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Understanding Sustainable Knowledge-Sharing in Agile Projects: Utilizing Follow-the-Sun Technique (FTS) in Virtual Teams

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Abstract

In Agile IT projects, promoting effective knowledge sharing is essential not only for achieving success but also for supporting Sustainable Development Goals (SDGs). However, Companies using virtual teams may face challenges in coordinating work, particularly when teams are distributed across different time zones, ultimately hindering their ability to consistently share knowledge. This can lead to delays and inefficiencies, ultimately impacting the project outcomes and the organization's profitability. To ensure sustainable knowledge sharing, a comprehensive framework is necessary that addresses the environmental, social, economic, and political aspects of the project. This paper proposes a framework that combines the Follow-the-Sun (FTS) technique and the Sustainable Knowledge Sharing Model, enabling 24-hour knowledge sharing in virtual teams and benefiting IT agile projects.

1. Introduction

In today's highly competitive market, sustainability goes beyond the development of new goods and services that impact business strategies [1]. When it comes to information technology (IT), the effectiveness of sustainable project

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management depends on the efficiency of actions taken, such as integrating new technologies, establishing networks, supporting key strategies, and using virtual teams to enable prompt response and data updates without compromising the project's outcomes and benefits throughout its lifecycle [2].

Agile methodologies provide a flexible and collaborative approach to software development that emphasizes continuous improvement and customer satisfaction [3]. However, while they can foster knowledge sharing, they may not be adequate for maintaining sustainable knowledge sharing, particularly when dealing with projects spread across multiple countries and time zones [4].

The importance of sustainable knowledge sharing in virtual teams cannot be overstated [5], [6]. Knowledge is a critical asset that drives innovation, improves decision-making, and enhances overall project performance. Sustainable knowledge sharing ensures that this asset is effectively leveraged and preserved for future use. This requires a comprehensive framework that addresses the environmental, social, economic, and political aspects of the project [7].

Virtual teams operating within an agile project management context often struggle to coordinate work across different time zones, leading to delays and inefficiencies that can significantly hinder knowledge sharing [39]. The cost of these challenges can be significant, both in terms of time and money. Therefore, innovative solutions that address these challenges and promote sustainable knowledge sharing are needed.

The Follow-the-Sun (FTS) technique is a work arrangement that leverages time zone differences to create a 24-hour work cycle, and it has been successfully used by organizations to improve productivity and efficiency in virtual teams [8]. The sustainable knowledge-sharing model is a comprehensive framework that addresses the environmental, social, economic, and political aspects of knowledge sharing in virtual teams [7]. By combining these two approaches, it is possible to create a 24-hour sustainable knowledge-sharing cycle for virtual teams.

The approach presented for virtual teams to share sustainable knowledge in IT agile projects through the Follow-the-Sun (FTS) technique aligns with the United Nations Sustainable Development Goals (SDGs) [9]. The Sustainable Knowledge Sharing Model and FTS technique address several SDGs, including SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation, and Infrastructure, and SDG 17: Partnerships for the Goals. The FTS technique further fosters collaboration and shared responsibility, creating opportunities for learning and development. Additionally, this approach supports SDG 13: Climate Action and SDG 12: Responsible Consumption and Production, contributing to a sustainable future [10], [11].

This paper introduces a theoretical framework that employs the Follow-the-Sun (FTS) methodology to facilitate sustainable knowledge sharing in IT Agile projects among virtual teams that leverages the sustainable knowledge-sharing model proposed by de Castro, Sanin, Levula, and Szczerbicki [7]. It provides an integrated knowledge-sharing model that considers the Follow-the-Sun (FTS) technique applied to Agile projects. Additionally, this paper provides recommendations for virtual teams, discusses study implications and limitations, and suggests areas for future research. The proposed framework also provides a structure for realizing the strengths of virtual teams across different time zones. The approach presented in this paper has the potential to make a positive impact on several SDGs, demonstrating the importance of sustainable practices in IT project management. However, the effectiveness of this framework in specific organizational contexts requires further refinement, adaptation, and finessing to suit the given context. Future research can expand upon the foundations.

