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RESEARCH ARTICLE

Scalable Agile Frameworks in Large Enterprise Project Portfolio Management

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This work involved human subjects or animals in its research. The authors confirm that all human/animal subject research procedures and protocols are exempt from review board approval.

ABSTRACT This article explores the implementation of scalable agile frameworks in project portfolio management (PPM) of large companies when companies should approach an agile transformation process that works successfully in their PPM. This study adds to the limited knowledge on how companies find and manage the challenges they may be susceptible to during planning or anticipation of agile transformation. The qualitative case study method allows for the analysis of project portfolios with the implementation of scalable agile frameworks in large companies. Fifty-nine project portfolios from 22 companies were studied, and 43 semi-structured in-depth interviews were conducted. The results found portfolios of projects with high variability in service, product, and innovation and hybrid implementations of the Scaled Agile Framework (SAFe), Spotify Model, and Scrum, as well as different challenges related to the implementation of scalable agile frameworks in PPM, organizational culture, resistance to change, and strategic leadership. These findings show that agile frameworks are a viable option for achieving fast time-to-market, increasing team productivity, and improving overall communication. Given that the study addressed fifty-nine portfolios of projects in large companies, the analytical generalizations allowed us to find and verify theoretically significant patterns that can only be applied to this type of company and not to SMEs. Finally, the findings suggest the need for managerial development that promotes a broader orientation of scalable agile frameworks in PPM; specifically, better knowledge and skills about implementing these frameworks in companies to lead and organize an agile transformation successfully.

INDEX TERMS Organizational agility, agile software development, agile project management, organizational transformation, project portfolio management, scaled agile framework (SAFe), project management.

I. INTRODUCTION

The agile project management (APM) approach has contributed significantly to software development [86]. Initially, agile methods focused on a single small team composed of up to nine collaborators [12], [36], and success stories have led to their implementation in geographically distributed global projects [45], [91], [107] and projects with multiple teams grouped in project portfolio management (PPM) in large companies [13], [54]. Consequently, several researchers have proposed the application of agile methods in these types of companies through the implementation of scalable agile frameworks [12], [89] such as the Scaled Agile Framework (SAFe) [66], Spotify Model [72], and large-scale scrum (LeSS) to facilitate business management in complex environments and face different challenges during an agile transformation [98], such as resistance to change, lack of investment, coordination of multiple teams [91], [93], top management support [68], and limited client collaboration [46]. Despite this, large companies continue to find it difficult to implement scalable agile frameworks in PPM and lead and organize successful agile transformations [16], [34], [59], [83], [109]. Studies on the implementation of scalable agile frameworks in PPM are scarce [16], [59], [68], [83], [109]. These studies are in an emerging state and lack advice on how and when large companies should approach an

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agile transformation process that works successfully in their PPM [34], [46].

Scalable agile frameworks provide flexible and adaptable environments for complex and finite-precision projects that deliver products or services in an incremental manner using continuous feedback loops [6], [55]. These incremental deliveries require the simultaneous integration of a shift in mindset and strong organizational structures to enforce quality practices [101]. Recent studies have proven that agile methods and scalable agile frameworks can complement established software engineering practices to ensure high-quality project deliverables [1].

Indeed, the existing research is strongly oriented towards studying the implementation of agile methods in software development projects with individual teams located in the same place [11], [65], which becomes a major obstacle when large companies want to achieve the benefits that agile methods have achieved in projects and individual teams. These include better productivity, cost reduction, alignment of requirements, and minimization of time-to-market (TTM) [99]. This study explored the implementation of scalable agile frameworks in the PPM of large companies in terms of reasons, characteristics, processes, and challenges.

As a research strategy, a case study was used by Latin American companies that implemented scalable agile frameworks or some of their methods [2]. Based on interviews with 43 leaders with the highest level of responsibility and governance for PPM in 22 companies to explore their experiences in the use or application of agile frameworks in the context of 59 project portfolios, our study focused on three aspects from the perspective of scalable agile frameworks in PPM. First, it highlights the potential characteristics of project portfolios managed using scalable agile frameworks and supplies an overview of project portfolio setup in practice. Second, it explores the challenges related to implementing scalable agile frameworks in PPM, and their candidate strategies to address the identified challenges. Third, it presents the benefits and organizational aspects that motivate companies to implement scalable agile frameworks in PPM. The present article is derived from the doctoral thesis defended and approved on November 22, 2022, titled ''Scalable agile frameworks in large enterprise Project portfolio management,'' from the Pontifical Catholic University of Peru [48]. The rest of this article is structured as follows: Section II presents the literature review; Section III describes the research method; Section IV describes the data extraction process; Section V explains the data analysis and findings of the study; Section VI discusses and finally, Section VII presents the conclusions and practical and theoretical implications.

II. LITERATURE REVIEW

A. AGILE PROJECT MANAGEMENT

Agility applied in the field of project management (PM) emerged in the late 1980s and the early 1990s [37], [111], enlightened mainly by studies focused on software projects, such as those by Eisenhardt and Tabrizi [50], who found that product development arises in a way that is more uncertain than predictable, more experimental than planned, and more iterative than linear or sequential. Subsequently, it was found that these projects not only involve innovation but also require great flexibility and agility owing to dynamic and changing environments [2]. Furthermore, agility is a new paradigm presented as a solution for keeping a competitive advantage in times of uncertainty and turbulence [103]. It is understood as the organizational capacity to create and respond to change, seek benefits in turbulent environments [57], be prosperous, increase competitiveness [22], [88], and respond quickly in a balanced, flexible, and stable manner [51], [57], [116]. The first agile methods were scrum [102], Lean Software Development [95], crystal [31], Feature-Driven Development (FDD) [92], Adaptive Software Development (ASD) [57], Dynamic Systems Development Method (DSDM) [105], and Extreme Programming (XP) [15]. These methods were implemented in software projects, and from the results obtained, the Agile Manifesto was created in 2001 [80]. It is composed of four values and 12 principles that propose a common framework for all agile methods [81]. This novel approach allows the replacement of traditional software development [44] based on top-down planning with complex process management, with an emphasis on detailed specifications and a comprehensive first design [20]. Therefore, the agile approach is described as flexible [103], adaptive [27], iterative, and extreme [15], [27], and includes other methods derived from the agile manifesto, such as Kanban Software Development [7], Scrumban [41], and Scrum/XP hybrid [10].

Later, other researchers adopted the term agile project management (APM) to describe the agile approach [58], which is designed to respond to the great challenges of the software industry and is used to implement flexibility in process project management [82]. Flexibility is achieved through a set of principles, values, and practices that help the team deliver value products or services in projects in challenging environments [57] by conducting activities that are simplified with better adherence to uncertain environments and constant change [29]. To achieve this, they integrated clients into a continuous process of learning and adaptation, considering their needs and environment [9]. These needs require practices that ease the adoption of agility not only in project teams but also in other areas of the company [58]. The implementation of agile practices in companies not only ensures that the project team adapts quickly to the uncertainties and accelerated changes that projects require but also minimizes risks due to short interactions, defined deliverables, and direct communication with stakeholders, generating trust in project management [27]. Consequently, the aim of APM is to make the project management process simple, flexible, and iterative; improve performance (cost, time, and quality); reduce effort; and achieve higher levels of innovation and added value for the client [35]. Indeed, APM

has contributed to PM in uncertain environments [37], [29] and has added more practices (e.g., organizational routines of the team through recurring micro-activities), which suggests its constant application in improving communication and alignment in projects [94].

However, although agile practices are difficult to adopt in large companies with well-established routines and structures that last over time [107], it is important to consider that improving project performance and increasing team productivity are important considerations for applying agile practices in large companies and in broader contexts, such as portfolios and programs [90]. Indeed, proper selection given the variety of agile methods is still a challenge for most organizations trying to implement agility [97]. However, given that agility in PM began in software development projects with individual teams, recent research highlights the idea that to obtain a better explanation of APM, it is essential to develop research in the broad context of companies [37].

B. PROJECT PORTFOLIO MANAGEMENT

In addition to combining itself as a strategic tool for companies from different industries, the PM theory is characterized by its principles of rigor because it requires a sequential and linear method of steps to develop the life cycle of projects [18], [20]. Research in this discipline has given rise to PPM, which is considered a more strategic and higher-level function than PM, although the two are interdependent [23], [69]. A PPM is a set of projects linked to a time-related business cycle, such as an annual plan [38], [52]. PPM aims to distribute portfolio resources and prioritize, select, integrate, manage, and control projects and programs that add value to the organization [89]. It also sets up the following objectives: to maximize the financial value of the portfolio, link the company's strategy with the portfolio, and balance the project within the portfolio with respect to the organization's capabilities [84]. Therefore, project managers must be concerned with the interests of the organization beyond individual projects, seek to share PPM decisions with top management and middle leaders, and show links between their projects and management [87].

