Organizational Collaborative Relationships in Agile Contexts: A Mapping Study

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Abstract

Context: Collaboration is used in intra- and inter-organizational relationships as a supportive practice to help organizations remain competitive. Agile methods and practices facilitate collaboration in relationships and interactions among software development team members, customers, and stakeholders. *Problem:* There are still gaps in understanding the effective use of agile methods in different organizational relationships (intra- and inter-organizational). *Solution:* This study aims to identify the state-of-the-art regarding organizational collaborative relationships supported by agile methods and practices. *IS Theory:* The study is analyzed from the perspective of General Systems Theory. *Method:* A systematic literature mapping was conducted. *Summary of Results:* From 37 studies, evidence was found that using agile methods and practices in different organizational collaborative relationships can positively impact aspects such as innovation, knowledge transfer, and management practices. Additionally, challenges were identified, especially regarding difficulties with collaboration, communication, and coordination in large-scale developments or those involving many actors. *Contributions and Impact on the IS Field:* The results enabled an understanding of the motivations behind agile adoption in different organizational collaborative relationships, identifying how these approaches influence collaborative interactions and relationships and presenting the managerial aspects involved. The findings are expected to help managers and organizations enhance collaborative practices by providing a comprehensive view of this topic's motivations, benefits, and challenges.

CCS Concepts

• **Software and its engineering** → **Agile software development**; **Collaboration in software development**; • **General and reference** → *Surveys and overviews.*

Keywords

Collaborative Relationships, Agile Methods, Agile Transformation, Collaboration, Organizations in Network, Ecosystems

1 Introduction

The highly connected and competitive scenario has forced organizations to review how they relate to each other and adapt to rapid changes [12, 70]. More agile, flexible and collaborative organizational structures have been increasingly necessary [18]. In this context, collaboration and agility play a central and strategic role, guiding several organizations to remain competitive [12, 73], especially those that have mission-critical collaborative tasks, such as software development [76] or involving projects in the information technology industry [52].

Collaboration is a critical and ubiquitous phenomenon in organizations [73, 76] and is associated with fundamental issues such as productivity, performance and competitiveness [12, 73, 76]. It involves sharing knowledge, resources, and efforts so that the results achieved collectively are efficient and effective compared to those obtained individually [63, 76]. Therefore, it can be said that an organization's results are based on collaboration among workers, managers, and other actors who make up the various work environments [4].

According to the McKinsey & Company report [3], when organizations move from hierarchical to collaborative commands, such as using agile approaches, there is a need to define new organizational structures, roles, and responsibilities that require training, encouragement of transparency, and the inclusion of the entire organization and its ecosystems in this perspective. According to the authors, "in practice, leaders and organizations need to break down rigid organizational silos and introduce open, transparent, and collaborative networks."

This study focuses on organizational collaborative relationships that emerge from relationships occurring at an internal organizational (or intra-organizational) level – for example, between intra- and inter-team, department and sector interactive activities – or among one or more organizations at an external organizational (or inter-organizational) level – for example, involving different collaborations within clusters, networks and ecosystems that represent ways of creating value through ties with other organizations [38].

Agile methods and practices have been adopted by many organizations in recent years [26]. Agile approaches enable collaboration in interactions among software development team members, customers, and stakeholders [40, 64]. Collaborative and agile practices are convergent, strategic, and linked to the joint effort involved in the interactive processes required in most modern business models. For this reason, creating agile and collaborative structures that support the wide diversity of internal and external organizational factors is not straightforward [13]. It is noted that management plays a fundamental and challenging role in ensuring the effective collaboration and performance of the various actors that make up the organization [4]. One of the reasons for this is that competitive advantage comes from the ability to assemble and manage collaborative networks [70].

