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Sustainability in Project Management and Project Success with Virtual Teams: A Quantitative Analysis Considering Stakeholder Engagement and Knowledge Management

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Abstract: Project success is crucial for businesses, but the impact of virtual teams on it is still not fully understood. The global outbreak of the COVID-19 pandemic in 2020 has led to the widespread adoption of virtual environment solutions to support geographically dispersed project teams. The growth in the use of virtual or hybrid teams in projects is expected to continue, as it presents an irreversible trend. Furthermore, there has been a significant increase in interest in sustainability in project management in recent years, emphasizing the long-term perspective for project success. To address this gap and contribute to the project success theory, a quantitative study was conducted to examine the impact of stakeholder engagement, knowledge management, and sustainable practices in project management on project success in virtual work environments using structural equation modeling. Experienced Portuguese-speaking project management professionals were surveyed. No evidence was found to support the moderating role of virtual teams, concluding that the virtual nature of a team does not diminish stakeholder engagement, knowledge-sharing, or sustainability in project management and its influence on project success. This study provides valuable insights for enhancing project success in virtual work environments, as it is the first of its kind to quantitatively address the sustainable long-term approach of project success in virtual environments.

Keywords: virtual teams; sustainability in project management; stakeholder engagement; knowledge management; project success; project management; sustainability; project; virtual work environment

1. Introduction

Over the years, different research findings have shown that project success can have different meanings for different people [1] and that it is a multidimensional concept that is directly dependent on context [2]. Project success is thus a matter of perception [3], i.e., a

project is perceived as an overall success when key stakeholders are highly satisfied with the outcome [4]. According to the literature, four main groups of project success factors are considered for project success assessment: (i) factors related to the project itself; (ii) factors related to the project manager and the team; (iii) factors related to the organization; and (iv) factors related to the external environment. For instance, besides the project itself, the three other groups are related to internal and external stakeholders and their environment. Project managers' managerial skill, team members' commitment, and environmental factors are as critical as other organizational factors [5].

The traditional view of project success has centered on the triple constraint of time, cost, scope, and quality for decades. However, contemporary research has expanded the scope of project success criteria to include additional factors such as stakeholder participation and satisfaction, organizational learning, customer benefits, and the overall well-being of society [6–8]. Recently, scholars have emphasized the need to shift the focus of critical project success factors from short-term indicators such as time, budget, and quality to a long-term approach that incorporates social, environmental, and economic priorities. This long-term perspective refers to the Triple Bottom Line (TBL) concept and has emerged as a promising framework for evaluating project success in a more holistic and sustainable manner [1,9–11].

Effective stakeholder engagement is essential for the success of sustainable project management, as it allows for the integration of stakeholder demands and the promotion of sustainable practices, which can lead to better decision-making and improved project outcomes [12–15]. Empowerment and psychological factors such as autonomy, meaning, and control can motivate stakeholders to actively participate in projects, leading to knowledge-sharing and management [16]. Establishing a reliable project environment also fosters effective stakeholder engagement and knowledge creation, enabling sustainable project management practices and ultimately project success [17,18]. In this context, knowledge-sharing plays a critical role in supporting sustainable practices within project management [16,18]. For this reason, considering stakeholder engagement, knowledge management, and sustainable project management practices is crucial when assessing project success from a contemporary long-term standpoint [8]. Hence, understanding the relationship between those variables and project success is an interesting investigation to contribute to project success theory and the project management field to achieve more sustainable results in organizations.

Considered as project success factors, the environment and the context of projects are continuously evolving [5]. The unprecedented global outbreak of the COVID-19 pandemic in 2020 has compelled organizations across the globe to adopt virtual environment solutions to facilitate geographically dispersed project teams. This inexorable shift towards the adoption of virtual or hybrid teams in project management is poised to persist and expand [19,20]. On the other hand, this growth also brings about complex challenges, such as effectively engaging project stakeholders and managing the information and knowledge generated in the projects. The use of information and communication technology (ICT) virtual tools and solutions can either pose a threat or present an opportunity, depending on the efficiency of the infrastructure, the appropriateness of use, and the adaptability of stakeholders to the new technologies. Nevertheless, the virtual team work environment has been viewed as a more viable and sustainable way of conducting project management and overall organizational work [21]. In addition, the adoption of virtual solutions for project management is perceived to contribute to overall sustainable practices, as it reduces carbon footprints and leads to a more reasonable use of resources [19,22].

The advent and irreversible trend of the virtual team environment has challenged traditional notions of project success and opened up new avenues of inquiry in project success theory. Given the significant impact of the virtual team environment on stakeholder perceptions, it begs the question of whether this emerging context should be factored in as a moderating variable in the overall framework of project success assessment [21–23].

Insufficient research has been conducted to quantitatively examine project success in the virtual work environment. To address this knowledge gap, a study was undertaken using Structural Equation Modeling (SEM) with the aim of understanding the contribution of stakeholder engagement, knowledge management, and sustainable practices in project management to enhancing project success, particularly focusing on the moderating impact of the virtual work environment. The data were collected through questionnaires distributed to experienced Portuguese-speaking project management professionals.

The central objective of this investigation is to explore the moderating influence of the new (virtual) context on the assessment of project success from the viewpoint of project management professionals, considering a long-term perspective. Therefore, this study investigated the following research questions:

RQ1. *What is the influence of sustainability in project management, stakeholder engagement, and knowledge management on project success?*

RQ2. *How do stakeholder engagement and knowledge management impact overall sustainability in project management?*

RQ3. *Does the virtual work environment of teams moderate the relationship between sustainability in project management, stakeholder engagement, knowledge management, and project success?*

The paper is organized into six sections. After the introduction, section two presents a detailed literature review of the constructs examined in the model. Section three outlines the methodology and materials employed in this study. Section four reports the results obtained from the SEM analysis. Subsequently, section five discusses the implications of the findings. Finally, section six presents conclusions, practical and theoretical implications, limitations of the study, and recommendations for future research.

2. Literature Review and Hypotheses Development

The literature review (LR) played a vital role in providing evidence for the hypothesis and model proposed, which highlights the connection between stakeholder engagement (SE), knowledge management (KM), sustainability in project management (SPM), and their impact on project success (PS), particularly in virtual team (VT) environments. Furthermore, the LR was instrumental in identifying and referencing previously tested questionnaires to be used in this study.

Initially, the research examined the relationship between project success and the proposed influencers in the model. The investigation then delved into sustainability in project management and its link to project success. Subsequently, the review focused on stakeholder engagement and knowledge management, their interrelation, and their impact on sustainability in project management and project success. Lastly, the virtual environment was examined as a potential moderator to the model.

2.1. Project Success (PS)

PS is complex and lacks a widely agreed-upon definition and measurement, requiring varied approaches. It is important to distinguish PS from project management success, which is necessary for achieving PS. Successful project management (PM) contributes to project achievements, but failing in PM does not necessarily mean overall project failure [24,25].

Projects are tools to achieve strategic goals in competitive environments [8] and should be viewed as a means to an end rather than an end in themselves. Their success should be evaluated based on both their own perspectives and their intended accomplishments as an end. Comprehensive evaluation models should consider diverse perspectives, even if they are contradictory, to account for different interests and contexts of stakeholders [26,27].

The success of a project is not only determined by meeting schedule and budget requirements but also by satisfying stakeholders' expectations. The perception of success in a project is dependent on time and may alter throughout the project life cycle. Moreover, different stakeholders have different perceptions; thus, PS is influenced by the situation and the stakeholders' expectations [4,12,28]. The tangible and objective aspects of a project, such as time and cost, are considered hard dimensions, which are measurable and quantifiable. In contrast, the soft dimensions, such as stakeholders' satisfaction, are more subjective, subtle, and challenging to measure [25,29].

Traditionally, PS has been evaluated based on scope, time, and cost metrics—called hard dimensions [29,30]. However, as the literature on PM has evolved, additional dimensions have been considered in conducting quantitative analyses [31,32]. These include efficiency, impact on clients (e.g., meeting technical specifications, improving quality of life), impact on team, business success (e.g., sales, profitability, competitiveness), and potential for future opportunities [33]. Moreover, a novel dimension for assessing PS has been considered, i.e., sustainability, which pertains to the long-term economic, environmental, and social benefits of a project—the Triple Bottom Line (TBL) concept [12,31,34].

PM success is commonly seen as the key factor in achieving PS. However, this view can neglect the long-term strategic elements of PS and lead to a narrow focus on internal, short-term objectives. This can result in project managers overlooking stakeholder management [27]. To address this limitation, models for assessing PS have emerged that consider longer-term outcomes [35]. These models consider additional criteria such as new skills acquisition, how effective the project's final product utilization is, customer satisfaction, commercial success, new business opportunity development, stakeholder satisfaction, impact on the project team, safety, effectiveness, conflict resolution, knowledge management, and sustainable PM practices [27,36,37].

The assessment of PS criteria lacks a consensus in the literature. Nonetheless, evaluating success is of great importance. The project's success is intertwined with its context, and this association should be considered when analyzing the project. This research delved into observing the project management environment and its possible influence on project success criteria [1,38,39].

2.1.1. The Perspective of Sustainability in Project Management (SPM)

Sustainability has been a focus of various fields, including PM, for several decades. Currently, incorporating sustainability principles in PM practices is an outstanding trend and requires significant changes in the organization's economic, environmental, and social objectives [34,40–45]. Projects driven by sustainability principles have a direct connection between the required change and the organization's strategy [34,43,44].

SPM is a new and emerging school of PM, and integrating sustainability requires a complex effort [13]. The challenge is to have a unique framework for sustainable PM that is equally appropriate for application in different industries. More than defining dimensions or variables to establish a framework, it is a matter of assessing them considering the peculiarities of each industry's projects and its context [35]. The TBL balance is the foundation of sustainability. Balancing ecological and social issues over economic interests is challenging [34].

In recent years, numerous authors have advocated for incorporating sustainability concepts into PM practices to achieve successful project execution and management [46,47]. Projects play a significant role in creating sustainable development [44,48]. In addition, PM is clearly affected by sustainability in all dimensions, including PS achievement. Hence, three major shifts must be considered to successfully integrate sustainability practices into PM: a scope shift to manage social, environmental, and economic impact, a paradigm shift to a flexible and complex approach, and a shift in the project manager's mindset towards taking responsibility for sustainable development [10,49]. The literature supports that PS is positively influenced by sustainable practices in PM when evaluated individually [22,31,50]. Therefore, the following first hypothesis was formulated:

Hypothesis 1. *Sustainability in project management (SPM) has a positive influence on project success (PS).*

2.1.2. The Perspective of Stakeholder Engagement (SE)

The evaluation of PS can vary among stakeholders depending on their interests and level of influence. It is important to recognize that PS is not solely determined by the traditional measures of the iron triangle [25,30]. SE involves the active participation of stakeholders in the project, which allows them to influence decision-making and remain informed of project progress. Consequently, stakeholder assessment of PS can be impacted by their level of engagement [51].

SE involves communicating and building relationships with stakeholders throughout the project lifecycle to ensure their participation in decision-making processes [52]. The two main levels of SE are involvement (informing and consulting) and participation (higher level of engagement to reduce conflicts) [53]. SE provides stakeholders with the opportunity to voice their opinions, influence project plans, and be informed of project decisions [54]. The ultimate goal of SE is to achieve transparent decision-making with stakeholder support for the decisions made [55].

In order to achieve long-term success in projects, authors have suggested shifting the focus of critical success factors from short-term indicators to a more sustainable approach that includes SE [8,22]. Research indicates that SE is a crucial factor in PS [56]. The early involvement of internal and external stakeholders is particularly important to avoid or mitigate negative effects that may arise from their interests. Active engagement and dialogue during project planning can reduce potential conflicts in later phases [52,55]. Ineffective planning, including inadequate stakeholder expectation management and communication strategies, can lead to significant project issues, potentially resulting in project closure [57]. In light of the literature, the second hypothesis posits that:

Hypothesis 2. *Stakeholder engagement (SE) has a positive influence on project success (PS).*

2.1.3. The Perspective of Knowledge Management (KM)

Knowledge has been recognized as an essential asset for exploring the future, leading to the development of the new discipline of KM. This involves understanding the processes of creating, identifying, assimilating, distributing, and deploying knowledge [58]. Integrating learning into current tasks is crucial for organizations to develop and retain knowledge for future needs. Projects are knowledge-intensive processes that require cross-functional temporary teams with different perspectives. To overcome challenges and solve technical problems, project teams must constantly incorporate new information into their knowledge base. This makes learning a fundamental part of their job [58,59].

Multi-cultural, geographically dispersed teams often characterize project-oriented organizations, leading to knowledge dispersion and the loss of valuable lessons learned. However, the two basic strategies for KM observed in projects, codification and personalization, can address this challenge by storing knowledge in artefacts and databases and sharing knowledge through personal interaction [60,61]. Paper documents and interaction with colleagues are often perceived as the most important sources of knowledge in projects. Implementing a systematic project KM approach can transform a project-oriented organization into a learning organization, taking advantage of lessons learned from one project into another [60,62].