Because PPM is a collection of unique, concurrent, and competitive projects, not only is the participation of senior management necessary but also in the allocation of resources [8], a strong alignment between PPM and organizational directives must be guaranteed [98]. This alignment is evident when adding all the projects to a portfolio because it represents the investment strategy of the organization [49] and gives it the opportunity to be more agile beyond individual projects.

Therefore, these investments must be continuously perfected to implement the strategy effectively [56]. It should be noted that the investments made in a portfolio must start from a dynamic decision-making process in which new projects and programs are evaluated, selected, prioritized, and balanced in the context of those existing within the portfolio [60]. These portfolios can be implicit within one division of the organization or implemented throughout it [60]. However, given that several project portfolios may be managed centrally [70], [96], this situation can lead to opaque allocation of resources [75], [96].

Although the application of PPM characteristics implies a portfolio of agile projects whose success and performance are guaranteed by practices that provide teams with freedom, authority, and the ability to produce tangible value for the client [79], the complexity of its implementation is presented in the need to reconcile the tensions between the client's needs and organizational strategy [110]. This circumstance generates a weaker relationship between agile projects and organizational strategy than usually occurs between traditional projects and organizational strategy [79], [109]. However, in the past decade, scalable agile frameworks to be implemented in large projects were usually grouped in portfolios [107], such as SAFe [66], Scrum-of-Scrums (SoS) [108], Enterprise Scrum [17], and Spotify Model [5]. Consequently, base documents with advanced tools for these frameworks have appeared. However, these studies are insufficient, and there is still a lack of empirical evidence to guide large companies in their agile transformation processes [34], [45], [46], [91].

C. SCALABLE AGILE FRAMEWORKS IMPLEMENTED IN PPM

Scalable agile frameworks arose because of projects that successfully applied agile methods in small companies and because of the interest of large companies in achieving the same results in more complex projects [90]. These frameworks allow scaling agility in large companies and ease the combination of agile and lean practices to meet industrial needs of industries [91]. The question then arises: what is meant on a large scale? According to Dikert et al. [45], a large-scale concept should be applied to software development organizations with more than 50 people, or at least six teams with an average size of six to seven people. Dingsoeyr et al. [46] considered speaking on a large scale when referring to projects with more than two development teams that include many actors. However, to scale agility in organizations, several factors must be considered: team size, geographic distribution, ingrained culture, system complexity, legacy systems, regulatory compliance, organizational distribution, degree of governance, and business focus [4]. The scalable agile frameworks with the greatest presence in organizations are SAFe, SoS, Enterprise Scrum, and Spotify Models [44]. Table 1 supplies a brief description of the agile frameworks currently used by the companies.

The foundation of all scalable agile frameworks is the practice of agile methods, particularly Scrum. Most companies start an agile transformation with scrum and then implement agile practices at the enterprise scale using a scalable agile framework. SAFe is the only framework with the best level of integrity and coverage at the portfolio level [2], [47].

TABLE 1. Scalable agile frameworks implemented in the PPM.

Scalable Agile Framework	Description
SAFe	It is a framework for *Lean* companies that describes various practices for implementing agile methods at an enterprise scale [66].
SoS	It is a framework presented by Sutherland [108] as a technique for scaling *Scrum* in large teams (more than a dozen people)
Disciplined Agile Delivery (DAD)	It is a hybrid agile approach geared towards people and learning to deliver Information Technology (IT) solutions [5].
Spotify Model	This model was developed by the company Spotify and uses the concept of *Squads* to name a *Scrum Team, Tribes* to group *Squads, Chapter* to group competitions of a *Tribe* and *Guilds* to group people who want to share knowledge in a specific area [72],
Large Scale Scrum (LeSS)	It is *Scrum* applied to several teams working together on a product [78]. These researchers stated that *less* has two frames: *LeSS* between two and eight teams and *LeSS Huge* with more than eight teams.
Enterprise Scrum	It is an improvement of *Scrum* that allowed it to be generalized in all types of domains and scale it in any initiative and organization of any size [17].
Agile Portfolio Management	It proposes the management of a dynamic portfolio based on agile principles with flexible financial models [75].
Nexus	It targets the core of scalability by minimizing dependencies between teams and integration problems [21].
Recipes for Agile Governance (RAGE)	It divides the levels of government into portfolio, program, and project, and suggests proper practices for each level [114].
Scrum at Scale	It allows *Scrum to* scale and has components that allow an organization to customize its transformation and implementation strategy [108].

SAFe has three levels: portfolio, essential, and large solution [66]. These are grouped into four settings: Essential, Portfolio, Large Solution, and Full, allowing for flexibility at deployment. SAFe functions as a container for good practices, including Enterprise Architecture [40], Development and Operations (DevOps) [71], and Desing Thinking [39]. SAFe is the main framework that shows progress in addressing its deficiencies [46] and is the most requested by large companies [2], [44], [47]. However, they continue to face great challenges during the implementation process, such as resistance to change, lack of investment and coordination among multiple teams [91], [93], and unconsciousness about the need to change and evolve [68].

Several researchers have emphasized the importance of conducting studies on scalable agile frameworks in the PPM of large companies to (a) consider multiple projects with a variety of organizational structures [37], [112]; (b) explore the implementation of these frameworks in PPM [59]; (c) develop case studies on the implementation of scalable agile frameworks, such as SAFe, in the PPM of large companies [91], [34], [46], [74], consistent with the relevance of the topic [45]; (d) guide large companies in the early identification and management of challenges amid an agile transformation [34], [46], [110]; and (e) add to the limited empirical evidence on the implementation of scalable agile frameworks in large companies [16], [83]. Consequently, there are clear gaps [16], [34], [46] that have not been addressed in detail. To support the need for this study, Table 2 summarizes the gaps in the literature.

This study addressed gaps in the literature as a contribution to knowledge by exploring the implementation of scalable agile frameworks in the PPM of large companies. This study supplies an understanding of how and when companies should approach the agile transformation process by working successfully in the PPM.

III. RESEARCH METHOD

Figure 1 supplies a visual representation of the method used in this study. The current study is exploratory in scope because scalable agile frameworks are in their infancy; therefore, there is little scientific evidence in the literature [16], [83]. Because our study contributes to the APM approach, the agile practices of its emerging frameworks in a real context in which events cannot be controlled, we opted for a case study because it allowed us to explore in depth [119], within the context of large companies, the phenomenon of the implementation of scalable agile frameworks in PPM, and the ability to make an important contribution to the literature and theories related to the research problem [25].

In addition, Azanha et al. [11], Dikert et al. [45], and Paasivaara et al. [91] recommend conducting qualitative case studies on the implementation of scalable agile frameworks in companies. Because these studies are based on practice, it is possible to explore the functional and everyday environment of project portfolios, which are characterized as increasingly complex, dynamic, and interconnected [30]. In this sense, the current study considered several cases to guarantee a stronger effect in the research [118] and to ensure variability and understanding of the phenomenon from different perspectives [43]. This study used a purpose-sampling method and a snowball technique [100] to ensure the selection of cases and the sample within the case.

A. RESEARCH QUESTIONS

It is noteworthy that although there is a growing implementation of various scalable agile frameworks in large companies, there is still little empirical evidence of their agile practices in risk mitigation, primarily in projects in which failure is a recognized problem. Therefore, more extensive research is needed on scalable agile frameworks in PPM for large enterprises [16]. Therefore, based on the limited evidence from studies, as well as the effectiveness and challenges of these frameworks in an emerging state in