This study is based on concepts derived from General Systems Theory (GST) to understand the complex and diverse web of collaborative relationships. These concepts allow an in-depth look at organizations' complexity and interdependencies [5]. Furthermore, the systemic perspective argues that companies do not operate

alone but are part of broader systems, such as those addressed in business ecosystems. In this way, it is possible to better understand how companies operate in a given market or sector concerning the complex interactions and collaborative relationships within and outside the organization [54].

There are still gaps in understanding the effective use of agile methods in different organizational relationships (intra- and inter-organizational) and how collaboration and agile methods can impact value creation and other expected results. Thus, this study aims to identify the state-of-the-art use of agile processes and practices in intra- and inter-organizational collaborative relationships. Through a systematic literature mapping, 37 studies were identified that provided evidence that using agile methods and practices in different collaborative organizational relationships can positively impact aspects such as innovation, knowledge transfer and management practices. Besides, challenges were identified, especially related to difficulties in collaboration, communication and coordination in large-scale projects or those involving many actors.

The results allowed us to understand the motivations behind agile adoption in different collaborative organizational relationships, identify how these approaches influence collaborative interactions and relationships, and present the managerial aspects involved. The results will help managers and organizations improve collaborative practices, providing a comprehensive view of the identified motivations, benefits and challenges.

Aside from this introduction, this paper is structured as follows: the related works are presented in Section 2, the study design is described in Section 3, the results are discussed in Section 4, and the conclusions are outlined in Section 5.

2 Background and Related Work

Organizational collaborative relationships have received attention and research importance over the years [13, 65, 76]. Most studies address inter-organizational collaborative relationships [21, 29, 80] – external strategic partnerships and alliances. Although relevant, intra-organizational or both types of collaboration are less explored [6, 23, 45]. Topics such as increasing organizational capabilities (competitiveness, knowledge transfer, and innovation) have been recurrent regarding intra- and inter-organizational collaboration.

For instance, Dean [23] reflects that organizations have much to gain if they increase internal collaboration, value, and competitiveness. Kaya [45] points out the challenges organizations face in obtaining competitive skills, especially with a focus on internal collaboration. Bettiol et al. [6] argue that the integration of internal functions with external partners enriches the action of new knowledge for innovation.

In turn, agile methods and practices have been the object of growing interest for more than two decades by organizations and researchers [14, 19, 25, 40]. Agile transformation is among the most explored topics, often associated with benefits, challenges, barriers, and critical success factors [27, 35, 41, 64, 68]. In this context, collaboration is often portrayed as a challenge [19, 35, 36, 64].

Agile collaboration is generally associated with software development teams and customer engagement. Themes such as communication and coordination are also recurrent, often associated with challenges related to large distributed teams and the diversity of customers and stakeholders in the agile transformation process.

Indeed, de Franco and Laplante [24] highlight that, in recent years, teamwork has been one of the most active themes in the literature on software engineering. Themes such as teams, collaboration, process, design, and coordination are among the most investigated in secondary studies aiming to understand the cooperation among members of distributed software development teams and the factors that affect their success and the interactions among all stakeholders. Regarding collaboration, the authors emphasize that there is a need for more research in communication and tools. For coordination management, Kalenda et al. [41] state that large-scale agile implementation faces problems due to more significant dependencies among projects and teams and the requirement for formal documentation, which reduces agility and increases the challenge of coordination. Batra et al. [2] point out that the nature and dimensions of collaboration in agile software development have been little examined. The authors also expose the challenges of outsourced work in this context.

Compared to this study, there is a lack of research focusing on intra- and inter-organizational collaborative relationships and adopting agile methods. These topics are commonly investigated separately. From this point of view, only one related study was identified.