PS heavily relies on KM practices in project-oriented organizations. Effective KM can bring numerous benefits to the project and the whole organization, such as cost savings, work efficiency, continuous learning, continuous improvement, specialized resource allocation, and fostering innovation. Research has identified culture and communication, information and communication technology (ICT), methods, and organization as critical factors that require management to achieve excellence in KM [63]. Complementarily, soft skills such as leadership, trust, influence, empathy, collaboration, stewardship, and adap-

tation have been included in the frameworks to enhance results in KM as well [61,64–66]. Truly, a proficient KM approach has the potential to enhance the efficiency and efficacy of a project [17].

Assessing the success of KM initiatives includes considering resources growth, knowledge content development, project survival, and financial return. To achieve success, organizations must foster a culture of KM, coordinate knowledge efforts, provide incentives and authority, use a suitable system for handling knowledge, and provide cultural support [67]. Learning should be integrated into current tasks rather than solely focusing on present goals for a prospective outlook of future success. This highlights the importance of viewing PM as a long-term endeavor to create valuable outcomes, not just deliver outputs [68].

Low rates of fully successful projects may indicate that PM practitioners struggle to effectively acquire and transfer knowledge from past projects to future ones. Proper management of this knowledge could potentially lead to higher PS rates [67,69]. Accordingly, the literature grounds the third hypothesis of the model:

Hypothesis 3. *Knowledge management (KM) has a positive influence on project success (PS).*

2.2. Sustainability in Project Management: The Perspective of Stakeholder Engagement and Knowledge Management

As previously stated, the sustainability concept is based on the TBL balance. Prioritizing and harmonizing ecological and social issues over economic motivation, on the other hand, is a challenging goal to manage among stakeholders' interests, as it requires balancing ecological, social, and economic issues as well as stakeholders' interests [34]. Particularly in PM, stakeholder management is a topic often discussed in publications related to sustainability, as the two areas are closely related [35,70,71].

Stakeholders' active participation, collaboration, and engagement propel PM toward a more sustainable management approach, so the importance of sustainability in PM cannot be overstated [7,11,44]. On the other hand, incorporating sustainability practices in PM significantly expands the list of project stakeholders, which places a greater burden of responsibility on project managers. Consequently, SPM demands ethical and fair decision-making from project managers beyond their knowledge, skills, and capabilities [48].

Research has recognized stakeholders' participation as one of the main aspects to enhance SPM. Therefore, considering and respecting stakeholders' interests is considered a key principle of sustainability [11,35]. The Sustainable Development Goals (SDGs) provide SE with a framework and motivate them to achieve superior project outcomes [12,72]. ISO 26000, on the other hand, encourages a behavioral approach to SPM by emphasizing "proactive SE" as a fundamental principle [73]. Essentially, incorporating stakeholder participation, collaboration, and engagement into PM can promote a more sustainable approach that takes into account social and ethical considerations [7,11,44], switching the emphasis towards long-term and sustainable strategy [46,74].

Stakeholder theory has positively impacted sustainability implementation in PM, which is evident by the growing number of related publications [72,75]. Recent research using quantitative analysis found that achieving SE in projects strongly influences and strengthens sustainable practices in SPM [18]. Building on the existing literature, the model's fourth hypothesis assumes that:

Hypothesis 4. *Stakeholder engagement (SE) has a positive influence on sustainability in project management (SPM).*

SPM involves KM, stakeholder management, corporate policies and practices, resource management, and an extended project life cycle focus [35]. Developing organizational capabilities in sustainability requires proactive stakeholder involvement to maximize economic, social, and environmental benefits, and to promote continuous organizational learning to better achieve future goals [35].

Effective KM is crucial for long-term organizational success and requires integrating learning with current tasks for future needs [58,59]. In particular, PM literature is shifting toward a sustainable approach, focusing on KM to achieve organizational continuous learning for successful results [46,74]. This view of PM emphasizes adding value with an outcome, not just achieving success with an output [8].

Knowledge is an essential asset to ensure projects' sustainable practices by aiding project managers in making informed decisions that consider long-term impacts [48,76]. Likewise, an effective KM—including capturing, sharing, and utilizing knowledge—can also contribute to the implementation of sustainable practices in projects, augmenting the ability to meet present needs without compromising future resources. [35]. Sharing knowledge can foster engagement, reduce duplication of effort, minimize errors, and improve project achievements, ultimately contributing to long-term success [61]. In essence, as recently confirmed by research [18], an efficient KM enhances project efficiency and effectiveness, at last contributing to sustainability [17]. Drawing on relevant theories and empirical evidence, this study suggests the following hypothesis:

Hypothesis 5. *Knowledge management (KM) has a positive influence on sustainability in project management (SPM).*

2.3. Virtual Team Environment

Working in project-oriented organizations presents a unique set of challenges, especially when the project teams are geographically dispersed and composed of individuals from diverse cultural and even linguistic backgrounds. The temporary nature of project teams, with team members coming and going as projects conclude or evolve, creates additional complications in knowledge-sharing and management, stakeholder engagement, and sustainable PM practices implementation [60].

Virtual teams, which are characterized by their distance and discontinuities in basic project conditions such as geography, time zone, organizational structure, national culture, work practices, and technology, present additional challenges [23]. These include communication barriers, conflict resolution, and maintaining social interactions across time, space, and organizational units [77]. Cultural intelligence and communication accommodation ability significantly influence team synergy and direction in virtual teams [20]. Understanding other cultures and values contributes to the effectiveness of such teams. Therefore, virtual team members should be carefully selected, possess basic skills in using communication tools, and be adaptable to virtual work environments [78]. Additionally, PM practices must be meticulously scrutinized to effectively tackle uncertainties and ambiguities by relentlessly seeking to mitigate discontinuities [21].

In contrast, virtual teams offer numerous benefits, such as economic advantages, diverse talent from different regions, greater autonomy, and a reduced risk of conflict [38]. The diversity of resources available and the ability to work in a remote environment also provide opportunities for resource saving, including time and financial cost. These aspects are seen as sustainable, making virtual teams an attractive option for PM [19,79]. Working remotely from home or other locations—co-working spaces, malls, cafes, libraries, vehicles—reduces travel time and increases the chances of avoiding peak hour travel. This highlights the potential benefits of virtual work teams, where members can work from anywhere without the need to commute, resulting in significant resource savings and more sustainable practices [19,21,38].

Globalization in the 1990s prompted companies to form geographically dispersed, cross-functional teams, posing communication and technology challenges [80]. By the 2000s, technology improved PM [81], but supporting integrated collaborative teamwork remained a challenge [77,82]. The emergence of global crises, such as the COVID-19 pandemic in 2020, has placed significant strains on traditional work arrangements. In response, the adoption of virtual teams has become a compelling solution for many organizations, providing them with a significant advantage in operational efficiency and the realization of sustainable

objectives. In particular, organizations experienced in project management using virtual teams have demonstrated greater resilience in the face of extreme circumstances [19].

Prior to the 2000s, a limited number of publications on VTs and project management was found. However, since 2015, there has been a significant increase in the annual average number of publications, and this trend skyrocketed from 2020 onwards. The growing interest in studying VTs in project management, revealed by the LR, highlights the need for further quantitative research to support their widespread adoption in practice [22].

The literature regarding the project success concept discusses the direct influence of individual perception [1,3,4], the context of the project [2], the project team, the project stakeholders, and the external environment [5]. On the other hand, clear communication rules, effective project management style with defined goals, and competent and trusting managers are essential for successful project execution in a dispersed setting of VTs [39]. Therefore, the moderation aspect of working in virtual environments should be considered. In summary, to achieve project success in VTs, organizations should focus on understanding virtual team dynamics, including the pros and cons, and prioritize the selection of team members with technical skills, effective communication, and adaptability to the virtual work environment [78,83].

The virtual teams project environment challenges the achievements of the effectiveness of SE and KM [18]. Conversely, working in virtual environments enhances sustainable practices implementation [22]. Although the examination of virtual teams in project management and their influence on project success has gained traction in the scholarly literature, their prevalence in projects has yet to be fully acknowledged [22]. This investigation, therefore, aimed to appraise the moderator impact of virtual teams on the relationships considered in the model.

2.3.1. Virtual Teams: The Perspective of Sustainability in Project Management Influence on Project Success

The trend of virtual teams adoption in projects is offering significant advantages in terms of operational efficiency and sustainable goals for organizations [19]. Remote work, even for just a day, reduces travel time (and consequentially carbon emissions) and increases resource savings [19,38]. By reducing reliance on physical workspaces, VT work solutions yield cost savings in physical assets and bring important social benefits by providing the flexibility to reside in more affordable cities. The dispersion of residential areas and workplaces contributes to sustainable land and space utilization [84]. Research evidences that virtual environments have the potential to enhance the influence of sustainable practices on project success, including environmental, economic, and social aspects [22]. Considering the research outcomes, the hypothesis to be investigated is:

Hypothesis 6. *Virtual teams (VTs) have a positive moderating effect on the influence of sustainability in project management (SPM) on project success (as stated by Hypothesis 1).*

2.3.2. Virtual Teams: The Perspective of Stakeholder Engagement Influence on Project Success

As previously described, PS can be directly impacted by the level of SE [51]. Conversely, a narrow focus on temporary team approaches can result in a limited perspective, neglecting the management of stakeholder interests in favor of achieving project management objectives [27]. In response to this limitation, there has been a shift towards project success assessment frameworks that embrace a more long-term perspective [35]. Thus, evaluating the impact of motivational factors on SE is essential, specifically considering the inherent challenges of working in virtual environments [20].

Strategic SE, encompassing early stakeholder identification, adept needs, and expectations management, is pivotal in creating an enabling environment and fostering project success. This entails establishing effective and customized communication channels that align with stakeholder requirements [57]. According to the literature, leadership, trust, team cohesion, technical management, and communication emerged as crucial factors

for PS in VTs. The Sharing Relations-Oriented Leadership behaviors exhibited in VTs undermine SE, leading to diminished perceptions of productivity and decreased PS [85].

The complexity of a team's communication dynamics also fluctuates based on the need to reconcile divergent perspectives, exchange feedback, or minimize the potential for misinterpretation [86]. Ensuring unobstructed communication channels and an effective engagement of stakeholders poses major challenges in VTs [77]. Building upon prior studies, the following hypothesis is suggested:

Hypothesis 7. *Virtual teams (VTs) have a negative moderating effect on the influence of stakeholder engagement (SE) on project success (as stated by Hypothesis 2).*

2.3.3. Virtual Teams: The Perspective of Knowledge Management Influence on Project Success

Virtual project teams encounter difficulties in knowledge creation due to diverse contexts among members. The sharing of explicit knowledge relies on formal and accessible frameworks, while the exchange of tacit knowledge can pose challenges, especially for teams without prior experience working together in person or in hybrid settings [87]. Socialization, the process of exchanging experiences to develop tacit knowledge, is complex in virtual and distributed environments. To foster organizational knowledge and innovation, the continuous interaction between tacit and explicit knowledge is vital [62]. Thus, externalizing tacit knowledge and facilitating the sharing of explicit knowledge play vital roles in this process [20,88].

The conditions of virtual teams have a direct impact on both SE and KM, ultimately influencing overall PS [89]. Enabling effective knowledge-sharing among innovation project team members is feasible, but it is equally important to establish processes that encourage the ongoing generation of tacit knowledge as a long-term asset [59,88]. Indeed, future knowledge creation processes in VTs are a challenge and must be considered as crucial achievements in projects [18]. In line with the theoretical perspectives, it is hypothesized that:

Hypothesis 8. *Virtual teams (VTs) have a negative moderating effect on the influence of knowledge management (KM) on project success (as stated by Hypothesis 3).*

2.4. Stakeholder Engagement and Knowledge Management

In project-based work, teams are often temporary, and their efforts are fragmented. This poses a challenge for preserving and leveraging the organization's knowledge assets. Organizational learning is further impeded by the fact that each project is unique and has a limited lifespan. As a result, SE is crucial for ensuring the long-term success of sustainable PM [63]. By involving stakeholders and sharing knowledge, project managers can overcome the obstacles of temporality and uniqueness and create a continuous learning process that contributes to the organization's competitive advantage [55]. Furthermore, sharing knowledge and distributing information is a primary means of involving stakeholders and making project information more accessible [6].

To ensure successful implementation of KM in projects, stakeholders need to understand that commitment to the practice requires time and effort. Communicating the strategic goals of KM practices and engaging stakeholders is fundamental for success [67]. Research highlights the mutual correlation of SE and KM as well as their positive impact on achieving SPM [18,90,91]. Engaging stakeholders through knowledge-sharing cultivates a sense of belonging and meaning, which is crucial for organizational strategy [16]. Given the current state of knowledge, this study proposes that:

Hypothesis 9. *Stakeholder engagement (SE) and knowledge management (KM) have a mutual positive correlation.*

2.5. Research Model and Hypothesis

This study aimed to quantify the relationship between SE, KM, and their impact on SPM, as well as the individual influences of SE, KM, and SPM on PS, particularly considering the context of the VT environment. Therefore, grounded in the relevant studies and theories that have been previously presented, nine hypotheses were proposed to test these relationships. Hypotheses H1 to H3 proposed that SPM, SE, and KM have a positive effect on PS. Hypotheses H4 and H5 proposed that SE and KM have a positive influence on SPM. Hypotheses H6, H7, and H8 proposed that the VT environment moderates the relationship between SPM, SE, and KM and PS. Lastly, H9 posited a positive correlation between SE and KM. With the purpose of quantitatively validating or rejecting this study's hypotheses, both null and alternative hypotheses were developed and examined. The proposed model and hypotheses (null and alternative) are backed by the literature review and are displayed in Table 1 and Figures 1 and 2.