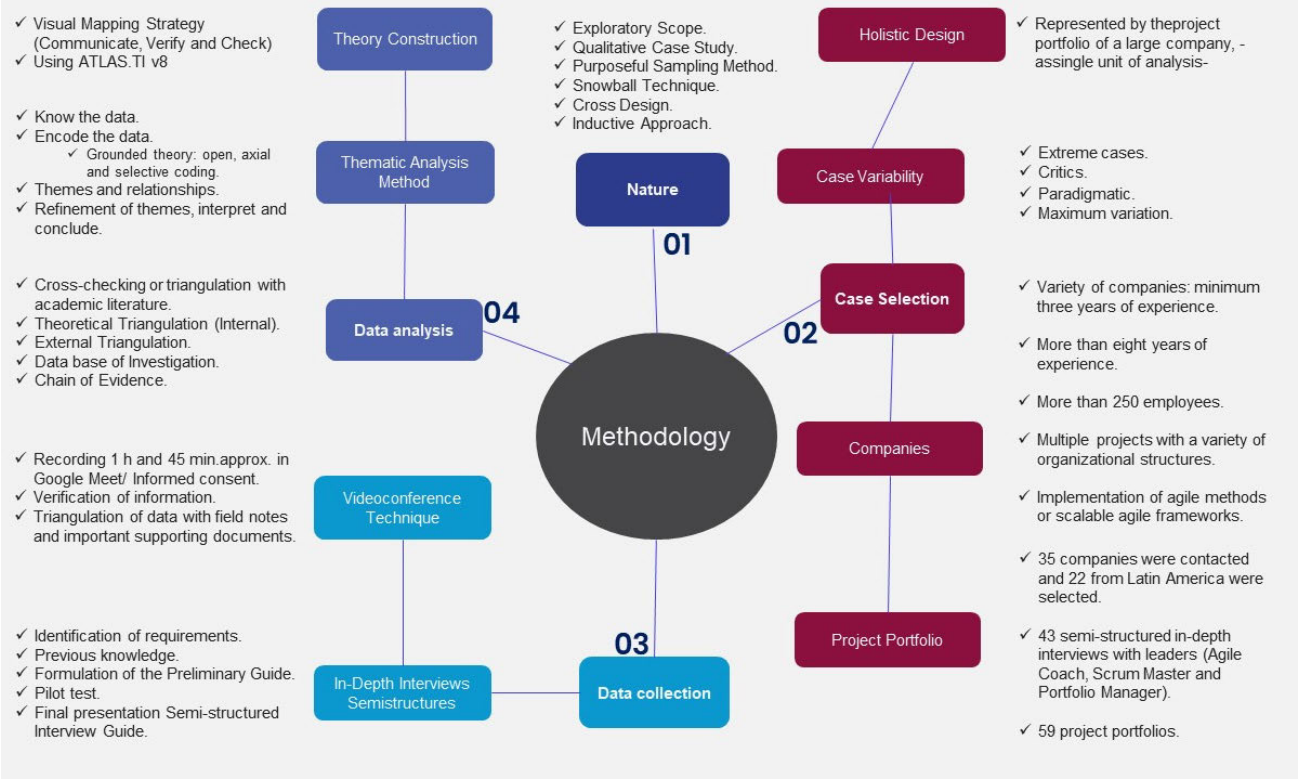


FIGURE 1. Method applied in this study.

companies [34], [46], [83], the current study considers it appropriate to pose the following research question: How and why are scalable agile frameworks implemented in the PPM of large companies? Likewise, it posed four sub-questions based on the following knowledge gaps.

1) RESEARCH QUESTION 1 (RQ1)

Stettina and Hörz [107] recommend further research on the characteristics of a PPM with agile projects. RQ1: What are the characteristics of project portfolios managed under the defined scalable agile frameworks? Paasivaara et al. [91] recommended conducting case studies on agile transformations in companies.

2) RESEARCH QUESTION 2 (RQ2)

Paasivaara et al. [91] recommend conducting case studies on agile transformations in companies. RQ2: How do companies start an agile transformation, and who is responsible for this process?

3) RESEARCH QUESTION 3 (RQ3)

Dikert et al. [45] stressed the importance of studying scalable agile frameworks scientifically. RQ3: What challenges are reported by companies implementing scalable agile frameworks? And

4) RESEARCH QUESTION 4 (RQ4)

RQ4: Why should companies implement scalable agile frameworks?

IV. DATA EXTRACTION PROCESS

A. CASE SELECTION

This study has a holistic design that understands the global nature of the phenomenon represented by the portfolio of projects of a large company as a single unit of analysis [119]. The portfolios of projects analyzed include the implementation of scalable agile frameworks, such as SAFe, or some of its adopted methods and practices [2]. As some companies use different terminologies for the project portfolio, this study uses the definitions of IPMA [60] and PMI [96] as a set of projects associated with a portfolio. This set of projects is considered strategic in nature and belongs to a time-related business cycle, such as an annual plan [38], [52]. According to Flyvbjerg [53], extreme, critical, pragmatic, and maximum variation cases are selected until the data saturation level is reached. The choice was based on two types of companies with experience in the development of large-scale projects and scalable agile frameworks: companies with at least three years of experience and companies with more than eight years of experience. All had more than 250 employees and developed multiple projects with a variety of organizational structures [107].

To guarantee the variability of the cases, this study found large companies from different industries in Latin America with various project portfolios using different avenues: LinkedIn, international symposia on agility, networking in scaled agile courses, consulting companies, and references from master's students and well-known executives. Based on the confirmation and availability of their leaders,

TABLE 2. Gaps in the literature review.

Year	Summary
2023	Despite the increasing popularity of scalable agile frameworks in enterprises, there are gaps in the academic literature on their effective implementations and on the coordination between their agile teams, these being two major challenges for practice and research [20].
2023	Lack of academic literature explaining in depth what makes agile teams more effective than others [115].
2023	There is a lack of theory-based research on scalable agile frameworks in agile transformations. Therefore, there are many opportunities to develop case studies in various contexts and industries to test their results [26].
2023	There is little literature on large-scale agile adoption in companies. This phenomenon should be studied as it is an iterative process of gradual refinement and adaptation based on the context of the organizations [63].
2021	Research with distributed agile teams is recommended to understand if SAFe practices are used in large enterprise projects [83].
2021	There is little empirical evidence on the practices of scalable agile frameworks to mitigate risk, especially in global software projects where failure is a frequent problem [16].
2019	Earlier research has presented some success factors and recommendations for the implementation of scalable agile frameworks in large enterprises. However, more empirical evidence on agility in larger environments or enterprises is suggested [34].
2016	It proposes conducting more in-depth case studies to gain a better understanding of agile transformations in large companies, how they are used in practice, and how they can be adapted [46].
2019	It is suggested that researchers supply relevant recommendations through empirical studies for the implementation of scalable agile frameworks in large enterprises. Also, it is important for researchers to understand the basic theory behind scalable agile frameworks to further extend them [47].
2017	It advocates conducting studies on the implementation of agile methods and scalable agile frameworks in PPM [59].
2018	This study not only brings new insights into the field of agile project management and software engineering, but also encourages academics to further research on this topic in other contexts [79].
2018	Current literature is oriented to the individual and team/project levels. Qualitative studies on large projects in greater depth and studies on the implementation of scalable agile frameworks in portfolios and programs are being proposed [90].
2018	More case studies on agile transformations in large enterprises are suggested since research in this area is scarce. Studies to prove the advantages of scalable agile frameworks indicated by consultants and interesting to companies, such as SAFe, LeSS and DAD [91].
2015	The line of research on the implementation of scalable agile frameworks in PPM is encouraged to gain a better understanding of the interaction of agile practices with agile roles [107].

35 contacted companies and 22 selected companies. The participants were leaders with the highest level of responsibility and governance for PPM in companies with roles such as the Agile Coach, Scrum Master, and Portfolio Manager. Forty-three interviews were conducted, with an approximate duration of one hour and forty-five minutes, and 4,297 minutes of recorded material. During the interview sessions, project portfolios that responded to the organizational strategy [70] were named, and data were collected from 59 project portfolios. Table 3 lists the protocols used for the preparation and execution of each interview.

TABLE 3. Semi-structured interview protocol.

One Month Prior	Three Weeks Prior	One Week Prior	Interview Day
Participants were contacted by telephone and e-mail. The typical characteristics of the research project were explained.	The main themes and initial interview questions were reviewed. Selected participants filled out the pre-interview form: demographic and other data. Important supporting documents were requested for the interview, project plans, business cases, management indicators, KPIs, OKRs.	The data and the Telepresence session of the interview were confirmed. The steps to carry out the interview were explained.	Estimated time: one hour to two hours. The session began with the participant signing the informed consent form. The semi-structured interview guide was followed, and new questions were added to the guide. The interview was recorded in digital format. Field notes were collected by the researcher.

1) DATA COLLECTION

Semi-structured in-depth interviews are the main source of information for collecting enriched data while maintaining flexibility during the application, as it is an exploratory study [107], and have close contact with participants [113], who are leaders of the highest level of responsibility and governance of the PPM with extensive knowledge and expertise in agile transformations.

The interviews followed the five phases defined by Kallio et al. [67]: identification of prerequisites, recovery and use of earlier knowledge, formulation of the preliminary guide, pilot test, and complete presentation of the semi-structured interview guide. Considering these phases, this study developed a semi-structured interview guide (see Appendix). Questions were added during the fieldwork from the analysis of the results of each interview carried out with the intention of exploring new topics not initially considered, because it is the most effective way of interviewing because it facilitates a deeper and more common understanding of the subject matter [43].

This study highlights the main topics related to demographic information, general PPM questions, strategic management of the project portfolio, governance of the project portfolio, and portfolio value management. Some examples of these questions are as follows: Why did your company start

TABLE 4. Data analysis phases.