Da Silva Amorim [22] presents a systematic literature review supported by interviews that address the architecture of software ecosystems and the challenges faced regarding the architectural aspects of these environments. Collaborative relationships are not the central focus of the study, although internal and external organizational iterations are emphasized, in which collaboration among teams is brought to the agenda, albeit superficially. Therefore, the study's adherence to related work is partial since the authors also discuss how organizational collaborative relationships require – just like the software ecosystem – structures and mechanisms that facilitate and improve collaboration, communication, knowledge exchange, and information sharing between external and internal stakeholders. They also emphasize the importance of collaborative support structures for third-party developers who use platforms in software ecosystems to build new applications. For internal and external activities of software ecosystems, the study highlights how using agile practices helps in facing architectural challenges. Agile practices such as continuous delivery, frequent releases, and daily meetings can help ensure the quality of the platform architecture, improving partnership and collaboration within the ecosystem.

3 Research Method

The study execution involved three phases [46, 61]: (i) *Planning*: definition of the protocol; (ii) *Execution*: identification and evaluation of primary studies according to the defined criteria; and (iii) *Reporting of Results*: extraction of data from the primary studies.

3.1 Planning

3.1.1 Objective and Research Questions. This study characterizes agile methods and practices in intra- and inter-organizational collaborative relationships. The following research questions were formulated to address this objective:

- *RQ1*: What are the contexts of the organizational collaborative relationships described?
- *RQ2*: What is the focus of the collaborative relationships described?
- *RQ3*: How is management approached in the studies?
- *RQ4*: What motivates the use of agile methods and practices?
- *RQ5*: What agile principles and values impact the relationships described?
- *RQ6*: What agile methods are mentioned?
- *RQ7*: What management benefits are mentioned?
- *RQ8*: What management challenges are mentioned?

3.1.2 Search Strategy. The digital libraries consulted were Scopus, IEEE Xplore, EI Compendex and ISI Web of Science, ACM Digital Library, and Springer Link. These digital libraries are relevant to Computer Science and Information Systems [32] and indexing studies from other repositories. The chosen language was English. National conferences, when indexed in the consulted databases, were considered.

The search expression was created iteratively from the terms identified in line with the PICOC (Population, Intervention, Comparison, Outcomes, Context) strategy [61]:

- **Population**: studies that refer to the target audience of the investigation, i.e., "organizational collaborative relationships."
- **Intervention**: studies that refer to the specific aspect of the research, i.e., "agile methods and practices."
- **Comparison**: not applicable.
- **Outcome**: not applicable.
- **Context**: studies that refer to the context of the investigation, i.e., "internal relationships (among teams, departments or organizational units) and external relationships (among two or more organizations, networked organizations or ecosystems)."

Scopus was used for testing the search string. The final version of the search expression was: *("Agile Methods" OR "Agile Practices" OR "Agile Adoption" OR "Agile Journey" OR "Agile Transformation" OR "Agile Transition") AND ("Collaborative Network" OR "Organization in Network" OR "Ecosystems" OR "Organizational Relationships" OR "Collaborative Relationships" OR "Internal Relationships").*

3.1.3 Selection Procedure. The following inclusion (IC) and exclusion (EC) criteria were defined to ensure the objective selection of studies.: IC 1 – Study that addresses organizational collaborative relationships and agile methods and practices; EC 1 – Duplicate study; EC 2 – Study not written in English; EC 3 – Study not peer-reviewed; EC 4 – Study not accessible in full text; EC 5 – Study refers to tutorial, round table, lecture, poster, book, preface of conference proceedings; EC 6 – Secondary study; EC 7 – Study that does not meet the inclusion criteria.

3.1.4 Selection of Studies. The search expression was executed in the selected databases. In the first filter, the inclusion and exclusion criteria were applied considering the title, abstract, and keywords. The inclusion and exclusion criteria were used in the second filter after the study had been read completely.

3.1.5 Data Extraction. A template was created to insert and organize data according to the information from the studies: (i) title, author(s), year and publication vehicle; (ii) data derived from the objectives and research questions; (iii) other data to better understand the studies, for example, themes addressed, characteristics of the organizations, research method used, particularities observed, and additional comments from the researcher. The studies selected after the second filter were stored in a database together with the templates containing the extraction of the synthesized data [34].

