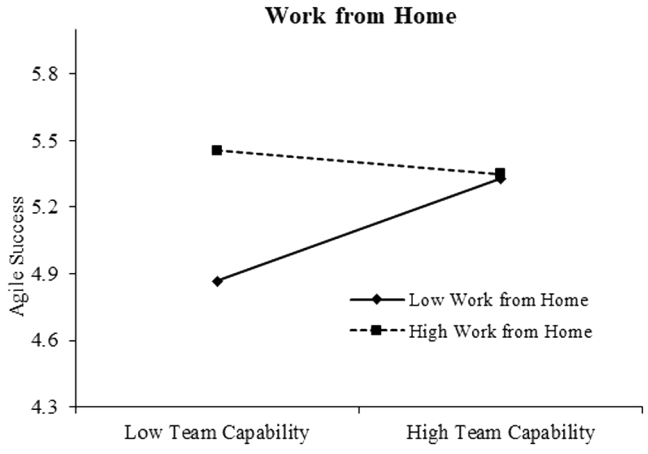

Fig. 3. . Moderator effect.

agile practices to their unique context instead of adopting a general approach. Incorporating AI and MI expands the scope beyond traditional metrics, enhancing agile project management success through flexibility in implementation guided by ongoing assessments and feedback. Focusing on the right mix of factors creates productive, innovative work environments, benefiting society with efficient resource utilization aligned with sustainability goals.

Prioritizing team capability enhancement involves continuous training, optimizing remote work practices, and developing adaptable, supportive policies and environments. A skilled and proficient team is vital for agile project management success, enabling efficient collaboration, adaptability, and problem-solving, even in high remote work settings. Supporting team skill development for practical remote work ensures consistent agile project management success across various arrangements by balancing effective practices with robust team capabilities.

6.3. Limitations and future research

The authors acknowledge this study's limitations and urge careful consideration from its readers. It relies on survey data, which might only partially capture project outcomes due to potential biases. Future research should focus on refining data collection methods through more robust pre-testing, such as cognitive interviews. This approach can enhance the accuracy of survey instruments and minimize response biases, ultimately ensuring more precise measurements of project outcomes. This research examines a limited set of factors, which might overlook critical influences, thereby risking oversimplification and lack of depth. Expanding the range of variables explored in future research could enhance the validity and provide a more comprehensive understanding of the complex factors affecting project management success, thereby addressing the risk of oversimplification in the current study. Evaluating success in agile projects is complex due to fixed budgets and small sample sizes, which can lead to response variability. Future studies should incorporate qualitative methodologies, such as in-depth interviews with industry professionals. Such an approach would allow for more affluent, context-specific insights, addressing the challenges in current evaluations and helping to mitigate the variability seen in smaller quantitative datasets. Additionally, larger sample sizes could benefit the findings, enhancing the results' reliability and generalizability. Increasing sample sizes through broader outreach, utilizing professional networks and online communities for example, could facilitate this expansion, providing a more representative sample of the agile project management landscape. Together, these strategies would deepen the research's impact and applicability in academic and professional settings.

7. Conclusion

Our study provides valuable insights into the factors influencing agile project management success, employing a comprehensive analysis combining seven key variables and PLS-SEM methodology. The study reaffirms the positive impact of PC and CI on agile project management success, consistent with previous literature. However, it challenges the influence of GAM and TC, demonstrating that while gamification may initially engage teams, its long-term effects on capability may be limited. Similarly, the study's findings suggest that while TC is often regarded as important for agile project management success, its significance may vary depending on contextual factors and interactions with other variables.

Our study also underscores the need for nuanced understanding and contextualization of variables such as gamification and TC within the agile framework. While literature suggests positive relationships, the current study reveals complexities and challenges traditional assumptions, highlighting the importance of tailored approaches and ongoing evaluation. Ultimately, achieving agile project management success requires a balance between fostering team capabilities, adapting to evolving work practices, and leveraging technological advancements to drive innovation and efficiency.

CRediT authorship contribution statement

Catarina Koudriachov: Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Carlos Tam:** Writing – review & editing, Validation, Supervision, Software. **Manuela Aparicio:** Writing – review & editing.

