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## Sustainable Knowledge Sharing Model for IT Agile Projects

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### Abstract

In order to overcome work environment challenges and remain competitive in the market, organisations must adapt. An organisation's competitiveness can be improved through knowledge sharing; however, improvement without responsibility can have a negative impact on the sociotechnical environment which people cannot fully comprehend. According to researchers, business involvement in sustainable development goals remains minimal [51]. As a result, a sustainable consciousness is crucial to improve the business. In the project profession, sustainability is a business approach that balances the environmental, social, economic, and political aspects of project-based work to fulfil the demands of stakeholders without jeopardising or overburdening the availability of natural resources for future generations [33]. This study goes a step further and proposes a theoretical design that aims to ensure sustainable development during conceptual knowledge transfer in Agile IT projects.

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### 1. Introduction

Changes are inevitable in the era of information technology, consumerism, smart cities, and uncontrollable innovation. In the context of sustainability, the evolution of uncontrollable innovation extends beyond developing new goods / services that affect business strategies [29]. The idea of sustainability presupposes the implementation of effective information technologies [27]. From an information technology (IT) point of view, the effectiveness of

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sustainable project management is determined by the efficacy of the steps performed, such as involvement and capacity to institute new technologies, networking, and supporting key strategies to enable quick response and data updates without overconsuming or exhausting the outcomes and benefits over the project life cycle [1]. Sustainable knowledge transfer ought to be characterised by the duties and significance of innovative IT solutions and their environments.

A sustainable technology is the one which alters organisational systems without limiting the use of management as a condition for productivity, efficiency, quality, or employee motivation [37]. Experience, rather than written documentation, is the primary means of gaining and sustaining knowledge [19].

Modern software development methodologies, such as Agile, place less emphasis on paperwork and put more emphasis on direct knowledge transfer between project participants. As a result, knowledge in the Agile framework has changed from being explicitly written and shared to being “conceptual” [41], [24]. which takes place only in individual minds and seems unlikely to being easily lost [41], [15]. This presents several significant threats and difficulties for managing sustainable knowledge assets in an organisation, and it may likely impact a company's ability to be innovative and competitive [22]. It is well understood that a company can only achieve innovation and performance improvement by implementing an effective knowledge sharing process [12].

Rodrigo et al. [12] states that, it is possible to suggest that the development of advanced information technologies and their impact on economic, political, environmental, and social life can be outlined in the context of sustainability. Organizations committed to developing sustainable projects with the objective of turning existing unsustainable businesses, companies, and institutions into more sustainable ones can further maximise the benefits over the project's life cycle. The model approach (Fig. 2), allows the implementation of sustainability initiatives based on a knowledge transfer, resulting in a sustainable knowledge transfer for products or services. The proposed approach to sustainable knowledge transfer is a model solution, which should be sought by any entity that wishes to make a genuine commitment in sustainability.

## 2. Innovation, Knowledge Management and Sustainable Project Management

### 2.1. Innovation

The term "innovation" refers to the use of a new or significantly upgraded product (good or service), new marketing tactics, or a new organisational approach [17]. In the scope of this study, we are only interested in innovation from Tavassoli & Karlsson [49] and Fenişer [17] point of view, which divides innovation into four categories: product innovations, process innovations, organisational innovations, and marketing innovations. When a new product or a new variation of an existing product is introduced into the market with the intention of meeting the needs of a specific customer, a product innovation occurs.

Process innovation entails the implementation of new manufacturing activities as well as new commercial strategies to a product or service. Reduced component costs of the goods manufactured is a main objective of process innovation. Organizational innovation refers to change practises that boost a company's efficiency, productivity, revenue growth, versatility, and creativity by utilising tacit knowledge that is derived not only from obvious and visible expertise (Empirical Knowledge), but also from invisible reservoirs of experience (Tacit Knowledge) that must be revitalised first before being used in the creative process [52]. Tacit knowledge is knowledge that is not easily codified or understood such as by reading a book; however, it is knowledge that is gained through personal wisdom, intuition, insights and experience [35]. Finally, marketing innovation is linked to improvements in the combination of core businesses, including product differentiation, as well as strategies of serving these marketplaces.