Table 1. Description of model hypotheses.

Hypothesis	Null	Alternative
H1	SPM does not have a positive influence on PS	SPM has a positive influence on PS
H2	SE does not have a positive influence on PS	SE has a positive influence on PS
H3	KM does not have a positive influence on PS	KM has a positive influence on PS
H4	SE does not have a positive influence on SPM	SE has a positive influence on SPM
H5	KM does not have a positive influence on SPM	KM has a positive influence on SPM
H6	VTs do not have a moderating effect on H1	VTs have a moderating effect on H1
H7	VTs do not have a moderating effect on H2	VTs have a moderating effect on H2
H8	VTs do not have a moderating effect on H3	VTs have a moderating effect on H3
H9	SE and KM do not have a positive correlation	SE and KM have a positive correlation

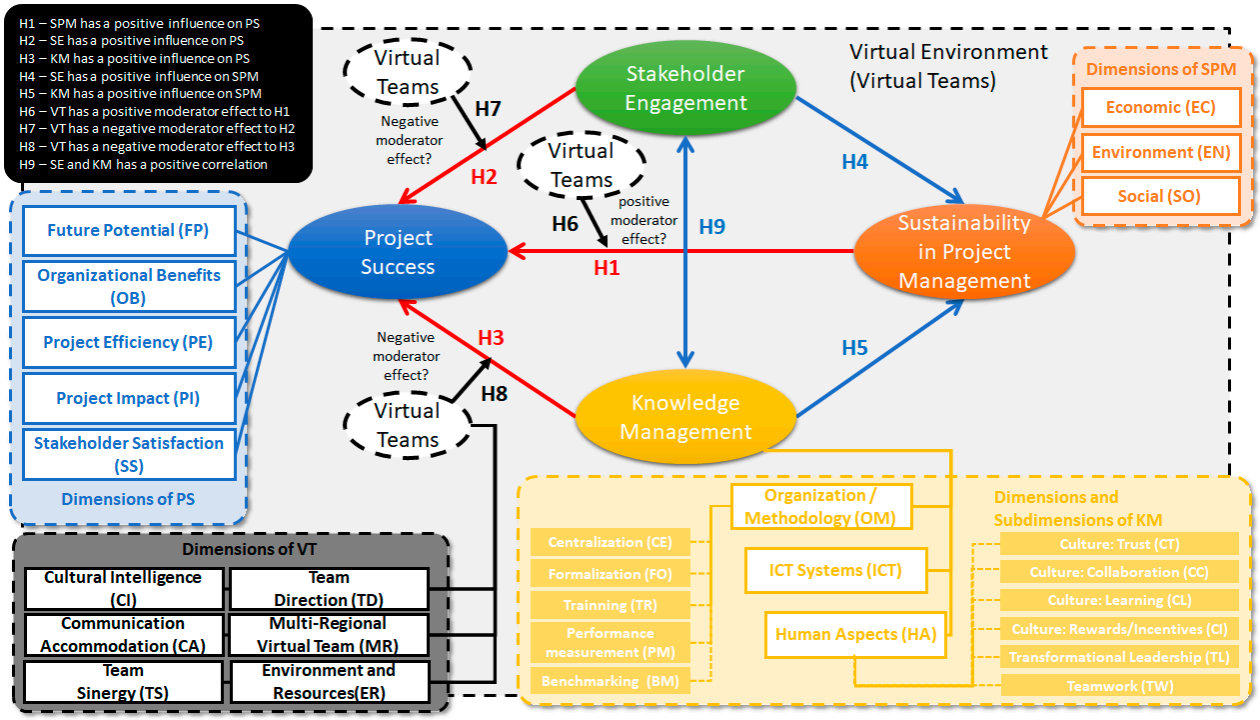

Figure 1. Conceptual Model and Hypotheses.

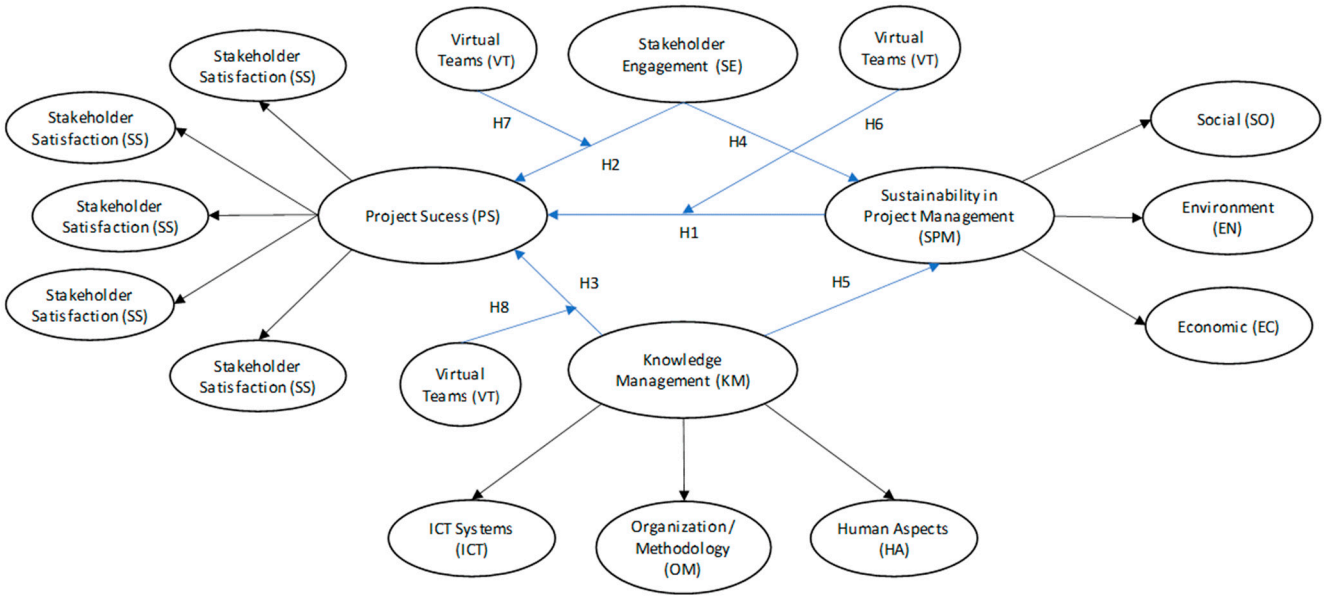

Figure 2. Hypothetical Theoretical Model.

3. Materials and Methods

This study employed survey-based research (SBR) to investigate how stakeholder engagement (SE) and knowledge management (KM) relate to sustainability in project management (SPM) and their combined impact on project success (PS) in the context of virtual teams (VTs). The research also explored the individual influence of SE, KM, and SPM on PS in the VT environment. The research methodology involved multiple stages, which are summarized as follows: (1) Administered a survey using selected questionnaires to collect data (Appendix A); (2) used SEM for data analysis and hypotheses testing; and (3) validated model using data collected.

3.1. Data Collection and Sample Characteristics

This study used a survey with a five-point Likert scale to collect data on constructs related to participants' recent virtual or in-person project team experience. Demographic and professional information was also gathered to classify participants' backgrounds and experience with VTs.

Considering the complexity of the model and to meet the study's objectives, a minimum of 200 responses from professionals with PM experience was required. The survey link was intended to be sent to approximately 8000 Portuguese-speaking professionals, mainly Brazilians. The estimated response rate was 25%, which is consistent with the average response rate in similar studies [92,93].

Sample size = [(minimum sample size required × 100) ÷ average percentage response rate expected] [93].

3.2. Measurement

The web-based survey employed validated questionnaires from established academic resources, selected via the literature review, with sources in Appendix A. For instance, the questionnaire for assessing SPM was selected based on the triple bottom line (TBL) dimensions [36], while the questionnaire for assessing KM was based on commonly used frameworks such as Organization and Methodology, ICT, and Human Aspects [64]. To evaluate the first-order SE construct, the questionnaire items were created based on two different references, as they are complementary, and for VT moderation, questionnaires were selected based on the essential virtual team development features [92,94]. In addition, the questionnaire selection process took into account a modern perspective on PS criteria approach evaluation [8].

3.3. Data Analysis

Categorical variables were analyzed using absolute and relative frequencies. Construct items were described using mean, standard deviation, and a 95% bootstrap percentile interval [95]. A Likert scale ranging from 1 to 5 was used, with intervals below 3 indicating disagreement, intervals above 3 indicating agreement, and intervals containing 3 indicating neutrality. To compare categorical variables between virtual and in-person environments, Fisher's Exact Test was employed [96].

Outliers were examined, considering univariate and multivariate cases. Univariate outliers were identified using standardized scores beyond |4.00| [97], while multivariate outliers were detected using the Mahalanobis D^2 measure. Both types of outliers were retained to maintain generalizability, despite their potential impact on the analysis results [98]. Given the adoption of a 5-point Likert scale, outliers are not commonly observed to have a significant influence, as the response options are limited within a narrow range of 1 to 5, reducing the likelihood of extreme data points that deviate significantly from the rest of the distribution [98].

Linearity was assessed through pairwise correlations and the Bartlett test [99] within constructs.

3.4. Structural Equation Modeling

Structural Equation Modeling (SEM) is a statistical technique that combines factor analysis and multiple regression analysis to examine relationships between multiple variables [98]. The SEM approach used in this study was Partial Least Squares (PLS), which is suitable for complex models and small sample sizes and makes fewer assumptions about data distribution compared to traditional methods [100]. Partial Least Squares (PLS) simultaneously evaluates multiple variable relationships, particularly applied to complex models and small sample sizes [100]. Since the sample is non-normally distributed, SEM PLS is a suitable approach that provides R^2 values and assesses the significance of relationships between constructs [101].

The "Two-Step" approach was employed to address the structure of measurement, whereas latent variable scores were computed through Principal Component Analysis [102]. This allowed the formation of second- and third-order constructs using other latent variables as indicators. To ensure the quality and validity of the constructs, various criteria were applied. Convergent validity was evaluated using Fornell and Larcker criterion, which suggests that the Average Variance Extracted (AVE) should exceed 50% or 40% for exploratory research [103–105]. Reliability was measured using Cronbach's Alpha (AC) and Composite Reliability (CC) indicators [106]. The dimensionality of the constructs was assessed using the Parallel Analysis [107] Acceleration Factor [108] criteria.

SEM involves creating an Outer Model to show how variables relate to constructs, and an Inner Model to illustrate links between constructs. Indicators with low factor loadings (<0.50) are removed from the model assessment [97]. The model fit was assessed by examining the R-squared (R^2) values, which measure the extent to which independent constructs explain the dependent constructs. Additionally, the Goodness-of-Fit (GoF) measure, a geometric mean of construct Average Variance Extracted (AVE) and model R-squared, provided an overall evaluation of model fit [109,110]. All analyses were conducted using R software, version 4.1.3.

4. Results

4.1. Sample Database Description

The sample database comprised 210 individuals who were assessed on 195 items related to 27 first-order constructs. Among them, 27 individuals (12.86%) had no prior experience with virtual team projects and were not included in the model adjustment process. No missing responses were observed in the database. Univariate outliers accounted for 17 values (0.05%) exceeding the scale range, while 9 observations (4.92%) were identified as multivariate outliers based on a significance threshold of 0.001 for the Mahalanobis D^2

measure. Despite their presence, both univariate and multivariate outliers were retained in the sample to maintain the generalizability of the multivariate analysis, considering their potential validity as representative cases of the population [97].

The dataset exhibits non-normal univariate and multivariate distributions due to its discrete and finite scale. The PLS approach was employed as an alternative to the traditional covariance-based structural equation modeling (CBSEM), allowing for greater flexibility in data modeling without strict assumptions such as multivariate normality, independence, and large sample sizes [100]. The absence of normality is not a major concern in SEM [98]. Linearity was assessed, revealing 10,516 significant relationships (55.60% of possible correlations) based on the Spearman correlation matrix. Bartlett's test confirmed significant linear relationships within the constructs ($p < 0.05$) [111].

4.2. Sample Descriptive Analysis

The descriptive analysis of the sample (participants of the survey) revealed that most individuals were of Brazilian nationality (82.86%), had an age range of 41 to 50 years old (36.37%), were male (70.00%), and had over 15 years of project work experience (54.29%). The majority of individuals had 1 to 5 years of experience working with teams in a virtual environment (53.81%), while 12.86% of individuals had never worked with teams in a virtual environment.