Phase	Activities
Phase 1. Understanding the Data	Transcribe semi-structured interview recordings. Classify transcriptions and field notes. Organize all records in the research database. Explore meanings, recurring themes, and patterns in the data.
Phase 2. Data Coding	Break down compiled data into smaller fragments. Assign codes to data fragments with similar meanings. Use ATLAS.TI v8 for data coding and source indexing. Review existing theory and literature to refine coding. Explore substantive themes for code reorganization.
Phase 3. Seek Themes and Establish Relationships	Find data patterns for developing categories and conceptual themes. Create themes related to the research question.
Phase 4. Refine Themes, Interpret, and Conclude	Define final themes. Describe, compare, and relate cases to interpret findings. Develop conclusions and recommendations for future research.

agile transformation? How are project portfolios prioritized and selected? What lessons have been converted into actions to be implemented in future project portfolios and why? The format was videoconferencing on the Google Meet platform and was recorded with the consent of the participants, who were present throughout the interview and delved into topics with the highest level of knowledge. To verify the correct interpretation of the information provided [24], the existence of inconsistencies in the information provided by the participants during the data collection exercise was verified.

The data obtained were triangulated with field notes and important supporting documents for the interviews, guaranteeing the convergence of the data and counteracting biases in the study [118].

2) DATA ANALYSIS

Data collection and analysis processes were interleaved and iterative according to the recommendations of the thematic analysis method, which involved cross-verification or triangulation to ensure the reliability of the study [43]. Table 4 addresses the four phases of development for the qualitative data analysis.

First, the study transcribed the interview recordings and field notes, organized the memories in the research database, and explored the meanings, recurring themes, and patterns of the data. Second, it decomposes the compiled data into smaller code snippets following grounded theory guidelines for encoding qualitative data [118]. Additionally, a revision of the academic literature to refine this encoding in ATLAS.TI v8. Some code examples include connecting strategy with execution, aligning PPM with strategy, and improving delivery times. Third, the categories and concepts related to the research questions were named to identify patterns between the codes and to draw inferences and explanations. explanations. Fourth, new concepts were defined, more information was collected, and academic literature was reviewed from the previous phases to understand and interpret the findings and conclusions. In this phase, different guidelines were included for the analysis of these issues: contrast between the cases, comparison of cases and their relationship with demographic aspects, and the relationship between the concepts and the formulation of questions about them [14].

The ATLAS.TI v8 tool contributes to the transparency, systematization, and structuring of the analysis process through the application of its main components [117]. In addition, Langley [77] recommended the construction of the theory with a visual mapping strategy using ATLAS TI v8 network diagrams for each case study to communicate knowledge, verify the existence of inconsistent statements, and check the correct interpretation of the information provided by the participants.

3) VALIDITY AND RELIABILITY

In data analysis, triangulation was performed using interviews, field notes, and documents. Theoretical triangulation was performed based on data from different theoretical perspectives [43]. In this study, categories and themes were triangulated with other research, conceptual frameworks, and theories related to Project Management (PM). This process was undertaken to achieve internal validity and reliability in this study with the aim of making significant contributions to existing literature and theories. Additionally, a thorough literature review was conducted to guide and propose a method for collecting and analyzing data to ensure the objectivity of this research [118].

The Google Drive database was used to store all research-related information, including (a) signed documents related to informed consent, (b) demographic data forms, (b) interview recordings, (c) interview transcriptions, (d) field notes taken during interviews, and (e) documents or files provided as supporting materials for semi-structured in-depth interviews. The chain of evidence principle of this study is derived from the research questions and their results [119]. This research followed the protocol for each semi-structured in-depth interview described in Table 3 and executed the data analysis phases outlined in Table 4.

In this study, inconsistent statements with interviewees were verified to ensure correct interpretation of the information provided [24]. Furthermore, this research evaluated the semi-structured in-depth interview guide and followed literature recommendations [66], [67] to enhance the instrument's quality (see Appendix). This instrument, with 40 questions, is a powerful tool for future research.

V. DATA ANALYSIS AND FINDINGS

Table 5 presents the main observed variables and scalable agile frameworks related to companies' PPM. Company

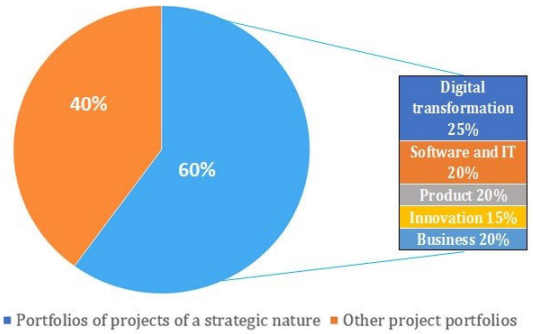


FIGURE 2. Characteristics of the project portfolio in practice.

names are represented with letter codes between "A" and "V" for privacy and ethical considerations. Next, we describe the project portfolio characteristics of the companies included in the study. Most of the project portfolios that were part of the research belonged to companies in the IT, financial, and telecommunication industries in Mexico, Colombia, and Peru, while the three project portfolios belonged to companies in Ecuador, Costa Rica, and Chile.

A. ANSWERS TO THE RESEARCH QUESTIONS

Regarding RQ1, the 59 portfolios of projects studied reveal the existence of an elevated level of variability in the contexts and experience of companies in the field of agility and include projects in the areas of IT, finance, merchandising, commercial and sales, business and innovation, and product. Additionally, companies C, H, K, and R have a set of independent projects focused on strategy; thus, they are a portfolio of projects [38] or a program of a business cycle [52]. Sixty percent of strategic portfolio projects make significant changes to businesses. These projects contribute to organizational strategy by focusing on the future of companies, digital transformation, IT software, products, innovation, and business (Fig. 2). Although all companies affirmed that their project portfolios are strategic, 40 per cent of the project portfolios use the objectives of the strategic project portfolios, audits, internal controls, and risks. "We define 30 per cent for normative projects, 10 per cent for tactical projects and the rest for projects of a strategic nature," said an agile Project Management Office manager (S).

It is noteworthy that 85 per cent of the project portfolios of the companies studied have high technological components, and although there is a high concentration in the investments required by these portfolios, there is a deficit of human capital (e.g., "we have a number of 260 projects…[which] means that we are not taking into account it takes into account the existing base of staff resources and their capabilities'), said a Transformation and People Analytics Manager (I). One hundred percent All companies have project portfolios with high work units over time, variability, and frequent changes, and projects with shorter work units are more stable and have clearer needs. These companies tend to have low project portfolio predictability because of their unstable and turbulent environmental conditions. For example, five portfolios of projects of the companies "C," "F," "G," "P," "S" use a combination of the agile practices of Scrum and Kanban because they consider that these two methods guarantee a better performance in the projects according to their nature (e.g., "we use Kanban for services and operations, Scrum for projects and products, and we apply ScrumBan in other Lean-Agile projects, this has allowed us to use the strengths of each agile method for the dynamic nature of the projects"), reported an Agility Consultant (S).

Table 6 shows the project portfolio characteristics of different companies. Only 59 percent of the companies have project portfolios (see Table 5). While companies' "A" and "T" have 11 portfolios of projects that stand for their business units, Company "M" has a single project portfolio that includes all the projects of the different business units, and Company "I" has three portfolios: strategic, innovation and product, and area. "We define the number of projects for each portfolio according to the needs of the company," says a Strategic Portfolio Coordinator (I). Although 100 per cent of the cases prioritize project portfolios at the business unit level or from a committee made up of senior executives that ensures alignment between strategy and execution, companies do not optimally use investments to minimize their risks. Indeed, "in the Portfolio Backlog there are 500 projects and in execution [only] we have 270" says an Agile Office Director (M). A Portfolio Backlog is an artifact that has projects approved and prioritized for implementation in the next business [66]. These results indicate that 59 per cent of the companies make up teams between six and 30, or between eight and 11 members for portfolios of projects in execution (for example, "We use multiple organizational structures to attend to the quantity and volume of projects carried out in the bank) and say an Agile Coach (T).

Regarding RQ2, the findings highlight that 100 per cent of the companies studied started the path to agility in an ascending manner, implementing the scrum framework at the team level. The company's Center of Excellence Leader statement (A) describes how it was conducted: "While scaling was structured from the bottom up, if top management hadn't been engaged, we wouldn't have done it." Seventy percent of companies develop strategic agility in a controlled manner, leading, for example, to present satisfactory results with the implementation of agile methods, specifically scrum, in short periods of time and making it visible at the business level that projects work better with the agile methods of the APM approach.

These companies have used these results to propagate agile practices in other contexts, such as PPM, and have defined the following steps: grow, experiment, and continue learning with the implementation of scalable agile frameworks, particularly SAFe, in PPM to obtain results with greater impact on the business and strategy (for example, "We recommend that an agile transformation should start with a strategy of growth, experimentation, and scaling in a controlled way to

TABLE 5. Case project portfolios.