A company can only bring innovative actions by restructuring and upgrading its old structures and strategies [38]. The effectiveness of a company's innovation efforts is determined by its ability to acquire and share knowledge within a specific time frame [18]. This results in a value creation, allowing an organisation to achieve its desired outcomes.

### 2.2. Knowledge Management

Institutions must organise knowledge and intellectual capital as disembodied assets in order to meet the needs of their competitors [44]. Knowledge management, according to Szczerbicki and Sanin [48], is the inspection, investigation, and enhancement of an institution's economies.. Cho [10] and Rodrigo et al. [41] divide knowledge

into two types: evidence-based knowledge (Empirical Knowledge) and conceptual understanding (Conceptual-based Knowledge).

Empirical knowledge proposes the ability and competency of an organisation to successfully demonstrate, codify, connect, and describe knowledge [10], [41]. Documents, applications, or manuals are commonly used by organisations to express their explicit knowledge. Explicit knowledge is knowledge that is easy to articulate, document and share.

Conceptual knowledge, on the other hand, refers to knowledge that has been developed in people's minds and it is difficult to obtain or distribute. [24], [41]. As per Konno & Schillaci [36], knowledge is built in companies through the ongoing assessment of both empirical (explicit) and conceptual (tacit) knowledge conversion processes, in order for them to be reusable by others.

### 2.3. Sustainable (or Green) Project Management

Sustainable project management is the use of methods, tools, and techniques to achieve an ultimate purpose while considering the project outcome has completed the lifecycle to enduring a large positive environmental, social, and financial effect that would guarantee the sustainability of resources for future generations [9]. As the project management field of study matures, its definition of project success evolves. The practise is now shifting away from its traditional focus on time, cost, and scope often referred to as the triple constraint to now concentrating on achieving the deliverables and milestones set out in a business case while preserving a value stream vision.

The next phase in the evolutionary path is to utilise a sustainability ideology in which projects do not harm the planet or its limited resources. Project management has to make larger attempts to address every project's social and environmental implications so that the society we live in, and the subsequent generations will be able to use and further enhance the opportunities that are available nowadays.

To make this move, project management must adopt a broader and more comprehensive perspective of the project's implication and valuation. To be sustainable, a project's focus must be on value creation. Project specifications and conditions must include strategies to mitigate negative environmental, social, and economic impacts as well as achieving the benefits outlined in the business case evaluation [9].

## 3. Agile Concepts

Agile is an Innovative methodology that ensures consistent, on-time product iterations that provide value to customers through regular and incremental deliveries that include both improved functionality and consumer feedback [43]. This strategy distinguishes itself from other approaches, which frequently does not require or, at the very least, does not match the customer's current specifications due to variations through time [45].

Although popularly used by the software development industry, the aspect described in the agile manifesto can also be implemented to other fields and have become a reliable and recommended method for an organisation to gain a competitive advantage in recent years [6], [14], [3].

The Agile methodology arose as an approach to address the shortcomings of the traditional waterfall model. From the customer's perspective, the waterfall approach has significant disadvantages, with requirements frequently changing in the meantime and a strong emphasis on documentation at the start of the project [26]. This has an impact on an organisation's ability to proactively adapt to market needs, which are also heavily influenced by both internal and external forces [13].

The Agile approach, on the other hand, has no technological or industrial constraints; it purely sets up a simple client direction on project construction that use Scrum or Kanban techniques [20]. All of these frameworks have one thing in common: an attempt to foster collaboration by removing workflow obstacles for effectiveness, with a focus on building the desired products [19].