2. Theoretical Background

2.1. Knowledge Management

To meet the needs of industry, institutions should treat knowledge and intellectual capital as assets for value creation [12]. Szczerbicki and Sanin [13] define knowledge management as the examination, exploration, and improvement of an institution's economies. Knowledge is divided into two types by Cho [14] and de Castro, Sanin, Szczerbicki, and Levula [15]: empirical knowledge and conceptual-based knowledge. Empirical knowledge involves the ability of an organization to demonstrate, codify, connect, and explain knowledge, which is typically expressed in documents, applications, or manuals [14], [15]. On the other hand, conceptual-based knowledge refers to knowledge that has been developed in people's minds, making it challenging to obtain or distribute [14], [16]. Conceptual-based knowledge is therefore not easily codified or explained, and it is unique to each individual based

on the complex interweaving of their knowledge and experience with that of their role and work environment. Konno and Schillaci [17] suggest that ongoing evaluation of both empirical and conceptual knowledge conversion processes is required to build knowledge in companies so that it can be reused by others.

2.2. Sustainable (or Green) Project Management

Sustainable project management aims to ensure that project management practices considers the impact on the environment as opposed to just focusing on contemporary project management approaches that only focuses on the triple constraints [18], [19].Green IT is still in its infancy stage and many organizations are still exploring how they can integrate it into their operations as technologies continues to evolve and each organization needs to be evaluate how they can contextualize such concepts into their business model [20], [21]. As the project management field matures, the definition of project success has evolved from traditional measures such as time, cost, and scope to achieving deliverables and milestones while preserving a value stream vision. The next phase of this evolution involves incorporating sustainability principles in project management practices to avoid harming the planet or its limited resources. This requires a comprehensive understanding of a project's impact and value creation potential. To achieve sustainability, project specifications must include strategies to mitigate negative environmental, social, and economic impacts while achieving the benefits outlined in the business case evaluation. Project management needs to make significant efforts to address the social and environmental implications of every project to ensure that current and future generations can experience and use the available resources [22], [23].

2.3. Agile Concepts

The Agile methodology is an approach that prioritizes consistent and timely delivery of valuable product iterations to customers through incremental releases and regular feedback [15]. This method stands out from other approaches that often do not prioritize meeting the customer's current needs due to changes over time [24]. While the software development industry commonly uses Agile, it has become an effective and recommended method for organizations in other fields to gain a competitive edge [25], [26], [27].

The Agile methodology emerged to address the limitations of the traditional waterfall model, which places heavy emphasis on documentation at the project's outset and often has outdated requirements by the time of completion [28]. This can hinder an organization's ability to adapt to changing market needs influenced by internal and external factors [29]. Agile has no constraints on technology or industry, rather it simply provides a client-focused direction to project development, utilizing frameworks such as Scrum or Kanban [30]. The overarching goal of these frameworks is to facilitate collaboration by removing workflow obstacles to achieve effectiveness and to prioritize building desired products [31].

2.4. Related Work on Sustainable Knowledge Sharing in IT Development: An Overview

de Castro, Sanin, Levula, and Szczerbicki [32] developed a conceptual framework that provides an alternative approach to conceptual knowledge transfer in Agile IT projects. The methodology begins with Assimilation (informal conceptual knowledge sharing) concentrating on conceptual knowledge and it is illustrated by person-to-person knowledge sharing, such as storytelling and informal meetings that occur among workforces in Agile interactions.

Second, Experimentation (formal conceptual knowledge sharing) refers to pre-planned sessions for person-to-person collaboration throughout agile work, such as joint training and discussion groups.

The collection and storage of evidence in documents and databases is the next stage of empirical knowledge named Attestation (formal empirical knowledge sharing) which concentrates on person-to-document knowledge sharing, which incorporates organisation reports and corporate networks.

The final stage is the Extemporisation (informal empirical knowledge sharing) which encompasses informal and ad hoc document exchanges in agile projects, revealing people's preference for using close contacts for statements rather than electronic databases (Attestation). The model developed by de Castro, Sanin, Levula, and Szczerbicki [32] explores relations across four modes: assimilation, experimentation, attestation, and extemporisation in two

