Cultural Problems and Solutions for the Adoption of Agile Methodologies: A Systematic Literature Review

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Abstract: Companies implementing software products are increasingly seeking deliverables within ever-shorter timeframes in order to enhance competitiveness, drive innovation, and better serve the market. In this context, agile methods have become prominent, offering processes that many project managers adopt to accelerate solution delivery while providing step-by-step visibility of progress. These methods are well-received by it technicians as they promote collaborative teamwork and encourage the participation of all team members. However, the enthusiasm of it technicians alone is insufficient for successful implementation. Business areas within companies often lack a clear understanding of support for the adoption of agile methods. Thus, this paper aims to: i) identify organizational challenges and solutions related to the adoption of Agile Methods in IT projects, as reported by scholars; ii) categorize these challenges and solutions and correlate specific challenges to their corresponding solutions; and iii) develop a roadmap for the practical application of agile solutions. To achieve these objectives, the study employed exploratory research and a systematic literature review. As a result, a model was proposed linking identified challenges to appropriate solutions. The primary limitation of this study is the reduced number of articles addressing business-related challenges.

Keywords: Adoption, agile methods, information technology, organizational issues, organizational culture.

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Problemas culturales y soluciones para la adopción de metodologías ágiles: una revisión sistemática de la literatura

Resumen: las empresas que implementan productos de software buscan entregar resultados en plazos más cortos, con el objetivo de incrementar su competitividad, impulsar la innovación y responder de manera más eficiente a las demandas del mercado. En este contexto, las metodologías ágiles han cobrado relevancia al ofrecer procesos que muchos gestores de proyectos adoptan para acelerar la entrega de soluciones, proporcionando al mismo tiempo visibilidad progresiva sobre el avance del proyecto. Estas metodologías suelen ser bien recibidas por el personal técnico en tecnologías de la información (TI), ya que fomentan el trabajo colaborativo e incentivan la participación de todos los miembros del equipo. No obstante, el entusiasmo del personal de TI resulta insuficiente para garantizar una implementación exitosa, debido a que las áreas de negocio, en muchas ocasiones, carecen de una comprensión clara sobre cómo apoyar de manera efectiva la adopción de metodologías ágiles. En este sentido, el presente artículo tiene como objetivos: i) identificar los desafíos organizacionales y las soluciones asociadas a la adopción de metodologías ágiles en proyectos de TI, según lo reportado en la literatura académica; ii) categorizar dichos desafíos y soluciones, correlacionando los retos específicos con sus respectivas respuestas; iii) desarrollar una hoja de ruta para la aplicación práctica de soluciones ágiles. Para alcanzar estos objetivos, se llevó a cabo una investigación exploratoria basada en una revisión sistemática de la literatura. Como resultado, se propone un modelo que vincula los desafíos identificados con soluciones adecuadas. La principal limitación del estudio radica en la escasez de artículos que aborden específicamente los desafíos desde la perspectiva del negocio.

Palabras clave: adopción, metodologías ágiles, tecnología de la información, problemas organizacionales, cultura organizacional.

Problemas culturais e soluções para a adoção de metodologias ágeis: uma revisão sistemática da literatura

Resumo: As empresas que implementam produtos de software estão cada vez mais buscando entregas em prazos cada vez mais curtos, a fim de aumentar a competitividade, impulsionar a inovação e atender melhor o mercado. Nesse contexto, as metodologias ágeis se tornaram proeminentes, oferecendo processos que muitos gerentes de projeto adotam para acelerar a entrega da solução, ao mesmo tempo que fornecem visibilidade progressiva do avanço do projeto. Essas metodologias são bem recebidas pelos técnicos de tecnologia da informação (TI), pois promovem o trabalho em equipe colaborativo e incentivam a participação de todos os membros da equipe. No entanto, o entusiasmo dos técnicos de TI por si só é insuficiente para uma implementação bem-sucedida. As áreas de negócios dentro das empresas muitas vezes carecem de uma compreensão clara sobre como apoiar de maneira eficaz a adoção de metodologias ágeis. Assim, este trabalho tem como objetivos: 1) identificar desafios organizacionais e soluções relacionadas à adoção de metodologias ágeis em projetos de TI, conforme relatado por estudiosos; 2) categorizar esses desafios e soluções e correlacionar desafios específicos com suas soluções correspondentes; e 3) desenvolver um roteiro para a aplicação prática de soluções ágeis. Para atingir esses objetivos, o estudo empregou pesquisa exploratória e revisão sistemática da literatura. Como resultado, foi proposto um modelo que vincula os desafios identificados às soluções adequadas. A principal limitação deste estudo é a escassez de artigos que abordem os desafios sob a perspectiva empresarial.

Palavras-chave: adoção, metodologias ágeis, tecnologia da informação, problemas organizacionais, cultura organizacional.

Introduction

The challenges faced by companies in driving innovation often require projects where the agile method serves as a means to generate products and partial deliveries within timelines that align with business needs. While the it sector generally recognizes the importance of agile methods, this is not always true for business areas. For these methods to be adopted effectively, alignment between it and business sectors is crucial. Therefore, the primary contribution and innovation of this article lie in demonstrating an association between the challenges of adopting agile methods and potential solutions from a management perspective.

The expansion of the Internet has created a need to reduce the delivery time for software-based products, making speed a critical competitive factor. Development methods based on sequential phases no longer suffice in a rapidly changing environment. As a result, companies are increasingly adopting methods that enable concurrent development phases. In this context, agile software development methods have emerged (Boehm & Turner, 2005).

A common effect of implementing agile methods in accounting systems is cost optimization, leading to improved financial results. Notably, accounting serves as a mediator in the implementation of innovations. This process leads to the integration of accounting functions into subsystems such as suppliers, customers, and personnel, and supports the materialization of innovations within the company (Volodymyr *et al.*, 2020).

In this setting, Dybå and Dingsøyr (2008) conducted a systematic literature review (SLR) covering empirical studies on agile methods, finding that Extreme Programming (XP) was the most widely used method, with few exceptions. However, this scenario shifted as interest in Scrum increased (Dingsøyr & Lassenius, 2016), making it the primary adopter of agile methods (VersionOne Inc., 2016).

Market pressures also demand shorter times for releases, making it impractical for some projects to follow the traditional waterfall approach (van der Vyver *et al.*, 2015). Consequently, many large organizations have identified this need as a driving force behind the adoption of agile methods. Nonetheless, despite the apparent benefits, several obstacles remain to be addressed.

According to VersionOne Inc. (2016), challenges arise when employing agile methods, often due to a lack of enthusiasm from business teams compared to it teams. In some cases, resistance from business teams is linked to the lack of precise estimations at the project's outset and the improper allocation of professionals. Gregory *et al.* (2016) investigated these challenges and found that they largely stem from two main factors: organizational structure and company culture. However, these authors noted that further research is needed to understand and address these issues.

A previous SLR aimed to identify the challenges and success factors related to large-scale transformations to Agile approaches but was unable to correlate the challenges directly with success factors (Dikert *et al.*, 2016). Therefore, the process of adopting agile methods is, first and foremost, an organizational management issue; otherwise, it may result in gaps in the method's effectiveness and outcomes. Unlike earlier studies, which merely identified challenges, this research goes further by associating identified problems with potential solutions.

Consequently, the present study aims to address the following research question: What are an organization's problems and solutions and how can they be associated to create a roadmap for adopting agile methods in IT projects? To address this query, the objective of this paper is to develop a roadmap for agile methods by linking organizational problems and solutions in order to facilitate their adoption in IT projects. The key contribution of this research lies in establishing the connection between problems and solutions in the adoption of agile methods using the model proposed by Dikert *et al.* (2016).

After this introduction, the paper is structured as follows: the next section outlines the research methodology, followed by a discussion of the initial findings from the first phase of the SLR. Subsequently, we provide a classification of studies based on the proposal by Dikert *et al.* (2016). This is followed by an analysis of the association between identified problems or challenges and their corresponding solutions. The final two sections present an analysis of the results and the main conclusions of the study, respectively.