## 4. Related Work

Rodrigo et al. [12] 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 repos 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 Rodrigo et al. [12] explores relations across four modes: assimilation, experimentation, attestation, and extemporisation in two dimensions Conceptual vs Empirical Knowledge and Formal and Informal Knowledge Sharing, see Fig. 1.

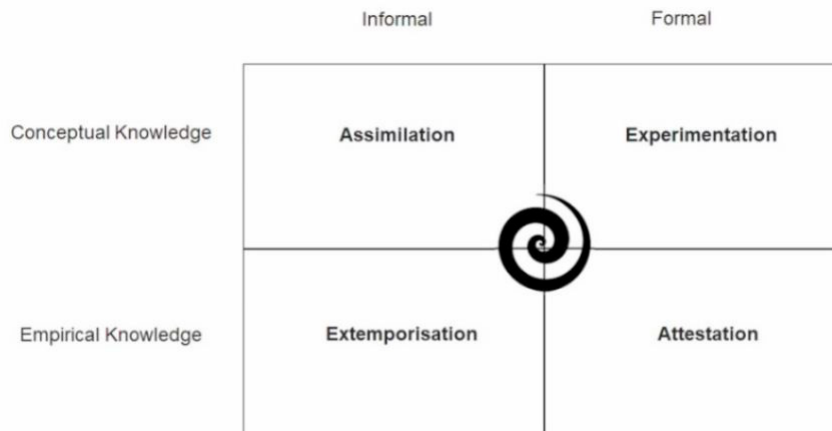


Fig. 1. Knowledge Sharing Model (Rodrigo et al. [12]).

Murray-Webster & Dalcher [33] investigated the aspects of sustainability in project-based institutions, which entails balancing shortcomings such as (i) the environment, e.g., climate change; (ii) society, e.g., community; (iii) the economy, e.g., affordability; and (iv) administration, e.g., health and safety, to conclude that for sustainability to be applicable these four elements must be considered simultaneously as they are interdependent on one another. This study focuses on combining all these points of view to build a sustainable knowledge transfer environment for IT Agile projects. Using the lens of systems thinking where the whole is more than the sum of its parts. It is important to look at projects holistically to determine how the element of the project affects the 17 SDGs [53] so that we can identify its positive implications on the environment as would be expected in a green project environment. Sustainable project management is not only restricted to green projects but there is also the concept of blue projects which deals with the protection of marine resources and marine life. This is important to ensure that marine resources are not overconsumed or exhausted that it would affect the availability of these resources on the next generation.

## 5. Proposed Framework

The new proposed model incorporates the concepts of sustainability and knowledge sharing for Agile IT projects. Project managers have a responsibility to guarantee that their work has a minimal impact on, or ideally, a positive impact on, long-term sustainability. This structure attempts to capture and distribute conceptual sustainable knowledge generated in IT projects that use agile methodology, regardless of where the staff members are located.

This framework is based on the knowledge transfer model developed by Rodrigo et al. [12], but unlike the Rodrigo

et al. model, the new model involves balancing different aspects of sustainability, such as economic, environmental, social, and political concerns, during the interactions that occur along the four components of Knowledge Sharing (assimilation, experimentation, attestation, and extemporisation). It is analysed, in this model, the idea that the sustainable development may be modelled with strategic interactions among the four sustainable agents and between the four knowledge-sharing components [12], by not deviating from their initial strategy of achieving a balance while the conceptual and empirical knowledge transfer occur. This point is represented as a spiral of sustainability in the middle of the proposed model, see Fig. 2. The goal is to ensure that the results, and benefits are sustainable over the project life cycle and during the process of creating, sharing, and storing knowledge. Moreover, the model incorporates sustainability into the vision at the very beginning of the project. As a result, it cannot be lost or forgotten.