dimensions Conceptual vs Empirical Knowledge and Formal and Informal Knowledge Sharing.
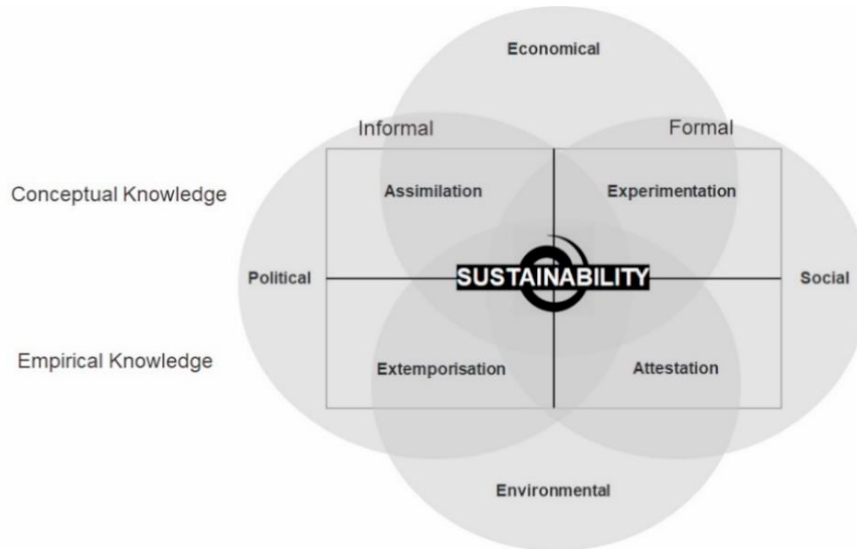

Fig. 1. Sustainable Knowledge Sharing Model (De Castro et al. [34]).

By combining the four dimensions of the knowledge sharing process, with the four sustainable dimensions: Political, Social, Economical, and environmental, a unique and sustainable process can be created [7], see Fig. 1. Sustainability is integral from the outset; beginning with Assimilation, which involves informal conceptual knowledge sharing through activities such as storytelling and informal conversations between members of the workforce in Agile interactions. This stage considers economic factors to ensure the project's economic sustainability for the business. The next stage, Experimentation, involves formal conceptual knowledge sharing and organised sessions for person-to-person engagement during agile tasks, such as cooperation and collaboration. In addition to economic factors, there is a greater emphasis on addressing social aspects such as policies and procedures that consider cultural values, human rights, and equity among project stakeholders.

The proposed sustainable knowledge sharing framework is designed to foster the exchange of conceptual and empirical knowledge in agile projects. To maximize the potential benefits of this framework, it is essential to determine whether such a framework can be practically applied to existing approaches in this case we explore the FTS technique, which ensures that work is carried out continuously across different time zones. This is the reality with many IT software development projects with the goal of reducing the software development life cycle [33], [34], [35]. By leveraging the expertise of virtual teams across the globe, the framework can benefit from diverse perspectives, knowledge, and skill sets, leading to increased productivity, efficiency, and improved collaboration. The FTS technique also reduces the time required to complete a project and eliminates delays caused by time zone differences. Therefore, it is crucial to incorporate FTS technique into the sustainable knowledge sharing framework to fully realize its potential and gain a competitive advantage in today's global economy, see Fig 2.

3. Proposed Framework

The proposed model for integrating sustainability and knowledge sharing in Agile IT projects combines the concept of sustainability and knowledge sharing with the "Follow-the-Sun (FTS)" technique for virtual teams. This method is widely used in software development and IT support to ensure uninterrupted work around the clock.

The model incorporates sustainability into the project vision from the beginning, ensuring that it is not overlooked as the project progresses. It also emphasizes balancing different aspects of sustainability, including economic, environmental, social, and political concerns, during knowledge sharing interactions. This promotes

knowledge sharing and collaboration among virtual team members, ensuring that their work has a positive impact on long-term sustainability.

By FTS technique, the proposed model ensures that virtual teams located in different time zones can work seamlessly without interruption. This reduces the need for overnight support, minimizes downtime, and increases productivity. Moreover, this method allows organizations to provide 24/7 sustainable knowledge transfer, which is particularly essential in critical industries such as healthcare and finance where downtime can have severe consequences.

