

Enablers, barriers, and a contingency framework for enterprise agile adoption: A cross-industry comparative case study

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Abstract

Agile management now extends well beyond software development, yet the organizational conditions for its systematic adoption across enterprise projects remain insufficiently explained. The aim of this study is the identification of the core agile principles, the organizational enablers and barriers, and the elements of a contingency framework for enterprise agile adoption across industries. A qualitative multiple comparative case study design was applied to six peer-reviewed case studies (2018–2026) selected through structured database search and eligibility screening. The cases cover telecommunications, manufacturing (two cases), hardware product development, enterprise software, and IT services and involve Scrum, Kanban, Lean, and hybrid configurations. Within-case thematic analysis, cross-case synthesis, and cross-methodology comparison produced twelve themes. Cross-functional collaboration, iterative development with continuous feedback, and methodological flexibility emerged as principles that transfer across industries, although their operationalization differed substantially between software and physical-product contexts. Leadership commitment, step-wise transformation, and organizational readiness were the recurring enablers, whereas risk aversion, resistance to change, coordination overload, and domain-specific constraints were the recurring barriers and favored hybrid rather than pure agile configurations. Reported outcomes included coordinated large-scale distributed development, organization-wide cost savings, a 53% reduction in product components, and more effective risk mitigation. The findings indicate that agile effectiveness depends on organizational context and that coordination mechanisms must evolve as enterprises scale. The resulting framework combines staged adoption, sustained leadership engagement, investment in training and coaching, hybrid governance where physical or regulatory constraints apply, and periodic review of coordination mechanisms, offering managers practical guidance for context-sensitive adoption.

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1. Introduction

1.1. Changing business environment

Since the onset of the digital era, rapid technological change has required organizations to shift their management practices toward greater adaptability and responsiveness. This fast-paced business environment creates a critical need for agility, because organizations must respond quickly to market shifts and to disruptions caused by new technologies [1]. Agility allows companies to change direction quickly and effectively and fosters innovation and resilience in the face of obstacles [2]. The limited flexibility of traditional management practices has therefore stimulated interest in agile management, which promotes iterative development, cross-functional teamwork, and customer-centered approaches that help organizations remain competitive and respond to changing market demands [3].

The management of innovative business development is also changing. In the current financial and economic environment, information and analytical support are becoming increasingly important for the effective management of enterprise development [4]. Beyond traditional knowledge and skills, strategic management requires the ability to integrate innovative tactics and to combine creativity with technological competence in order to create distinctive market propositions. Understanding the needs and expectations of modern consumers, adapting to a rapidly changing market, and using current technologies to develop innovative goods and services are central to this capability [5]. Contemporary project management scholarship likewise holds that agile practices allow companies to respond efficiently to disruptive technologies and to meet growing customer demand for rapid value delivery [6]. This growing complexity has placed new demands on the way organizations manage their projects.

1.2. Project management and the limits of traditional approaches

In project management, success depends on the appropriate application and integration of the processes defined for a project, and project management is the mechanism through which organizations execute their projects efficiently [7]. Projects have become central to all types of organizations; they typically carry a substantial financial dimension, operate under strict deadlines, and require standardization [8]. The project manager is responsible for initiating, planning, designing, executing, monitoring, and controlling the project, and technological progress increasingly requires information, including intellectual capabilities, to be treated as a managed resource [9]. Regardless of the qualifications of project managers, established procedures must be followed if a project is to succeed. Enterprises approach projects in various ways, but Waterfall and Agile remain the most widely used methodologies [10]. Project management provides guidance and leadership; without it, a project may proceed without direction, control, or a clear objective. Senior leadership enables team members to perform well by providing vision, motivation, and training and by encouraging each participant to fulfill their role [11]. However, the limitations of traditional project management become more visible as projects grow larger and more complex and as market conditions change faster. This recognition has led organizations to explore alternative methodologies and has driven the widespread adoption of agile project management across industries.

1.3. Agile adoption in project management

The roots of agile project management can be traced to the 1930s, when Walter Shewhart conceptualized short improvement cycles as a method of quality improvement, later known as the Plan–Do–Study–Act (PDSA) cycle. In the 1960s, an internal IBM report recognized the value of iterative refinement, and in the 1970s the company's Federal Systems Division completed projects worth more than \$100 million using iterative methods [12]. In the late 1980s, researchers observed that small multidisciplinary teams, combined with elements of

Toyota's production approach, reduced the number of developed but unused systems and improved customer perceptions of quality [13]. Agile methodologies were formally articulated only in 2001 [14].

Agile methodologies originated in software development but have since spread widely across industries. According to the 18th State of Agile report, 74% of surveyed organizations now use blended, hybrid, or homegrown agile approaches rather than a single framework, and only 13% report that agile is deeply embedded across their business [15]. The same survey shows that the use of artificial intelligence (AI) in agile work increased from 68% to 84%, with early adopters experimenting with agentic systems that act autonomously [16]. Reference [17] documents both the achievements and the persisting challenges of applying AI in software development and shows that such tools are reshaping how development and management work is organized. An industry survey cited in [18] reports that 95% of organizations have adopted some form of agile, although only 50% state that more than half of their teams use agile at scale. In software development, agile approaches have gained popularity because they accelerate delivery: according to data from the Standish Group CHAOS reports, only 29% of traditional projects succeed, whereas agile projects that release frequently succeed 42–64% of the time [19], and a recent systematic review reports that agile methods can raise project success rates by up to 28% relative to traditional approaches [20]. Agile methodologies have also been associated with lower development costs, better product quality, higher productivity, and greater business satisfaction [21], and the ability to change direction swiftly is one of the main reasons for their acceptance. Survey evidence on comparative performance is, however, less clear-cut: respondents who use agile approaches (39% of the sample) report the highest average project performance rate (75.4%), yet this rate only marginally exceeds those reported for predictive (74.4%) and hybrid (74.6%) approaches [22]. Hybrid project models that blend agile methods with traditional elements are spreading rapidly; Project Management Institute data show a 57% increase in their use and an average project performance rate of 73.8% [23].

Agile adoption also has downsides. In the 17th State of Agile survey, 47% of respondents identified generalized resistance to organizational change or a culture clash as the greatest obstacle to adoption, followed by insufficient leadership participation, inadequate management support, and insufficient training [24]. These difficulties are compounded where basic planning, accounting, and control routines are weak: such routines act as core risk management tools in investment projects, particularly in small businesses, and their absence leaves agile initiatives exposed to unmanaged risk [25]. Enterprises also find it difficult to scale agile beyond the team level and to integrate it across the organization. A systematic review of agile and hybrid project management studies found that difficulty in scaling agile was the barrier reported most often (60.53% of the reviewed cases) and that the underlying research concentrates on a limited set of sectors, led by aerospace and defense, business services, and construction [20].