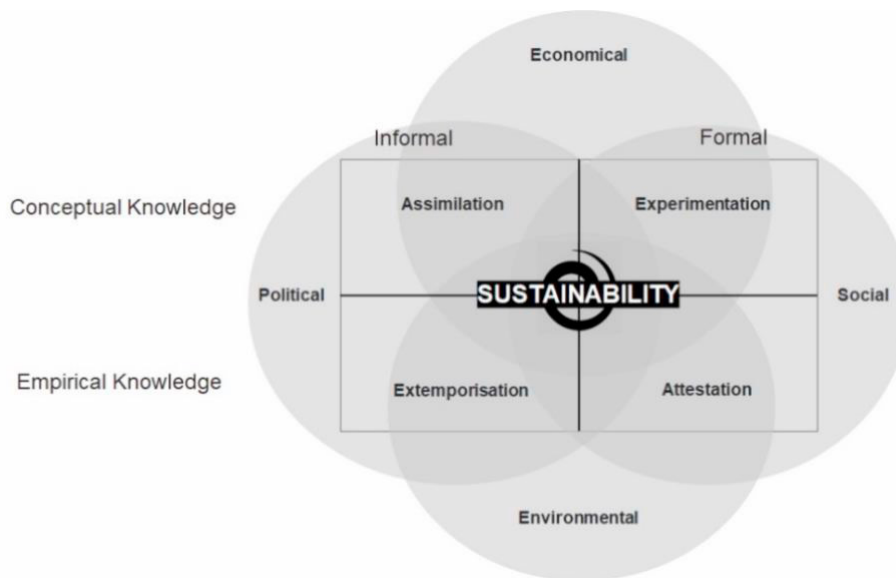


Fig. 2. Proposed Sustainable Model.

### 5.1. Conceptual and Empirical Knowledge

*Conceptual Knowledge is connected with abstract or theoretical principles. Intellectuals and philosophers typically use it to create new models or re-define existing ones [10], [41]. On the other hand, Empirical knowledge is rooted on the documentation of patterns, technology, applications, or experimentation-based data. In this type of knowledge, it is crucial to gather facts before actively developing the required information or application [24], [41]. The proposed model fosters sustainable ideas from the very beginning of conceptualisation knowledge, which will have an essential impact during documentation preparation (Empirical Knowledge). Formal and Informal Knowledge Sharing*

The creation and dissemination of knowledge and information through formal institutionalised documentation is defined as formal knowledge sharing. It is usually based on formal decisions, and official records [34], [7]. Informal knowledge sharing, according to Andrea Bencsik & Tímea Juhasz [4], applies to all types of knowledge that exist in addition to formal knowledge. Dialogue and ideas shared at the coffee machine, dinners, lunches, and while moving together to work or to a client are all illustration of informal knowledge sharing [39]. Similarly, to the conceptual and

empirical approaches described above, the proposed model nurtures the responsibility of sustainability through formal and informal actions taken by stakeholders from the initial stage of Agile IT initiatives.

### 5.2. Knowledge Assimilation

Assimilation is a cognitive process that guides how new information is absorbed and incorporated into our current knowledge [23]. Assimilation takes place once new information is added to something you already know for it to be internalised as new knowledge. As a result, assimilation is the merging of previous and new knowledge [40]. Assimilation is represented in this model by the act of informal knowledge sharing between people, such as storytelling and informal meetings that occur between employees in Agile interactions [12].

### 5.3. Knowledge Experimentation

Experimentation is a crucial element of the scientific method, which is a strategic approach to discover the world around us [5]. Controls are typically included in experimentations to minimize the adverse effects of variables. This improves the quality of the findings, which is often accomplished by comparing control and other types of measurements [11]. Utilizing that as a preliminary step, we can describe Knowledge Experimentation as an experiment, trial, or initial process; a sequence of activities or operations conducted to explore something unidentified or examine a principle. The experimentation process reflected in this paper demonstrates scheduled sessions for people engagement during agile work, such as joint training and peer coaching.