Declaration of competing interest

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

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Appendix

Appendix A. Questionnaire items

Constructs		Items	Source
Gamification	GAM1	Gamification offers me the possibility to obtain points as a reward for my activities.	(Suh et al., 2017)
	GAM2	Gamification offers me the possibility to express my identity through game elements.	
	GAM3	Gamification offers me the possibility to compare my performance with that of others.	
	GAM4	Gamification offers me the possibility to try to increase my status.	
	GAM5	While using gamification, I am absorbed in what I am doing.	
	GAM6	While I am using the gamification, I am aware of how to proceed to fulfill my purposes.	
Artificial Intelligence	AI1	I can identify the AI technology employed in the applications and products I use.	(Wang et al., 2023)
	AI2	I can skillfully use AI applications or products to help me with my daily work.	
	AI3	It is usually hard for me to learn to use a new AI application or product.	
	AI4	I can use AI applications or products to improve my work efficiency.	
	AI5	I can evaluate the capabilities and limitations of an AI application or product after using it for a while.	
	AI6	I am never alert to privacy and information security issues when using AI applications or products.	
Marketing Intelligence	MI1	Through MI, my company adeptly gathers insights on both customers and competitors, showcasing our proficiency in data acquisition.	(Falahat et al., 2020;

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(*continued*)

Constructs		Items	Source
	MI2	Utilizing MI, we excel in monitoring and understanding customer needs and desires.	Weng, 2020)
	MI3	Leveraging our expertise in MI, we excel in dissecting and effectively distributing marketing insights.	
	MI4	Through MI, we are competent in developing effective marketing programs.	
	MI5	Utilizing MI, our organization has the ability to understand competitors' movements.	
	MI6	Enhanced by MI, our organization has the capacity to comprehend product trends.	
Team Capability	TC1	Team members with high competence and expertise	(Stankovic et al., 2013)
	TC2	Team members with great motivation	
	TC3	Managers knowledgeable in agile	
	TC4	Managers who have light-touch or adaptive management style	
	TC5	Appropriate technical training to team	
Personal Characteristics	PC1	The majority of our team members have strong interpersonal and communication skills.	(Misra et al., 2009)
	PC2	Most of the members of our team are honest.	
	PC3	Most of the members of our team are motivated.	
	PC4	Most of the members of our team have a collaborative attitude.	
	PC5	Most of the members of our team have a sense of responsibility.	
	PC6	Most of the members of our team are eager to learn.	
Customer Involvement	CI1	The team members have a good relationship with the client.	(Stankovic et al., 2013)
	CI2	The team members have a strong commitment and client presence.	
	CI3	The team members give the client full authority.	
Work from Home	WFH1	I like working remotely.	(Chatterjee et al., 2022)
	WFH2	I feel more satisfaction in working remotely.	
	WFH3	I think remote working improves productivity.	
	WFH4	I think the remote working option provides better flexibility to employees.	
	WFH5	I believe most of my friends and colleagues are satisfied while working remotely.	
	WFH6	I believe employees become more productive while working remotely.	
Agile Project Management Success	SUC1	The project respects the budget initially negotiated.	(Serrador and Pinto, 2015; Stankovic et al., 2013; Tam et al., 2020)
	SUC2	The project respects the initially negotiated delivery date.	
	SUC3	The project outcome exceeds the customer's expectations.	
	SUC4	The team members are very satisfied with the project outcome.	
Filters and Controls	Age - What is your age (in years)?		
	Gender - What is your gender?		
	Education - What is the highest education degree you have earned?		
	TeamSize - How many members are on your team (in numbers)?		