1.4. Literature review

Rapid change is a defining characteristic of the contemporary business environment and requires quick responses to shifting demands [26]. With globalization, organizations are no longer confined to a single region and have expanded their scope accordingly [27]. Exposure to globalization, changing demands, and large-scale production has revealed that approaches deeply embedded in traditional organizational processes cannot meet rapidly evolving expectations, and this limitation stimulated the emergence of the agile process model, or agile project management. Agile development is currently the most widely used strategy in software development [28]. The review below does not describe agile methods in detail; it examines the assumptions and empirical limitations of the three most widely used frameworks, the barriers and success factors reported in the literature, and the theoretical lenses used to interpret them.

1.4.1. Scrum, Kanban, and Lean: promises and critiques

Scrum was developed by Ken Schwaber and Jeff Sutherland to enable iterative and incremental software development and has since been adopted in other fields. Its capacity to support iterative progress and stakeholder collaboration is considered the main reason for its applicability across environments [28]. The framework rests

on defined roles, events, and artifacts. The Scrum master coaches the team, removes impediments, and mediates between the team and external stakeholders; the product owner maximizes product value by managing and prioritizing the product backlog on the basis of business value and customer feedback; and the cross-functional development team delivers an increment at the end of each sprint [29]. The events comprise the sprint, a time-boxed iteration that usually lasts two to four weeks, together with sprint planning, the daily Scrum of about 15 minutes, the sprint review, in which completed work is demonstrated to stakeholders, and the sprint retrospective, which identifies successes, areas for improvement, and actions for future sprints; the artifacts are the product backlog, the sprint backlog, and the increment [30]. Empirical scrutiny has nevertheless identified limitations. Rigid time-boxing, which suits many software projects, can become a source of dysfunction in project environments that do not fit the Scrum cadence. Reference [31] further argues that when agile rituals are not grounded in agile principles, organizations drift into “wagile,” which adopts the trappings of agility without its benefits and carries the overheads of both approaches.

Kanban originated in Toyota’s automotive production system and has since been adopted in project management in sectors such as healthcare and software development [30]. It makes work items visible, limits the amount of work in progress (WIP), and seeks efficient delivery of products and services. Its principles are visualization of the workflow on a Kanban board with columns such as “To Do” and “In Progress,” which lets every member see the current status of work; limitation of WIP, which helps the team finish current tasks before starting new ones and thus reduces bottlenecks [26]; continuous flow instead of fixed iterations, with new items entering the workflow as capacity becomes available; feedback loops through regular reviews that support process optimization; and transparent communication that reduces coordination friction. In operations with steady-state delivery rather than episodic feature releases, Kanban has improved throughput and workflow efficiency. Its open-endedness can, however, become a problem when tasks lack defined roles and iterations. Reference [31] notes that Kanban’s flexibility and emphasis on flow can be a disadvantage for projects with fixed release dates and in settings where WIP cannot easily be limited, and [32] characterizes the adoption of Kanban boards for visualization without a commitment to optimizing flow as a common surface-level appropriation that yields cosmetic change without substantive improvement.

Lean management, which also originated in the Toyota production system, maximizes customer value while minimizing waste through workflow optimization, elimination of non-value-adding activities, and continuous process improvement. In software development, Lean imposes fewer rules and procedures than Scrum and is therefore more flexible; at the same time, it follows a top-down logic in which principles are defined by senior management and applied across the company [26]. Its core principles are value identification from the customer’s perspective, value stream mapping to separate value-adding from non-value-adding steps, flow creation to minimize delays and interruptions, pull-based production driven by actual customer demand rather than forecasts, and continuous improvement (kaizen), in which all employees are encouraged to identify inefficiencies and propose improvements. Combined with agile methodologies, Lean can strengthen a firm’s capability to respond quickly to customer feedback and evolving market requirements [33], because the agile emphasis on iterative development and teamwork complements Lean principles. The integration is not without problems. Lean originated in manufacturing, where constraints on physical material flows differ from those on information flows, so tools such as value stream mapping require substantial reinterpretation in software and service contexts. Reference [33] also warns that organizations combining Lean principles with agile methods can fall into process overload, spending more time measuring processes than delivering value.

All three frameworks share a critical blind spot: insufficient attention to quantitative performance evaluation. Reference [34] identifies a gap between the theoretical advantages of agile and their practical realization and attributes it to limited empirical rigor in outcome evaluation and to the influence of “cargo cult” agile practices. Hybrids that combine agile with other methodologies can achieve both flexibility and effectiveness, which suggests that methodological pluralism may be more productive than strict adherence to a single pure framework.

1.4.2. Comparative synthesis of Scrum, Kanban, and Lean

Scrum, Kanban, and Lean share three foundational values: iterative development, customer collaboration, and rapid response to change [28], [30], [33]. They differ, however, in structuring principles, operational emphasis, and suitable project contexts. Scrum's prescriptive structure provides predictability and rhythm but can be too rigid for some contexts [29]. Kanban is flexible and supports continuous flow without fixed iterations or roles, which allows work to proceed according to capacity and to absorb frequent priority changes; it is therefore useful for steady-state delivery, support, and maintenance work [30]. Lean focuses on waste reduction, value stream optimization, and demand-driven workflows; like Kanban, it emphasizes flow, but it also applies to broader strategic decisions [26]. On the continuum from structure to flexibility, Scrum offers the most structure, Kanban the least, and Lean occupies a middle position. Scrum prescribes specific roles, whereas Kanban and Lean are largely role-agnostic. Hybrid approaches combine elements of several frameworks, and the choice among them depends on project characteristics, team capabilities, and organizational context: Scrum may benefit projects with well-defined requirements and stable teams, Kanban suits contexts with high variability and unpredictable workloads, and Lean fits organizations that seek systematic transformation.

1.4.3. Barriers to agile adoption

Practitioner literature frequently names resistance to change as the principal barrier to agile adoption. A more differentiated picture emerges from a recent systematic review that identifies 19 challenges grouped into three categories: people, leadership, and organization and processes. People-related challenges are the most frequent and include lack of knowledge, inefficient collaboration, and plan-driven thinking; leadership challenges comprise cultural mismatch and insufficient management support; and organizational challenges include weak coordination and inadequate planning [35].