Research methodology

This section outlines the method used to achieve the aims of the present study. Considering that a literature review should methodologically analyze and synthesize high-quality literature, provide a solid foundation for the research topic, justify the selection method, and demonstrate that the study's aims contribute new knowledge to the research field (Levy & Ellis, 2006), we opted to perform an SLR.

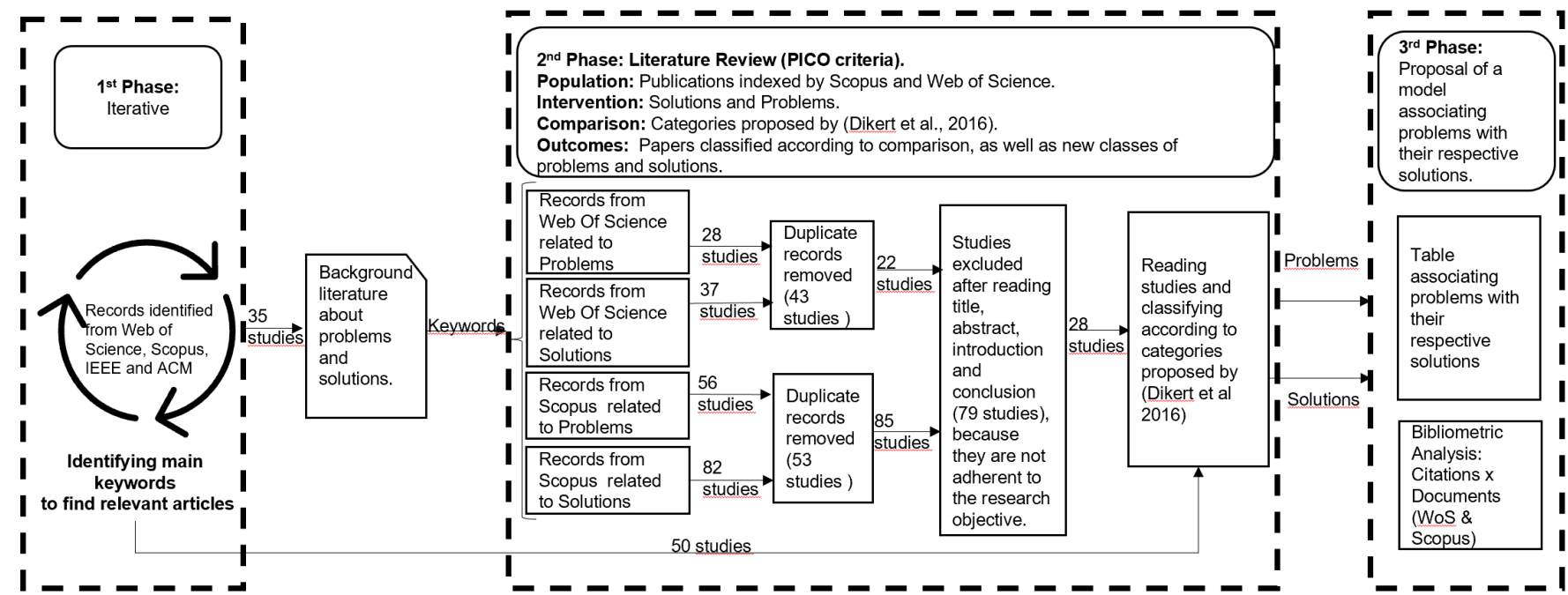As shown in figure 1, the following subsections will detail the three research phases that were conducted.

First phase: Iterative research

To identify literature on organizational problems and challenges related to the adoption of Agile methods, an iterative search was conducted across Web of Science, Scopus, IEEE, and ACM databases using general terms such as "adoption," "agile," "method," "scrum," and "problem." Several articles were retrieved and reviewed. During this process, additional terms emerged that could potentially provide access to a broader range of articles, with a greater focus on our objective. The new terms that surfaced included "method" and "acceptance" in the context of adoption. To specifically highlight issues related to the adoption of agile methods, we included terms such as "lack," "gap," "failure," and "unsuccessful." It is also worth mentioning that the words and their variations added after reading the first articles included "facilitator," "framework," "standard," "organizational," "transformation," and "systematic review."

These searches were conducted iteratively. To further increase the number of articles related to our research question and ensure the accuracy of the review, we expanded our search to include literature comparing traditional and Agile development methods by adding the terms "waterfall versus agile" and "abandonment" and their synonyms. Another search string, designed to identify articles with models and solutions to problems associated with the adoption of Agile methods, followed a similar structure to that used in our search for problems.

The results of this initial phase are presented in the subsections devoted to describing the identified *Problems and Solutions* (which will come some pages below). These results were also integrated with the papers identified during the second research phase to be classified according to Dikert *et al.* (2016). It is important to note that this iterative research process was conducted multiple times, with some publications leading to the discovery of additional articles and new search keywords.

Figure 1. Research methodology.

1st Phase: Iterative

Records identified from Web of Science, Scopus, IEEE and ACM

35 studies

Identifying main keywords to find relevant articles

Background literature about problems and solutions.

Keywords

2nd Phase: Literature Review (PICO criteria).
Population: Publications indexed by Scopus and Web of Science.
Intervention: Solutions and Problems.
Comparison: Categories proposed by (Dikert et al., 2016).
Outcomes: Papers classified according to comparison, as well as new classes of problems and solutions.

Records from Web Of Science related to Problems

28 studies

Records from Web Of Science related to Solutions

37 studies

Duplicate records removed (43 studies)

22 studies

Records from Scopus related to Problems

56 studies

Records from Scopus related to Solutions

82 studies

Duplicate records removed (53 studies)

85 studies

Studies excluded after reading title, abstract, introduction and conclusion (79 studies), because they are not adherent to the research objective.

28 studies

Reading studies and classifying according to categories proposed by (Dikert et al 2016)

Problems

Solutions

50 studies

3rd Phase: Proposal of a model associating problems with their respective solutions.

Table associating problems with their respective solutions

Bibliometric Analysis: Citations x Documents (WoS & Scopus)

Source: authors.

Second phase: Literature review

After the first phase, and based on the results obtained, a series of new keywords were identified and included, such as "acceptance," "framework," "abandonment," "organization,"* "non-technical," "lack," and "gap." In addition to these new terms, synonyms identified using the *Thesaurus - Synonyms, Antonyms, and Related Words* (n.d.) and relevant to the subject matter were also included.

To expand the research, we conducted an SLR following Biolchini *et al.* (2005) protocol, as described in table 1, using the P.I.C.O. criteria: i) Population, which refers to the organizations that implemented agile methodologies; ii) Intervention, that address the organizational and not technical aspects that influence the adoption of agile methodologies; iii) Control, that is, the collection of problems and solutions; and iv) Outcome, which is the association between problems and solutions to be a roadmap.

Table 1. Search criteria.

Population	Organizations that adopted agile methodologies in software development	
	Organizational aspects	cultural or human or non-technical or organi*ation* or commitment or engagement or support or alignment
	Problems	issue or problem or challenges or gap or lack or failure or abandonment or unsuccessful or barrier or obstacle or impediment or shortfall or insufficiency
	Solutions	framework or structure or scheme or model or solution or enable or pattern or method*
Intervention	Adoption	adopt* or approv* or endorse* or implement* or acceptance or operationali*ation
	Agile methods	scrum or agile
	Information technology	"information technology"
	Software Development	"software development"
Control	Categories proposed by Dikert *et al.* (2016) along with papers found in the first phase	
Outcome	Papers are classified according to comparison, as well as new classes of problems and solutions	

Note. The * symbol was used to obtain variations of a term, e.g., organization OR organizations OR organisation OR organizations; method OR methods OR methodology OR methodologies; adopt OR adopts OR adopted OR adopting OR adoption; approve OR approve OR approved OR approving OR approval; endorse OR endorses OR endorsed OR endorsing

OR endorsement; implement OR implements OR implemented OR implementing OR implementation; operationalization OR operationalisation

Source: authors.