Appendix B. PLS loadings and cross-loading

Constructs		GAM	AI	MI	TC	PC	CI	WFH	SUC
Gamification (GAM)	GAM1	**.822**	.329	.388	.304	.218	.280	.215	.227
	GAM2	**.829**	.355	.451	.321	.188	.329	.199	.306
	GAM3	**.847**	.394	.420	.261	.157	.279	.205	.306
	GAM4	**.660**	.262	.307	.183	.043	.148	.141	.246
	GAM5	**.829**	.317	.409	.217	.118	.192	.164	.209
	GAM6	**.868**	.384	.471	.297	.246	.328	.263	.297
Artificial Intelligence (AI)	AI1	.265	**.647**	.300	.303	.209	.237	−0.047	.259
	AI2	.316	**.795**	.190	.435	.294	.267	.164	.241
	AI3	.235	**.617**	.213	.213	.096	.186	.061	.271
	AI4	.362	**.878**	.315	.485	.393	.206	.214	.385
	AI5	.316	**.843**	.208	.325	.281	.217	.138	.323
	AI6	.376	**.604**	.288	.200	.088	.186	.031	.322
Marketing Intelligence (MI)	MI1	.286	.168	**.758**	.322	.250	.325	.079	.308
	MI2	.445	.226	**.853**	.367	.228	.418	.122	.367
	MI3	.399	.308	**.875**	.408	.325	.450	.095	.430
	MI4	.403	.336	**.841**	.444	.336	.312	.103	.440
	MI5	.462	.293	**.842**	.391	.248	.317	.093	.376
	MI6	.509	.335	**.823**	.358	.340	.447	.200	.399
Team Capability (TC)	TC2	.172	.296	.277	**.697**	.797	.438	.347	.400
	TC3	.254	.356	.358	**.757**	.368	.412	.210	.375
	TC4	.284	.452	.348	**.861**	.535	.359	.360	.474
	TC5	.306	.327	.446	**.799**	.475	.495	.129	.422
Personal Characteristics (PC)	PC3	.162	.342	.360	.627	**.904**	.384	.419	.488
	PC4	.223	.323	.278	.584	**.874**	.462	.371	.467
	PC6	.141	.141	.244	.557	**.800**	.385	.327	.337
Customer Involvement (CI)	CI1	.283	.277	.413	.467	.421	**.882**	.226	.439
	CI2	.196	.259	.376	.488	.432	**.883**	.257	.438
	CI3	.340	.189	.354	.398	.337	**.733**	.211	.452
Work from Home (WFH)	WFH1	.251	.127	.165	.297	.398	.264	**.849**	.310
	WFH2	.225	.080	.073	.286	.351	.221	**.861**	.286
	WFH3	.245	.128	.160	.309	.399	.229	**.856**	.336
	WFH4	.090	.222	.107	.262	.340	.242	**.683**	.334

(*continued on next page*)

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Constructs		GAM	AI	MI	TC	PC	CI	WFH	SUC
	WFH5	.102	.057	−0.001	.149	.269	.149	**.736**	.251
	WFH6	.271	.071	.149	.289	.351	.227	**.871**	.347
Agile Project Management Success (SUC)	SUC1	.201	.318	.334	.435	.415	.357	.221	**.793**
	SUC2	.188	.251	.255	.287	.246	.311	.204	**.740**
	SUC3	.294	.306	.404	.440	.417	.498	.332	**.854**
	SUC4	.337	.409	.465	.521	.514	.499	.431	**.838**

Appendix C. Heterotrait-Monotrait Ratio of correlations (HTMT)

Constructs	GAM	AI	MI	TC	PC	CI	WFH	SUC
Gamification(GAM)								
Art.Intelligence(AI)	.489							
Mark.Intelligence(MI)	.551	.390						
Team Capability(TC)	.384	.548	.541					
Personal Charac.(PC)	.233	.354	.390	.865				
Customer Involv.(CI)	.384	.367	.539	.700	.592			
Work from Home(WFH)	.269	.184	.160	.397	.497	.329		
Agile Proj. Manag. Success(SUC)	.365	.482	.515	.644	.576	.640	.421	

Data availability

Data will be made available on request.

References

Abou-Shouk, M., Soliman, M., 2021. The impact of gamification adoption intention on brand awareness and loyalty in tourism: the mediating effect of customer engagement. J. Destin. Mark. Manage. 20. https://doi.org/10.1016/j.jdmm.2021.100559.

Agbejule, A., Lehtineva, L., 2022. The relationship between traditional project management, agile project management and teamwork quality on project success. Int. J. Org. Anal. 30 (7), 124–136. https://doi.org/10.1108/IJOA-02-2022-3149.

Alhammad, M.M., Moreno, A.M., 2020. Challenges of gamification in software process improvement. J. Softw. (6), 32. https://doi.org/10.1002/smr.2231.

Al-Hashem, A.O., 2020. Mediation impact of marketing intelligence in the relationship between technology based knowledge sharing and product innovation. TEM J. 9 (2), 688–693. https://doi.org/10.18421/TEM92-35.

Alias, Z., Zawawi, E.M.A., Yusof, K., Aris, N.M., 2014. Determining critical success factors of project management practice: a conceptual framework. Procedia - Social Behav. Sci. 153, 61–69. https://doi.org/10.1016/j.sbspro.2014.10.041.

Alvarez, A., Sanchez, B.B., 2022. Agile Transformation processes: Impact of Factors in the Success of failure: An ongoing Work On Identiying and Charactering What Influences Transformations, 17th. CISTI. https://doi.org/10.23919/CISTI54924.2022.9820358.