Industry-specific barriers are less well understood. Agile methods support adaptability and continuous improvement in the software industry [36], but other sectors lack comparable standardization. In healthcare, for example, the absence of standard processes and the diversity of workflows make it difficult to establish the consistent practices on which agile methods depend [37]. Empirical studies of agile methods in other industries, sectors, and project types also remain scarce [38]. The transport sector illustrates this gap: intelligent transport systems are reshaping urban mobility through complex, multi-stakeholder, and technology-intensive projects [39], yet agile adoption in such settings remains largely undocumented.

1.4.4. Critical success factors

Research attention has shifted from methodological mechanics to the organizational preconditions of agile success. When agile moves from small-scale software settings to large projects in non-software firms, organizational factors interact in significant ways, particularly co-location and the availability of technical resources [2]. Enablers of agile adoption have been examined across five domains, namely organizational, people, process, technical, and project factors, and the evidence assigns greater weight to organizational and people-related factors such as management commitment, team capability, and the organizational environment. This pattern is consistent with a socio-technical perspective, according to which successful implementation requires simultaneous attention to human, structural, and tool-based dimensions [40]. Leadership commitment has been empirically confirmed as a critical success factor, but only when it takes the form of sustained engagement with the cultural and behavioral changes that agility demands rather than resource allocation or executive approval alone [41]. Changes in leadership behavior, supported by training, effective communication, and knowledge management, therefore play a central role in agile transformation.

1.4.5. Theoretical foundations and conceptual framework

This study adopts a conceptual framework that synthesizes the principal dimensions of agile adoption in enterprise project environments and structures the interpretation of the case evidence in relation to the research questions. Agile effectiveness is conceptualized as a function of the dynamic interaction among three

components: methodological practices, organizational context, and implementation approach. Contingency theory explains why these components must be aligned for an implementation to be effective: organizations operating in different industries, regulatory environments, and cultural settings require different configurations of agile practices [42]. Socio-technical systems theory adds that social, technical, and organizational subsystems are interdependent, so that changes in practices succeed only when the human and structural dimensions change with them [43]. Research on hybrid project management, finally, shows how agile practices can be combined with plan-driven structures such as stage-gate processes [44], [45]. Project outcomes are therefore assessed through both quantitative performance metrics and qualitative indicators.

The framework guides the empirical analysis in three ways. First, it structures the information captured for thematic analysis. Second, it enables cross-case comparison of how practices, contexts, and implementation approaches interact in different industry environments. Third, it informs the development of the agile adoption framework presented in Section 3.8.

1.5. Research gap and justification of the study

The literature reviewed above reveals three interrelated inconsistencies. First, the operational details of agile frameworks are well documented for software projects, whereas the integration of agile principles with broader project governance across enterprise functions, particularly outside IT and in hybrid structures, remains insufficiently explained [26], [46]. Agile methods have been studied extensively in software and technology-intensive manufacturing but much less in service industries, construction, and professional services [46], and empirical studies in other sectors remain scarce [38]. Second, survey-based studies tend to associate agile adoption with project success, whereas case studies frequently document implementation failures; self-selection and definitional ambiguity may explain part of this contradiction. Comparison across studies is further hindered because widely cited industry surveys do not show whether agile practices are deeply embedded in organizational change or only superficially complied with [47], and failure cases, which could support robust theories of implementation failure, are underrepresented in the literature. Third, few longitudinal studies can distinguish initial enthusiasm, mid-implementation crises, and sustainable transformation.

These inconsistencies define the research gap addressed in this study: a cross-industry, case-based explanation is missing of how agile principles are configured in enterprise projects, which organizational enablers and barriers shape their adoption beyond the team level, and how these factors can be combined into a contingency-based framework for enterprise-wide adoption in non-software and hybrid settings. This gap limits the ability of managers to anticipate implementation risks and to decide when pure or hybrid configurations are appropriate. The study is timely because blended and hybrid approaches now dominate practice [15], while evidence on non-software industries remains limited [26].

1.6. Aim, research questions, and contribution

The aim of this study is the identification of the core principles of agile management as enacted in enterprise projects, the organizational enablers and barriers that shape their adoption, and the elements of a contingency framework for systematic enterprise agile adoption across industries. The study addresses three research questions.

RQ1. Which core principles and foundational methodologies of agile management are enacted in enterprise project environments, and how are they adapted across industry contexts?

RQ2. Which organizational enablers and barriers shape the implementation of agile management in enterprise settings beyond the team level?

RQ3. Which elements should a contingency-based framework for systematic agile adoption in enterprise project management include?

RQ1 establishes how agile principles are enacted, RQ2 explains the contextual conditions of implementation, and RQ3 integrates the answers to RQ1 and RQ2 into managerial guidance that moves beyond the positivity bias of much of the literature. The study contributes to the literature in three ways. First, it synthesizes recent

case evidence (2018–2026) that challenges both dogmatic agile advocacy and equally dogmatic traditionalist resistance. Second, it extends the analysis from team-level and project-level agility to enterprise-wide concerns and explicitly addresses the scalability and hybrid governance challenges identified in earlier studies. Third, it draws on socio-technical systems theory to explain why organizational factors consistently outweigh technical factors in determining implementation outcomes and what this implies for resource allocation. The remainder of the paper is structured as follows: Section 2 describes the research method, Section 3 presents and discusses the findings from the six case studies, and Section 4 summarizes the conclusions, limitations, and directions for future research.

2. Research method

The study applies a qualitative multiple comparative case study design to examine the core principles, organizational enablers and barriers, and systematic adoption of agile management in contemporary enterprises. The procedure is documented in sufficient detail to allow replication and to provide an evidence base for the three research questions.

2.1. Research philosophy and design

The study follows an interpretivist philosophy because agile management practices are socially constructed and shaped by context, leadership behavior, team dynamics, and organizational culture. A qualitative multiple comparative case study design was selected for three reasons: the research questions are exploratory and explanatory; the design allows a rich, in-depth examination of how agile principles are enacted in different organizational contexts; and the comparative structure supports the identification of patterns, contingencies, and transferable insights across methodologies (Scrum, Kanban, Lean, and hybrid configurations). The unit of analysis is the implementation of a project management methodology in an enterprise project setting. Reference [48] recommends treating multiple cases as a series of independent experiments and preferring replication logic to sampling logic when selecting cases; this approach strengthens external validity and supports the development of an integrative adoption framework. The evidence base consists exclusively of published case studies; the design is therefore a multiple case study with literature-based case selection, not a systematic review.