An analysis of categorical variables related to individuals' experience with virtual teams (VTs) showed that a significant portion (39.89%) of participants worked on virtual team (VT) projects for 5 years or less. Most participants (55.74%) held leadership or management positions. The Southeast region was the most common personal (71.04%) and team (36.61%) location during the project. Almost half (41.53%) of participants reported working with a small team of 10 or fewer people, regardless of the size of the organization (27.32% reported more than 1000 colleagues). The majority (36.61%) of projects had a budget of between 1 million and 500 million reais, and most projects (75.96%) were in the private sector, with technology, digital media, or telecommunications being the most common area (36.61%).

Regarding the individuals who answered the survey but had no experience in VT projects, the descriptive analysis of categorical variables of companies with only on-site teams shows that the majority (55.56%) had participated in on-site team projects but were not working on them anymore. Most (44.44%) worked as team members on the projects. The predominant personal (59.26%) and team location (59.26%) during the project was the Southeast region of Brazil. Over half (51.85%) reported that the team size was small, with 10 or fewer people. The majority (37.04%) reported that there were up to 10 colleagues in the organization. The budget for the majority (29.63%) of the projects was between 1 million and 500 million reais. The predominant sector (59.26%) of the projects was private and the predominant area (40.74%) was engineering or architecture.

Additional detailed information can be found in the Tables A6–A8 provided in Appendix B.

4.3. First-Order Construct Descriptive Analysis

Descriptive analysis of the first-order constructs revealed that individuals tended to agree with all items in most constructs, indicating a general consensus. However, there were some items that showed disagreement or neutrality, highlighted in Table A9 (Appendix C). For instance, individuals showed neutrality towards some items in the Environment construct and disagreed with some items in the Rewards/Incentives and Transformational Leadership constructs. Overall, the analysis provided valuable insights into the model's major issues.

4.4. Mesurement Model (Outer Model)

Appendix D (Table A10) displays the measurement model of this study. It should be noted that the item Multi-Regional VT (MR) × 7.10 in the construct Stakeholder Engage-

ment (SE) moderated by VTs had a factor load of less than 0.50, but it was retained as it did not affect the construct validation criteria.

Table 2 indicates that the analysis of the model's constructs revealed strong results for convergent validity, construct reliability, discriminant validity, and dimensionality. The results suggest that the constructs demonstrate convergent validity with AVE values above 0.40, have high reliability with reliability indexes above 0.60, exhibit discriminant validity with a shared variance lower than AVE, and are one-dimensional based on the Acceleration Factor criterion.

Table 2. Validation of the Measurement Model.

Construct	Items	AVE. [1]	M.S.V. [2]	C.A. [3]	C.R. [4]	Dim. [5]
Knowledge Management (KM) × Virtual Teams (VT)	18	0.60	0.83	0.96	0.96	1
Stakeholder Engagement (SE) × Virtual Teams (VT)	60	0.54	0.83	0.99	0.99	1
Sustainability in Project Management (SPM) × Virtual Teams (VT)	18	0.62	0.84	0.97	0.97	1
Knowledge Management (KM)	3	0.73	0.83	0.81	0.89	1
Stakeholder Engagement (SE)	10	0.60	0.83	0.93	0.94	1
Sustainability in Project Management (SPM)	3	0.69	0.84	0.79	0.88	1
Project Success (PS)	5	0.67	0.38	0.88	0.91	1

[1] Average Variance Extracted; [2] Maximum Shared Variance; [3] Cronbach's Alpha; [4] Composite Reliability; [5] Dimensionality.

4.5. Structural Model (Inner Model) and Results

Table 3 shows the structural model and quantifies the relationships between the constructs. Complementarily, Figure 3 illustrates these results, with a Goodness-of-Fit (Gof) value of 46.41%. Upon the validation or rejection of the null hypotheses, the study findings reveal the subsequent outcomes:

1. Related to Sustainability in Project Management (SPM):
    a. Higher levels of KM were found to have a significant (p-value < 0.001) and positive (β = 0.27 [0.12; 0.43]) influence on SPM.
    b. Higher levels of SE were found to have a significant (p-value < 0.001) and positive (β = 0.39 [0.24; 0.53]) influence on SPM.
    c. The correlation between SE and KM is 0.6435.
    d. Indeed, KM and SE explained 31.73% of the variability in SPM.
2. Related to Project Success (PS) in Virtual Team Environment (VT):
    a. Higher levels of KM were found to have a significant (p-value = 0.001) and positive (β = 0.23 [0.11; 0.37]) influence on PS.
    b. Higher levels of SE were found to have a significant (p-value < 0.001) and positive (β = 0.39 [0.24; 0.53]) influence on PS.
    c. However, higher levels of SPM were not found to have a significative influence (p-value > 0.05) on PS.
    d. In the same path, VTs were not found to have a significant moderating (p-value > 0.05) effect on the relationship between the constructs.
    e. The correlation between SE and KM is 0.6435.
    f. KM, SE, SPM, and their interactions with VT explained 42.06% of the variability in PS.

4.6. Model Hypotheses Results

The study's results are summarized in Table 4. The findings revealed that KM and SE have a significant positive impact on both SPM and PS. The correlation between KM and SE was found to be positive and strong at 0.6435. Additionally, KM and SE together accounted for 31.73% of the variability in SPM and 42.06% of the variability in PS. However, there was no significant moderating effect of VTs detected.

Table 3. Structural Model (Inner Model).

Endogenous	Exogenous	β	S.E. (β) [1]	C.I. 95% [2]	*p*-Value	R^2
Sustainability in Project Management (SPM)	Knowledge Management (KM) [3]	0.27	0.07	[0.12; 0.43]	<0.001	31.73%
	Stakeholder Engagement (SE) [3]	0.39	0.07	[0.24; 0.53]	<0.001	
Project Success (PS)	KM × VT	0.50	0.48	[−0.73; 1.62]	0.296	42.06%
	SE × VT	0.52	0.79	[−1.70; 2.51]	0.509	
	SPM × VT	−0.60	0.66	[−2.21; 1.16]	0.358	
	Knowledge Management (KM) [3]	0.23	0.07	[0.11; 0.37]	0.001	
	Stakeholder Engagement (SE) [3]	0.41	0.07	[0.26; 0.54]	<0.001	
	Sustainability in Project Management (SPM)	0.12	0.07	[−0.03; 0.26]	0.100	

[1] Standard Error; [2] Bootstrap Confidence Interval; Gof = 46.41 percent; [3] KM × SE: *p*-value < 0.001 and r = 0.6435.

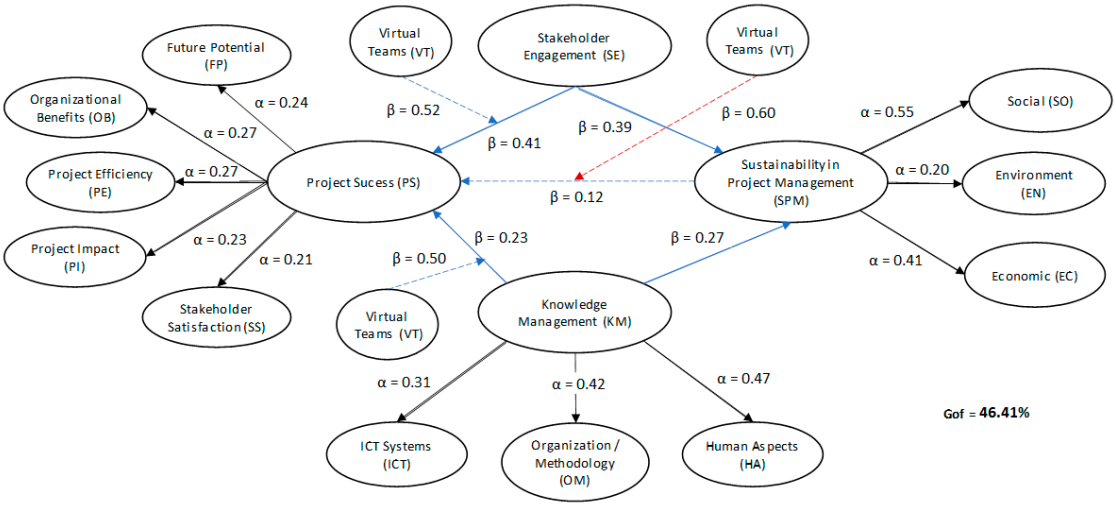

Figure 3. Structural Model Illustration.

Table 4. Result of the initial hypotheses of the model.

Hypothesis	Description	Result
H1	SPM has a positive influence on PS	Not confirmed
H2	SE has a positive influence on PS	Confirmed
H3	KM has a positive influence on PS	Confirmed
H4	SE has a positive influence on SPM	Confirmed
H5	KM has a positive influence on SPM	Confirmed
H6	VT has a moderating effect on H1 (SPM × PS)	Not confirmed
H7	VT has a moderating effect on H2 (SE × PS)	Not confirmed
H8	VT has a moderating effect on H3 (KM × PS)	Not confirmed
H9	SE and KM have a positive correlation	Confirmed

5. Discussion

In recent years, there has been growing attention to sustainable practices in project management (PM) [13,22,112–115]. In addition, stakeholder engagement (SE) and knowledge management (KM) have been recognized as important factors in promoting sustainable PM practices [18,35,46]. These factors contribute to an extended project life cycle that includes resource management, process improvement, and the evaluation of project outcomes from a sustainable perspective. Therefore, the adoption of sustainable practices in project management is seen as an ongoing learning process for organizations aiming to minimize negative environmental and social impacts while maximizing positive outcomes.

Moreover, recent PM publications have emphasized the significance of adopting a long life-cycle perception of value which can contribute to project success (PS). This shift towards

product management involves considering iterative outcomes to be tested, rather than focusing solely on a singular project result [8,116]. Consistent with this trend, the present study highlights the importance of assessing organizational continuous learning, managing and engaging participants, and implementing sustainable practices. These factors can contribute to a more sustainable and successful project outcome in the long run [18,114].

In the aftermath of the events of 2020, numerous organizations have adopted remote work arrangements as a permanent fixture for their workforce, in addition to as a temporary solution for the pandemic. Virtual and hybrid teams have been identified as a decisive solution for integrating geographically separated project teams. However, the moderation effect of VTs on PM practices studies has not kept pace with their increasing presence in projects [18–20,22,117]. As virtual work has become ubiquitous, it is crucial to conduct further studies, such as this one, to assess the effectiveness of virtual teams (VTs) and their impact on project results.

To address this gap, the present study sought to investigate the relationship between sustainability in project management (SPM) and PS, while also examining the potential moderating role of virtual teams. Specifically, we explored the influence of two additional key factors, SE and KM, on PS, as previous research has shown these variables to be positively associated with sustainable project practices [18]. In pursuit of this goal, endorsed by the literature, the research proposed six main hypotheses—the influence of SPM, KM, and SE on PS, as well as the moderation of VT on those relationships—and three other auxiliar hypotheses related to the relationship between SE, KM, and SPM.

The findings of this study confirmed the hypotheses that SE and KM influence PS positively, with SE having a slightly stronger effect ($\beta = 0.41$) than KM ($\beta = 0.23$). On the other hand, SPM's significance for PS was not as strong when analyzed together with other variables, contrary to prior findings in which it was analyzed alone in a model linking only SPM to PS [22]. This highlights the importance of considering multiple factors that contribute to PS, including SE and KM, rather than relying solely on SPM.

Furthermore, the results of this study reinforce the importance of the influence of SE and KM on SPM, confirming previous research findings [18]. The correlation between SE and KM indicates a potential overlap between the two factors. Overall, KM and SE together explained a notable portion of the variability in SPM (31.73%). These findings underscore the importance of considering multiple factors in sustainable PM and the need to prioritize SE as a key factor for achieving SPM practices.

In short, the authors previously found a positive relationship between SPM and PS [18,22]. However, this study discovered that SE and KM are important and positively influence both SPM and PS. Nonetheless, the findings provide important contributions to the project management field, as they suggest that project managers should prioritize both SE and KM practices in order to enhance PS, while also considering the role of sustainable practices in PM. This study underscores the need for a comprehensive approach to PM that incorporates various sustainable practices. Virtual teams face challenges in trust, communication, technical support, and corporate backing [39]. Strategies and technological tools can enhance project success in virtual environments [86], but the moderating role of virtual teams on project management results lacks empirical evidence [84]. Interestingly, this study found that VT did not have a significant moderating effect on the relationship between the constructs. In other words, the relationship between KM, SE, SPM, and PS was consistent regardless of whether the team was working in a virtual or co-located environment.

5.1. Theoretical Contributions

This study provides substantial theoretical contributions that enhance existing knowledge in the field of project management and sustainability. The findings shed light on the significance of SE and KM in achieving PS, thereby expanding the theoretical understanding of these concepts. The empirical support provided by this study contributes to the validation and refinement of existing theoretical frameworks.