Cases				Implementation							Leaders			
Company	Industry	#Portfolios	#Projects	Agility experience (Years)	Scrum	XP	Kanban	ScrumBan	Spotify Model	SAFe	LeSS	#Interviews	Roles
A	Financial	11	350	8	X					X		5	CEL, AC, RTE, RTE, HSD
B	Retailer	4	59	4	X					X		5	SDIT, SITM, LSE, LSE, MPM
C	Financial	1	5	5	X		X			X		1	AC
D	Financial	5	160	3	X					X		1	PM
E	IT	1	40	5	X		X			X		1	DCE
F	IT	1	78	16	X	X	X					1	DCE
G	IT	1	83	8	X	X	X					1	SM
H	IT	1	97	5	X							2	SM, DTA
I	Tele-communications	3	260	4	X					X		7	SPOC, SPOC, SPOC, PO, SPLC, TPAM, PM
J	IT	1	80	3	X							2	SDD, AD
K	IT	1	65	4	X							1	AC
L	IT	1	60	8	X	X	X	X		X		1	PMA
M	Financial	1	270	8	X					X		2	AOD, TM
N	Services	4	128	6	X							2	AL, EAM
O	IT	1	20	3	X							1	PTD
P	Pharmacist	1	15	6	X		X					1	SM
Q	IT	1	30	7	X		X			X		1	RTE
R	IT	3	70	7	X		X		X		X	1	AC
S	Financial	1	35	3	X		X	X				2	AC, APMO
T	Financial	11	400	6					X	X		1	AC
U	Tele-communications	3	85	6						X		3	PMA, PL, LC
V	Financial	2	10	4						X		1	AC

Roles: Center of Excellence Leader (CEL), Agile Coach (AC), Release Train Engineer (RTE), Head of Solutions Development (HSD), Senior Director Information Technology (SDIT), Senior Information Technology Manager (SITM), Lead Software Engineer (LSE), Marketing Portfolio Manager (MPM), Agility Consultant (AC), Project Manager (PM), Director Center Excellence (DCE), Scrum Master (SM), Digital Transformation Architect (DTA), Strategic Portfolio Coordinator (SPOC), Product Owner (PO), Strategic Planning Coordinator (SPLC), Transformation and People Analytics Manager (TPAM), Program Manager (PM), Software Development Director (SDD), Architecture Director (AD), Product Manager (PMA), Tech Manager (TM), Agile Office Director (AOD), Agility Leader (AL), Excellence and Agility Manager (EAM), Projects and Technology Director (PTD), Agile Project Management Office Manager (APMO), Project Leader (PL), Lean Consultant (LC).

TABLE 6. Characteristics of the project portfolios.

Company	#Portfolios	#Projects	#Teams	Characteristics
F, G, H, J, K, N	9	531	5 to 8	6 to 9 people per team
A, B, C, D, E, I, L, M, Q, R, T, U, V	47	1799	6 to 30	8 to 11 people per team.
O, P, S	3	70	3	4 to 7 people per team.

successfully progress in other directions of the organization,'' said Director Center Excellence. Eighty percent of companies use the scrum framework and 60 per cent use the business and strategy areas with pilot projects that include a large IT part that drives agility and the scrum method (Table 5).

However, while company ''H'' justifies the implementation of scrum because it considers that it is the framework with the greatest use or application in companies. In company ''J,'' they do not find that this framework offers them security and confidence because they consider that scrum does not have a roadmap that demonstrates its effectiveness in an implementation; or in company ''U,'' the agile transformation arose from an area–marketing–using Scrum and Kanban, and later they implemented SAFe. On the other hand, although 54 percent of the companies use the SAFe framework (Table 4), they do not follow it specifically and choose to implement hybrid schemes based on the APM frameworks to integrate various agile practices that better adapt to their needs and evolution (e.g., ''The reference is SAFe but it has been adapted and tropicalized with Scrum and Kanban to meet the needs of the company''), said a Release Train Engineer (A). The study also found that the 11 portfolios of company ''T'' have a hybrid model for the organization of teams based on the Spotify Model and scaled with SAFe (e.g., ''The Spotify Model has allowed us a better organization of teams and SAFe a better governance scaling in the company''), said an Agile Coach (T). The company's Agile Coach (AC) statement (R) describes that: ''SAFe is a rigid framework and the Spotify Model has better flexibility for companies.'' Finally, no project portfolio of companies ''A,'' ''B,'' ''C,'' ''D,'' ''E,'' ''I,'' ''L,'' ''M,'' ''Q,'' ''R,'' ''T,'' ''U,'' and ''V'' explicitly implement scalable agile frameworks such as SAFe [66], Spotify Model [72], and

LeSS [78], and companies H, J, K, N, and O explicitly follow the scrum framework [102] (Table 2). Consequently, 77% of the surveyed companies use an agile practice hybrid model of APM methods and frameworks.

On the other hand, 59 per cent of the companies studied have implemented a Center of Excellence (COE) (e.g., ''the COE has allowed [us] to promote and evangelize agility, thanks to the Agile Coaches, the company has been adopting these with better receptivity changes,'' said a Senior Director Information Technology (B); ''the commitment of the top management for the establishment of a COE in the organizational structure is fundamental because it requires advance investments''), affirming an Agile Office Director (M). One hundred percent of companies concluded that agility has increased work in teams (e.g., 'As agility brings results in short iterations, then the company wants more and more results, and this has overwhelmed the capacity of the teams') said a Project Manager (I).

There was no valid reason to implement the SAFe framework in the surveyed companies. Indeed, the company Center of Excellence Leader (A) said that: ''there is no valid reason, we did not do an in-depth study, I have known little about other frameworks, but I have been with SAFe for eight years and it seems the best to me.'' Consequently, none of the companies evaluated the APM methods or frameworks to find which were aligned with a specific business situation. From the 43 in-depth interviews and visual process models created for each case, the action patterns that reappeared in the project portfolio configuration were grouped to respond to RQ1. After several iterations, in which the study collected more information, consulted the literature, and identified four groups of actors in practice (senior management, project portfolio management, program management, and project management), it was necessary to associate the activities in the following six practice domains (Fig. 3).

B. PROJECT PORTFOLIO CONFIGURATION IN PRACTICE

1) Strategy describes the future horizon proved in companies, between one and three years, and is defined by senior management (e.g., holding ''A,'' Board of Directors ''J,'' or presidency and key vice-presidencies from ''A,'' and ''I'' companies.
2) Strategy themes refer to the business aims that connect strategy and PPM. Although companies define Key Performance Indicators (KPI), the novelty lies in the use of Objectives and Key Results (OKR).
3) OKR that allow aligning strategy, tactics, and operations ''S,'' and ''T.''
4) Portfolio Backlog is the main domain because it contains all the projects that have been approved and prioritized by an evaluation committee for their implementation ''A,'' ''B,'' ''C,'' and ''D,'' based on their criticality, value contribution and alignment with the strategy ''A,'' ''B,'' and ''S.''
5) In this domain, the scalability of agility is concentrated and contains the programs or solutions that companies wish to implement in cooperation and collaboration with multiple teams, as evidenced in companies that implement scalable agile frameworks, such as SAFe ''A,'' ''B,'' and ''I.''
6) An agile release train is a domain that specifies the multiple teams of agile teams that deliver an increment of the program (P, I) in operation over 12 weeks, which usually occurs in six iterations ''A,'' ''U,'' and ''I.'' This is also evident in companies implementing scalable agile frameworks, such as SAFe ''A,'' ''B,'' and ''I.''

Agile teams represent the base domain of the project portfolio configuration in practice because they specify the work from a set of multidisciplinary collaborators also defined squares ''A,'' ''B,'' and ''I'' or scrum teams ''O,'' ''P,'' and ''S'' that typically reiterate every two weeks to deliver an increment or set of Engaged User Stories ''N,'' and ''O.'' This situation is evident in companies with scrum implementation ''H,'' ''J,'' ''K,'' ''N,'' and ''O.''.

C. PERCEIVED CHALLENGES IN PRACTICE AND STRATEGIES

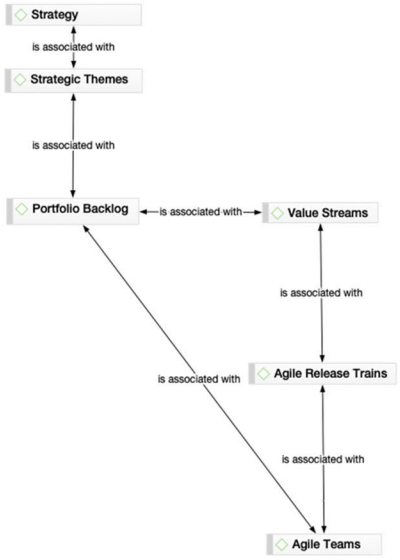
Regarding RQ3, Table 7 lists the critical challenges found and grouped into five categories and the strategies to address them. The coded subjects were mentioned in the transcripts on 178 occasions: 33 per cent were related to organizational culture, 24 per cent to resistance to change, 19 per cent to strategic leadership, 15 per cent to a lack of knowledge and skills, and 9 per cent to inconsistency in the processes.