2.2. Case selection strategy

2.2.1. Search strategy and database screening

Six case studies were selected through purposive sampling intended to maximize the diversity of industry sectors and organizational contexts. Candidate studies published between 2018 and 2026 were searched in Google Scholar, Scopus, Web of Science, SpringerLink, MDPI, and Sage Journals. The search string was (“agile management” OR “Scrum” OR “Kanban” OR “Lean management”) AND “case study” AND (“modern enterprise” OR “organization”) AND “project management.” Because Google Scholar also indexes grey literature, peer review was enforced as an explicit eligibility criterion rather than assumed from the database.

2.2.2. Inclusion and exclusion criteria

To be included, a study had to meet five criteria: (1) it had to be a publicly accessible, peer-reviewed case study of agile methodology implementation in an enterprise project context; (2) it had to be published between 2018 and 2026; (3) it had to describe the implementation context, processes, challenges, and outcomes in sufficient detail; (4) it had to specify the primary agile methodology implemented; and (5) it had to add an industry or organizational context not already represented in the sample, to allow cross-sectoral comparison. Non-peer-reviewed sources, studies published before 2018, studies without a clear specification of the agile methodology, studies with insufficient detail, and studies with restricted access were excluded. The time frame was chosen to capture recent empirical evidence. A sample of six cases was considered sufficient because patterns in qualitative multiple case study research typically emerge with four to six cases, while this number remains manageable for in-depth cross-case comparison.

2.2.3. Selection procedure and final sample

Figure 1 summarizes the selection procedure. The database search identified 108 records, of which 50 duplicates were removed before screening. Of the 58 records screened, 17 were excluded because their research design differed from the case study format. Of the 41 reports sought for retrieval, 5 could not be retrieved, and the remaining 36 were assessed for eligibility. Thirty reports were excluded at this stage for insufficient detail ($n = 16$), unclear methodology specification ($n = 9$), or an industry context already represented in the sample ($n = 5$). The six case studies that met all criteria constitute the final sample analyzed in this paper.

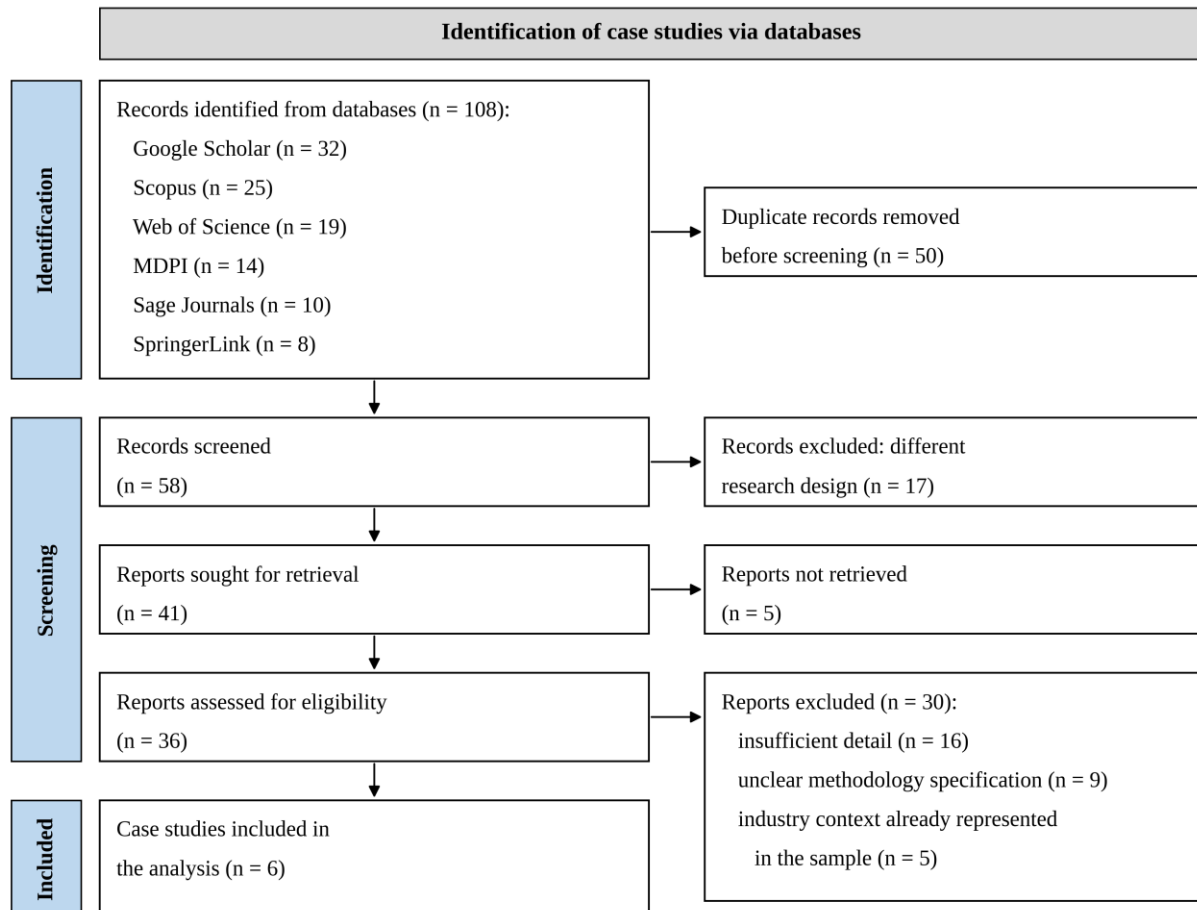


Figure 1. Flow diagram of the case study selection procedure

2.3. Data extraction

Each selected study was analyzed with a standardized data extraction template to ensure systematic and replicable data collection, and all extracted data were entered into NVivo 14 for coding, theme development, and cross-case comparison. The template captured four categories of information for each case: contextual information (industry, enterprise size, location, project type, and scale); methodology specification (agile framework, implementation duration, and scaling approach); enablers and barriers (organizational factors that supported or hindered adoption); and performance outcomes (reported effectiveness, efficiency, stakeholder satisfaction, and challenges).

2.4. Data analysis framework

The analysis proceeded in four stages, each explicitly linked to the research questions.

Stage 1: Within-case analysis (RQ1 and RQ2). Each case study was first analyzed separately to identify how agile principles were configured (RQ1) and how implementation unfolded, including the factors that facilitated or hindered it (RQ2). An initial codebook was developed following the six-phase approach to thematic analysis

described in [49]: familiarization through repeated reading of each study; generation of initial codes in NVivo 14; grouping of codes into candidate themes; review and refinement of themes; definition and naming of each theme; and preparation of within-case summaries for each of the six studies.