Firstly, the integration of SE and KM emerges as pivotal for achieving favorable strategic outcomes in sustainability. This theoretical contribution highlights the imperative of regarding sustainability as a strategic organizational objective rather than solely a matter of project execution, given its societal significance. Therefore, the results suggest that a long-term approach to PS is essential, particularly when considering sustainable development goals.

Furthermore, this study demonstrates the consistent relationship between the examined variables in both virtual and co-located teams. The findings underscore the applicability and robustness of the proposed model across diverse team settings, indicating its generalizability. Hence, by providing empirical support for the model's effectiveness across diverse team environments, this research expands the theoretical understanding of project management practices.

5.2. Practical Implications

The practical implications of this research hold relevance for organizations leveraging virtual teams (VTs), particularly those operating across geographically dispersed settings in various industries such as technology, consulting, engineering, healthcare, and education. The findings suggest that organizations can adapt their project management practices to virtual environments without significantly compromising project effectiveness, thereby dispelling concerns about the potential loss of knowledge management and stakeholder engagement in VTs.

The insights derived from this study offer valuable guidance to practitioners in the field of project management and signal avenues for further research and the development of best practices in virtual and sustainable project management. By recognizing the criticality of SE and KM and their impact on project success, organizations can enhance their sustainable project management practices and contribute effectively towards the attainment of sustainable development goals.

In summary, this research contributes both theoretically and practically. The theoretical contributions enhance understandings of stakeholder engagement, knowledge management, and their relationship with project success. The practical implications provide actionable recommendations for practitioners in diverse industries, offering insights into effective project management practices, especially in virtual and sustainable project environments.

5.3. Limitations and Future Research

The present study has some limitations that must be acknowledged. Firstly, the sample size was relatively small, considering the complexity of the model proposed, which may restrict the generalizability of the findings. Future research could replicate this study with a larger and more diverse sample to improve its external validity. Secondly, this study relied on self-reported measures, which may be prone to social desirability bias and common method variance. Self-reported measures are subject to individuals' subjective perceptions and may not always accurately reflect their true behaviors or experiences. Future studies should incorporate multiple sources of data and objective measures to enhance validity. Integrating self-reported data with objective measures (e.g., behavioral observations, performance indicators, physiological measurements) enhances understanding, reduces biases, and improves the validity and reliability of findings. Thirdly, the sample of Portuguese speakers was mostly focused on a specific industry and country (Brazil), which may limit the generalizability of the findings to other contexts. Future research could broaden the scope of this study to include other industries, cultures, regions, and countries to determine the generalizability of the findings.

Furthermore, this study did not investigate the potential moderating or mediating effects of other notable variables related to PS that may also influence the relationships among the variables examined. Future research could explore the potential moderating and mediating effects of other variables, such as organizational support and project complexity, to better understand the underlying mechanisms of the relationships. Additionally, future

research should aim to examine the interplay between sustainability and organizational strategy across a wide range of cultural contexts in order to enhance the understanding of this relationship, which may influence the success of sustainability initiatives, as it may differ across different cultural contexts. Thus, the impact of project team diversity (e.g., in terms of gender or ethnicity) could be of research interest.

Finally, research must consider limitations, particularly related to the moderating role of VTs. It is noteworthy that a significant proportion of participants (41.53%) reported working in small teams (10 or fewer individuals) and in technology-related fields, such as information technology, digital media, or telecommunications (36.61%). Commonly, technology-related projects are assigned to teams that have a high level of technological maturity in working within virtual environments. However, no information was collected in the survey about VTs' initial level of technological maturity.

This suggests that the results may not be generalizable to all ranges of team sizes and contexts, particularly those that face wide geographic distribution, low levels of technological maturity, poor information and technology resources, multicultural mixed stakeholders, and also those that may rely heavily on technology and virtual collaboration. Future research endeavors should consider incorporating qualitative analyses of the technological maturity of virtual teams to delve deeper into the potential moderating effects.

Hence, given the increasing prevalence of VTs in today's globalized and technologically advanced work environment, further research is needed to confirm this finding and explore potential moderating factors.

6. Conclusions

The current investigation aimed to quantitatively evaluate nine hypotheses of the proposed model that were rooted in the literature. The outcomes of the testing of these hypotheses are displayed in Section 4. In summary, the findings lead to the following observations, which provide answers to the research questions raised:

- Both stakeholder engagement (SE) and knowledge management (KM) have a significant positive influence on project success (PS) and on sustainability in project management (SPM).
- The relationship between KM, SE, SPM, and PS was consistent irrespective of whether the team was working in a virtual or co-located environment.

Virtual work solutions have become increasingly widespread in organizations. Ergo, by demonstrating the resilience of the proposed model in virtual team environments, the conducted analysis provides valuable insights for project management practitioners. The revelations demystify concerns about KM and SE in VT, allowing for the seamless adaptation of project management practices to virtual environments without compromising project effectiveness.

In a growing virtual world where future needs must be considered in other to better manage present resources, the concept of PS is expected to shift from a short-term to a long-term approach. Overcoming challenges in SE and knowledge exchange to achieve long-term sustainable goals in project management has been unequivocally established as critical contributors to PS.

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Appendix A

Table A1. Virtual teams: legend and questionnaires—adapted from [20,65].

Construct	Item	Legend		Question
Virtual Teams (VT)	Cultural Intelligence (CI)	VT-CI1	5.1.1	I know the legal and economic systems of other cultures.
		VT-CI2	5.1.2	I know the rules (e.g., vocabulary, grammar) of other languages.
		VT-CI3	5.1.3	I know the cultural values and religious beliefs of other cultures.
		VT-CI4	5.1.4	I know the rules for expressing nonverbal behaviors in other cultures.
		VT-CI 5	5.1.5	I am conscious of the cultural background I use when interacting with people with different cultural backgrounds.
		VT-CI6	5.1.6	I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.
		VT-CI7	5.1.7	I am conscious of the cultural knowledge I apply to cross-cultural interactions.
		VT-CI8	5.1.8	I check the accuracy of my cultural knowledge as I interact with people from different cultures.
		VT-CI9	5.1.9	I enjoy interacting with people from different cultures.
		VT-CI10	5.1.10	I am confident that I can socialize with locals in a culture that is unfamiliar to me.
		VT-CI11	5.1.11	I am sure I can deal with the stresses of adjusting to a culture that is new to me.
		VT-CI12	5.1.12	I enjoy living in cultures that are unfamiliar to me.
		VT-CI13	5.1.13	I am confident that I can get accustomed to the shopping conditions in a different culture.
		VT-CI14	5.1.14	I change my verbal behavior (e.g., accent, tone) when a cross-cultural interaction requires it.
		VT-CI15	5.1.15	I use pause and silence differently to suit different cross-cultural situations.
		VT-CI16	5.1.16	I vary the rate of my speaking when a cross-cultural situation requires it.
		VT-CI17	5.1.17	I change my nonverbal behavior when a cross-cultural situation requires it.
		VT-CI18	5.1.18	I alter my facial expressions when a cross-cultural situation requires it.
	Communication Accommodation (CA)	VT-CA1	5.2.1	I try to match the communication style of other members in the GVT.
		VT-CA2	5.2.2	I show interest when speaking to others in the GVT.
		VT-CA3	5.2.3	I can easily adjust when communicating to others in the GVT.
		VT-CA4	5.2.4	I respond constructively when communicating with others in the GVT.
		VT-CA5	5.2.5	I am open-minded in evaluating the feedback given to me by other members of the GVT.
		VT-CA6	5.2.6	I adjust my communication styles with others in the GVT.
		VT-CA7	5.2.7	I show my willingness to listen when communicating with others in the GVT.

Table A1. *Cont.*

Construct	Item	Legend		Question
Virtual Teams (VT)	Team Sinergy (TS)	VT-TS1	5.3.1	He/she openly shares information about the task.
		VT-TS2	5.3.2	He/she demonstrates flexibility with others.
		VT-TS3	5.3.3	He/she helps actively in resolving conflicts in the team.
		VT-TS4	5.3.4	He/she is good in communicating when making decisions.
		VT-TS5	5.3.5	He/she contributes significantly to the team.
		VT-TS6	5.3.6	He/she promotes friendly team climate.
		VT-TS7	5.3.7	He/she is effective in coordinating group efforts.
		VT-TS8	5.3.8	He/she is cooperative with other team members.
		VT-TS9	5.3.9	He/she helps team members beyond what is required.
	Team Direction (TD)	VT-TD1	5.4.1	He/she sets goals effectively.
		VT-TD2	5.4.2	He/she continually improves.
		VT-TD3	5.4.3	He/she is effective in problem-solving.
		VT-TD4	5.4.4	He/she sets high quality standards.
		VT-TD5	5.4.5	He/she focuses on common team goals.
		VT-TD6	5.4.6	He/she is enthusiasm for team direction and performance.
	Multi-Regional Virtual Team (MR)	VT-MR1	5.5.1	I strengthen ties between other teammates and myself.
		VT-MR2	5.5.2	It is challenging to deal with different languages in virtual team (in your organization).
		VT-MR3	5.5.3	It is challenging to deal with different cultures in virtual team (in your organization).
		VT-MR4	5.5.4	It is challenging to deal with different time zones in virtual team collaborations (in your organization).
		VT-MR5	5.5.5	It is challenging to use virtual technologies in virtual team collaborations (in your organization).
		VT-MR6	5.5.6	It is challenging to establish and respect standards/rules for meetings and team collaboration.
	Environment and Resources (ER)	VT-ER1	5.6.1	There was a reduction in the administrative expenses of the project (natural resources such as energy, water, others).
		VT-ER2	5.6.2	There was an increase in productivity considering that there was no displacement.
		VT-ER3	5.6.3	There was a reduction in environmental impacts considering that there was no displacement.
		VT-ER4	5.6.4	There was a reduction in environmental impacts considering that there was no use of an administrative office.
		VT-ER5	5.6.5	There was increased productivity due to remote work.
		VT-ER6	5.6.6	There was increased productivity due to the satisfaction and well-being of the team.

Table A2. Sustainability in project management: legend and questionnaires—adapted from [36].

Construct	Item	Legend		Question
Sustainability in Project Management (SPM)	Economic (EC)			*(The project considers relevant/applied . . . Is it Important?)*
		SPM-EC1	6.1.1	Financial performance (return on investments, solvency, profitability, and liquidity)
		SPM-EC2	6.1.2	Financial benefits of good practices (social, environmental, health and safety, job creation, education, and training)
		SPM-EC3	6.1.3	Business ethics (fair trade, relationship with competition and anti-crime policies, codes of conduct, bribery and corruption, technical and legal requirements, tax payments)
		SPM-EC4	6.1.4	Cost management (resources)
		SPM-EC5	6.1.5	Management of the company's relationship with customers (marketing and brand management, market share, management opportunities, risk management, and pricing)
		SPM-EC6	6.1.6	Participation and involvement of stakeholders (corporate governance)
		SPM-EC7	6.1.7	Innovation management (research and development, consumption patterns, production, productivity, and flexibility)
		SPM-EC8	6.1.8	Economic performance (profit sharing, GDP)
		SPM-EC9	6.1.9	Culture of the organization and its management (heritage)
		SPM-EC10	6.1.10	Economics and environmental accounting
		SPM-EC11	6.1.11	Management of intangibles
		SPM-EC12	6.1.12	Internationalization
	Environment (EN)			*(The project considers relevant/applied . . . Is it Important?)*
		SPM-EN1	6.2.1	Natural resources (reduction of resource use, material input and output minimization, reduction of waste production and soil contamination, impact reduction)
		SPM-EN2	6.2.2	Energy (generation, use, distribution, and transmission of energy, global warming)
		SPM-EN3	6.2.3	Water (water quality, reduction of liquid waste, risks)
		SPM-EN4	6.2.4	Biodiversity (air, protection of oceans, lakes, coasts, forests)
		SPM-EN5	6.2.5	Management systems of environmental policies (environmental obligations, environmental adaptation, environmental infractions)
		SPM-EN6	6.2.6	Management of impacts on the environment and the life cycle of products and services (analysis of product disassembly, post-sale tracking, reverse logistics)
		SPM-EN7	6.2.7	Eco-efficiency (business opportunities for products and services, environmental footprint)
		SPM-EN8	6.2.8	Environmental justice and responsibility (intergenerational equity, compromise with the improvement of environmental quality)
		SPM-EN9	6.2.9	Environmental education and training
		SPM-EN10	6.2.10	High-risk projects, climate strategy and governance
		SPM-EN11	6.2.11	Environmental reports

Table A2. *Cont.*

Construct	Item	Legend		Question
Sustainability in Project Management (SPM)	Social (SO)	SPM-O1	6.3.1	*(The project considers relevant/applied . . . Is it Important?)* Labor practices (health, safety and working conditions, training and education)
		SPM-O2	6.3.2	Labor practices (relations with employees, employment, diversity, opportunity, remuneration, benefits and career opportunities)
		SPM-O3	6.3.3	Relationships with the local community (impacts, child labor, human rights, non-discrimination, indigenous rights, forced and compulsory labor)
		SPM-O4	6.3.4	Engagement of stakeholders
		SPM-O5	6.3.5	Financing and construction of social action (philanthropy and corporate citizenship, governmental social projects, leadership and social influence)
		SPM-O6	6.3.6	Society (competition and pricing policies, anti-bribery and anti-corruption practices and suborn)
		SPM-O7	6.3.7	Concepts of social justice
		SPM-O8	6.3.8	Relationships with suppliers and contractors (selection, evaluation, partnership)
		SPM-O9	6.3.9	Society (contribution to social campaigns)
		SPM-O10	6.3.10	Products and services (responsibility, consumer health and safety, marketing, respect and privacy)
		SPM-O11	6.3.11	Human rights (freedom of association and collective bargaining and relationship with trade unions)
		SPM-O12	6.3.12	Human rights (strategy and management, disciplinary procedures)
		SPM-O13	6.3.13	Social Reports

Table A3. Stakeholder engagement: legend and questionnaires—adapted from [92,94].