After excluding duplicate studies and those not related to the research topic, the remaining articles were categorized following the framework proposed by Dikert *et al.* (2016), who coded primary studies according to their research questions using the approach by Cruzes and Dybå (2011). This framework established five code families: reasons for change, transformation process, challenges, success factors, and contextual factors. The papers processed in this step are discussed later in the section *Classification of selected papers*.

Third phase: Proposal of a model

After classifying the papers, as shown in appendix 1 and table 6, we developed a model that associates the identified problems or challenges with corresponding solutions. The criterion for making these associations was that the descriptions in the articles addressed solutions specifically tailored to the types of problems they aimed to solve. In some cases, we observed that a single solution could address multiple problems mentioned in articles categorized under solutions. After thoroughly reviewing each of the selected articles retrieved during the three research phases, we aimed to align the themes with the established classification (Dikert *et al.*, 2016).

Problems were classified and numbered as P-number, while solutions as S-number. For example, item P13, "*The role of the Product Owner is in conflict with that of Project Management*" (Nuottila *et al.*, 2016a), was related to "*the new role of middle managers is unclear*" (Dikert *et al.*, 2016), since this topic involves the introduction of new functions, such as Scrum Master, which creates a conflict of interest between the Scrum Master functions and Project Management. In this case, three items were indicated as a solution for P13: S03 "*Leadership*," S09 "*Mindset and Alignment*," and S10 "*Team Autonomy*."

In case a topic was not previously listed according to Dikert *et al.* (2016), a new classification was created and coded as np-number, such as items NP01 "*Outsourcing and offshoring*" (van der Vyver *et al.*, 2015) and NP03 "*Problems in contracting for Agile Development*" (Chang *et al.*, 2016). A similar approach was employed when a new item indicated as a new solution (ns) to the referred problem was found, as with item NS03 "*Agile Outsourcing success Factors*" (Chang *et al.*, 2016).

Bibliometric analysis of authors, journals, and countries

Using data from the Web of Science and Scopus, processed through vosViewer software, tables 2 and 3 below provide an overview of the most influential authors on the subject in each of these databases. In addition to the most frequently cited authors, table 4 lists the most significant journals where the cited articles were published and table 5 the countries of origin of these journals.

Table 2. Most cited authors in the Web of Science (WoS).

Authors	Citations
dyba (2008)	1149
dikert (2016)	328
hoda (2011)	121
cao (2009)	115
iivari (2011)	103
conboy (2011)	96
cohn (2003)	89
paasivaara (2014)	76
paasivaara (2018)	59
gregory (2016a)	55
bass (2015)	47
gandomani (2015)	45
gandomani (2016)	37
heikkila (2017)	34
jovanovic (2017)	32
azanha (2017)	30
papatheocharous (2014)	24
tessem (2017)	7
cram (2019)	6
fourie (2017)	1
dyba (2008)	1149
hoda (2011)	121
gandomani (2016)	37
gandomani (2015)	45
cao (2009)	115
iivari (2011)	103
gregory (2016a)	55
jovanovic (2017)	32
cohn (2003)	89
dikert (2016)	328
conboy (2011)	96
cram (2019)	6
paasivaara (2014)	76
heikkila (2017)	34
fourie (2017)	1
bass (2015)	47
azanha (2017)	30

Authors	Citations
papatheocharous (2014)	24
tessem (2017)	7
paasivaara (2018)	59

Source: authors, using vosViewer.

Table 3. Most cited authors in Scopus.

Authors	Citations
levy y.; ellis t.j. (2006)	928
boehm b.; turner r. (2005)	384
misra s.c.; kumar v.; kumar u. (2009)	229
sidky a.; arthur j.; bohner s. (2007)	134
moe n.b.; aurum a; dybåt. (2012)	118
fruhling a.; de vreede g.-j. (2006)	98
mahanti a. (2006)	60
gandomani t.j.; zulzalil h.; ghani a.a.a.; sultan a.b.m.;.	55
nuottila j; aaltonen k; kujala j. (2016)	52
schlosser f.; wagner h.-t.; coltman t. (2012)	34
hajjdiab h.; taleb a.s.; ali j. (2012)	26
qumer a; henderson-sellers b.; mcbride t. (2007)	21
prochazka j.; kokott m.; chmelar m.; krchnak j. (2011) denning s. (2019)	9
denning s.(2019)	9
carew p.j: glynn d. (2017)	8
abdalhamid s.; mishra a. (2017)	6
louis v.w.; carl m. (2016)	5
chaipraserth r; leelasantitham a; kiattisins. (2013)	1
gandomani t.j.; zulzalil h.; nafchi m.z. (2015)	1
fransisca d.; raharjo t.; hardian b.; suhanto a. (2023)	0

Source: authors, using vosViewer.

Table 4. Main journals cited in this article.

This section presents conclusions and findings as well as contributions to the specific disciplinary field of this article.
ieee Software
Information and Software Technology
Information Systems Management
Informing Science
Innovations in Systems and Software Engineering

This section presents conclusions and findings as well as contributions to the specific disciplinary field of this article.
International Journal of Human Capital and Information Technology Professionals
International Journal of Information Systems and Project Management
International Journal of Information Technology Project Management
International Journal of Managing Projects in Business
International Journal of Quality & Reliability Management
Journal of Computer Science
Journal of Computing and Information Technology
Journal of Enterprise Information Management
Journal of Human Behavior in the Social Environment
Journal Of Management Information Systems
Journal Of Organizational Change Management
Journal Of Software
Journal Of Software-Evolution and Process
Journal Of Systems and Software
Journal Of Systems and Software

Source: authors.

Table 5. Countries of origin of the referred journals.

Country	Total
USA	14
Finland	10
India	5
Norway	4
Australia	3
Brazil	3
Iran	3
Indonesia	3
Malaysia	2
Pakistan	2
Germany	2
Canada	1
Cyprus	1
England	1

Source: authors.

Background

In this section, we present the Systematic Literature Review basis for the organizational culture, as well as the problems, solutions, and frameworks related to the adoption of agile methods identified in the first research phase.

Agile methods

This subsection presents a brief description of the most commonly used approaches of agile methods, according to information retrieved from the Project Management Institute (PMI, 2017).

Scrum

Scrum is a framework for managing product development within a single team. This framework utilizes an iterative process to deliver a functional product and comprises several key components: Scrum roles (product owner, development team, and Scrum master), events (Sprint, Sprint planning, Daily Scrum, Sprint Review, and Sprint Retrospective), artifacts (Product Backlog, Sprint Backlog, and Increments), and rules. During each sprint, which is conducted within timeboxes of one month or less, a potentially releasable increment of the product is produced.

eXtreme Programming

eXtreme Programming (XP) is a programming approach that emphasizes teamwork, continuous feedback, and adaptability. It prioritizes small, regular releases to enhance customer satisfaction while encouraging practices such as pair programming and knowledge sharing. Developers are advised to implement unit tests for their code, maintain simple designs, and perform refactoring. Software quality is ensured through continuous integration and automated testing. Regular communication with stakeholders facilitates the rewriting of requirements and iteratively improves the development process. XP fosters a responsive and adaptable environment that encourages collaboration and effective software delivery.

Kanban Method

The Kanban Method is a software development approach derived from the automotive industry that utilizes a visual representation of workflow through a board featuring distinct columns corresponding to various stages of work. In this system, tasks are represented as cards that move across the board. As team members take on additional responsibilities, they can also acquire new tasks. The primary objective is to optimize efficiency by implementing a strategy that limits the amount of work in progress while promoting the consistent and uninterrupted delivery of products or services. The adoption of the Kanban methodology enables teams to swiftly adapt to changes, streamline workflow, and enhance overall efficiency.

Crystal

Crystal is a family of methodologies designed to scale and provide varying levels of methodological rigor based on project size (the number of individuals involved) and project criticality. The Crystal Methodology recognizes that each project may require a tailored set of policies, methods, and processes to address its specific needs. The techniques within this family utilize different colors to

indicate "weight," guiding the selection of the appropriate methodology to adopt. The term "Crystal" is derived from the gemstone, where the multiple "faces" symbolize the underlying fundamental beliefs and principles.