Stage 2: Cross-case synthesis (RQ1 and RQ2). A cross-case comparative matrix was then used to compare the cases on five dimensions: core agile principles enacted, methodology-specific practices, implementation barriers, performance outcomes, and industry-specific contingencies. The matrix made patterns and anomalies across the six cases visible and supported analytical generalization, which [48] defines as the extension of empirical findings to theoretical propositions.

Stage 3: Cross-methodology comparison (RQ1 and RQ2). Scrum, Kanban, Lean, and hybrid configurations were compared to identify commonalities and differences, followed by an assessment of whether the enablers, barriers, and performance outcomes were specific to particular methodologies or generalizable across approaches.

Stage 4: Framework development (RQ3). The findings of Stages 2 and 3 were synthesized into an integrative framework for agile adoption through pattern matching against the theoretical propositions derived from the literature review.

2.5. Validity and reliability

Four strategies were applied to ensure rigor and trustworthiness: the use of multiple case studies supported credibility; rich description of each implementation context and process supported transferability; documentation of the search strategy supported dependability; and reflexive journaling, used to mitigate interpretive bias, supported confirmability.

2.6. Limitations of the method

The method has five limitations. First, it relies on publicly available case materials rather than primary data, so the depth of insight depends on the original case authors. Second, published case studies carry an inherent positivity bias, which may lead to under-reporting of failures and implementation challenges. Third, the authors could not independently verify the reported data, performance metrics, or implementation details and relied on the credibility of the original studies. Fourth, although the cases represent diverse sectors, not all industries are covered, and all six cases concern European organizations, which limits generalization to unrepresented sectors and regions. Fifth, differences in the research designs, data collection methods, and reporting conventions of the original studies introduce heterogeneity in the depth and reliability of the available information.

2.7. Linking the analysis to the research questions

The analytical framework was designed to address each research question while maintaining integration across the study. RQ1 is addressed through within-case analysis of each methodology's implementation practices and cross-methodology comparison of the enacted principles. RQ2 is addressed through thematic analysis of the success factors and challenges reported in each case, followed by cross-case synthesis to identify recurring patterns and industry-specific contingencies. RQ3 is addressed through synthesis of the findings for RQ1 and RQ2, using pattern-matching logic to derive a contingency-based framework for systematic agile adoption.

3. Results and discussion

This section presents the findings from the six case studies, organized according to the three research questions, and then discusses them in relation to theory, previous empirical studies, and managerial practice. The sample includes two manufacturing cases that differ in enterprise size and product type: a small and medium-sized enterprise (SME) that produces beds and mattresses and an industrial manufacturer of joining systems. Table 1 provides an overview of the selected cases, their industries, methodologies, and principal reported outcomes.

Table 1. Overview of the selected case studies

Case (year)	Industry/sector	Methodology	Source	Principal reported outcomes
Ericsson (2018)	Telecommunications (large-scale R&D)	Scrum (large-scale)	Paasivaara et al. [50]	Faster delivery cycles; improved responsiveness; better communication
Deluxe Beds (2021)	Manufacturing (bed and mattress SME)	Scrum (partial implementation)	Javed et al. [51]	Cost savings above £1.8 million from an organization-wide improvement program that embedded Scrum; improved productivity, process innovation, and collaboration
Tele and Radio Research Institute (2022)	Hardware product development	Iterative agile practices within stage-gate-like governance	Weichbroth [52]	More effective risk mitigation; greater adaptability; closer communication and collaboration
Entur (2023)	Enterprise software	Scrum + Kanban	Berntzen et al. [53]	Continuous evolution of coordination mechanisms; recognition of informal communication; maturing governance
Progetti e Soluzioni (2024)	IT services	Scrum/Kanban	Ndou et al. [54]	Stronger leadership support, structure, competencies, and culture
Atlas Copco Henrob (2026)	Manufacturing (joining-system product development)	Lean + Agile integrated with stage-gate	Fargher et al. [55]	53% fewer components; about 35% shorter assembly time; 25% more complete knowledge documentation; faster decision-making

3.1. Core agile principles identified (RQ1)

Thematic analysis identified three themes related to the core principles and foundational methodologies of agile management.

Theme 1: Cross-functional collaboration as a foundational enabler. All six cases emphasized the need to establish cross-functional teams. Ericsson moved from component-based virtual teams to fully cross-functional, cross-component, and cross-site teams, which enabled continuous feature delivery and end-to-end development [50]. At Deluxe Beds, daily morning meetings and weekly Toolbox Talks built on Scrum principles improved productivity and process innovation, produced more effective teams, and strengthened communication across the workforce [51]. The Progetti e Soluzioni case reported improved collaboration and communication as a principal benefit of agile adoption [54], and the implementation of the Lean and Agile Model for Product Development (LAMPD) at Atlas Copco Henrob increased cross-functional participation and the frequency of cross-functional meetings [55].

Theme 2: Iterative development and continuous feedback. In the Tele and Radio Research Institute (TRRI) case, respondents agreed that short iterations reduced the process overhead needed to keep work on course and partly agreed that such iterations provided more frequent customer feedback, more opportunities to reflect on and improve work practices, and faster responses to changing priorities [52]. Ericsson delivered features continuously through an experimental, step-wise transformation [50], the Progetti e Soluzioni framework explicitly included iterative development among its benefits [54], and the LAMPD model aligned time-boxed sprints with the phase boundaries of the stage-gate process [55].

Theme 3: Methodological flexibility and contextual adaptation. The cases also showed that flexibility, rather than prescribed practice, was necessary. The Entur longitudinal study documented how coordination mechanisms were continuously redeveloped in response to external and internal events [53]. The TRRI case illustrated how software-derived techniques (short iterations, release planning, and iteration planning) were adapted to a mixed hardware and software development context, while practices such as daily stand-ups and Kanban boards were not adopted [52]. The LAMPD study explicitly combined stage-gate processes with Scrum ceremonies and Kanban visualization [55].

3.2. Organizational enablers and barriers (RQ2)

Thematic analysis identified six recurring themes related to RQ2: three describe enablers and three describe barriers.