### 5.4. Knowledge Attestation

Merriam-Webster [31] defines attestation as "an official verification of something as true or authentic". An attester is somebody who confirms the truthfulness or validity of something or someone in writing to prove the declarations. Attestation is the act of witnessing and signing a formal document to guarantee that it is properly registered by those who are bound by its contents [47]. In this method, knowledge Attestation is used as a proof or evidence to attest knowledge sharing. It focuses on person-to-document knowledge sharing which includes organisational repositories, and intranets.

### 5.5. Knowledge Extemporisation

Extemporisation is a concept used for both musical and theatrical performances to define whenever a musician can use patterns and small elements of structure consciously in their improvisation [2]. Extemporisation is used by the artist to achieve musical spontaneity, brio, drive, and variety [21]. As per Everitt [16], extemporisation is the ability to speak or perform without prior preparation or thought. The Knowledge Extemporisation mechanism proposed in this paper encompasses ad hoc and informal document exchanges in agile projects, indicating people's preferences for personal contacts for texts over electronic databases (Attestation).

### 5.6. Proposed Assembly

The model begins with the economic, environmental, political, and social dimensions of sustainability, all of which are interconnected and influences each other in different ways. From the beginning of the process, the four dimensions can provide a harmonised and balanced relationship between themselves and Rodrigo et al. [12] model, resulting in positive sustainable outcomes.

Economical sustainability – Obtaining economic sustainability entails far more than company performance metrics such as ROI (return on investment) on specific projects. It is more focused with interacting the project and its goals and outcomes to the organization's main economic drivers, how the project will support the organisation, and how the project will ensure the financial sustainability of the business [8].

Social sustainability – A social aspect in projects is crucial for a company's long-term sustainable growth. It is





associated with the development of a sustainable organisational culture, processes, and procedures that address the culture, gender, and other social aspects of employees, shareholders, partners, and throughout the project lifecycle [42,] [8].

Environmental sustainability – Working in harmony with nature is one of the most fundamental and identifiable aspects of sustainable management. Environmental sustainability should be a core value in business planning and operations, as it corresponds to the evaluation of capital equipment and facility requirements, resource utilisation, purchasing patterns, contract negotiation, and industry standards [33], [8].

Political sustainability – This is about reaching agreements among people to meet current political aims and resource needs without jeopardising or overburdening future generations. It describes a set of laws based on ethical principles, such as regulation and registration, health and safety, and resource efficiency [33], [8].

When these four dimensions are combined with the knowledge sharing process, they produce a unique sustainable process. Sustainability begins at the outset, when the Assimilation (informal conceptual knowledge sharing), such as storytelling and informal conversations that occur between workforce in Agile interactions, will consider Economics factors that answer questions such as: how the project will assuring economic sustainability of the business. Then, during Experimentation (formal conceptual knowledge sharing), which reflects organised sessions for person-to-person engagement during agile task, such as cooperation and collaborations, not only economics will be brought up, but also with a greater emphasis on dealing with social aspects such as policies and procedures that consider the value stream of culture, human rights, and equity among the project stakeholders.

The following stage is related to empirical knowledge, where knowledge is captured and stored in documents and databases. The Environmental aspect, which relates to capital equipment evaluation, best use of resources, purchasing practises, and contract management, will be the main concern during the Attestation (formal empirical knowledge sharing), which focuses on person-to-document knowledge sharing via organisation repositories and intranet. The final step is Extemporisation (informal empirical knowledge sharing). It addresses informal and ad hoc document exchanges in agile projects, reflecting a preference for people to use personal contacts for documents rather than electronic databases (Attestation). During Extemporisation, political aspects such as regulation and registration, health and safety, and resource efficiency rise to the frontline.