Annosi, M.C., Lanzolla, G., 2023. The evolution of line managers during agile transformation: from missionaries to priests. Calif. Manage Rev. 65 (4), 116–136. https://doi.org/10.1177/00081256231175706.

Arslan Haider, S. (2019). *Impact customer knowledge manage. capability on project performance with mediating role agility moderating role team skills*. https://www.researchgate.net/publication/357286136.

Badewi, A., 2016. The impact of project management (PM) and benefits management (BM) practices on project success: towards developing a project benefits governance framework. Int. J. Project Manage. 34 (4), 761–778. https://doi.org/10.1016/J.IJPROMAN.2015.05.005.

Barradas, G., 2023. Gamification Applied to Project Management and Agile Methodologies For Fast Development. Instituto Superior de Tecnologias Avançadas de Lisboa.

Barros, L., Tam, C., Varajão, J., 2024. Agile software development projects–Unveiling the human-related critical success factors. Inf. Softw. Technol. 170. https://doi.org/10.1016/j.infsof.2024.107432.

Bernerth, J.B., Aguinis, H., 2016. A critical review and best-practice recommendations for control variable usage. Pers. Psychol. 69 (1), 229–283. https://doi.org/10.1111/peps.12103.

Chatterjee, S., Chaudhuri, R., Vrontis, D., 2022. Does remote work flexibility enhance organization performance? Moderating role of organization policy and top management support. J. Bus. Res. 139, 1501–1512. https://doi.org/10.1016/j.jbusres.2021.10.069.

Chatterjee, S., Chaudhuri, R., Vrontis, D., Thrassou, A., Ghosh, S.K., 2021. Adoption of artificial intelligence-integrated CRM systems in agile organizations in India. Technol. Forecast. Soc. Change 168. https://doi.org/10.1016/j.techfore.2021.120783.

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. Research. 14 (2), 189–217. https://www.jstor.org/stable/23011467.

Chow, T., Cao, D.B., 2008. A survey study of critical success factors in agile software projects. J. Syst. Softw. 81 (6), 961–971. https://doi.org/10.1016/j.jss.2007.08.020.

Cinque, M., Carretero, S., Napierala, J., 2021. Non-cognitive skills other related concepts. https://creativecommons.org/licenses/by/4.0/.

Ciric Lalic, D., Lalic, B., Delić, M., Gracanin, D., Stefanovic, D., 2022. How project management approach impact project success? From traditional to agile. Int. J. Managing Projects Bus. 15 (3), 494–521. https://doi.org/10.1108/IJMPB-04-2021-0108.

Cooke-Davies, T., 2002. The '"real'" success factors on projects. Int. J. Project Manage. 20, 185–190. www.elsevier.com/locate/ijproman.

da Cruz Andrade, Á.J., Mattos, C.S., Fortuna, A., Ramos, L.F., dos Santos, R.P., Santos, G., 2023. Critical success factors of agile transformation initiatives from a project management perspective. In: ACM International Conference Proceeding Series, pp. 443–450. https://doi.org/10.1145/3592813.3592936.

Debnath, B., Shakur, M.S., Bari, A.B.M.M., Karmaker, C.L., 2023. A Bayesian Best–Worst approach for assessing the critical success factors in sustainable lean manufacturing. Decis. Anal. J. 6. https://doi.org/10.1016/j.dajour.2022.100157.

Deterding, S., Dixon, D., Khaled, R., Nacke, L., 2011. From Game Design Elements to Gamefulness: Defining "Gamification. ACM.

Dewnarain, S., Ramkissoon, H., Mavondo, F., 2021. Social customer relationship management: a customer perspective. J. Hosp. Mark. Manage. 30 (6), 673–698. https://doi.org/10.1080/19368623.2021.1884162.

Dong, H., Dacre, N., Baxter, D., Ceylan, S., 2024. What is agile project management? developing a new definition following a systematic literature review. Project Manage. J. https://doi.org/10.1177/87569728241254095.

Donthu, N., Kumar, S., Pandey, N., 2021. A retrospective evaluation of marketing intelligence and planning: 1983–2019. Market. Intell. Plann. 39 (1), 48–73. https://doi.org/10.1108/MIP-02-2020-0066.

Dubey, R., Bryde, D.J., Dwivedi, Y.K., Graham, G., Foropon, C., 2022. Impact of artificial intelligence-driven big data analytics culture on agility and resilience in humanitarian supply chain: a practice-based view. Int. J. Prod. Econ. 250. https://doi.org/10.1016/j.ijpe.2022.108618.