D. PERCEIVED BENEFITS IN PRACTICE

On the other hand, Table 8 shows the benefits in the cases studied and grouped into four categories. The coded topics were mentioned 151 times in the transcripts: 29 per cent were related to time-to-market, 29 per cent to productivity, 17 per cent to communication, 14 per cent to adaptation to change, and 11 per cent to continuous improvement. In addition, the main organizational aspects that companies consider when implementing scalable agile frameworks are in response to RQ4.

Additionally, the findings show the main organizational aspects manifested by the participants, which drive companies to implement scalable agile frameworks in the PPM. These were grouped into five categories (Fig. 4). Coded topics appeared 92 times in the transcripts: 41 per cent were related to improving delivery times, 22 per cent to achieving organizational agility, 18 per cent to improving project management methods, 10 per cent to requests from senior management, and 9 per cent to incorporating changes in projects. The first three categories present the most relevant topics that motivate companies to implement scalable agile frameworks in the PPM. Companies are first inclined towards the faster time-to-market option, which is why they implement agility in PPM, thereby increasing satisfaction and improving the customer experience.

Then, companies look to achieve organizational agility; in this option, the scalable agile frameworks propose a



Roles	Objective
Top and Senior Management (e.g. CEO, Board of Directors)	Strategic targeting.
Project Portfolio Management (e.g. MPM, CTO, VP)	Alignment between strategy and execution. Maximizing the value of the portfolio.
Program Management (e.g. RTE , PMA)	Multiple teams to deliver solutions.
Project Management (e.g. SM, PO)	Early deliveries based on value prioritization.

FIGURE 3. Project portfolio configuration in practice.

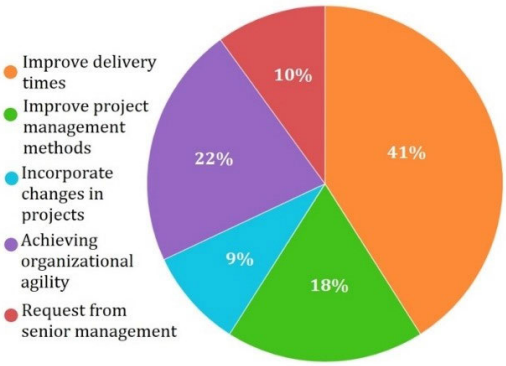


FIGURE 4. Aspects of organizations reported by companies.

complete transformation of the companies, which requires several years, and significant changes and major adaptations are made. Finally, companies look to improve their project management methods and extend the traditional PM approach by gradually replacing them with APM methods and frameworks. In this regard, a Scrum Master (G) stated that agile practices such as Daily Standups and Retrospectives were incorporated into the few traditional projects that still remain in the company. ''The use of five agile scrum practices (Daily Standups, Retrospectives, Reviews, Planning, Backlog refinement) improved communication and transparency in project portfolios (I, L, and M).

VI. DISCUSSION

This study explores the implementation of scalable agile frameworks in project portfolio management (PPM) of large companies to understand how and when companies should approach an agile transformation process that works successfully in their PPM. The main findings and conclusions are as follows. Indeed, the results show considerable similarities in all the cases studied of the variability of the project portfolios; that is, the project portfolios in companies are characterized by low predictability, given that the environment in which they operate is increasingly unstable and turbulent. Despite these general similarities with respect to the characteristics of the project portfolios, there are four agile methods (Scrum, XP, Kanban, and ScrumBan) and three scalable agile frameworks (SAFe, LeSS, and Spofify Model) implemented in the PPM of companies (Table 5). These seven methods and frameworks differ in terms of the scope and coverage of PPM needs and are used in a hybrid manner in project portfolios. In the cases studied, participants pointed out the challenges (Table 7) and benefits (Table 8) to consider in planning or in the middle of an agile transformation. This transformation requires key roles with specific goals in the configuration of the project portfolio to promote strategic agility in the company (Fig. 2).

The findings show that agile transformation usually starts from the bottom up, specifically with scrum, and that initial results with individual teams are vital to propagate agile practices, 54 per cent with SAFe, in much broader contexts until PPM is achieved. In addition, companies were found to adapt and integrate agile methods and scalable agile frameworks to meet the needs and evolution of the business dynamics contained in the PPM. In this sense, the results corroborate the findings of Stettina and Hörz [107] because it is confirmed that the combination of various agile practices in PPM is common in companies, and those of Niederman et al. [90] because the business practices of hybrid schemes ensure better organizational integration of projects and programs in the PPM.

Additionally, the findings of the current study present the main benefits of scalable agile frameworks to companies,

TABLE 7. Critical findings and strategies.

Challenges	Findings
Organizational cultural	Hierarchical, bureaucratic culture with a bias in agile values and principles. Fear of cultural transformation. Firmness in keeping organizational silos. The role of middle leaders is unclear in the Lean-Agile transformation.
Resistance to change	Little disposition of the collaborators. Fear of assuming new roles. General resistance to change. The descending structure creates resistance and little adaptation to change.
Strategic leadership	Lack of advanced investments. Little understanding of earlier preparation. Lack of training and coaching. Too many project portfolios. Little interest in a remote work environment. Lack of a governance model that encourages agility.
Knowledge and skills shortage	Implementation of surface level agility. Need for constant education and training. Lack of orientation of the literature for implementing agility. Failures in the application of techniques and tools. High rotation. Unclear interpretations of scalable agile frameworks. Lack of resolute teams.
Process inconsistency	Disarticulation between the different areas. Inflexible and rigorous process structure. Lack of automation. Process misalignment. Obsolete processes. Cascade management.
Challenges	**Strategies**
Organizational cultural	Experimentation with strategic pilot projects. Show satisfactory results in short iterations. Involve the organization in an evolutionary way.
	Encourage the leadership of leaders in the transformation.
Resistance to change	Training and constant training. Repetitive accompaniment in the implementation of agility. Focus on people with leadership, coaching and mentoring workshops. Application of the model Kotter [73].
Strategic leadership	Investments in training and qualifications in Lean Change Management, Leadership 5.0, Lean-Agile Mindset, ontological and executive coaching. Inclusion in the organizational structure of the company of a Center of Excellence (COE) with high abilities [66].
Knowledge and skills shortage	Case-based learning. Adoption of prioritization techniques such as MoSCoW [105], Weighted Shortest Job First (WSJF) [66]. Use of estimation practices such as Planning Poker [32]. Retention programs. People Analytics.
Process inconsistency	Analysis and evaluation tools. Optimization of processes. Use of technological tools.

TABLE 8. Perceived benefits in practice.

Benefits	Findings
Time-to-market	Strategic results, such as customer satisfaction, often increase with the use of agile practices. Faster time-to-market and Business value delivered have great benefits that are perceived in practice. Compliance with OKRs and KPIs are strengthened by minimizing process times and prioritizing value.
Productivity	Agile practices as recurring routines (for example, Daily Standups, Retrospectives, System Demo, Program Increment (PI) Planning) often increase the productivity of multiple teams responsible for project portfolios. Alignment, cohesion, speed, and collaborative work lead organizations to have initiative-taking teams generating a better work environment for companies.
Communication	Agility supplies better communication on the true state of project portfolios. Better communication with transparency is perceived in practice at all organizational levels and with clients.
Adaptation to change	Participants noted that although there is resistance to change, scalable agile frameworks also favor organizations with better adaptation to change and agility towards global trends over time. In addition, it is perceived in practice that bureaucracy decreases and the benefits of a flat organization with a better distribution of work begin to appear.

consisting of the fast time-to-market of project portfolios and increase in team productivity, which coincides with the findings of Russo [99]. Verification of the implementation of scalable agile frameworks has been carried out without evaluation of strategy, growth, experimentation, and scaling, which generates superficial adoptions in companies and does not consider an evaluation of criteria, such as those proposed by Alqudah and Razali [2], Dolman and Spearman [47], and Dingsoeyr et al. [46]. This finding causes companies to be unaware of their true strengths, weaknesses, and opportunities in the practice of scalable agile frameworks for specific business situations, as noted by Dingsoeyr [46].