Scrumban

This is an agile approach that transitions from Scrum to Kanban, using Scrum as a framework while employing Kanban for process improvement. It organizes work into small sprints and utilizes Kanban boards for visualization, managing workflow through work-in-progress limits. Daily meetings foster collaboration and address any impediments. Scrumban does not prescribe predefined roles, allowing teams to retain their existing roles while adopting this methodology.

Feature-driven development

Feature-driven development (FDD) is an agile methodology for software development that emphasizes the incremental and iterative delivery of features. It focuses on identifying and prioritizing customer-oriented features. FDD consists of five key processes: developing an overarching model, generating a comprehensive list of features, planning based on these features, designing with features in mind, and building the software accordingly. Throughout the development lifecycle, FDD fosters collaboration, productivity, and adaptability.

Dynamic Systems Development Method

The Dynamic Systems Development Method (DSDM) is an agile project delivery framework developed in the 1990s to introduce greater rigor to the iterative methods popular at that time. DSDM was established through a non-profit collaboration among industry executives and is particularly recognized for its emphasis on constrained delivery. The framework initially defines constraints related to cost, quality, and time, and then employs formalized scope prioritization to ensure these requirements are met.

Agile Unified Process

The Agile Unified Process is derived from the Unified Process (UP). Compared to its predecessor, the Agile Unified Process features faster cycles and simplified procedures. It aims for more iterative cycles across seven core disciplines, incorporating corresponding feedback before formal delivery.

Organizational culture

Organizational culture plays a crucial role in determining key outcomes like commitment, satisfaction, leadership effectiveness, and overall performance. It is recognized as a fundamental factor that shapes individuals' attitudes and behaviors, aligning them with organizational values and

facilitating significant support for transformational leadership (Khan *et al.*, 2021; Schneider *et al.*, 2013). Transformational leadership is essential for achieving organizational excellence, as noted by Lasrado and Kassem (2021). The Project Management Institute (PMI, 2021) outlines eight steps for effective change leadership: establishing a sense of urgency, building a powerful coalition, creating a vision for change, communicating that vision, removing obstacles, generating short-term wins, developing the change, and anchoring it within the corporate culture. This approach to leadership is intrinsically linked to the innovation process. Wu *et al.* (2019) confirm this relationship, highlighting the impact of organizational culture and operations strategy on innovation while underscoring the importance of cultural satisfaction in enhancing employees' referral intentions (Seo & Lee, 2021).

The combination of organizational culture and intrinsic motivation, particularly through the practice of informal controls, can significantly enhance employees' affective commitment (Gheitani *et al.*, 2019; Kaveski & Beuren, 2022; Kleine & Weißenberger, 2014). Hence, understanding the concept of organizational culture is fundamental to identifying the challenges and solutions associated with the adoption of agile methodologies. This understanding provides a foundation for linking specific problems to proposed solutions, thereby facilitating more effective implementation of agile practices.

Problems

The alignment of the it and business sectors is based on three fundamental dimensions: human, social, and intellectual. The human dimension encompasses the knowledge necessary for implementing these methods, while the social dimension focuses on the processes that facilitate collaboration between it and business areas. The intellectual dimension involves aligning goals, infrastructure, it architecture, and other essential components. This study will concentrate on the factors associated with the social dimension (Schlosser *et al.*, 2011).

Over the past two decades, numerous studies have examined the relationship between it and business sectors, revealing that organizations encounter various challenges and gaps that must be addressed to implement it projects effectively (Alaceva & Rusu, 2015; Luftman & Brier, 1999; Qumer *et al.*, 2007). In the context of employing agile methods, misalignments between it and business areas manifest in several key issues, such as lack of communication (Javdani Gandomani & Ziaei Nafchi, 2016; Jovanović *et al.*, 2017), conflict of methods (Hajjdiab & Al Shaima, 2011; Jovanović *et al.*, 2017), cultural issues (Javdani Gandomani & Ziaei Nafchi, 2016; Schwaber, 2007), the role of the product owner (po) (Eloranta *et al.*, 2013; Hoda *et al.*, 2011; Jovanović *et al.*, 2017; Lopez-Martinez *et al.*, 2016; Siddique & Hussein, 2016; Sousa *et al.*, 2016); and the transition of managerial roles (Jovanović *et al.*, 2017; Lopez-Martinez *et al.*, 2016).

Solutions

In response to the aforementioned challenges, various studies have proposed solutions and models for the effective adoption of agile methods. The role of the po is particularly critical in this process, as they are responsible for prioritizing project requirements. Therefore, the po must possess a

solid understanding of the business and act as an intermediary and communicator among project members (Bass, 2014).

Unger-Windeler *et al.* (2020) conducted a systematic mapping that underscores the importance of the PO's communication function, based on data from a case study in the oil and gas industry. Their findings reveal that the PO spends 65% of their time in meetings aimed at synchronizing and aligning the work of PO's, resolving team-related issues, and facilitating the agile process. During these meetings, the PO interacts with 15 different functions, highlighting their significance in the effective adoption of agile methodologies.

Additionally, Qumer *et al.* (2007) and Javdani Gandomani and Ziaei Nafchi (2015) proposed a framework that identifies critical factors for transitioning to Agile methods. They emphasize the importance of training, coaching, mentoring, and fostering engagement between management and personnel to reduce resistance to the change in development methods. Other facilitating factors include adequate staffing, team empowerment, ongoing meetings, negotiations, and incentives (Javdani Gandomani & Ziaei Nafchi, 2015; Javdani Gandomani *et al.*, 2014).

On their part, Conboy *et al.* (2011) suggest that small, frequent, and interactive training modules can provide developers with valuable business insights. Moreover, recruiting employees and graduates with a blend of IT and business knowledge is crucial, as this combination enhances the adoption of Agile practices.

Reflecting on the lessons learned from four years of Scrum implementation across seven organizations, Cohn and Ford (2003) note that one of the significant challenges in implementing Scrum is persuading top management not to adhere strictly to deadlines. They argue that delivering projects on time and within budget often relies on a combination of luck and inflated estimates. In organizations with a history of inaccurate project estimates, it may be easier to convince senior management that an Agile process is a viable alternative. Conversely, in organizations that consistently meet project deadlines and budgets, management must be persuaded that Agile practices could lead to faster delivery with fewer resources.

Organizational and management spheres can significantly benefit from Communities of Practice (CoP), as highlighted by Paasivaara and Lassenius (2014). These organized groups share a common interest in specific technical or business sectors, collaborating to facilitate organizational change, provide support, bridge knowledge gaps, and advance the company's overall knowledge.

Iivari and Iivari (2011) employed the Competing Values Framework (CVF) to analyze the relationship between organizational culture and the adoption of agile methods. Their findings indicate that agile methods are ill-suited for hierarchical cultures that prioritize control, stability, and adherence to regulations, while they thrive in organizations that embrace agile values.

Moreover, Hovorka and Larsen (2006) examined the processes and characteristics within networks of relationships, finding that individuals' actions and communication within these networks significantly influence the decision to adopt new practices, such as agile methods. Additionally, Boehm and Turner (2005) suggest that understanding communication dynamics within development teams, educating stakeholders, translating agile and software-related issues into management and client

language, emphasizing value, selecting skilled professionals, rewarding pilot project outcomes, reorganizing reward systems, and recognizing individual contributions can address challenges associated with agile processes.

On an additional note, the capacity to absorb knowledge encompasses the routines and strategic processes by which organizations acquire, assimilate, transform, and exploit knowledge to create value. This capacity's dynamic nature is focused on strategic changes that enable companies to create and leverage new knowledge (Zahra & George, 2002).

Cao *et al.* (2009) proposed a framework for adapting XP to meet the needs of various projects and organizational environments. They addressed the challenge of inadequate initial project estimates by recommending that companies make assumptions about project requirements during the planning phase. Furthermore, they emphasize that management should be prepared to re-evaluate project costs and benefits when significant changes arise during development.