Dugnol-Menéndez, J., Jiménez-Arberas, E., Ruiz-Fernández, M.L., Fernández-Valera, D., Mok, A., Merayo-Lloves, J., 2021. A collaborative escape room as gamification strategy to increase learning motivation and develop curricular skills of occupational therapy students. BMC. Med. Educ. 21 (1). https://doi.org/10.1186/s12909-021-02973-5.

Ekici, M., 2021. A systematic review of the use of gamification in flipped learning. Educ. Inf. Technol. (Dordr) 26 (3), 3327–3346. https://doi.org/10.1007/s10639-020-10394-y.

Falahat, M., Ramayah, T., Soto-Acosta, P., Lee, Y.Y., 2020. SMEs internationalization: the role of product innovation, market intelligence, pricing and marketing communication capabilities as drivers of SMEs' international performance. Technol. Forecast. Soc. Change 152. https://doi.org/10.1016/j.techfore.2020.119908.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 18 (1), 39–50.

Fortune, J., White, D., 2006. Framing of project critical success factors by a systems model. Int. J. Project Manage. 24 (1), 53–65. https://doi.org/10.1016/j.ijproman.2005.07.004.

Ganguly, A., Nilchiani, R., Farr, J.V., 2009. Evaluating agility in corporate enterprises. Int. J. Prod. Econ. 118 (2), 410–423. https://doi.org/10.1016/j.ijpe.2008.12.009.