The proposed model is a significant contribution to the field, as it provides a practical and comprehensive approach for capturing and distributing conceptual sustainable knowledge generated in Agile IT projects. Future research can investigate the effectiveness of this model in different contexts and evaluate its impact on project outcomes.
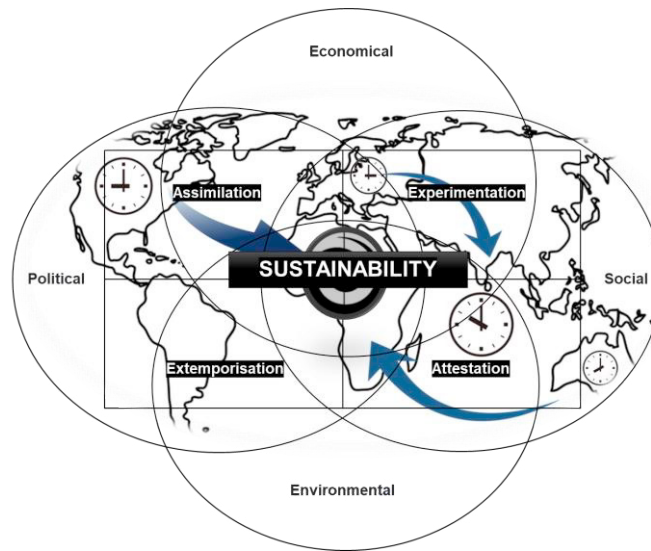

Fig. 2. Proposed 24-Hour Sustainable Knowledge-Sharing Cycle approach.

3.1. The "Follow-the-Sun (FTS)" technique.

The "Follow-the-Sun (FTS)" technique is a method used in software development and IT support to ensure that work is being done around the clock, without interruption [33]. The idea is to have different teams located in different time zones, so that when one team finishes their workday and goes home, another team in a different time zone takes over and continues working. This allows for a seamless transition of work and ensures that there is always someone available to address any issues that may arise.

The technique is often used in organizations that have a global presence, with teams located in different parts of the world. By Follow-the-Sun (FTS), organizations can reduce the need for overnight support, minimize downtime, and increase productivity [8].

3.2. Conceptual and Empirical Knowledge

Theoretical and abstract principles are linked with Conceptual Knowledge, which is often used by intellectuals and philosophers to construct novel models or redefine existing ones [14], [15]. Conversely, Empirical knowledge is based on documented patterns, technology, applications, or data obtained from experiments. It is critical to gather information before developing the necessary knowledge or application [15], [16]. The suggested model encourages sustainable ideas from the initial stages of Conceptual Knowledge creation, which will have a significant impact on

documentation preparation related to Empirical Knowledge. The proposed model emphasizes both Formal and Informal Knowledge Sharing.

3.3. Knowledge Assimilation

Assimilation refers to the mental process that governs the way we integrate and assimilate new information into our existing knowledge [36]. It occurs when fresh information is added to our pre-existing knowledge, leading to the formation of new knowledge. Therefore, assimilation entails the combination of old and new knowledge [37]. In this proposed model, assimilation is represented by the informal sharing of knowledge among individuals, such as casual meetings and storytelling that occur among employees during Agile interactions [32].

3.4. Knowledge Experimentation

Experimentation is an essential component of the scientific method, which is a systematic approach to understanding the world around us. To minimize the effects of variables, controls are typically included in experiments, which improves the accuracy of the results. Comparing control and other types of measurements is often used to achieve this goal [38]. With this as a starting point, Knowledge Experimentation can be defined as a trial, test, or preliminary process, consisting of a series of activities or procedures designed to explore an unknown or test a theory. The experimentation process described in this study involves scheduled sessions for engagement between individuals in Agile work, such as peer coaching and joint training [39].

3.5. Knowledge Attestation

According to Merriam-Webster [40], attestation refers to an official confirmation of something's truth or authenticity. An attester is an individual who affirms the veracity or validity of something or someone in writing to provide evidence. The act of attestation involves observing and signing a formal document to verify that it has been properly recorded by those who are obligated to follow its contents [41]. In the present approach, knowledge attestation is utilized as proof or evidence to validate knowledge sharing. It emphasizes person-to-document knowledge sharing, which includes organizational repositories and intranets.

3.6. Knowledge Extemporisation

The term "Extemporisation" is used to describe the process of improvisation in both music and theatre, in which the performer consciously incorporates small elements of structure or patterns to create a spontaneous and varied performance [42]. It is the ability to speak or perform without prior preparation, according to Everitt [43].The proposed Knowledge Extemporisation mechanism in this paper refers to the informal exchange of documents in agile projects, reflecting people's preference for personal contact over electronic databases for sharing knowledge [44].