Construct	Legend		Question
Stakeholder Engagement (SE)	SE1	7.1	Project Management team explained project objectives and implications to all stakeholders
	SE2	7.2	Project management team carefully considered stakeholders opinions and views
	SE3	7.3	Project Management team actively built a good relationship with stakeholders
	SE4	7.4	Project Management team operated an effective communication system for the project
	SE5	7.5	Project Management team implemented a governance system for the project
	SE6	7.6	Stakeholder interests were carefully considered throughout the project lifecycle
	SE7	7.7	Key stakeholders were empowered to participate in the decision-making process
	SE8	7.8	Involving relevant project stakeholders at the inception stage and whenever necessary to refine project mission
	SE9	7.9	Formulating appropriate strategies to manage/engage different stakeholders
	SE10	7.10	Considering corporate social responsibilities (paying attention to economic, legal, environmental, and ethical issues)

Table A4. Knowledge management: legend and questionnaires—adapted from [64].

ConstructItem	Subitem	Legend		Question
Knowledge Management (KM)	Organization/Methodology (OM)	Centralization (CE)		*Our company members . . .*
			KM-OM-CE1	8.1.1.1	can take actions without a superior
			KM-OM-CE2	8.1.1.2	are encouraged to make their own decisions
			KM-OM-CE3	8.1.1.3	do not need to refer to someone else
			KM-OM-CE4	8.1.1.4	do not need to ask their supervisors before taking actions
			KM-OM-CE5	8.1.1.5	can make decisions without approval
		Formalization (FO)		*In our company . . .*
			KM-OM-FO1	8.1.2.1	there are many activities that are not covered by some formal procedures
			KM-OM-FO2	8.1.2.2	contacts with organizational members are made on a formal or planned basis
			KM-OM-FO3	8.1.2.3	rules and procedures are typically written
		Training (TR)		*Our organization . . .*
			KM-OM-TR1	8.1.3.1	places people at the right job position
			KM-OM-TR2	8.1.3.2	provides training for sharing of knowledge
			KM-OM-TR3	8.1.3.3	provides continuous training program within the organization
			KM-OM-TR4	8.1.3.4	provides continuous training program outside the organization
			KM-OM-TR5	8.1.3.5	facilitates us to use knowledge management systems
			KM-OM-TR6	8.1.3.6	is able to retain outstanding staff
		Performance measurement (PM)		*Our company employs a procedure to measure . . .*
			KM-OM-PM1	8.1.4.1	distribution of knowledge within the organization
			KM-OM-PM2	8.1.4.2	amount of reports generated on knowledge activity by employees
			KM-OM-PM3	8.1.4.3	number of relationships established due to knowledge systems and networking
			KM-OM-PM4	8.1.4.4	number of employees accepting knowledge activity as part of their daily work
			KM-OM-PM5	8.1.4.5	changes of job performance due to proper management of knowledge in place
			KM-OM-PM6	8.1.4.6	performance of target activities to previously set baseline
			KM-OM-PM7	8.1.4.7	job performance data and information
			KM-OM-PM8	8.1.4.8	actual performance improvement and reward/recognition
		Benchmarking (BM)		*Our company has processes for . . .*
			KM-OM-BM1	8.1.5.1	generating new knowledge from existing knowledge
			KM-OM-BM2	8.1.5.2	using feedback from past experience to improve future projects
			KM-OM-BM3	8.1.5.3	exchanging knowledge with external partners
			KM-OM-BM4	8.1.5.4	acquiring knowledge about new products and services within our industry
			KM-OM-BM5	8.1.5.5	acquiring knowledge about competitors within our industry
			KM-OM-BM6	8.1.5.6	benchmarking performance amongst employees and departments
			KM-OM-BM7	8.1.5.7	identifying and upgrading best practices
			KM-OM-BM8	8.1.5.8	encouraging employees to benchmark best practices of other organizations

Table A4. *Cont.*

ConstructItem	Subitem	Legend		Question
				Our company provides IT support for . . .
	ICT Systems (ICT)	KM-ICT1	8.2.1	collaborative works regardless of time and place
		KM-ICT2	8.2.2	communication amongst organizational members
		KM-ICT3	8.2.3	searching for and accessing necessary information
		KM-ICT4	8.2.4	simulation and prediction
		KM-ICT5	8.2.5	systematic storing of data and information
Knowledge Management (KM)	Human Aspects (HA)			*Our company members . . .*
		KM-HA-CT1	8.3.1.1	are generally trustworthy
		KM-HA-CT2	8.3.1.2	have reciprocal faith in the intention and behaviors of other members
		KM-HA-CT3	8.3.1.3	have reciprocal faith in the behaviors of others to work towards organizational goal
		KM-HA-CT4	8.3.1.4	have reciprocal faith in the behaviors of others to work towards organizational goal
		KM-HA-CT5	8.3.1.5	have reciprocal faith in the decision of others towards organizational interest than individual interest
		KM-HA-CT6	8.3.1.6	have relationship based on reciprocal faith
				Our organization members . . .
		KM-HA-CC1	8.3.2.1	Our organization members are satisfied with the degree of collaboration
		KM-HA-CC2	8.3.2.2	Our organization members are supportive of each other
		KM-HA-CC3	8.3.2.3	Our organization members are helpful
		KM-HA-CC4	8.3.2.4	There is a willingness to collaborate across organizational units within our organization
		KM-HA-CC5	8.3.2.5	There is a willingness to accept responsibility for failure
				Our company . . .
		KM-HA-CL1	8.3.3.1	provides various formal training programs related to the performance of our duties
		KM-HA-CL2	8.3.3.2	provides opportunities for informal individual development other than formal training such as work assignment and job rotation
		KM-HA-CL3	8.3.3.3	encourages people to attend seminars, symposia and so on
		KM-HA-CL4	8.3.3.4	provides various programs such as clubs and community gathering
		KM-HA-CL5	8.3.3.5	members are satisfied by the contents of job training
		KM-HA-CL6	8.3.3.6	members are satisfied with the self-development programs
				In our company . . .
		KM-HA-CI1	8.3.4.1	it is more likely that I will be given a pay rise or promotion if I finish a large amount of work
		KM-HA-CI2	8.3.4.2	it is more likely that I will be given a pay rise or promotion if I do a high- quality work
		KM-HA-CI3	8.3.4.3	getting work done quickly increase my chances of a pay rise or promotion
		KM-HA-CI4	8.3.4.4	getting work done on time is rewarded with high pay
		KM-HA-CI5	8.3.4.5	when I finish my job on time, my job is more secured
		KM-HA-CI6	8.3.4.6	in my team, knowledge-sharing is strongly encouraged

Table A4. *Cont.*

ConstructItem	Subitem	Legend		Question
Knowledge Management (KM) / Human Aspects (HA)	Transformational Leadership (TL)			*In our company . . .*
		KM-HA-TL1	8.3.5.1	I feel comfortable with the concept of shared leadership
		KM-HA-TL2	8.3.5.2	our organizational leaders motivate employees to share knowledge
		KM-HA-TL3	8.3.5.3	our organizational leaders build up trust amongst employees to share knowledge
		KM-HA-TL4	8.3.5.4	our organizational leaders promote initiatives to acquire knowledge
		KM-HA-TL5	8.3.5.5	our organization actively develops leadership skills of our staff
		KM-HA-TL6	8.3.5.6	knowledge is acquired by one-to-one mentoring
		KM-HA-TL7	8.3.5.7	informal conversations and meeting are used for knowledge-sharing
		KM-HA-TL8	8.3.5.8	our organization provides rewards and incentives for sharing knowledge
	Teamwork (TW)			*In our company . . .*
		KM-HA-TW1	8.3.6.1	I feel comfortable with the concept of shared leadership
		KM-HA-TW2	8.3.6.2	I feel comfortable with the decision-making process within the team
		KM-HA-TW3	8.3.6.3	I spend time with team members to clarify the expectations of the team
		KM-HA-TW4	8.3.6.4	team exercises good judgement during decision-making process
		KM-HA-TW5	8.3.6.5	team members provide input/thoughts throughout the project
		KM-HA-TW6	8.3.6.6	I help my team whenever anyone has difficulties in performing tasks

Table A5. Project Success: legend and questionnaires—adapted from [8].

Construct	Item	Legend		Question
Project Success (PS)	Future Potential (FP)	PS-FP1	9.1.1	Enabling of other project work in future.
		PS-FP2	9.1.2	Resources mobilized and used as planned.
		PS-FP3	9.1.3	Improvement in organizational capability.
		PS-FP4	9.1.4	Motivated for future projects.
	Organizational Benefits (OB)	PS-OB1	9.2.1	Adhered to defined procedures.
		PS-OB2	9.2.2	Learned from project.
		PS-OB3	9.2.3	New understanding/knowledge gained.
		PS-OB4	9.2.4	End product used as planned.
		PS-OB5	9.2.5	The project satisfies the needs of users.
	Project Efficiency (PE)	PS-PE1	9.3.1	Finished within budget.
		PS-PE2	9.3.2	Met planned quality standards.
		PS-PE3	9.3.3	Met safety standards.
		PS-PE4	9.3.4	Minimum number of agreed scope changes.
		PS-PE5	9.3.5	Finished on time.
		PS-PE6	9.3.6	Complied with environmental regulations.
		PS-PE7	9.3.7	Activities carried out as scheduled.
		PS-PE8	9.3.8	Cost effectiveness of work.

Table A5. *Cont.*

Construct	Item	Legend		Question
Project Success (PS)	Project Impact (PI)	PS-PI1	9.4.1	Project's impacts on beneficiaries are visible.
		PS-PI2	9.4.2	Project achieved its purpose.
		PS-PI3	9.4.3	Project has good reputation.
		PS-PI4	9.4.4	End-user satisfaction.
	Stakeholder Satisfaction (SS)	PS-SS1	9.5.1	Met client's requirements.
		PS-SS2	9.5.2	Steering group satisfaction.
		PS-SS3	9.5.3	Sponsor satisfaction.
		PS-SS4	9.5.4	Met organizational objectives.

Appendix B

Table A6. Descriptive analysis of categorical variables of individual characteristics.

	Variables	N	%
Nationality	Brazilian	174	82.86%
	Dual nationality, one of them being Brazilian	29	13.81%
	Others	7	3.33%
Age Range	From 21 to 30 years old	13	6.19%
	From 31 to 40 years old	43	20.48%
	From 41 to 50 years old	77	36.67%
	From 51 to 60 years old	51	24.29%
	61 years or older	26	12.38%
Gender	Female	62	29.52%
	Male	147	70.00%
	Other	1	0.48%
Experience working with projects	Less than 1 year	9	4.29%
	From 1 to 5 years	30	14.29%
	From 6 to 10 years	29	13.81%
	From 11 to 15 years	28	13.33%
	More than 15 years	114	54.29%
Experience working with projects in a virtual team environment.	Less than 1 year	27	12.86%
	From 1 to 5 years	113	53.81%
	From 6 to 10 years	15	7.14%
	More than 10 years	28	13.33%
	Never worked on projects with a virtual team environment	27	12.86%

Table A7. Descriptive analysis of categorical variables related to companies—Virtual Environment.

	Variables	N	%
Time working on projects with a virtual team environment	Not at this moment	46	25.14%
	For 1 years or less	41	22.40%
	For 5 years or less	73	39.89%
	For 10 years or less	6	3.28%
	For More that 10 years	17	9.29%
Type of participation/role in the project	Leader or Project Manager	102	55.74%
	Team Member	69	37.70%
	Others	12	6.56%

Table A7. *Cont.*

Variables		N	%
Personal location during the project	Southeast region	130	71.04%
	International	19	10.38%
	North, Northeast, or Central-West regions	13	7.10%
	South region	11	6.01%
	Brazil (multi-local/no fixed location)	10	5.46%
Location of team members during the project	Southeast region	67	36.61%
	Brazil (multi-local/no fixed location)	64	34.97%
	International	41	22.40%
	North, Northeast, or Central-West regions	11	6.01%
Team Size	Up to 10 members	76	41.53%
	11 to 50 members	71	38.80%
	51 to 100 members	15	8.20%
	101 to 500 members	16	8.74%
	501 or more members	5	2.73%
Organization Size	Up to 10 members	49	26.78%
	11 to 50 members	35	19.13%
	51 to 100 members	18	9.84%
	101 to 500 members	22	12.02%
	501 to 1000 members	9	4.92%
	1001 or more members	50	27.32%
Project Budget	Up to R$100,000	24	13.11%
	R$101,000 to R$500,000	41	22.40%
	R$501,000 to R$1,000,000	36	19.67%
	R$1,000,001 to R$500,000,000	67	36.61%
	R$500,000,001 to R$1 billion	6	3.28%
	Above R$1 billion	9	4.92%
Sector	Private	139	75.96%
	Public	18	9.84%
	Public-Private	26	14.21%
Area	Technology, Digital Media, or Telecommunications	67	36.61%
	Engineering or Architecture	44	24.04%
	Education	20	10.93%
	Healthcare	12	6.56%
	Administrative (Accounting, Finance, HR)	8	4.37%
	Commercial (Sales, Marketing, Corporate Communication)	8	4.37%
	Others	24	13.11%

Table A8. Descriptive analysis of categorical variables related to companies—On-site Environment.