Gebhardt, G.F., Farrelly, F.J., Conduit, J., 2019. Market intelligence dissemination practices. J. Mark. 83 (3), 72–90. https://doi.org/10.1177/0022242919830958.
Goldeman, S., Nagel, R., Preiss, K., 1995. Agile Competitors and Virtual Organizations. Van Nostrand Reinhold, New York.
Gorenc, M., Kastelic, M., Valentinčič, K., 2023. Advantages and disadvantages of working from home in public administration. Int. J. Juridical Sci.
Götz, O., Liehr-Gobbers, K., Krafft, M., 2009. Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. Springer Berlin Heidelberg, Heidelberg.
Haas, M.R., 2006. Knowledge gathering, team capabilities, and project performance in challenging work environments. Manage. Science 52 (8), 1170–1184. https://doi.org/10.1287/mnsc.1060.0530.
Haider, S.A., Kayani, U.N., 2021. The impact of customer knowledge management capability on project performance-mediating role of strategic agility. J. Knowl. Manage. 25 (2), 298–312. https://doi.org/10.1108/JKM-01-2020-0026.
Hair, J.F., Hult, G., Ringle, C., Sarstedt, M., 2017. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), 2nd Edition. Sage.
Heidt, L., Gauger, F., Pfnür, A., 2023. Work from home success: agile work characteristics and the Mediating Effect of supportive HRM. Rev. Manager. Sci. 17 (6), 2139–2164. https://doi.org/10.1007/s11846-022-00545-5.
Henseler, J., Ringle, C.M., Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J. Acad. Mark. Sci. 43 (1), 115–135. https://doi.org/10.1007/s11747-014-0403-8.
Hu, Q., Lu, Y., Pan, Z., Gong, Y., Yang, Z., 2021. Can AI artifacts influence human cognition? The effects of artificial autonomy in intelligent personal assistants. Int. J. Inf. Manage 56. https://doi.org/10.1016/j.ijinfomgt.2020.102250.
Jackson, M.B., 2012. Agile: a decade in. PM Network.
Jain, S., Mishra, S., Saxena, G., 2023. Luxury customer's motivations to adopt gamification. Mark. Intell. Plann. 41 (2), 156–170. https://doi.org/10.1108/MIP-05-2022-0207.
Johnson, R.E., Rosen, C.C., Djurdjevic, E., 2011. Assessing the Impact of Common Method Variance on Higher Order Multidimensional Constructs. J. Appl. Psychol. 96 (4), 744–761. https://doi.org/10.1037/a0021504.
Jovanovic, M., Campbell, M., 2022. Generative artificial intelligence: trends and Prospects. Computer. (Long. Beach. Calif) 55 (10), 107–112. https://doi.org/10.1109/MC.2022.3192720.
Kalaignanam, K., Tuli, K.R., Kushwaha, T., Lee, L., Gal, D., 2021. Marketing agility: the concept, antecedents, and a research agenda. J. Mark. 85 (1), 35–58. https://doi.org/10.1177/0022242920952760.
Kaur, G., Kaur, I., Harnal, S., Malik, S., 2023. Factors and techniques for software quality assurance in agile software development. Agile Software Development. Wiley, pp. 257–272. https://doi.org/10.1002/9781119896838.ch13.
Kerzner, H., 2022. A Guide to Measuring and Monitoring Project Performance, Third Edition. The International Institute for Learning.
Kučera, J., Krulický, T., Navrátilová, P., 2023. The trend of work from home and its advantages and disadvantages during the Covid-19 pandemic: a comparative study. J. Interdiscip. Res. www.hrnews.cz.
Lies, J., 2019. Marketing intelligence and big data: digital marketing techniques on their way to becoming social engineering techniques in marketing. Int. J. Interact. Multimedia Artif. Intell. 5 (5), 134–144. https://doi.org/10.9781/ijimai.2019.05.002.
Lies, J., 2022. Marketing intelligence: boom or bust of service marketing? Int. J. Interact. Multimedia Artif. Intell. 7 (7), 115–124. https://doi.org/10.9781/ijimai.2022.10.001.
Lindell, M.K., Whitney, D.J., 2001. Accounting for common method variance in cross-sectional research designs. J. Appl. Psychol. 86 (1), 114–121. https://doi.org/10.1037/0021-9010.86.1.114.
Liu, Y., Yang, Z., Yu, Z., Liu, Z., Liu, D., Lin, H., Li, M., Ma, S., Avdeev, M., Shi, S., 2023. Generative artificial intelligence and its applications in materials science: current situation and future perspectives. In: Journal of Materiomics, 9. Chinese Ceramic Society, pp. 798–816. https://doi.org/10.1016/j.jmat.2023.05.001.
Mahdi AL-shammari, A.M., Kadhim Shamran, M., & Naji Hussein, A. (2023). *The Role Marketing Intelligence in Achieving Customer Satisfaction*. https://www.scholarexpress.net.
Mandhachitara, R., Allapach, S., 2017. Small business performance in Thailand: key success factors. J. Res. Mark. Entrepreneurship 19 (2), 161–181. https://doi.org/10.1108/jrme-06-2016-0018.
Marnewick, C., 2023. Student experiences of project-based learning in agile project management education. Project Leadersh. Soc. 4. https://doi.org/10.1016/j.plas.2023.100096.
Merhi, M.I., 2023. An evaluation of the critical success factors impacting artificial intelligence implementation. Int. J. Inf. Manage 69. https://doi.org/10.1016/j.ijinfomgt.2022.102545.
Mikalef, P., Gupta, M., 2021. Artificial intelligence capability: conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. Inf. Manage. 58 (3). https://doi.org/10.1016/j.im.2021.103434.
Milosevic, D., Patanakul, P., 2005. Standardized project management may increase development projects success. Int. J. Project Manage. 23 (3), 181–192. https://doi.org/10.1016/j.ijproman.2004.11.002.
Misra, S.C., Kumar, V., Kumar, U., 2009. Identifying some important success factors in adopting agile software development practices. J. Syst. Softw. 82 (11), 1869–1890. https://doi.org/10.1016/j.jss.2009.05.052.
Mohsen Alawag, A., Salah Alaloul, W., Liew, M.S., Ali Musarat, M., Baarimah, A.O., Saad, S., Ammad, S., 2023. Critical success factors influencing total quality management in industrialised building system: a case of malaysian construction industry. Ain Shams Eng. J. 14 (2). https://doi.org/10.1016/j.asej.2022.101877.