In addition, Sidky *et al.* (2007) introduced a four-stage model to assist companies in determining: i) their willingness to adopt agility; ii) the practices to be adopted; iii) potential difficulties that may emerge; and iv) necessary actions for successful adoption. Finally, authors such as Gangwar *et al.* (2015) advocate for utilizing the Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE) framework to address organizational prerequisites for adopting new technologies.

Having outlined the theoretical background regarding the problems, solutions, and frameworks related to the adoption of agile methods, the following section will discuss the research methodology employed to address our research question.

Classification of selected papers

As stated in the section *Second Phase: Literature Review*, pages above, the articles identified during this stage of the research along with those resulting from the first phase of the literature review (i.e., iterative research) were framed according to the classification proposed by Dikert *et al.* (2016).

The classification of papers was conducted in two phases, resulting in the identification of three new categories of problems and solutions related to adopting agile methods. This section is divided into two subsections. The first subsection, *Problems and challenges*, outlines the issues and challenges identified (denoted by 'P'), along with newly identified problems and challenges (denoted by 'NP'). The second subsection, *Success factors and solutions*, details the solutions and critical success factors using the same notation, that is, 'S' for categories under Dikert *et al.* (2016) and 'NS' for newly identified solutions.

Problems and challenges

This subsection presents the organizational problems associated with adopting agile methods. It is important to note that the following problems and challenges are organized according to the categorization outlined by Dikert *et al.* (2016). In addition to Dikert's categories, this research identified and incorporated several new problems.

Table 6. Problems

	Skepticism towards the new way of working
P01	Professionals' reluctance to shift from traditional cascade to interactive, incremental processes reflects their fear toward change. Additionally, certain R&D teams try to gain support against agile methods because of their negative perception (Abdalhamid & Mishra, 2017; Mahanti, 2006; Nuottila *et al.*, 2016; Papatheocharous & Andreou, 2014; Salleh *et al.*, 2014; van der Vyver *et al.*, 2015).
P02	Management unwilling to change
	Factors such as lack of support, sponsorship and official support from management can discourage people from adopting agile methods (Abdalhamid & Mishra, 2017; Carew & Glynn, 2017; Hajjdiab *et al.*, 2012; Jovanović *et al.*, 2017; Papatheocharous & Andreou, 2014; Vatan *et al.*, 2022).
P03	Lack of training
	Contributing factors in the unsuccessful transition to Agile Methods are insufficient and inadequate personal preparation and incompetent project management (Abdalhamid & Mishra, 2017; Azanha *et al.*, 2017; Hajjdiab *et al.*, 2012; Mahanti, 2006; Nuottila *et al.*, 2016; Ozkan, 2016; Papatheocharous & Andreou, 2014.).
P04	Too high workload
	Daily Scrum meetings can add extra weight to team schedules and commitments (Hajjdiab *et al.*, 2012; Salleh *et al.*, 2014).
P05	Old commitments kept
	Team culture, environment, and atmosphere are critical to agile processes and are often ignored (van der Vyver *et al.*, 2015).
P06	Misunderstanding Agile concepts
	po does not always assume his role correctly and often does not have high technical and business knowledge (Eloranta *et al.*, 2013; Heikkilä *et al.*, 2017; Javdani Gandomani & Ziaei Nafchi, 2016; Lopez-Martinez *et al.*, 2016; Siddique & Hussein, 2016; Sousa *et al.*, 2016).
P07	Agile customized poorly
	Observed agile anti-patterns that impact development team productivity, effectiveness, and workflow (Hajjdiab *et al.*, 2012).
P08	Reverting to the old way of working
	Need for tremendous effort to emphasize the iterative and evolutionary nature of agile methods (Azanha *et al.*, 2017).
P09	Excessive enthusiasm
	This factor creates zealous teams that want to adopt agile methods as quickly as possible (Hajjdiab *et al.*, 2012).
P10	Autonomous team model challenging

The change in the profile of the development team from specialist to cross-functional is a coordination problem. Another barrier is the lack of a process that allows staff to store and retrieve information easily (Moe *et al.*, 2012; Suryaatmaja *et al.*, 2020).

	Global distribution challenges
P11	Collaboration and communication between resources within an agile team, with other agile teams, with the business and with the customer inhibit global distribution (Fourie & de Vries, 2017; Shrivastava & Rathod, 2015).
	Interpretation of agile differs between teams
P12	Difficulty in understanding the additional responsibilities that teams have (Heikkilä *et al.*, 2017).
	Middle managers' role in Agile unclear
P13	If there is a conflict between the role of the po and that of the Project Manager, the transition to Agile will be inhibited (Nuottila *et al.*, 2016).
	Management in waterfall mode
P14	There is strong external pressure to follow the waterfall model and resistance to change is higher in waterfall organizations (Papatheocharous & Andreou, 2014; van der Vyver *et al.*, 2015).
	Keeping the old bureaucracy
P15	Documentation requirements are essentially derived from the governance system, top management, iso certificate requirements, and traditional development methods that reflect traditional organizational culture (Abdalhamid & Mishra, 2017; Hajjdiab *et al.*, 2012; van der Vyver *et al.*, 2015).
	Internal silos kept
P16	There are three main obstacles to the adoption of agile methods: the retention of people who do not have the required skills, team members who do not contribute to product development, and clients who are not committed to agile processes (van der Vyver *et al.*, 2015).
	High-level requirements management largely missing in agile
P17	It is important that the po encourages more interaction and collaboration to understand the business requirements, create clear and high-quality requirements and achieve a productive working process (Suryaatmaja *et al.*, 2020).
	Creating and estimating user stories hard
P18	Poor requirements engineering, lack of traceability and poor requirements implementation make requirements estimation and extraction difficult (Fourie & de Vries, 2017).
	Gap between long and short-term planning
P19	The development team is under pressure to produce unrealistic plans, and detailed plans are a lot of work and are often demanded by stakeholders (Heikkilä *et al.*, 2017).
	Quality assurance challenge
P20	Solving quality problems requires quality assurance from the start, testing happening in parallel with development and the involvement of all cross-functional teams during testing (Agarwal *et al.*, 2014).
P21	Integrating non-development functions

	The introduction of agile methods with the late involvement of non-it areas has an impact on the organization. The Scrum method takes more time, and this is only realized after several Sprints (Abdalhamid & Mishra, 2017; Cao *et al.*, 2009; Cohn & Ford, 2003; Hajjdiab & Al Shaima, 2011; Nuottila *et al.*, 2016).
	Other functions unwilling to change
P22	Another challenge in adopting agile methods is the alignment between the po (business) and the development team (it). For the development team, the po cannot prioritize the generically described features. For the po, the development team does not have the technical competence to transform the described functionality into functional software (Moe *et al.*, 2012).
	Challenges in adjusting to the incremental delivery pace
P23	Agile software development projects typically lack an initial commitment to scope, cost and schedule, and unrealistic predictions about the pace of development have also been cited in the literature (Cao *et al.*, 2013, van der Vyver *et al.*, 2015).
	Rewarding model not team working centric:
P24	To reap all the benefits of becoming agile, the organization needs to be aligned and consider rewarding team performance to avoid people working against the adoption of agile (Alaceva & Rusu, 2015; Luftman & Brier, 1999).

Source: authors.

In addition to the categories proposed by Dikert *et al.* (2016), we also identified the three additional problems that are described in table 7.

Table 7. Additional problems

NP1	Outsourcing and offshoring
	The relationship is contractual. Lack of communication, control, distance and agility are situations that cannot realistically be met (van der Vyver *et al.*, 2015).
NP2	Risk of projects
	Projects that have a high level of risk or where the understanding and measurement of risk is critical (van der Vyver *et al.*, 2015).
	High-risk projects or projects where it is essential to understand and measure the risks involved (van der Vyver *et al.*, 2015.
NP3	Problems in contracting for agile development
	Long projects have become a major obstacle to agile contracting because not all requirements are detailed. Agile contracting should be designed to support short and small releases of the deliverable as required by the it team (Chang *et al.*, 2016).