The results show that scalable agile frameworks generate significant interest in companies and their teams' expectations, in several ways. The first is a portfolio of projects with strong components of research innovation, as suggested by Alqudah and Razali [2]. PPM is driven by the changing dynamics of the environment. Second, transparency in communication and agile practices (e.g., Daily Standups, Retrospectives, and Reviews) developed by the teams generated an environment of collective responsibility and continuous progress, confirming the findings of Azanha et al. [11]. Third, these agile practices are essential for ensuring better control of project portfolios and team synchronization, which is consistent with the findings of Stettina and Heijstek [106]. Fourth, the Product Owner and Scrum Master play two key roles in the agile team domain (Fig. 1). While the former drives agility in the team, the latter prioritizes the creation of value for the business. This result confirms the findings of Schwaber and Beedle [102]. However, when those responsible for these roles take on other responsibilities, the project success is compromised. Fifth, the agile practices of the Agile Release Trains domain (for example, PI Planning, Scrum of Scrum, and System Demo) are difficult to implement in their first stages because they involve different organizational levels of the company, as demonstrated by Stettina and Hörz [107]. Finally, in practice, these results are not in line with the recommendations of earlier research, which suggests dedicated, self-managed, and self-organized teams [27], [29], [57] because in 79% of the cases studied, teams are not fully dedicated to project portfolios.

Although companies' PPM concentrates on large investments in various project portfolios, they carry out a continuous prioritization process based on their criticality, value generation, and alignment with the strategy of having a centralized and optimized portfolio [66]. Although PPM is the investment strategy of companies [49], the studied companies use unclear mechanisms to prioritize and select investments that generate several portfolios with multiple projects, including a finite capacity for human capital. Consequently, the findings show a different trend from that indicated by previous research, which highlights the importance of not only identifying projects that meet the criteria established at a strategic level to be included in the portfolio [61]; however, when a company has several portfolios of projects, this can lead to an untransparent allocation of resources [75], [96].

Finally, in line with previous research (e.g., [45], [46], [34], [83], [91], [93]), it was demonstrated that agile methods and scalable agile frameworks are a viable option for faster time-to-market, increasing team productivity, improving communication at a general level, and favoring adaptation to change in companies. It was also verified that the support of top management for the constant learning of employees makes a difference in terms of the results of agility and positive transformation of companies. The results also highlight the importance of an agile governance structure to create favorable conditions for three backgrounds: employee learning and knowledge, the use of APM methods and frameworks in their daily work, and the mitigation of susceptible challenges in planning or during an agile transformation to expect them in practice. Indeed, a governance structure open to agility can create an environment of constant training, education, and evangelization at different organizational levels, which is conducive to successful agile transformation.

VII. CONCLUSION, PRACTICAL AND THEORETICAL IMPLICATIONS

Few investigations of scalable agile frameworks in the PPM of large companies [45], [46], [34], [91] have focused on studying agile methods in projects with individual teams [11], [65]. Agile transformation is difficult for companies [45] because it consists of iterative stages that require financial investment and time for the organizational culture to focus on change and adaptation. The literature offers recommendations on how to successfully deal with this process. Therefore, the qualitative approach and research strategy of the case study are important tools for exploring the reality of scalable agile frameworks in the PPM of large companies and for the construction of theory.

This study explores the implementation of scalable agile frameworks in the PPM of large companies by naming fifty-nine project portfolios in 22 Latin American companies, highlighting four contributions to the theory. The first contribution to the theory is the exploration of how large companies that implement scalable agile frameworks in PPM achieve significant economic results within a reasonable period. This contribution is reflected in a conceptual framework with deep explanations and meaning for fifty-nine project portfolios and 22 companies. This framework adds knowledge when describing the potential characteristics of project portfolios managed with scalable agile frameworks and provides an overview of project portfolio configurations in practice. In addition, it explains why companies should implement scalable agile frameworks, why they are implemented in PPM, how they start agile transformation, and who is responsible for the process.

The conceptual framework of this study provides well-founded recommendations to guide large companies in Latin America and those with similar characteristics in their transition towards agility. This framework outlines the characteristics of project portfolios managed under scalable agile frameworks to ensure the achievement of these companies'strategic objectives. The results of this study pave the way for improved performance in companies running in an increasingly challenging environment; however, one is also filled with tremendous opportunities. This research contributes to our understanding of how companies name and manage the challenges they may encounter during planning, or how to proactively address them in the midst of an agile transformation.

APM describes scalable agile frameworks designed for large enterprises with multiple organizational structures that include many stakeholders [45], [46] corresponding to their enormous size. These stakeholders tend to be geographically distributed by performing activities within the organizational integration of various projects and programs in PPM [4], [90]. In addition, scalable agile frameworks have appeared from the need for large companies to achieve agile transformation [91], [16] that promotes cultural alterations in management processes and technological tools to achieve organizational agility [57], [103]. Therefore, the second contribution to the theory of this study is to fill the gap in the literature by referring to how an agile transformation is realized by explaining the five challenges about the implementation of scalable agile frameworks in PPM and their prospective strategies to remedy the identified challenges. In addition, four benefits and five organizational aspects that drive companies to implement scalable agile frameworks in PPM were highlighted.

This study shows that large companies have several project portfolios with a high variability in services, products, and innovation. This study reveals that companies face the following challenges in implementing scalable agile frameworks in PPM: organizational culture, resistance to change, strategic leadership, shortage of knowledge and skills, and inconsistency of procedures. Furthermore, these findings are aligned with previous research (for example,, [45], [46], [34], [83], [91], [93]) as key challenges in the agile transformation of large companies, lack of investment and coordination of multiple teams [93], [91], and the need to build and maintain a shared understanding of customer value with a shortfall in supporting change [46], [68].

Regarding the benefits perceived in practice with the implementation of scalable agile frameworks in PPM, this study emphasizes that these frameworks are a practical option for reducing time-to-market, increasing team productivity and communication at a general level, and boosting adaptation to change. Reducing time to market, achieving organizational agility, and improving project management methods are the main organizational aspects, which is why companies implement scalable agile frameworks in PPM. These results support recent studies (e.g., [34], [44], [62], [83]) that reported that faster time-to-market, increased revenue growth, lower costs, and attracting more competitive staff are important enablers for generating interest in implementing scalable agile frameworks in PPM.

Earlier studies on the implementation of agile methods at the individual and team/project levels have demonstrated success factors and offered suitable recommendations [34]. However, recent research has supplied more in-depth empirical evidence on scalable agile frameworks in large-company environments [16], [83]. The third contribution of this study is that it supplies in-depth empirical evidence from six Latin American countries regarding the implementation of scalable agile frameworks in PPM. This empirical evidence supplies new insights and relevant recommendations on the use or application of scalable agile frameworks in the practice of large multiteam companies in Latin America and those that share the same characteristics. This requires adaptation of these frameworks to such contexts, achieving better interaction between agile practices and roles, and implementing hybrid schemes or models derived from the unification of several scalable agile frameworks in global software projects to ensure better results and reduce failure factors. This study developed a semi-structured interview guide (see Appendix) following the recommendations of the academic literature [67]. This fourth contribution supplies an important tool for future research and organizational consulting exercises.

In relation to management, our results highlight the need for top management and organizational structures to promote a broader orientation of scalable agile frameworks in PPM; specifically, better knowledge and development of skills related to the implementation of these frameworks to lead and organize successful agile transformation in the company. This study highlights six key aspects to consider when implementing scalable agile frameworks for large companies' PPM practices.

1) Hybrid models: Considering that the trend in large companies is to manage project portfolios with high variability, it is necessary to have a deep understanding and evaluation of agile methods, such as scrum [102], kanban [7], and XP [15], and scalable agile frameworks, such as SAFe [66], Spotify Model [72], and LESS [78]. These are the most widely adopted in companies, and they recommend the establishment of hybrid schemes or models that merge their agile practices with better performance to adapt to the needs of companies.
2) Prioritization of the project portfolio: Because of the large investments required to meet strategic and stated project objectives, it is necessary to centralize strategic projects into a single portfolio as the focus of the entire organizational strategy based on a rigorous process of prioritization and selection of investments based on their criticality, value generation, and alignment with the strategy [63].
3) Agile practices: The implementation of agile frameworks must start with the application of frequent routines (for example, Daily Standups, Retrospectives, and Reviews) in the Agile Teams domain, which stimulates the need for frequent ceremonies (for example, PI Planning, Scrum of Scrum, and System Demo) in the Agile Release Trains domain so that agility can be propagated or extended in a controlled manner in enterprises.
4) People: People are at the center of agile transformation. Therefore, it is necessary to focus on people's well-being at the organizational level to achieve satisfactory results in the short term. In addition, it supplies training, coaching, and constant support to mitigate the challenges that arise when implementing agile frameworks in the PPM.
5) Advanced investments: Agility seeks changes and major transformations that require early capital investments in physical and technological infrastructure adjustments, training programs, in-depth training, and organizational reorganization programs with new job titles and functions.
6) Transition: Scalable agile frameworks must be implemented in a structured manner. Starting experimentation with pilot projects applying agile methods, such as scrum [102], kanban [7], or XP [15], has become the best experience and reference for propagating, expanding, scaling, and jumping to the implementation of scalable agile frameworks in large-scale contexts according to the needs of the company.