Mueller, S. (2024). *Leveraging gamification for improved collaboration in DevOps*. doi:10.36227/techrxiv.171174564.40878250/v1.
Ndlela, M., Tanner, M., 2022. Business analysts' contributions to the dynamic capabilities of agile software development teams. Inf. Technol. People 36 (8), 1–20. https://doi.org/10.1108/ITP-08-2021-0656.
Neffati, M.R., Sallam, M.A.M., 2021. Measurement and analysis of macroeconomic (In) stability in North African countries. Montenegrin J. Econ. 17 (2), 119–132. https://doi.org/10.14254/1800-5845/2021.17-2.10.
Nivedhitha, K.S., 2023. Key in socially driven game dynamics, open the doors of agility - an empirical study on gamification and employee agility. Behav. Inf. Technol. 42 (11), 1659–1685. https://doi.org/10.1080/0144929X.2022.2093792.
Noteboom, C., Ofori, M., Sutrave, K., El-Gayar, O., 2021. Agile Project Management: A Systematic Literature Review of Adoption Drivers and Critical Success Factors. University of Hawai'i at Manoa.
O'brien, M.P., Costin, Y., 2023. Using gamification to develop students as strategic thinkers: a qualitative perspective. In: Proceedings of the 22nd European Conference on e-Learning. ECEL.
Pacagnella, A.C., da Silva, V.R., 2023. 20 years of the agile manifesto: a literature review on agile project management. Manage. Prod. Eng. Rev. 14 (2), 37–48. https://doi.org/10.24425/mper.2023.146021.
Pargaonkar, S., 2023. A comprehensive research analysis of Software Development Life Cycle (SDLC) agile & waterfall model advantages, disadvantages, and application suitability in software quality engineering. Int. J. Scientific Research Publications 13 (8), 120–124. https://doi.org/10.29322/ijsrp.13.08.2023.p14015.
Pillai, S.V., Prasad, J., 2023. Investigating the key success metrics for WFH/remote work models. Industr. Commercial Training 55 (1), 19–33. https://doi.org/10.1108/ICT-07-2021-0053.
Pinto, J.K., 1988. Project success: definitions measurement techniques. Project Manag. J. 19 (1), 67–72.
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. J. Appl. Psychol. 88 (5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879.
Raharjo, T., Purwandari, B., 2020. Agile project management challenges and mapping solutions: a systematic literature review. In: ACM International Conference Proceeding Series, pp. 123–129. https://doi.org/10.1145/3378936.3378949.
Rahayu, F.S., Nugroho, L.E., Ferdiana, R., Setyohadi, D.B., 2022. Motivation and engagement of final-year students when using e-learning: a qualitative study of gamification in pandemic situation. Sustainability (Switzerland) 14 (14). https://doi.org/10.3390/su14148906.
Riahi, Y., Saikouk, T., Gunasekaran, A., Badraoui, I., 2021. Artificial intelligence applications in supply chain: a descriptive bibliometric analysis and future research directions. Expert. Syst. Appl. 173. https://doi.org/10.1016/j.eswa.2021.114702.
Ringle, C.M., Wende, S., Becker, J.-M., 2024. SmartPLS 4. SmartPLS, Bönningstedt.
Sadeghi, K., Ojha, D., Kaur, P., Mahto, R.V., Dhir, A., 2024. Explainable artificial intelligence and agile decision-making in supply chain cyber resilience. Decis. Support. Syst. 180. https://doi.org/10.1016/j.dss.2024.114194.
Sakirin, T., Kusuma, S., 2023. A survey of generative artificial intelligence techniques. Babylonian J. Artif. Intell. 2023, 10–14. https://doi.org/10.58496/bjai/2023/003.
Saldanha, T.J.V., Mithas, S., Krishnan, M.S., Smith, R.H., 2017. Leveraging customer involvement for fueling innovation: the role of relational and analytical information processing capabilities. MIS Q. 41 (1), 267–286. https://doi.org/10.2307/26629647.
Salehi, F., 2022. Role of artificial intelligence on agile planning and organizational performance in the ICT industry. Finance Manage. 8 (4), 1–6. https://www.researchgate.net/publication/368381945.
Salhab, H.A., Allahham, M., Abu-Alsondos, I.A., Frangieh, R.H., Alkhwaldi, A.F., Ali, B.J. A., 2023. Inventory competition, artificial intelligence, and quality improvement decisions in supply chains with digital marketing. Uncertain Supply Chain Manage. 11 (4), 1915–1924. https://doi.org/10.5267/j.uscm.2023.8.009.
Santy, R.D. & Iffan, M. (2023). *The effect of artificial intelligence and gamification on online purchase intention mediated by customer experience: study on Indonesian marketplace users*. Jornal IImiah Manajement.
Schmidtner, M., Doering, C., Timinger, H., 2021. Agile working during COVID-19 pandemic. IEEE Eng. Manage. Rev. 49 (2), 18–32. https://doi.org/10.1109/EMR.2021.3069940.
Serrador, P., Pinto, J.K., 2015. Does Agile work? - A quantitative analysis of agile project success. Int. J. Project Manage. 33 (5), 1040–1051. https://doi.org/10.1016/j.ijproman.2015.01.006.
Sheffield, J., Lemétayer, J., 2013. Factors associated with the software development agility of successful projects. Int. J. Project Manage. 31 (3), 459–472. https://doi.org/10.1016/j.ijproman.2012.09.011.
Singh, A. & Simon, R. (2023). *Effectiveness of agile sustainable project management approach in software industries* (pp. 292–306). doi:10.1007/978-3-031-47055-4_25.
Singh, P., Verma, A., Vij, S., Thakur, J., 2023. Implications & impact of artificial intelligence in digital media: with special focus on social media marketing. In: E3S Web Conferences, p. 399. https://doi.org/10.1051/e3sconf/202339907006.
Staller, M.S., Koerner, S., 2021. Beyond classical definition: the non-definition of gamification. SN. Comput. Sci. 2 (2). https://doi.org/10.1007/s42979-021-00472-4.
Stankovic, D., Nikolic, V., Djordjevic, M., Cao, D.B., 2013. A survey study of critical success factors in agile software projects in former Yugoslavia IT companies. J. Systems Software 86 (6), 1663–1678. https://doi.org/10.1016/j.jss.2013.02.027.