3.2.1. Enablers

Theme 4: Leadership commitment and top management support. Leadership commitment was the most frequently reported enabler. The Progetti e Soluzioni case emphasized top management support and continuous learning and showed that formalizing agile initiatives through structured processes and continuous engagement created a sense of purpose among team members [54]. The Ericsson case showed that common training and coaching, backed by leadership, were essential to prevent fragmentation of a large-scale transformation [50]. At Deluxe Beds, the change manager was the central actor in implementing organizational change [51].

Theme 5: Structured and step-wise transformation approaches. Ericsson deliberately adopted an experimental, step-wise transformation to manage the complexity of its large-scale R&D environment [50]. The Progetti e Soluzioni case presented a phased agile journey that progressed from preliminary analysis and roadmap definition through training and coaching to the assessment of outcomes [54]. The LAMPD model was developed in three stages: company engagement, integration of the product development model, and Lean–Agile harmonization [55].

Theme 6: Organizational readiness and cultural adaptation. The Progetti e Soluzioni case identified four dimensions of successful agile transformation: culture, competencies, structure, and approaches [54]. At Deluxe Beds, a culture of avoiding meetings and a communication gap between senior leadership and the factory floor preceded the adoption of Scrum-based practices, which subsequently produced more effective teams and better communication [51].

3.2.2. Barriers

Theme 7: Resistance to change and risk aversion. Several cases identified resistance to change as the main obstacle. In the TRRI case, the project partner reported general organizational resistance to change and an unwillingness to admit mistakes and learn from delivery failures [52]. At Deluxe Beds, the change manager acknowledged that a cautious approach, driven by fear of failure, limited the benefits of a partial Scrum implementation [51]. The Ericsson case addressed this obstacle indirectly through common training and coaching that built confidence and alignment [50].

Theme 8: Scalability and coordination complexity. Scaling agile beyond the team created a recurring coordination problem. The Entur study showed that external and internal events, such as the acquisition of new clients and changes in team structure, directly affected coordination mechanisms, which therefore required continuous adjustment; appropriate mechanisms applied at the right time supported resilience, but achieving this alignment took a long time [53]. At Ericsson, cross-functional and cross-site teams also raised coordination concerns, and the interchangeability of teams in complex settings proved limited [50].

Theme 9: Domain-specific constraints. In non-software environments, industry-specific restrictions were significant obstacles. The TRRI project combined hardware and software development, and fragmented tooling and the pervasiveness of traditional development methods acted as barriers [52]. The LAMPD study addressed domain specificity directly by integrating Lean principles into agile frameworks to accommodate hardware development constraints that basic agile principles do not cover [55].

3.2.3. Cross-case synthesis of enablers and barriers

Table 2 compares the main enabler, main barrier, and principal outcome of each case. Across the six cases, the enablers cluster around leadership commitment, structured transformation, and adaptive coordination, whereas the barriers cluster around risk aversion, resistance to change, coordination overload, and domain-specific

constraints. The reported outcomes range from cost savings and faster delivery to more mature governance and a shared sense of purpose.

Table 2. Cross-case synthesis of enablers, barriers, and outcomes

Case	Methodology	Main enabler	Main barrier	Principal outcome
Ericsson	Scrum	Step-wise transformation; common training and coaching	Coordination complexity across distributed teams	Faster delivery cycles; improved responsiveness
Deluxe Beds	Scrum (partial)	Dedicated change management leadership	Risk aversion; cautious, partial implementation	Organization-wide savings above £1.8 million; improved collaboration
TRRI	Iterative agile practices (stage-gate-like governance)	Short iterations; release planning	Resistance to change; fragmented tooling	More effective risk mitigation; closer collaboration
Entur	Scrum + Kanban	Dynamic adjustment of coordination	Coordination overload; organizational inertia	Resilient coordination mechanisms; mature governance
Progetti e Soluzioni	Scrum/Kanban	Top management support; structured framework	Cultural resistance; competency gaps	Shared purpose; sustained commitment
Atlas Copco Henrob	Lean + Agile	Lean–Agile harmonization	Tension between Lean and Agile logics; integration complexity	53% fewer components; 25% more complete knowledge documentation

3.3. Elements of an enterprise adoption framework (RQ3)

The results of the six cases were used to identify the elements of an integrative framework for systematic agile adoption, which are captured in three further themes.

Theme 10: Hybrid and context-sensitive configurations. Hybrid models, rather than pure agile, proved most suitable, particularly in non-software environments. The LAMPD study combined Lean product development principles with agile practices by integrating stage-gate processes with Scrum ceremonies and Kanban visualization [55]. In the TRRI case, iterative agile practices operated within a project governance structure that the author found very similar to the hybrid Agile–Stage-Gate model [52]. In the Entur study, Scrum teams worked with Kanban-style coordination mechanisms [53].

Theme 11: Socio-technical interdependence. Successful agile adoption required simultaneous attention to social and technical aspects. The Progetti e Soluzioni case identified socio-technical interdependencies as determinants of success, since culture, competencies, structure, and approaches had to be addressed in a coordinated way [54]. The Ericsson case likewise combined social and technical measures, including training and coaching, communication, cross-functional teams, and continuous integration [50]. At Deluxe Beds, closing the communication gap between senior leadership and operational teams proved as important as the Scrum-based routines themselves [51].

Theme 12: Continuous evolution as an organizational capability. Agile adoption was not a one-time event but a way of working that had to be developed continuously as an organizational capability. The Entur study showed that continuous scaling entails continuous change and adjustment [53]. The Progetti e Soluzioni framework included coaching and outcome assessment to foster agile maturity [54], and the three-stage development of the LAMPD model likewise indicates that agile adoption unfolds in phases over time [55].

3.4. Quantitative performance outcomes

Table 3 summarizes the quantitative outcomes reported in the cases. Only two of the six cases reported quantified performance outcomes; the others described their results qualitatively. Deluxe Beds reported cost savings exceeding £1.8 million from an organization-wide improvement program in which Scrum was

embedded, although the original study does not quantify the share attributable to Scrum [51]. Atlas Copco Henrob reported a 53% reduction in component count (from 19 to 9 components), an approximately 35% reduction in assembly time in initial trials, and a 25% improvement in the completeness of knowledge documentation [55]. The TRRI case reports the project budget (€1.2 million for 2019–2021) but no quantified performance outcome [52].

Table 3. Quantitative performance outcomes reported by the cases

Case	Outcome measure	Reported result
Deluxe Beds	Cost savings	More than £1.8 million (organization-wide program; share attributable to Scrum not quantified)
Atlas Copco Henrob	Component count	53% reduction (from 19 to 9 components)
	Assembly time	Approximately 35% reduction (initial trials)
	Completeness of knowledge documentation	25% improvement

The remainder of this section interprets the results in relation to management theory, previous empirical studies, and current practice. The discussion addresses the theoretical implications of agility as an organizational capability, a cross-industry comparison of agile adoption, a deeper analysis of organizational barriers, the proposed adoption framework, and practical implications for managers; methodological limitations are addressed in Sections 2.6 and 4.4.