Extemporisation is a double-edged sword that can significantly impact knowledge management (KM) in the context of the Following-the-sun (FTS) technique. FTS teams, geographically distributed across different time zones, may benefit from the ability to adapt quickly to changing situations and improvise solutions in real-time [33]. This could be instrumental in ensuring effective knowledge sharing and utilization within the organization. The ability of team members to use their expertise and knowledge to make quick decisions and act in the absence of formal processes or guidelines can expedite problem-solving and decision-making processes.

However, there are potential negative consequences of excessive extemporisation in FTS. If team members rely heavily on improvisation without proper documentation and communication practices, this could result in a lack of institutional memory, making it difficult to transfer knowledge between team members. Improper training or support could lead to poor decisions, resulting in negative outcomes and errors.

Therefore, it is essential to strike a balance between extemporisation and formal KM processes in FTS. Organizations should encourage teams to leverage their creativity and expertise to make quick decisions while

training them in effective documentation and communication practices. By doing so, the organization can reap the benefits of FTS while minimizing potential drawbacks.

3.7. Extemporisation and Role-Playing in Agile Project Management

There is a close relationship between the use of extemporisation in the Following-the-sun (FTS) technique and agile project management in software development [33]. Agile project management is a methodology that emphasizes flexibility, adaptability, and collaboration in project execution. Similarly, FTS methodology also values the ability of teams to improvise and adapt to changing situations in real-time [45].

Role-playing is a technique used in project management to help team members understand their roles and responsibilities and prepare for important meetings and presentations. This technique involves team members assuming the roles of others to simulate scenarios and ensure that everyone understands their responsibilities and how to work together effectively. Role-playing can be particularly valuable in agile project management, where the emphasis is on collaboration and teamwork [46].

Similarly, in FTS methodology, teams are often geographically dispersed, and effective communication and collaboration are critical to success. The ability to improvise and adapt to changing situations in real-time is also an asset in FTS methodology. Role-playing can be used in FTS methodology to help team members understand their roles and responsibilities in a global context and prepare for effective communication and collaboration [8], [46]. Overall, the use of role-playing and extemporisation techniques can be valuable in both agile project management and FTS methodology to promote effective communication, collaboration, and adaptability in project execution.

3.8. Proposed Assembly

The sustainability model considers four interconnected dimensions - economic, environmental, political, and social - which interact with each other to produce positive sustainable outcomes [7].

Economic sustainability involves more than just return on investments (ROI) on projects and requires aligning project goals with the organization's economic drivers to ensure financial sustainability [34].

Social sustainability is crucial for a company's long-term sustainable growth and involves developing sustainable organizational culture, processes, and procedures that address cultural, gender, and other social aspects of employees, shareholders, and partners [34], [46].

Environmental sustainability should be a core value in business planning and operations, reflecting the evaluation of capital equipment, resource utilization, purchasing patterns, contract negotiation, and industry standards [34], [35].

Political sustainability aims to meet current political aims and resource needs without jeopardizing future generations and is based on ethical principles such as regulation, registration, health and safety, and resource efficiency [34], [35].

When combined with the knowledge sharing process, these four dimensions produce a unique sustainable process. The knowledge sharing process involves four stages - Assimilation, Experimentation, Attestation, and Extemporisation - that focus on informal and formal conceptual and empirical knowledge sharing between project stakeholders. The combination of the sustainable layers and the de Castro, Sanin, Levula, and Szczerbicki [7] model results in a sustainable knowledge sharing process that benefits all stakeholders involved in an IT project. To ensure effective information retrieval, it is recommended that the organization implement their own query mechanism to access information from a structured data portal and enhance knowledge creation and sharing within a projectized organization, resulting in a competitive advantage. By aligning those sustainable goals, virtual teams can ensure that their knowledge sharing is sustainable and contributes to the long-term growth and success of the organization. This promotes a culture of collaboration and openness, which can enhance team morale and engagement.