Variables		N	%
Time working on projects with a on-site team environment	Not at this moment	15	55.56%
	For 1 years or less	2	7.41%
	For 5 years or less	3	11.11%
	For 10 years or less	1	3.70%
	For More than 10 years	6	22.22%
Type of participation/role in the project	Leader or Project Manager	11	40.74%
	Team Member	12	44.44%
	Others	4	14.81%
Personal location during the project	Southeast Region	16	59.26%
	International	5	18.52%
	Northeast or South Regions	4	14.81%
	Others	2	7.41%

Table A8. *Cont.*

Variables		N	%
Localização dos integrantes durante o projeto	Southeast Region	16	59.26%
	International	5	18.52%
	Northeast Region	3	11.11%
	Others	3	11.11%
Team Size	Up to 10 members	14	51.85%
	11 to 50 members	8	29.63%
	51 to 100 members	2	7.41%
	101 to 500 members	3	11.11%
Organization Size	Up to 10 members	10	37.04%
	11 to 50 members	4	14.81%
	51 to 100 members	4	14.81%
	101 to 500 members	4	14.81%
	501 to 1000 members	2	7.41%
	1001 or more people	3	11.11%
Project Budget	Up to R$100,000	6	22.22%
	R$101,000 to R$500,000	3	11.11%
	R$501,000 to R$1,000,000	5	18.52%
	R$1,000,001 to R$500,000,000	8	29.63%
	R$500,000,001 to R$1 billion	1	3.70%
	Above R$1 billion	4	14.81%
Sector	Private	16	59.26%
	Public	8	29.63%
	Public-Private	3	11.11%
Project Area	Engineering or Architecture	11	40.74%
	Technology, Digital Media, or Telecommunications	3	11.11%
	Education	2	7.41%
	Others	11	40.74%

Appendix C

Table A9. Descriptive analysis and comparison of construct items.

Construct		Item	Mean	S.D.	C.I. 95%
Virtual Teams (VT)	Cultural Intelligence (CI)	5.1.1	3.28	1.03	[3.13: 3.42]
		5.1.2	3.83	0.91	[3.70: 3.96]
		5.1.3	3.56	0.92	[3.42: 3.70]
		5.1.4	3.57	0.92	[3.43: 3.69]
		5.1.5	4.26	0.66	[4.17: 4.35]
		5.1.6	4.32	0.71	[4.22: 4.43]
		5.1.7	4.18	0.63	[4.09: 4.27]
		5.1.8	4.02	0.83	[3.90: 4.13]
		5.1.9	4.51	0.65	[4.42: 4.61]
		5.1.10	4.10	0.88	[3.96: 4.23]
		5.1.11	4.06	0.81	[3.95: 4.17]
		5.1.12	3.57	1.04	[3.43: 3.72]
		5.1.13	3.83	0.89	[3.70: 3.96]
		5.1.14	3.62	1.10	[3.46: 3.79]
		5.1.15	3.84	0.86	[3.72: 3.95]
		5.1.16	4.10	0.75	[4.00: 4.22]
		5.1.17	3.95	0.90	[3.83: 4.08]
		5.1.18	3.62	1.01	[3.47: 3.77]

Table A9. *Cont.*

Construct		Item	Mean	S.D.	C.I. 95%
Virtual Teams (VT)	Communication Accommodation (CA)	5.2.1	4.08	0.67	[3.98: 4.17]
		5.2.2	4.40	0.56	[4.32: 4.48]
		5.2.3	4.20	0.72	[4.09: 4.30]
		5.2.4	4.30	0.65	[4.20: 4.38]
		5.2.5	4.32	0.64	[4.23: 4.41]
		5.2.6	4.16	0.71	[4.06: 4.26]
		5.2.7	4.42	0.64	[4.32: 4.50]
	Team Sinergy (TS)	5.3.1	3.58	0.96	[3.43: 3.71]
		5.3.2	3.58	0.88	[3.45: 3.71]
		5.3.3	3.62	0.89	[3.49: 3.74]
		5.3.4	3.34	0.96	[3.20: 3.47]
		5.3.5	3.86	0.79	[3.75: 3.98]
		5.3.6	4.02	0.77	[3.90: 4.13]
		5.3.7	3.72	0.86	[3.58: 3.85]
		5.3.8	3.95	0.81	[3.84: 4.07]
		5.3.9	3.52	1.05	[3.37: 3.68]
	Team Direction (TD)	5.4.1	3.43	0.92	[3.29: 3.55]
		5.4.2	3.68	0.82	[3.56: 3.79]
		5.4.3	3.70	0.86	[3.58: 3.83]
		5.4.4	3.56	1.02	[3.42: 3.70]
		5.4.5	3.72	0.90	[3.58: 3.85]
		5.4.6	3.73	0.85	[3.61: 3.85]
	Multi-Regional Virtual Team (MR)	5.5.1	3.61	1.06	[3.46: 3.75]
		5.5.2	3.56	1.02	[3.40: 3.71]
		5.5.3	3.52	1.03	[3.37: 3.67]
		5.5.4	3.62	1.03	[3.47: 3.78]
		5.5.5	3.29	1.20	[3.10: 3.46]
		5.5.6	3.39	1.16	[3.22: 3.55]
	Environment and Resources (ER)	5.6.1	3.91	1.01	[3.75: 4.05]
		5.6.2	3.75	1.07	[3.59: 3.90]
		5.6.3	4.19	0.86	[4.05: 4.30]
		5.6.4	3.99	0.93	[3.85: 4.12]
		5.6.5	3.66	1.09	[3.50: 3.81]
		5.6.6	3.66	1.09	[3.50: 3.81]
Sustainability in Project Management (SPM)	Economic (EC)	6.1.1	3.76	0.92	[3.62: 3.88]
		6.1.2	3.62	0.94	[3.48: 3.75]
		6.1.3	3.83	0.98	[3.69: 3.97]
		6.1.4	3.99	0.79	[3.88: 4.09]
		6.1.5	3.85	0.83	[3.73: 3.96]
		6.1.6	3.85	0.88	[3.72: 3.98]
		6.1.7	3.79	0.88	[3.66: 3.91]
		6.1.8	3.48	0.94	[3.35: 3.61]
		6.1.9	3.73	0.90	[3.59: 3.85]
		6.1.10	3.42	0.96	[3.28: 3.56]
		6.1.11	3.83	0.95	[3.69: 3.95]
		6.1.12	3.57	1.02	[3.43: 3.72]
	Environment (EN)	6.2.1	3.37	1.03	[3.22: 3.51]
		6.2.2	3.38	1.10	[3.23: 3.54]
		6.2.3	3.24	1.13	[3.07: 3.40]
		6.2.4	3.11	1.08	[2.96: 3.26]
		6.2.5	3.25	1.08	[3.09: 3.41]
		6.2.6	3.20	1.06	[3.05: 3.35]
		6.2.7	3.20	1.06	[3.04: 3.36]
		6.2.8	3.22	1.04	[3.07: 3.37]
		6.2.9	3.20	1.04	[3.05: 3.35]
		6.2.10	3.16	1.08	[3.01: 3.31]
		6.2.11	3.08	1.05	[2.93: 3.25]

Table A9. *Cont.*

Construct			Item	Mean	S.D.	C.I. 95%
Sustainability in Project Management (SPM)	Social (SO)		6.3.1	3.92	0.97	[3.78: 4.05]
			6.3.2	3.81	0.99	[3.67: 3.97]
			6.3.3	3.48	1.05	[3.32: 3.63]
			6.3.4	3.95	0.84	[3.83: 4.08]
			6.3.5	3.20	1.09	[3.03: 3.36]
			6.3.6	3.86	1.07	[3.70: 4.01]
			6.3.7	3.48	1.11	[3.34: 3.65]
			6.3.8	3.92	0.86	[3.80: 4.05]
			6.3.9	3.34	1.10	[3.19: 3.51]
			6.3.10	3.83	0.97	[3.69: 3.97]
			6.3.11	3.52	1.03	[3.37: 3.66]
			6.3.12	3.68	1.07	[3.52: 3.83]
			6.3.13	3.24	1.01	[3.09: 3.39]
Stakeholder Engagement (SE)			7.1	4.14	0.94	[3.99: 4.27]
			7.2	3.98	0.95	[3.85: 4.13]
			7.3	4.15	0.89	[4.02: 4.27]
			7.4	3.95	0.91	[3.81: 4.08]
			7.5	3.83	1.00	[3.69: 3.97]
			7.6	3.96	0.92	[3.82: 4.08]
			7.7	3.96	0.97	[3.80: 4.11]
			7.8	4.02	0.91	[3.90: 4.15]
			7.9	3.74	0.96	[3.61: 3.88]
			7.10	3.72	0.98	[3.57: 3.85]
Knowledge Management (KM)	Organization/ Methodology (OM)	Centralization (CE)	8.1.1.1	3.23	1.12	[3.07: 3.38]
			8.1.1.2	3.33	1.08	[3.17: 3.49]
			8.1.1.3	2.87	1.00	[2.72: 3.01]
			8.1.1.4	2.95	1.06	[2.81: 3.11]
			8.1.1.5	2.79	1.17	[2.62: 2.96]
		Centralization (FO)	8.1.2.1	3.43	1.14	[3.27: 3.59]
			8.1.2.2	3.16	1.02	[3.01: 3.33]
			8.1.2.3	3.33	1.13	[3.17: 3.50]
		Training (TR)	8.1.3.1	3.56	0.99	[3.42: 3.70]
			8.1.3.2	3.55	1.10	[3.40: 3.72]
			8.1.3.3	3.49	1.11	[3.33: 3.65]
			8.1.3.4	3.07	1.14	[2.91: 3.22]
			8.1.3.5	3.32	1.14	[3.14: 3.48]
			8.1.3.6	3.22	1.18	[3.05: 3.38]
		Performance measurement (PM)	8.1.4.1	2.98	1.13	[2.83: 3.14]
			8.1.4.2	2.74	1.12	[2.58: 2.90]
			8.1.4.3	2.87	1.16	[2.70: 3.04]
			8.1.4.4	2.91	1.15	[2.74: 3.08]
			8.1.4.5	3.16	1.16	[2.99: 3.32]
			8.1.4.6	3.16	1.11	[2.99: 3.32]
			8.1.4.7	3.49	1.00	[3.34: 3.63]
			8.1.4.8	3.29	1.08	[3.13: 3.44]
		Benchmarking (BM)	8.1.5.1	3.62	1.06	[3.48: 3.76]
			8.1.5.2	3.83	0.96	[3.69: 3.97]
			8.1.5.3	3.63	1.07	[3.46: 3.78]
			8.1.5.4	3.86	0.93	[3.73: 3.99]
			8.1.5.5	3.74	0.98	[3.60: 3.88]
			8.1.5.6	3.45	1.08	[3.29: 3.60]
			8.1.5.7	3.74	0.97	[3.60: 3.87]
			8.1.5.8	3.50	1.17	[3.33: 3.67]