Recent studies have added that companies rely on scalable agile frameworks to improve communication, coordination, and productivity of agile teams [19], [83], [115]. These multifunctional, self-organized, and highly skilled teams are responsible for the success of projects and the roles of traditional project managers [26], [54], which have become the focus of agile practices developed in release planning because they represent the essential needs of customers [63], [64]. This role seeks to realize business benefits through frequent deliveries to customers with continuous feedback loops [6], resulting in higher success rates for software project portfolios [85].

The quality of software projects should be significantly enhanced to improve the punctuality of frequent deliveries [1], [101]. This quality is achieved through the proper refinement of requirements, good agile team stability, and excellent management of interdependencies among multiple teams [76]. To ensure better transparency about project portfolios in large enterprises, teams should share release plans

to determine which teams have excessive work to transfer or receive from other teams [55]. The SAFe framework is positioned as a benchmark tool for global software projects in large enterprises to achieve better coordination in project portfolios [83], which in turn generates complexity and rigidity [74].

The study is useful for companies that are starting or are in an agile transformation process with implementations of agile methods and scalable agile frameworks because it provides managers with advanced information to face the challenges of agile transformation. The study concludes that the road to agility is long and has many obstacles, since it is a process of learning and continuous improvement as a resistance of companies to successfully overcoming five challenges: organizational culture, resistance to change, strategic leadership, lack of knowledge and skills, and inconsistency in processes. This process is difficult for traditional companies to change and adapt to and is a significant transformation of people, processes, systems, and technology over time.

A. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The use of self-reported data (interviews) implies potential limitations about the validity of the concept and internal validity of the results [94]. To address this limitation, the study used, as described above, a triangulation procedure based on data from diverse sources (semi-structured in-depth interviews, field notes, and important supporting documents for the interviews). As Yin [119] argued, the purpose of multiple case studies lies in the possibility of making analytical or theoretical generalizations instead of statistical generalizations, that is, to name and replicate theoretically significant situations in several cases. The findings and conclusions of the present study meet this methodological requirement by being based on observed patterns and partly contrasted through a set of fifty-nine cases, as well as supported by theory and earlier research.

Considering the exploratory scope of this study and its importance for academia and the business sector, the number of cases analyzed calls for a potential basis for future research. Therefore, the findings of this novel study on the implementation of scalable agile frameworks in PPM create opportunities for researchers to pursue this line of inquiry, owing to their importance within companies. This inquiry has a promising future and requires attention in developing practice-based research that explores the functional and daily environments of scalable agile frameworks in PPM. This environment is increasingly complex, dynamic, interconnected, and involves the implementation of strategic conceptual aspects [30].

Further research is suggested to confirm the findings of this study and to prove the practical results of implementing scalable agile frameworks in the agile culture of large companies. Further research on agile transformations is recommended because of the scarcity of research in this area of knowledge to (a) implement an agile governance structure in enterprises, (b) confirm whether organizational agility is more successful with the implementation of this structure, and (c) explore the implementation of value streams and agile release tracts in enterprises.

Recent studies have pointed out the need to study the quality of software projects with agile implementation, considering that current research supplies little information on the additional value of agile methods and scalable agile frameworks on software quality [1]. Additionally, research needs to be conducted to supply conceptual frameworks on how an agile organization can further enhance its performance and what promoting quality aspects imply [101]. These gaps in the recent literature say that there is interest in studying agile methods and scalable agile frameworks because of the relevance of this phenomenon to academia and practice. Researchers should enhance this line of inquiry by exploring the day-to-day aspects of software development projects using and applying agile frameworks to prove that projects improve their quality. Finally, it is recommended to inquire into the challenges of scaling agility in the context of global software projects [83] and explore the artifacts of the SAFe framework in large enterprises [74].

APPENDIX
SEMI-STRUCTURED INTERVIEW GUIDE

Part I. Demographic information and general questions of PPM:

Identify the company's project portfolio (s) and the highest-level manager of the PPM's responsibility and governance. In addition, the relationship of PPM with strategic goals and the existence of scalable agile frameworks or agile methods in the organization.

Code	Required information	Question
Q1	Company name	What is the name of the company?
Q2	Name of the employee	What is her name?
Q3	Position in the organization	What is your position within the company?
Q4	Economic sector	What is the sector of your organization?
Q5	Existence of a PPM	How is strategy connected to execution?
Q6	Definition form of communication.	How is project portfolio management (PPM) defined and communicated?
Q7	Alignment between PPM and strategy.	Do your vision and strategic goals align the project portfolio management with the company's strategy?
Q8	Application and use of agile frameworks	What scalable agile frameworks or agile methods are implemented in the organization?
Q9	Reasons to apply or use scalable agile frameworks or agile methods.	Why have you implemented scalable agile frameworks or agile methods? (a) request from senior management, (b) improve project management methods, (c) incorporate changes in projects, (d) improve delivery times, (e) achieve business agility, (d) other and specify.
Q10	Responsible for agile transformation.	Who handle organizational agility? Why?
Q11	Background of agility in the company.	Why do you start agile transformation in the company?

Part II. Strategic Project Portfolio Management (PPM):

Explore portfolio lifecycle, strategic management, and ability management and identify agile tools and techniques used.

Code	Required information	Question
Q12	Number of project portfolio.	How many project portfolios does the company have?
Q13	Types of projects in the portfolio (s).	What types of projects make up the project portfolio (s)? Why?
Q14	Number of projects.	How is the number of projects defined in the portfolio (s)?
Q15	Existence of a display and administration dashboard	What tool is used to visualize and manage epics or strategic goals? (For example: *Kanban,* Balanced Scorecard - BSC) Why?
Q16	Business case type	Why is your organization using traditional or *lean* business cases?
Q17	Origin and approval of the business case	Who generates the business cases and who approves them? Why?
Q18	Prioritization and selection process	How are project portfolios prioritized and selected?
Q19	Project portfolio approval	Who or who handle the approval of project portfolios? Why?
P20	Project portfolio organization type	Why are work breakdown structures or value chains used in the organization of project portfolios?
Q21	Portfolio ability management	How is the allocation, administration and balancing of resources carried out?
Q22	Management of interdependencies	How do you manage the interdependencies between the different project portfolios?

Part III. Project Portfolio Governance:

Explore the roles and responsibilities of the project portfolio, decision-making, inspection, adaptation, and integration into the agile culture of the organization.

Code	Required information	Question
Q23	Roles and responsibilities of the project portfolio	What roles and responsibilities were defined for the project portfolio (s)? Why?
Q24	Planning and estimation process	What agile practices are applied in planning and estimating the project portfolio? (e.g: Lean Budget Guardrails, increments, iterations, story points, planning poker) Why?
Q25	Inspection and adaptation process	What agile practices are applied in the inspection and adaptation of the project portfolio? (e.g., Business Synchronization (PO-Sync), *Scrum of Scrums,* Backlog Refinement, Retrospectives, Reviews) Why?
Q26	Benefits of applying or using agile practices	What are the benefits of implementing these agile practices? Why?
Q27	Strategies to face the challenges	What strategies have been implemented to face the challenges? Why?
Q28	New normal of the COVID-19 pandemic	How was the transition process to a remote work environment?

Part IV. Portfolio Value Management:

Find and predict the expected performance of the project portfolio as defined by the organizational strategy, transparency, and commitment to stakeholders.

Code	Required information	Question
Q29	Predictive indicators of the project portfolio	What predictor indicators does the project portfolio (s) use to predict outcomes? Why?
P30	Fact-based measures to evaluate performance	What are the Key Performance Indicators (KPIs) that are used to assess performance on the project portfolio (s)? Why?
Q31	Interpretation of the indicator results	How are the results of the project portfolio indicators interpreted as defined by the organizational strategy?
Q32	Periodicity of information and evaluation of results	How often are the results reported and evaluated?
Q33	Review and update of the project portfolio	How is the project portfolio (s) reviewed and updated?
Q34	Monitoring automation	How is the collection of information for the results of the indicators carried out?

Part V. Closing Questions:

It allows obtaining additional information and generating snowball sampling through referrals to expand the information of the current case or referrals to include in the sample.

Code	Required information	Question
Q35	Satisfaction with the current PPM process	Are you satisfied with the current project portfolio management process? Why?
Q36	Continuous improvement	What lessons learned have been converted into actions to be implemented in future project portfolios? Why?
Q37	Topics to consider for the study	What important topic was not covered during the interview? Anything else you want to add?
Q38	Instrument scope	How did you feel about the issues that were addressed in the interview?
Q39	To amplify information	What other manager within the organization could expand on the questions related to portfolio value management? (Name, position, contact information)
P40	Case recommendation	Which manager has a high level of responsibility and governance in another portfolio? (Name, position, contact information).

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