3.5. Theoretical implications: agility as a dynamic organizational capability

The results support and extend contingency theory in the context of agile project management. Contingency theory holds that a management practice must fit the task context, environmental uncertainty, and organizational structure [42]. In the Ericsson case, this fit was explicit: the transition to cross-functional, cross-component, and cross-site teams was designed specifically for the coordination needs of large-scale distributed R&D [50]. The limited interchangeability of teams observed in this environment, which a pure Scrum logic would not anticipate, extends contingency theory by showing that even a single methodology requires considerable adaptation to contextual factors.

In the Atlas Copco Henrob case, Lean and agile principles complemented rather than replaced the stage-gate process, whose activities were retained for corporate governance, compliance, and stability in hardware development [55]. This finding challenges the universalist claims of practitioner literature that advocates pure agile adoption irrespective of context and supports the growing literature on hybrid models in non-software settings [44].

The results also corroborate socio-technical systems theory [43], which emphasizes the interdependence of social, technical, and organizational subsystems [56]–[58]. The four dimensions of successful transformation identified in the Progetti e Soluzioni case (culture, competencies, structure, and approaches) reinforce recent studies that question whether agile can be implemented without addressing its human and organizational dimensions [59], [60]. The Entur study extends socio-technical theory by showing that coordination mechanisms change continuously in response to internal and external events [53]. Agility therefore appears not as a state to be attained but as a capability that must be continuously recreated and adjusted, which departs from earlier, more static conceptualizations of agile adoption.

A comparison of the two manufacturing cases offers a further theoretical insight. Both Deluxe Beds and Atlas Copco Henrob introduced agile practices in manufacturing settings, with different degrees of success. Deluxe Beds achieved substantial savings but acknowledged that incomplete implementation driven by fear of failure held back further benefits [51]. Atlas Copco Henrob deliberately integrated Lean and agile practices with stage-gate governance and achieved quantified product and process improvements [55]. The comparison suggests that, in manufacturing, deliberate methodological hybridity delivers greater benefits than a cautious partial

adoption of a single framework. This finding challenges the pure agile advocacy of much practitioner literature and supports the contingency-based approaches promoted in recent scholarly research [42], [45].

3.6. Cross-industry comparison: enablers, barriers, and contingencies

The six cases cover telecommunications, manufacturing (two cases), hardware product development, enterprise software, and IT services, and this diversity reveals how industry context shapes agile adoption. Table 4 summarizes the adaptations of agile practice required in each industry context; the corresponding enablers and barriers are listed in Table 2.

Table 4. Cross-industry synthesis of required agile adaptations

Industry	Case	Required agile adaptation
Telecommunications	Ericsson	Scale agile through cross-functional, cross-site teams; account for limited team interchangeability
Manufacturing (SME)	Deluxe Beds	Address psychological barriers; build organizational courage through visible leadership commitment
Hardware product development	TRRI	Adapt iterations to physical testing cycles; integrate agile practices with regulatory compliance testing
Enterprise software	Entur	Treat coordination as a dynamic capability; reassess coordination mechanisms continuously
IT services	Progetti e Soluzioni	Address socio-technical dimensions simultaneously; avoid focusing solely on structural change
Manufacturing (product development)	Atlas Copco Henrob	Integrate Lean with agile; run Scrum ceremonies alongside stage-gate processes

Telecommunications (Ericsson). The principal challenge in large-scale R&D was coordination among distributed teams, and the enabler was an experimental, step-wise transformation supported by common training and coaching [50]. The risk of agile fragmentation, in which teams apply agile inconsistently, has to be addressed proactively. This result is consistent with evidence that coordination complexity recurs in large-scale agile settings [6], [53].

Manufacturing SME (Deluxe Beds). The principal challenges were risk aversion and partial implementation. The change manager's observation that fear of failure constrained the implementation highlights a psychological and cultural obstacle that is often neglected in accounts of Scrum implementation [51]. Strong change management leadership was a decisive enabler, yet the case shows that even a successful agile implementation remains suboptimal when organizational courage is missing.

Hardware product development (TRRI). This case highlights barriers specific to physical products. Short iterations that produce potentially releasable increments are central to Scrum [3], but physical prototyping and regulatory testing, such as the electromagnetic compatibility testing that shaped the second hardware iteration in this project [52], constrain their use. Agile practices therefore have to be adapted fundamentally to ensure product safety and regulatory compliance in physical product contexts [44].

Enterprise software (Entur). Coordination mechanisms had to be continually redeveloped. Organizational inertia, that is, resistance to change even when established approaches no longer fit their purpose, was a central challenge, and ceremonies risked becoming rituals that continued after they had ceased to add value [53]. This finding extends previous research by showing that coordination is not a one-off design problem but an organizational capability that evolves over time.

IT services (Progetti e Soluzioni). The principal challenges were competency gaps and cultural resistance. The four-dimension framework developed in this case demonstrates that simultaneous action at several organizational levels is required and that concentrating on structural changes, such as new agile roles, without addressing culture and competencies produces agile in name only [54]. This finding is consistent with recent studies on the human and organizational dimensions of agile transformation [59], [60].

Manufacturing product development (Atlas Copco Henrob). The most recent case represents the most advanced methodological integration. It implicitly addresses the historical Lean-versus-Agile dichotomy, which treats the two approaches as competitors; dogmatic attachment to either tradition prevents organizations from realizing the benefits of integration [55]. The case indicates that integration, rather than methodological purity, may be the most productive direction for industrial practice.

3.7. Organizational barriers: a deeper analysis

Across the six cases, three types of organizational barrier can be distinguished. **Psychological barriers**, such as fear of failure and risk aversion, receive limited attention in the agile literature. They differ from active resistance to change because they operate as passive constraints: adoption remains partial because of fear rather than open opposition [51]. Such barriers may be more widespread and less visible than open conflict. Ericsson's investment in common training and coaching can be interpreted as a means of reducing psychological uncertainty and the perceived risk of full adoption [50], which indicates that interventions must address both the psychological and the structural sources of resistance.