Source: authors, using vosViewer.

Success factors and solutions

In this subsection, we present solutions related to the problems outlined in the previous one. These solutions, associated with the adoption of agile methods, include those identified by Dikert's categorization, along with additional solutions discovered through this research, as detailed in table 8.

Table 8. Solutions.

	Management support
S01	The key to adopting agile methods is to have management support inside and outside it, receive support from stakeholders, and communities of practice and use project management practices (Ghani & Bello, 2015; Eilers *et al.*, 2022; Fransisca *et al.*, 2023; Hajjdiab *et al.*, 2012; Louis & Carl, 2016; Paasivaara & Lassenius, 2014; van der Vyver *et al.*, 2015).
	Commitment to change
S02	Migrating to Agile methods is not always easy and requires commitment from all stakeholders. The implementation of agile methods "top-down" can be problematic but not impossible and it is important to emphasize that the implementation in part of the organization e inherently unstable (Denning, 2019; Fransisca *et al.*, 2023; Hidayati *et al.*, 2021; van der Vyver *et al.*, 2015).
	Leadership
S03	It is important to recognize that during the transition it is difficult to get everyone to change their mindset overnight. Creating a leadership team with an agile mindset is essential for the success of the agile method. This includes having a key stakeholder who is a strong advocate for the project (Almeida & Simões, 2019; Baker & Thomas, 2007; Fruhling & De Vreede, 2006; Paasivaara *et al.*, 2018).
	Choosing and customizing the Agile approach:
S04	Frameworks can be chosen to support the transition to Agile Methods, such as Agile Deployment Framework, Agile Adoption Framework or the Soft Systems Methodology proposed by many authors (Bianchi *et al.*, 2021; Hassan *et al.*, 2021; Pikkarainen *et al.*, 2005; Sidky *et al.*, 2007; Suryaatmaja *et al.*, 2020).
	Piloting
S05	The importance of pilot projects in the success of agile adoption has been pointed out previously by Hajjdiab *et al.* (2012). Moreover, Mahanti (2006) stated that starting with pilot projects helps transition to agile methods.
	Training and coach
S06	The transition to the Agile method is important to be done with training and coaching. Formal training should be replaced by orientation and continuous learning using mentors and discussions appear to facilitate the transition process (Almeida & Simões, 2019; Conboy *et al.*, 2011; Francisca *et al.*, 2023; Javdani Gandomani *et al.*, 2014; Javdani Gandomani & Ziaei Nafchi, 2015; Misra *et al.*, 2009; Paasivaara *et al.*, 2018; Schwaber, 2007; Spagnoletti *et al.*, 2022).
	Engaging people
S07	The solution proposed in S06 can also be used to actively engage people. Another way to engage with the community is to monitor the memes that are introduced. This involves staying in touch with the leaders, understanding their situation, and learning to recognize which memes survive (Baker & Thomas, 2007; Fransisca *et al.*, 2023).
	Communication and transparency
S08	Communication and transparency in the company are some of the most important points when implementing new methods, as recommended by various authors in the literature (Cram, 2019; Hovorka & Larsen, 2006; Iivari & Iivari, 2011; Mahanti, 2006; Misra *et al.*, 2009; Moløkken-østvold & Furulund, 2007; Spagnoletti *et al.*, 2022; Tessem, 2017; Zahra & George, 2002).
S09	Mindset and alignment

Transitioning an organization to agile requires a change in mindset, and it has to be all or nothing. The key to a successful transition is a change in mindset and a complete transformation with the right combination of people with strong analytical and technical skills in a supportive culture, along with confidence and interpersonal skills (Denning, 2019; Dybå & Dingsøyr, 2008; van der Vyver *et al.*, 2015).

Team autonomy

S10 | Autonomy and collaboration are essential to the use of agile methods. Autonomy can be promoted through plans and quality control that are prepared and monitored internally by the team. Team empowerment can facilitate the process of agile adoption by giving responsibility to agile teams and making them multifunctional, from the initial plans to product implementation (Francica *et al.*, 2023; Javdani Gandomani *et al.*, 2014; Misra *et al.*, 2009).

Requirements management

S11 | Requirements management is critical to software development. The effective use of user stories promotes agile practices, discourages old methods, and encourages collaboration and customer engagement. Learning to refine requirements and recognizing the role of the po are also emphasized in the literature (Azanha *et al.*, 2017; Bass, 2014; Mahanti, 2006; Misra *et al.*, 2009; Unger-Windeler *et al.*, 2020).

Source: authors.

In addition to the categories proposed by Dikert *et al.* (2016), our research has revealed additional solutions to agile development problems discussed in the previous subsection, which are described in table 9 below.

Table 9. Countries of origin of the referred journals.

Quality assurance challenges

NS1 | In software development, time constraints often undermine testing and affect code quality. However, this varies depending on the nature of the project. For example, biomedical software requires close collaboration between biologists and engineers to ensure accurate use of technical terms (Chaipraserth *et al.*, 2013; Kane *et al.*, 2006; Fransisca *et al.*, 2023; Spagnoletti *et al.*, 2022).

Agile innovation management

NS2 | In the context of introducing digital innovation to the u.s. government and circumventing the problems of the waterfall model, "agile innovation management" has been proposed. This term encompasses project management, software development processes, modified procurement methodologies (it acquisition policies), and personnel policies and organizational strategies. These adaptations facilitate innovative digital service delivery in government. It is also important to note that several large organizations have used R&D for specific projects, which is fertile ground for agile methods (Mergel, 2016; van der Vyver *et al.*, 2015).

Agile outsourcing success factors:

NS3 | Agile outsourcing success factors include frequently releasing small software releases to users; embracing change; establishing partnerships between requirements, acquisition, and contractors; relying on small, empowered teams for exceptional results; and leveraging a portfolio structure (Chang *et al.*, 2016).

Source: authors.

Associating problems or challenges with the solutions

After categorizing the papers, we associated each problem or challenge with its corresponding solution. A consolidated view of these associations is presented in table 10, where the rows represent challenges and problems, and the columns represent solutions and models. The intersections indicate which problems can be addressed by specific solutions. The criterion for this association was based on the alignment between the articles' descriptions of solutions and the specific types of problems they aim to address, as outlined in the section *Third phase: Proposal of a model*, which can be found pages above.

Table 10. Consolidated view: Problems and challenges in the adoption of agile methods (*).

Challenges and problems		S01	S02	S03	S04	S06	S08	S09	S10	S11	NS01	Coverage
	P01	X	X				X		X			Y
	P02		X				X					
	P03	X				X						Y
	P06				X	X		X				Y
	P07				X							Y
	P08				X							Y
	P09				X							Y
	P10	X		X					X			Y
	P12				X							Y
	P15		X	X				X	X			Y
	P16		X									Y
	P20				X					X	X	Y
	P21			X			X	X				Y
	P22			X			X	X				Y

*This table consolidates the association between problems and solutions. It is important to note that this table only displays those problems and solutions with three or more citations.
Source: authors.

Results analysis

This section presents conclusions and findings as well as contributions to the specific disciplinary field of this article. It also identifies the primary limitations of the study and suggests future research directions derived from this work.

After associating solutions with their respective classes of problems, each problem category is covered by at least one model or solution. Additionally, new classes emerged, specifically issues related to agile outsourcing and risk management, as well as solutions focused on quality and agile innovation management, which were not identified in Dikert *et al.* (2016).

An analysis of the challenges and issues column reveals that the majority of references relate to skepticism toward new working methods, resistance to change and adherence to old bureaucratic practices, lack of training, misunderstandings about agile concepts, challenges with the autonomous team model, and difficulties in integrating agile teams with other functions. These factors heavily contribute to the limited effectiveness in adopting agile methods.