The combination of the sustainable layers and the Rodrigo et al. [12] knowledge management model results in a sustainable knowledge sharing process, see Fig. 2. All stakeholders are expected to benefit from the sustainable knowledge proposed model during an IT project. It is not, however, a guarantee that other people would be able to find the stored information. It is recommended that the organisation implement their own query mechanism to assist in the retrieval of required data from the framework covered in this study. As a result, the organisation's competitive advantage is dependent on its members' ability to access information from a structured data portal, ensuring that information can be successfully retrieved to enhance knowledge creation and sharing within a projectized organisation [52].

The incorporation of nature into projects, as well as questions about human rights, resources efficiency and affordability, heralds the arrival of a new framework in IT Agile projects. The number of minds attracted by the concept of sustainability, the rapid growth and enthusiasm it generates, its broad effect as a unifying concept, and its possibilities for modernising culture all indicates that today we are facing an iconic transition. Most communities strive for economic growth, environmental improvement, social and political promotions to ensure rising standard of life for themselves and future generations.

Using the proposed model, the Agile team can consider the interrelations as a "enabler" and a tool to aid not only in knowledge transfer but also in realising the benefits of a sustainability initiatives that uses technology from the beginning of the project.

Cloud computing, for example, may reduce the need to construct new facilities to house computer hardware. Server virtualization has reduced or eliminated computer server sprawl. Data centres are becoming more energy efficient because of new technologies and the ability to power down when not in use. Web 2.0 technologies are making it possible to do more work virtually, reducing the need to commute to work or travel for business meetings [54]. All those examples, as well as new approaches, will be revealed and implemented once using the intended framework, which also will integrate the political (legislation, regulation, and resource efficiency), social (equity and community), economic (affordability and profits), and environmental (energy efficiency, paper reduction) aspects during agile IT projects, resulting in more sustainable knowledge acquisition for the company.

As mentioned before using the intended framework, the IT Agile project can gain efficiencies through a sustainable approach from the start. For example, developing a computer programme that reduces left turns on delivery routes outcomes in less fuel waste, less environmental damage, and increased political and social commitment for society. It is estimated that by incorporating new software into the navigation devices of delivery trucks, the savings in truck idling at left turns will save three million gallons of gasoline and thirty-one metric tonnes of carbon emissions annually [55].

Many organisations are reducing their environmental impact by utilising information and communication technology (ICT). WebEx, Go-To-Meetings, SharePoint, High-Definition Video, and other tools enable employees to work remotely [54]. Using ICT to telecommute and create "virtual teams" provides the extra benefit of allowing people to work on a project even if they are not co-located [54].

When the purposed framework is implemented, the conceptual, empirical, formal, and informal elements of knowledge sharing will coalesce with sustainable actions among the team members throughout the IT agile lifecycle naturally, rather than being imposed by top management.

## 6. Conclusion and Limitations

The importance of long-term knowledge sharing in IT projects cannot be mitigated, according to this paper. There was a particular attempt to implement a new schema that facilitate the construction of values towards more sustainable initiatives while collecting, sharing, and disseminating conceptual knowledge inside a business organisation. Furthermore, the framework is intended to support agile practises and assist organisations throughout efficaciously sharing knowledge.

One significant limitation of this research initiative is that the innovative sustainable conceptual framework must be checked by several companies that incorporate agile knowledge sharing strategies into their operations. Managers and organisations can collect and store long-term conceptual knowledge as part of their structure, and it will be identified as a valuable ally through market economies.

A further weak point is that this paper only focused on sustainable knowledge transfer for Agile IT projects, which exists in two directions: business knowledge transfers from customer to consultant and IT technical knowledge transfers from consultant to customer. Another drawback is that the definition of innovation was based on the viewpoints of Fenişer [17] and Rodrigo et al. [12], so other types of agile knowledge transfer or innovation are far beyond the scope of this study and will be left for future investigations.

Finally, this paper proposed a novel approach for collecting and storing long-term conceptual sustainable knowledge in agile IT projects. It is indeed worth noting that the general method evaluation needs to be improved and reinforced in future research.

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