Suh, A., Cheung, C.M.K., Ahuja, M., Wagner, C., 2017. Gamification in the workplace: the central role of the aesthetic experience. J. Manage. Information Systems 34 (1), 268–305. https://doi.org/10.1080/07421222.2017.1297642.
Tabassum, M., Raziq, M.M., Rice, J.L., Borini, F.M., Wajid, A., 2023. Co-creating organizational performance and project success through customer participation, requirement risk and knowledge integration: a multi-study evidence. Benchmarking. https://doi.org/10.1108/BIJ-10-2022-0632.
Tam, C., Moura, E.J., da, C., Oliveira, T., Varajão, J., 2020. The factors influencing the success of on-going agile software development projects. Int. J. Project Manage. 38 (3), 165–176. https://doi.org/10.1016/j.ijproman.2020.02.001.
Tominc, P., Oreški, D., Rožman, M., 2023. Artificial intelligence and agility-based model for successful project implementation and company competitiveness. Information (Switzerland) (6), 14. https://doi.org/10.3390/info14060337.
Tosic, D., 2023. Artificial Intelligence-driven web Development and Agile Project Management Using OpenAI API and GPT Technology. Mittuniversitetet Department of Information Systems and Technology.
Vos, T.P., Perreault, G.P., 2020. The discursive construction of the gamification of journalism. Convergence 26 (3), 470–485. https://doi.org/10.1177/1354856520909542.
Wang, B., Rau, P.L.P., Yuan, T., 2023. Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. Behav. Inf. Technol. 42 (9), 1324–1337. https://doi.org/10.1080/0144929X.2022.2072768.
Wang, X., Lin, X., Shao, B., 2022. How does artificial intelligence create business agility? Evidence from chatbots. Int. J. Inf. Manage 66. https://doi.org/10.1016/j.ijinfomgt.2022.102535.
Wang, Y., Ma, J., Zhang, Y., 2024. Application of improved frog leaping algorithm in multi objective optimization of engineering project management. Decis. Making 7 (1), 364–379. https://doi.org/10.31181/dmame712024896.
Weng, W., 2020. Effect of Internet of Things on Business Strategy: The Mediating Role of Marketing Intelligence Capability. National Chengchi University.
Werbach, K., Hunter, D., 2020. For the Win. Wharton School Press.
Wu, T., 2022. Digital project management: rapid changes define new working environments. J. Bus. Strategy 43 (5), 323–331. https://doi.org/10.1108/JBS-03-2021-0047.
Yang, L.R., Huang, C.F., Wu, K.S., 2011. The association among project manager's leadership style, teamwork and project success. Int. J. Project Manage. 29 (3), 258–267. https://doi.org/10.1016/j.ijproman.2010.03.006.
Yang, Q.F., Lian, L.W., Zhao, J.H., 2023. Developing a gamified artificial intelligence educational robot to promote learning effectiveness and behavior in laboratory safety courses for undergraduate students. Int. J. Educ. Technol. High. Educ. 20 (1). https://doi.org/10.1186/s41239-023-00391-9.
Yontar, E., 2023. Critical success factor analysis of blockchain technology in agri-food supply chain management: a circular economy perspective. J. Environ. Manage 330. https://doi.org/10.1016/j.jenvman.2022.117173.
Zaman, S., Wang, Z., Rasool, S.F., Zaman uz, Q., Raza, H., 2022. Impact of critical success factors and supportive leadership on sustainable success of renewable energy projects: empirical evidence from Pakistan. Energy Policy 162. https://doi.org/10.1016/j.enpol.2022.112793.

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