Conversely, in the solutions column, the majority of references highlight management support, leadership, training and coaching approaches, communication and transparency, mindset alignment, team autonomy, requirements management, and quality assurance. Leadership, training and coaching, along with mindset alignment, emerge as the most critical success factors for overcoming the challenges in agile adoption, as they address the widest range of problem categories.

Our research indicates that organizational issues significantly hinder agile method adoption, making it essential to address these barriers for successful implementation. Resolving these organizational challenges is crucial for the effective application of agile methods. Addressing these barriers with attention to organizational aspects is essential, and the key factors for successfully implementing agile methods are summarized in table 11.

Table 11. Roadmap to successful agile implementation.

Dimension	Solution	Description
Attitude	S01	Management support
	S02	Commitment to change
Behavior	S03	Leadership
	S07	Engaging people
	S08	Communication and transparency
	S09	Mindset and alignment
Method	S04	Choosing and customizing the agile approach
	S05	Pilot projects
	S10	Team autonomy
	S11	Requirements management
	S12	Quality assurance challenges

Dimension	Solution	Description
	S13	Agile innovation management
	S14	Agile outsourcing success factors
Training	S06	Training and coaching

Source: authors.

This research addressed the question: *What are the organizational problems, solutions, and their associations in developing a roadmap for adopting Agile methods in it projects?* Conducted in three phases, the study identified organizational challenges and solutions for adopting Agile methods in it projects.

The *Research methodology* section introduced figure 1, which outlines the research process, along with the most significant foundational authors, countries, and journals cited, as detailed in tables 2, 3, 4, and 5. The first phase's findings informed the keyword selection for the second phase (SLR) and provided essential background literature. Results from the second phase, where studies were categorized as problems or solutions, served as inputs for the third phase. In this final phase, papers were further classified according to the framework proposed by Dikert *et al.* (2016), establishing the foundation for a proposed model in which problems are mapped to specific solutions.

The primary academic contributions of this study include the identification of three new categories each for both problems and solutions, the association of problems with their respective solutions, and an update to Dikert *et al.* (2016) proposal. For industry, the principal contribution lies in the proposed model, depicted in the roadmap for successful agile implementation (table 11), which provides a practical framework for addressing organizational challenges when adopting agile in it projects.

A potential next step for this research is to validate the model with a survey of companies that have implemented agile methods in it projects, assessing specific organizational problems and solutions. The main limitation of this study is the relatively low number of articles focused on organizational aspects compared to those addressing technical issues.

The analysis of articles with fewer than three references, listed in appendix 1, identified the following organizational challenges as gaps in the literature: excessive workload (PO4), the maintenance of outdated commitments (PO5), issues with outsourcing and offshoring (NPO1), and challenges in contracting for agile development (NPO3). Future research should explore these underrepresented challenges in Agile adoption.

Finally, most studies included in this research predate the covid-19 pandemic, when the term "together" implied working in the same physical space. The pandemic, however, forced a previous behavioral change through virtual engagement and commitment. A further avenue for research would be examining how companies are now managing employee engagement and commitment in the context of virtual and hybrid work environments.

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Appendix 01: Problems and challenges for adopting agile methods and the association between them.

			Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach
	Index	Description	,05,27, 44,57, 75,79	05,27, 44,57, 75,79	5.59, 75,78	,60, 61, 63,77	32,52, 62. 80,81	40.44	17,24,25,26, ,60, 64,75, 76,77		COVERAGE
	P01	Skepticism towards the new way of working.	5,38,40−43	X	X					Y
	P02	Management unwilling to change.	13,41,43− 45,82	X	X					Y
	P03	Lack of training.	38,40,41,43, 44,46,47	X				X		Y
	P04	To high workload	42.44	X				X		Y
	P05	Old commitments kept.	5	X				X		Y

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach
Index	Description	References	05,27, 44,57, 75,79	5.59,75,78	,60, 61, 63,77	32,52, 62. 80,81	40.44	17,24,25,26, ,60, 64,75, 76,77
P06	Misunderstanding agile concepts.	12,16,18–20, 48				X	X	X	Y
P07	Agile customized poorly	44				X	X	X	Y
P08	Reverting to the old way of working	47				X	X	X	Y
P09	Excessive enthusiasm	44				X	X	X	Y
P10	Autonomous team model challenging	49,52	X		X				Y

Note: rows include a COVERAGE column (Y) at far right. Row/column side labels: "problems and Challenges" and "COVERAGE".

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach
	Index	Description	References	,05,27, 44,57, 75,79	5.59,75,78	,60, 61,63,77	32,52, 62. 80,81	40.44	17,24,25,26, ,60, 64,75, 76,77	
problems and Challenges	P11	Global distribuition challenges	53.54	X		X				Y
	P12	Interpretation of agile differs between teams.	48			X	X			Y
	P13	Middle managers' role in agile unclear	38			X		X		Y
	P14	Management in waterfall mode	5.41			X				Y

(Note: rightmost column header reads COVERAGE, oriented vertically)

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

				Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06	
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach	
	Index	Description	References	05,,23,27, 44,57, 75,79	5.59,75,78	60,61,63,77	32,52, 62. 80,81	40.44	17,24,25,26, 60, 64,75, 76,77	
problems and Challenges	P15	Keeping the old bureaucracy.	5,43,44		X	X				Y
	P16	Internal silos kept	5		X	X				Y
	P17	High-level requirements management largely missing in agile.	52					X		Y
	P18	Creating and estimating user stories hard	54					X		Y

COVERAGE

Source: Elaborated by the authors

31

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach
	Index	Description	References	05,23, 27, 44,57, 75,79	5.59,75,78	60, 61, 63,77	32,52, 62. 80,81	40.44	17,24,25,26, ,60, 64,75, 76,77
problems and Challenges	P19	Gap between long and short - term planning	48						N
	P20	Quality assurance challenge	55				X		Y
	P21	Integrating non-development functions	14,15,31, 38,42,43			X			Y
	P22	Other functions unwilling to change	49			X			Y

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S01	S02	S03	S04	S05	S06
		Description	Management support	Commitment to change	Leadership	Choosing and customizing the agile approach	Pilot Projects	Training and coach
	Index	Description	References	05,23,27, 44,57, 75,79	5.59,75,78	60,61, 63,77	32,52, 62. 80,81	40.44	17,24,25,26, ,60, 64,75, 76,77	COVERAGE
problems and Challenges	P23	Challenges in adjusting in incremental delivery pace	5,56			X				Y
	P24	Need for aligment	9,11			X				Y
	NP01	Outsourcing and offshoring	5							N
	NP02	Risk of projects	5					X		Y
	NP03	Problems in contracting for Agile Development	39							N

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
			Index	S07	S08	S09	S10	S11
			Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management
	Index	Description	References	63,75	28,29,30,40, 64,66–68,76	02,05, 59,	25, ,64, ,75	22,40,47,64,65
	P01	Skepticism towards the new way of working.	5,38,40–43	X	X		X		Y
	P02	Management unwilling to change.	13,41,43–45,82	X	X		X		Y
	P03	Lack of training.	38,40,41,43, 44,46,47						N
	P04	To high workload	42.44						N
	P05	Old commitments kept.	5						N

problems and Challenges (left side vertical) — COVERAGE (right side vertical)

Source: Elaborated by the authors

34

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions						
			Index	S07	S08	S09	S10	S11	
			Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management	
		Index	Description	References	63	28,29,30,40, 64,66–68,76	02,05, 59	25, ,64, ,75	22,40,47,64,65	
problems and Challenges		P06	Misunderstanding agile concepts.	12,16,18– 20, 48			X			Y
		P07	Agile customized poorly	44			X			Y
		P08	Reverting to the old way of working	47			X			Y
		P09	Excessive enthusiasm	44			X			Y
		P10	Autonomous team model challenging	49,52	X			X		Y