Structural constraints. The Atlas Copco Henrob and TRRI cases reveal constraints that agile techniques cannot remove, including regulatory compliance, physical testing cycles, and supply chain dependencies [52], [55]. Because of these physical limitations, expectations regarding iteration frequency and responsiveness must be realistic. This result corroborates the contingency perspective, according to which certain constraints on methodology choice are non-negotiable once the context is set [42].

Coordination barriers. As the Entur case shows, coordination overhead increases disproportionately as agile scales, and coordination overload arises when the cost of coordinating agile teams exceeds the benefits of their agility [53]. The limited interchangeability of teams at Ericsson suggests that coordination is a matter not only of standardization but of managing, rather than eliminating, team heterogeneity [50]. This finding reinforces the need to adapt coordination mechanisms continuously when scaling agile.

3.8. A contingency framework for enterprise agile adoption (RQ3)

The six cases indicate the main components of a systematic framework for enterprise agile adoption. The first component is a sequence of adoption stages that recurs across the cases: (1) initiation, in which the limitations of current practices are recognized; (2) structured implementation through step-wise or phased approaches; (3) coaching and capability building through investment in training, coaching, and continuous learning; and (4) continuous adaptation, in which coordination mechanisms and practices are treated as dynamic rather than static.

The second component comprises five non-negotiable requirements: leaders who engage actively in cultural and behavioral change rather than merely allocating resources [50], [54]; structured, phased implementation instead of big-bang approaches [54], [55]; investment in training and coaching to develop skills and reduce psychological uncertainty [50], [54]; contextual rather than purely methodological adaptation, with hybrid approaches where appropriate [50]–[55]; and ongoing review of coordination mechanisms as organizations grow [53].

The third component concerns enterprise governance, which must balance team autonomy with organizational alignment. The Entur case shows that coordination mechanisms must change as enterprise or project scale increases, which requires adaptive governance processes [53]. The Ericsson case shows that allowing teams to proceed in different ways, while relying on common training and coaching, enabled local flexibility without loss of alignment [50].

3.9. Practical implications for managers

The cases yield five practical lessons for managers who intend to apply agile practices. Invest in agile training and coaching. In both the Ericsson and the Progetti e Soluzioni cases, regular training and coaching supported the transformation [50], [54]; systematic training programs should therefore develop both technical skills and

cultural awareness of agile principles. Adopt a phased implementation strategy. The cases consistently show that a gradual, experimental process is more likely to succeed than a big-bang transformation, so pilot implementations in selected projects or teams should precede enterprise-wide rollout.

Avoid dogmatic use of agile frameworks. Dogmatic application of agile methodology proved less effective than situational adaptation [53]; agile frameworks should be treated as toolkits to be adapted to the organizational environment rather than as blueprints. Where physical products, regulatory requirements, or other domain-specific constraints apply, hybrid models that combine agile principles with traditional governance processes such as stage-gate reviews may be more effective than full agile adoption [51], [52], [55], as the Atlas Copco Henrob case illustrates.

Review and refresh coordination mechanisms. As agile practices expand, coordination arrangements should be reviewed regularly to determine whether they remain fit for purpose [50], [53]. Address psychological as well as structural barriers. The Deluxe Beds case shows that fear of failure and risk aversion can limit agile benefits even when delivery appears successful [51]; managers should counter these obstacles through visible leadership, open communication, and recognition of learning from failure.

4. Conclusions

This study examined the core principles of agile management, the organizational enablers and barriers that shape its adoption, and the systematic implementation of agile practices in enterprise projects. Through a multiple comparative case study of six enterprises in telecommunications, manufacturing, hardware product development, enterprise software, and IT services, it provides evidence on how agile principles can be applied in different industry contexts.

4.1. Summary of findings by research question

With regard to RQ1, the analyzed cases indicate that cross-functional collaboration, iterative development with continuous feedback, and methodological flexibility are agile principles that transfer across industries, although their operationalization differs substantially; manufacturing and hardware contexts in particular require significant adaptation of practices developed for software. With regard to RQ2, leadership commitment, step-wise transformation, and organizational readiness were the consistent enablers, while three types of barrier emerged: psychological barriers (risk aversion and fear of failure), structural barriers (regulatory compliance, physical testing cycles, and supply chain dependencies), and coordination barriers (coordination overload as agile scales). With regard to RQ3, the evidence supports hybrid, context-sensitive configurations rather than strict methodological prescription. The proposed framework combines four adoption stages (initiation, structured implementation, coaching and capability building, and continuous adaptation) with attention to socio-technical aspects and periodic review of coordination mechanisms as organizations grow.

4.2. Contributions to the literature

The study contributes to the literature on agile management in three ways. First, it synthesizes recent case evidence (2018–2026) on agile methodologies outside software development, evidence that contradicts dogmatic agile advocacy. Second, it moves beyond team-level agility to enterprise-wide issues and explicitly addresses the scalability and hybrid governance challenges identified in earlier studies. Third, it develops a contingency-based framework that explains how organizational factors, such as leadership commitment, team capability, and the organizational environment, consistently influence implementation outcomes and what this implies for the allocation of resources to agile transformation.

4.3. Managerial implications

For managers, the findings imply that agile should be introduced progressively through pilots rather than through a big-bang transformation; that common training and coaching reduce fragmentation and psychological uncertainty; that hybrid models combining agile processes with traditional governance, such as stage-gate

reviews, are preferable where physical products, regulatory requirements, or other domain-specific constraints apply; that coordination should be treated as a capability to be reviewed continuously rather than as a one-time design; and that psychological barriers require visible leadership commitment, open communication, and recognition of learning from failure.

4.4. Limitations

The findings rest on secondary case study evidence and therefore support analytical rather than statistical generalization. Publication bias may overrepresent success stories, the depth of insight is limited by what the original case authors chose to report, and the sample covers European organizations in five sectors, excluding industries such as construction, public services, and education. The proposed framework should therefore be regarded as a provisional synthesis that requires further empirical testing (see Section 2.6).

4.5. Future research directions

Future research could extend this study in five directions. Primary data collection through interviews, surveys, and direct observation would confirm and extend the present results. Multi-year longitudinal studies would distinguish initial enthusiasm from lasting change. Quantitative validation through survey research and statistical analysis would strengthen the evidence for the proposed framework. Comparative studies of pure agile and hybrid configurations would clarify the conditions under which each performs better. Finally, studies of other sectors, including construction, public services, education, and non-profit organizations, would broaden the applicability of the findings. Overall, agile management is best understood not as a set of processes to be followed but as a flexible organizational capability that continuously adapts, depends on leadership engagement, and is sensitive to context.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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