This framework can be a valuable strategy for organizations to effectively leverage virtual teams and enhance productivity. By following a set of well-defined steps, organizations can successfully implement this technique and overcome the challenges of coordinating work across different time zones using an agile PM approach.
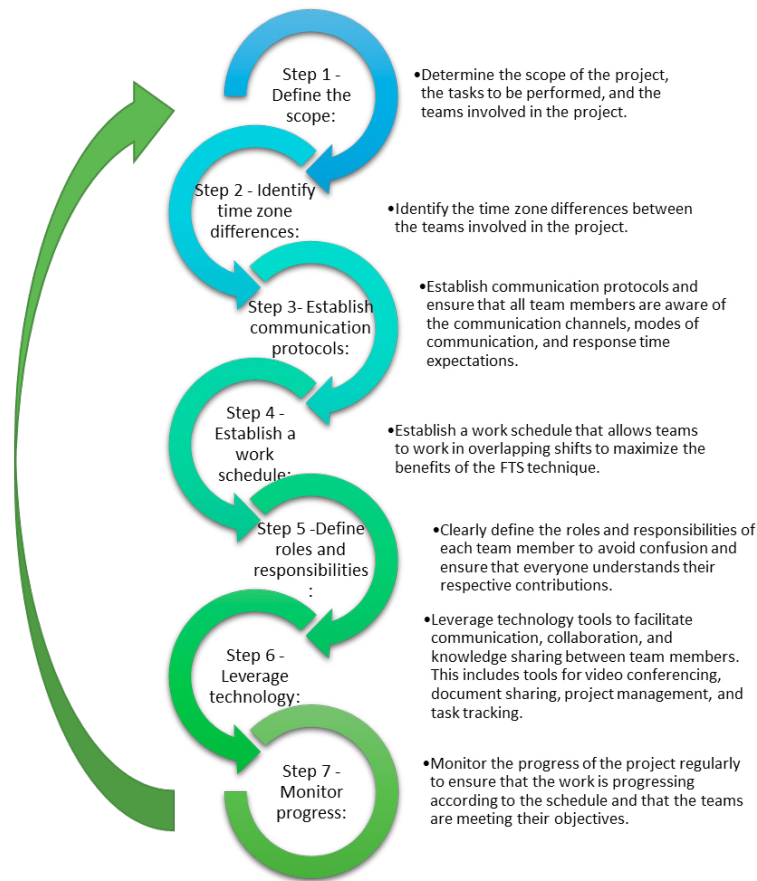
Fig. 3: Agile Sustainable FTS KM Methodology

By adhering to these steps, virtual teams that utilize this framework can obtain a multitude of benefits, including increased productivity and efficiency, enhanced knowledge sharing and collaboration, and the ability to overcome the challenges of coordinating work across different time zones.

4. Conclusion and Limitations

In conclusion, the model is a framework designed to help organizations effectively manage virtual teams and increase productivity. It involves nine steps, including defining the project scope, identifying time zone differences, establishing communication protocols, setting a work schedule, defining roles and responsibilities, leveraging technology, monitoring progress, addressing issues promptly, and evaluating results. By following these steps, organizations can overcome the challenges of coordinating work across different time zones and reap benefits such as increased productivity and efficiency, enhanced knowledge sharing and collaboration. The FTS Sustainable Knowledge-Sharing Cycle offers an innovative approach for virtual teams to share sustainable knowledge in IT Agile Projects. By combining the Castro, Sanin, Levula, and Szczerbicki [7] Sustainable Knowledge Sharing Model and the FTS technique, virtual teams can effectively promote sustainable knowledge sharing and overcome the limitations that they may face, thereby ensuring the success of their projects. However, the study has some limitations that need to be addressed in future research.

One limitation of the study is that the effectiveness of the models might depend on various factors such as the size of the virtual team, the complexity of the project, and the cultural differences among team members, which are

not addressed in the study. Another limitation is that the study focuses on the context of IT Agile projects, and the applicability of the models in other contexts might require further investigation.

To overcome these limitations, future research should be conducted to validate the effectiveness of the models in different contexts and settings. This can help to identify the factors that might influence the effectiveness of the models and provide guidance for implementing them in practice. Moreover, the impact of cultural differences among team members on the effectiveness of the models should be investigated, as it can help to develop strategies to address cultural barriers to sustainable knowledge sharing.

Further research should also explore the use of technology and tools to support the Follow-the-Sun (FTS) technique and promote sustainable knowledge sharing among virtual teams. This can help to identify the most effective tools and technologies for supporting sustainable knowledge sharing and improve the scalability of the approach. Lastly, the role of leadership and communication in promoting sustainable knowledge sharing in virtual teams should be investigated, as it can help to develop strategies for creating a supportive and collaborative team environment that encourages knowledge sharing. By adopting this approach, organizations can promote sustainable knowledge sharing among virtual teams and enhance the success of their Agile IT projects. Overall, the study provides a valuable contribution to the field of sustainable knowledge sharing and virtual team collaboration and opens avenues for future research.

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