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S07	S08	S09	S10	S11	
		Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management	
	Index	Description	References	63	28,29,30,40, 64,66–68,76	02,05, 59	25, ,64, ,75	22,40,47,64,65,22,23,40,47,56,64,71–73	
problems and Challenges	P11	Global distribuition challenges	53.54	X			X		Y
	P12	Interpretation of agile differs between teams.	48						N
	P13	Middle managers' role in agile unclear	38			X	X		Y
	P14	Management in waterfall mode	5.41			X	X		Y

COVERAGE

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
			Index	S07	S08	S09	S10	S11
			Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management
	Index	Description	References	63, 75	28,29,30,40, 64,66–68,76	02,05, 59	25, ,64, ,75	22,40,47,64,65
problems and Challenges	P15	Keeping the old bureaucracy.	5,43,44			X	X		Y
	P16	Internal silos kept	5			X	X		Y
	P17	High-level requirements management largely missing in agile.	52					X	Y
	P18	Creating and estimating user stories hard	54					X	Y

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S07	S08	S09	S10	S11	
		Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management	
Index	Description	References	63,75	28,29,30,40, 64,66–68,76	02,05, 59	25, ,64, ,75	22,40,47,64,65	
P19	Gap between long and short - term planning	48				X		Y
P20	Quality assurance challenge	55				X		Y
P21	Integrating non-development functions	14,15,31, 38,43	X	X	X			Y
P22	Other functions unwilling to change	49	X	X	X			Y

(Left margin label: problems and Challenges) (Right margin label: COVERAGE)

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions					
		Index	S07	S08	S09	S10	S11	
		Description	Engaging People	Communication and transparency	Mindset and alignment	Team autonomy	Requirements management	
Index	Description	References	63,75	28,29,30,40, 64,66−68,76	02,05, 59	25, ,64, ,75	22,40,47,64,65	
P23	Challenges in adjusting in incremental delivery pace	5,56	X	X	X			Y
P24	Need for aligment	9,11	X	X	X			Y
NP01	Outsourcing and offshoring	5						N
NP02	Risk of projects	5		X				Y
NP03	Problems in contracting for Agile Development	39				X		Y

Source: Elaborated by the authors

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Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions		
		Index	NS01	NS02	NS03
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors
problems and Challenges	Index	Description	References	51,71,75,76	5,74	39
	P01	Skepticism towards the new way of working.	5,38,40−43			N
	P02	Management unwilling to change.	13,41,43−45,82			N
	P03	Lack of training.	38,40,41,43,44,46,47			N
	P04	To high workload	42.44			N
	P05	Old commitments kept.	5			N

(COVERAGE, rotated at right)

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions				
		Index	NS01	NS02	NS03		
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors		
	Index	Description	References	51,71,75,	5,74	39	
problems and Challenges	P06	Misunderstanding agile concepts.	12,16,18–20, 48				N
	P07	Agile customized poorly	44	X			Y
	P08	Reverting to the old way of working	47		X		Y
	P09	Excessive enthusiasm	44				N
	P10	Autonomous team model challenging	49,52				N

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions			
		Index	NS01	NS02	NS03	
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors	
		References	51,71,75,	5,74	39	
	Index	Description				
problems and Challenges	P11	Global distribuition challenges	53.54			N
	P12	Interpretation of agile differs between teams.	48			N
	P13	Middle managers' role in agile unclear	38			N
	P14	Management in waterfall mode	5.41	X		Y

COVERAGE

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions		
		Index	NS01	NS02	NS03
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors
Index	Description	References	51,71,75,	5,74	3939
P15	Keeping the old bureaucracy.	5,43,44		X	Y
P16	Internal silos kept	5		X	Y
P17	High-level requirements management largely missing in agile.	52	X		Y
P18	Creating and estimating user stories hard	54	X		Y

problems and Challenges — COVERAGE

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

			Models and Solutions			
		Index	NS01	NS02	NS03	
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors	
	Index	Description	References	51,71,75,	5,74	39	
problems and Challenges	P19	Gap between long and short - term planning	48	X			Y	**COVERAGE**
	P20	Quality assurance challenge	55	X			Y
	P21	Integrating non-development functions	14,15,31, 38,43				N
	P22	Other functions unwilling to change	49				N

Source: Elaborated by the authors

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

				Models and Solutions		
		Index	NS01	NS02	NS03	
		Description	Quality assurance challenges	Agile Innovation management	Agile outsourcing sucess factors	
Index	Description	References	51,71,75,	5,74	39	
P23	Challenges in adjusting in incremental delivery pace	5,56				N
P24	Need for aligment	9,11				Y
NP01	Outsourcing and offshoring	5		X	X	Y
NP02	Risk of projects	5	X		X	Y
NP03	Problems in contracting for Agile Development	39			X	Y

problems and Challenges

COVERAGE

Appendix 01: Problems and challenges for adopting agile methods and the association between them (cont'd).

ID	Author	ID	Author
1	(Boehm & Turner, 2005)	46	(Ozkan, 2015)
2	(Dybå & Dingsøyr, 2008)	47	(Azanha et al., 2017)
5	(Van Der Vyver et al., 2011)	48	(Heikkilä et al., 2017)
6	(Gregory et al., 2016)	49	(Moe et al., 2012)
8	(Schlosser et al., 2012)	50	(Prochazka et al., 2011)
9	(Luftman & Brier, 1999)	51	(Kane et al., 2006)
10	(Qumer et al., 2007)	52	(Suryaatmaja et al., 2020)
11	(Alaceva & Rusu, 2015)	53	(Shrivastava & Rathod, 2015)
12	(Javdani Gandomani & Ziaei Nafchi, 2016)	54	(Fourie& De Vries, 2017)
13	(Jovanović et al., 2017)	55	(Agarwal et al., 2014)
14	(Hajjdiab & Al Shaima Taleb, 2011)	56	(Cao et al., 2013)
15	(Cohn & Ford, 2003)	57	(Ghani & Bello, 2015)
16	(Lopez-Martinez et al., 2016)	59	(Denning, 2019)
17	(Schwaber, 2007)	60	(Paasivaara et al., 2018)
18	(Eloranta et al., 2013)	61	(Fruhling & Vreede, 2006)
19	(Hussein & Siddique, 2016)	62	(Pikkarainen et al., 2005)
20	(Lima De Sousa et al., 2016)	63	(Baker & Thomas, 2007)
21	(Hoda et al., 2011)	64	(Misra et al., 2009)
22	(Bass, 2015)	66	(Molokken-Ostvold & Furulund, 2007)
23	Louis & Carl, 2016	65	Unger-Windeler et al., 2020).

ID	Author	ID	Author
24	(Javdani Gandomani & Ziaei Nafchi, 2015)	67	(Tessem, 2017)
25	(Javdani Gandomani et al., 2014)	68	(Cram, 2019)
26	(Conboy et al., 2011)	69	(Kanavittaya et al., 2010)
27	(Paasivaara & Lassenius, 2014)	71	(Chaipraserth et al., 2013)
28	(Iivari & Iivari, 2011)	72	(Cheng et al., 2009)
29	(Hovorka & Larsen, 2006)	73	(Campanelli et al., 2018)
30	(Zahra & George, 2002)	74	(Mergel, 2016)
31	(Cao et al., 2009)	75	(Fransisca, Raharjo, Hardian, & Suhanto, 2023)
32	(Sidky et al., 2007)	76	(Spagnoletti, Kazemargi, & Prencipe, 2022)
33	(Gangwar et al., 2015)	77	(Almeida & Simões, 2021)
38	(Nuottila et al., 2016)	78	(Hidayati, Budiardjo, & Purwandari, 2021)
39	(Chang et al., 2016)	79	(Eilers, Peters, & Leimeister, 2022)
40	(Mahanti, 2006)	80	(Bianchi, Conforto, & Amaral, 2021)
41	(Papatheocharous & Andreou, 2014)	81	(Hassan, Younas, & Bhaumik, 2021)
42	(Salleh et al., 2014)	82	(Vatan, Ardali & Shahin, 2022)
43	(Abdalhamid & Mishra, 2017)		
44	(Hajjdiab et al., 2012)		
45	(Carew & Glynn, 2017)		

Source: Elaborated by the author