Table A9. *Cont.*

Construct			Item	Mean	S.D.	C.I. 95%
Knowledge Management (KM)	ICT Systems (ICT)		8.2.1	3.67	1.16	[3.48: 3.83]
			8.2.2	3.97	0.99	[3.84: 4.11]
			8.2.3	3.83	1.02	[3.68: 3.97]
			8.2.4	3.49	1.10	[3.33: 3.64]
			8.2.5	3.99	0.96	[3.86: 4.13]
	Human Aspects (HA)	Culture: Trust (CT)	8.3.1.1	4.02	0.85	[3.90: 4.14]
			8.3.1.2	3.96	0.82	[3.84: 4.07]
			8.3.1.3	3.98	0.79	[3.88: 4.09]
			8.3.1.4	4.08	0.73	[3.98: 4.19]
			8.3.1.5	3.95	0.83	[3.82: 4.06]
			8.3.1.6	3.91	0.87	[3.78: 4.03]
		Culture: Collaboration (CC)	8.3.2.1	3.58	0.84	[3.47: 3.70]
			8.3.2.2	3.98	0.77	[3.87: 4.10]
			8.3.2.3	3.98	0.84	[3.86: 4.09]
			8.3.2.4	3.66	0.99	[3.51: 3.79]
			8.3.2.5	3.28	1.07	[3.13: 3.43]
			8.3.2.6	3.38	1.22	[3.20: 3.54]
		Culture: Learning (CL)	8.3.3.1	3.22	1.14	[3.05: 3.38]
			8.3.3.2	3.50	1.20	[3.34: 3.68]
			8.3.3.3	3.17	1.17	[3.01: 3.34]
			8.3.3.4	3.30	1.07	[3.14: 3.45]
			8.3.3.5	3.21	1.09	[3.05: 3.37]
		Culture: Rewards/Incentives (CI)	8.3.4.1	2.87	1.16	[2.69: 3.05]
			8.3.4.2	3.49	1.20	[3.31: 3.66]
			8.3.4.3	2.93	1.11	[2.77: 3.09]
			8.3.4.4	2.76	1.07	[2.61: 2.91]
			8.3.4.5	3.43	1.11	[3.27: 3.58]
			8.3.4.6	3.78	1.03	[3.63: 3.92]
		Transformational Leadership (TL)	8.3.5.1	3.79	0.94	[3.66: 3.92]
			8.3.5.2	3.76	1.01	[3.61: 3.90]
			8.3.5.3	3.69	1.05	[3.54: 3.84]
			8.3.5.4	3.72	1.03	[3.57: 3.86]
			8.3.5.5	3.47	1.12	[3.30: 3.63]
			8.3.5.6	3.14	1.17	[2.98: 3.30]
			8.3.5.7	3.67	0.97	[3.52: 3.80]
			8.3.5.8	2.76	1.25	[2.59: 2.95]
		Teamwork (TW)	8.3.6.1	4.01	0.86	[3.89: 4.13]
			8.3.6.2	4.02	0.82	[3.89: 4.12]
			8.3.6.3	4.05	0.77	[3.94: 4.16]
			8.3.6.4	3.89	0.78	[3.78: 4.00]
			8.3.6.5	4.10	0.72	[4.00: 4.20]
			8.3.6.6	4.34	0.69	[4.24: 4.43]
Project Success (PS)	Future Potential (FP)		9.1.1	4.22	0.72	[4.11: 4.32]
			9.1.2	3.96	0.89	[3.82: 4.08]
			9.1.3	4.04	0.80	[3.93: 4.17]
			9.1.4	4.14	0.81	[4.02: 4.26]
	Organizational Benefits (OB)		9.2.1	3.93	0.83	[3.83: 4.05]
			9.2.2	4.31	0.65	[4.22: 4.40]
			9.2.3	4.31	0.68	[4.20: 4.41]
			9.2.4	4.16	0.78	[4.04: 4.27]
			9.2.5	4.23	0.77	[4.11: 4.33]

Table A9. *Cont.*

Construct		Item	Mean	S.D.	C.I. 95%
Project Success (PS)	Project Efficiency (PE)	9.3.1	3.64	1.07	[3.49: 3.79]
		9.3.2	4.05	0.84	[3.93: 4.17]
		9.3.3	4.09	0.81	[3.97: 4.19]
		9.3.4	3.13	1.17	[2.95: 3.31]
		9.3.5	3.65	1.23	[3.48: 3.81]
		9.3.6	3.96	0.89	[3.84: 4.09]
		9.3.7	3.66	1.07	[3.51: 3.81]
		9.3.8	3.84	0.99	[3.70: 3.97]
	Project Impact (PI)	9.4.1	4.19	0.73	[4.08: 4.28]
		9.4.2	4.29	0.69	[4.20: 4.39]
		9.4.3	4.17	0.76	[4.06: 4.28]
		9.4.4	4.29	0.70	[4.20: 4.39]
	Stakeholder Satisfaction (SS)	9.5.1	4.19	0.76	[4.07: 4.30]
		9.5.2	4.17	0.75	[4.07: 4.27]
		9.5.3	4.15	0.78	[4.04: 4.26]
		9.5.4	4.23	0.75	[4.12: 4.35]

Appendix D

Table A10. Measurement Model (Outer Model).

Construct	Item	F.L. [1]	Com. [2]	Weight
Knowledge Management (KM) × Virtual Teams (VT)	Cultural Intelligence (CI) × OM	0.83	0.69	0.07
	Communication Accommodation (CA) × OM	0.87	0.75	0.08
	Team Sinergy (TS) × OM	0.83	0.68	0.07
	Team Direction (TD) × OM	0.85	0.73	0.08
	Multi-Regional Virtual Team (MR) × OM	0.56	0.31	0.03
	Environment and Resources (ER) × OM	0.77	0.59	0.08
	Cultural Intelligence (CI) × ICT	0.76	0.58	0.07
	Communication Accommodation (CA) × ICT	0.78	0.62	0.07
	Team Sinergy (TS) × ICT	0.83	0.69	0.07
	Team Direction (TD) × ICT	0.86	0.74	0.08
	Multi-Regional Virtual Team (MR) × ICT	0.54	0.30	0.04
	Environment and Resources (ER) × ICT	0.72	0.52	0.08
	Cultural Intelligence (CI) × HA	0.80	0.64	0.08
	Communication Accommodation (CA) × HA	0.86	0.73	0.09
	Team Sinergy (TS) × HA	0.83	0.68	0.07
	Team Direction (TD) × HA	0.85	0.73	0.09
	Multi-Regional Virtual Team (MR) × HA	0.53	0.28	0.03
	Environment and Resources (ER) × HA	0.75	0.57	0.09
Stakeholder Engagement (SE) × Virtual Teams (VT)	Cultural Intelligence (CI) × 7.1	0.75	0.56	0.03
	Cultural Intelligence (CI) × 7.2	0.79	0.62	0.03
	Cultural Intelligence (CI) × 7.3	0.78	0.62	0.02
	Cultural Intelligence (CI) × 7.4	0.75	0.56	0.02
	Cultural Intelligence (CI) × 7.5	0.72	0.52	0.02
	Cultural Intelligence (CI) × 7.6	0.78	0.62	0.02
	Cultural Intelligence (CI) × 7.7	0.78	0.61	0.02
	Cultural Intelligence (CI) × 7.8	0.76	0.57	0.02
	Cultural Intelligence (CI) × 7.9	0.78	0.60	0.02
	Cultural Intelligence (CI) × 7.10	0.66	0.43	0.02
	Communication Accommodation (CA) × 7.1	0.76	0.57	0.03
	Communication Accommodation (CA) × 7.2	0.83	0.68	0.03
	Communication Accommodation (CA) × 7.3	0.82	0.68	0.03
	Communication Accommodation (CA) × 7.4	0.80	0.65	0.02

Table A10. *Cont.*

Construct	Item	F.L. [1]	Com. [2]	Weight
Stakeholder Engagement (SE) × Virtual Teams (VT)	Communication Accommodation (CA) × 7.5	0.74	0.54	0.02
	Communication Accommodation (CA) × 7.6	0.82	0.68	0.02
	Communication Accommodation (CA) × 7.7	0.79	0.62	0.02
	Communication Accommodation (CA) × 7.8	0.76	0.58	0.02
	Communication Accommodation (CA) × 7.9	0.83	0.69	0.02
	Communication Accommodation (CA) × 7.10	0.67	0.45	0.02
	Team Sinergy (TS) × 7.1	0.76	0.58	0.03
	Team Sinergy (TS) × 7.2	0.81	0.66	0.03
	Team Sinergy (TS) × 7.3	0.79	0.63	0.02
	Team Sinergy (TS) × 7.4	0.78	0.61	0.02
	Team Sinergy (TS) × 7.5	0.73	0.54	0.02
	Team Sinergy (TS) × 7.6	0.78	0.61	0.02
	Team Sinergy (TS) × 7.7	0.80	0.64	0.02
	Team Sinergy (TS) × 7.8	0.74	0.55	0.02
	Team Sinergy (TS) × 7.9	0.79	0.63	0.02
	Team Sinergy (TS) × 7.10	0.69	0.47	0.02
	Team Direction (TD) × 7.1	0.80	0.65	0.03
	Team Direction (TD) × 7.2	0.83	0.69	0.03
	Team Direction (TD) × 7.3	0.84	0.71	0.03
	Team Direction (TD) × 7.4	0.82	0.67	0.02
	Team Direction (TD) × 7.5	0.78	0.61	0.02
	Team Direction (TD) × 7.6	0.81	0.66	0.02
	Team Direction (TD) × 7.7	0.81	0.65	0.02
	Team Direction (TD) × 7.8	0.79	0.62	0.02
	Team Direction (TD) × 7.9	0.83	0.70	0.02
	Team Direction (TD) × 7.10	0.73	0.54	0.03
	Multi-Regional Virtual Team (MR) × 7.1	0.53	0.28	0.01
	Multi-Regional Virtual Team (MR) × 7.2	0.59	0.35	0.01
	Multi-Regional Virtual Team (MR) × 7.3	0.59	0.35	0.01
	Multi-Regional Virtual Team (MR) × 7.4	0.59	0.35	0.01
	Multi-Regional Virtual Team (MR) × 7.5	0.52	0.27	0.01
	Multi-Regional Virtual Team (MR) × 7.6	0.59	0.35	0.01
	Multi-Regional Virtual Team (MR) × 7.7	0.58	0.33	0.01
	Multi-Regional Virtual Team (MR) × 7.8	0.55	0.30	0.01
	Multi-Regional Virtual Team (MR) × 7.9	0.61	0.37	0.01
	Multi-Regional Virtual Team (MR) × 7.10	**0.48**	0.23	0.01
	Environment and Resources (ER) × 7.1	0.69	0.47	0.03
	Environment and Resources (ER) × 7.2	0.75	0.57	0.03
	Environment and Resources (ER) × 7.3	0.74	0.55	0.03
	Environment and Resources (ER) × 7.4	0.75	0.56	0.02
	Environment and Resources (ER) × 7.5	0.69	0.48	0.02
	Environment and Resources (ER) × 7.6	0.74	0.55	0.02
	Environment and Resources (ER) × 7.7.5	0.74	0.54	0.02
	Environment and Resources (ER) × 7.8	0.72	0.52	0.02
	Environment and Resources (ER) × 7.9	0.75	0.56	0.02
	Environment and Resources (ER) × 7.10	0.64	0.42	0.03

Table A10. *Cont.*

Construct	Item	F.L. [1]	Com. [2]	Weight
Sustainability in Project Management (SPM) × Virtual Teams (VT)	Cultural Intelligence (CI) × EC	0.82	0.68	0.08
	Communication Accommodation (CA) × EC	0.84	0.71	0.08
	Team Sinergy (TS) × EC	0.78	0.61	0.08
	Team Direction (TD) × EC	0.83	0.69	0.09
	Multi-Regional Virtual Team (MR) × EC	0.66	0.44	0.03
	Environment and Resources (ER) × EC	0.75	0.57	0.08
	Cultural Intelligence (CI) × EN	0.77	0.59	0.04
	Communication Accommodation (CA) × EN	0.78	0.62	0.04
	Team Sinergy (TS) × EN	0.77	0.60	0.05
	Team Direction (TD) × EN	0.81	0.66	0.06
	Multi-Regional Virtual Team (MR) × EN	0.66	0.44	0.01
	Environment and Resources (ER) × EN	0.76	0.59	0.05
	Cultural Intelligence (CI) × SO	0.81	0.66	0.09
	Communication Accommodation (CA) × SO	0.85	0.73	0.10
	Team Sinergy (TS) × SO	0.85	0.73	0.10
	Team Direction (TD) × SO	0.88	0.77	0.10
	Multi-Regional Virtual Team (MR) × SO	0.66	0.44	0.04
	Environment and Resources (ER) × SO	0.81	0.66	0.10
Knowledge Management (KM)	Organization/Methodology (OM)	0.89	0.79	0.42
	ICT Systems (ICT)	0.76	0.57	0.31
	Human Aspects (HA)	0.91	0.83	0.43
Stakeholder Engagement (SE)	7.1.6	0.77	0.59	0.13
	7.2.6	0.82	0.68	0.13
	7.3.6	0.83	0.69	0.13
	7.4.6	0.78	0.61	0.13
	7.5.6	0.72	0.51	0.12
	7.6.6	0.82	0.67	0.14
	7.7.6	0.78	0.61	0.13
	7.8.6	0.75	0.57	0.11
	7.9.6	0.81	0.66	0.13
	7.10.6	0.66	0.43	0.16
Sustainability in Project Management (SPM)	Economic (EC)	0.86	0.73	0.41
	Environment (EN)	0.71	0.51	0.20
	Social (SO)	0.91	0.84	0.55
Project Success (PS)	Future Potential (FP)	0.75	0.57	0.24
	Organizational Benefits (OB)	0.85	0.73	0.27
	Project Efficiency (PE)	0.82	0.66	0.27
	Project Impact (PI)	0.84	0.70	0.23
	Stakeholder Satisfaction (SS)	0.84	0.70	0.21

[1] Factorial Load; [2] Commonality.

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