3.1.6 Data analysis. For research questions RQ1 and RQ2, data extraction was performed based on content analysis. For research questions RQ3 to RQ8, thematic analysis was used [66]. The data were organized into themes and response patterns, from which categories emerged. For categorization, similarities, repetitions, and other characteristics were considered in the response patterns according to the research question. Thus, the collected data allowed the consolidation of explicit and underlying themes, following guidelines from studies on qualitative analysis [66].

Figure 1 simplifies the association and interrelations of the themes for forming the categories and subcategories associated with research question RQ4 (Section 3.3.4), which seeks to identify what leads organizations to adopt agile methods. For example, the excerpt (...) *"given the inherent communication and coordination challenges faced by distributed teams, conflict management is crucial for effective team performance"* (S1) was associated with the codes *'Communication'* and *'Coordination.'* The excerpt *"careful coordination allows us to respond quickly to necessary changes, which can provide a competitive advantage"* (S2) was associated with the code *'Coordination.'* We followed the same strategy for the other qualitative responses.

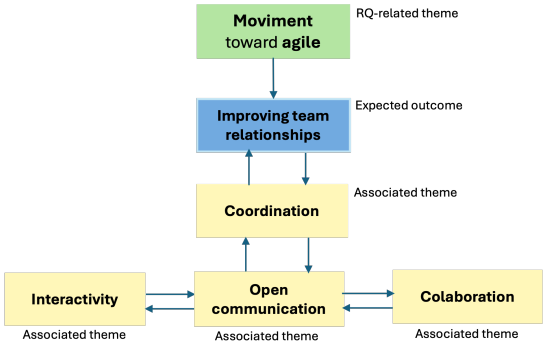

Figure 1: Themes Association for Category Formation

3.2 Execution

The study was conducted between May and July 2023. A total of 608 studies were identified from the database searches. After applying criterion EC 1, 562 studies remained. After applying exclusion criteria EC 2, EC 3, EC 4, and EC 5, 456 studies remained for evaluation by reading the title, abstract, and keywords. A total of 402 studies were excluded due to criteria EC 6 and EC 7, leaving 54 studies for full reading. Finally, 37 studies were selected by applying criterion IC 1. Figure 2 summarizes the application of the filters.

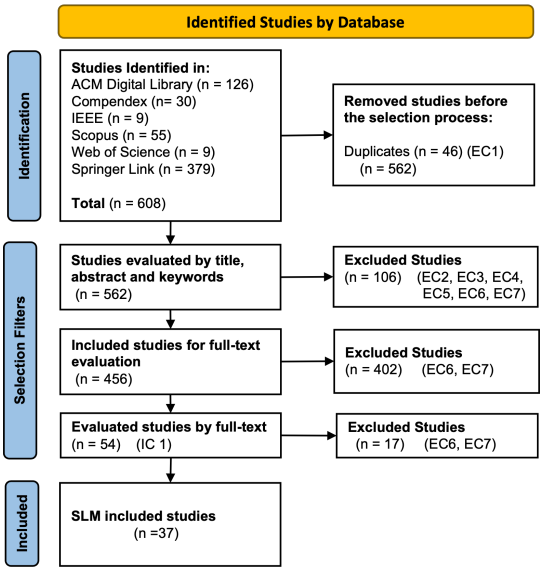

Figure 2: Study Selection Summary (based on [60])

3.3 Results

Table 1 presents the selected studies, 54.01% (20 studies) have authors working in academia (see 'A' in column 'Orig.'), 13.5% (5 studies) have authors from industry (see 'I' in column 'Orig.'), and 32.4% (12 studies) have authors from both industry and academia. Figure 3 shows the countries of the authors' affiliation organizations. Sweden has the most significant number of studies, followed by the USA and Australia. Figure 4 shows the publication vehicle by year, considering conference papers, journal articles, and book chapters. It is noted that the studies have been consistently published over the last eight years.

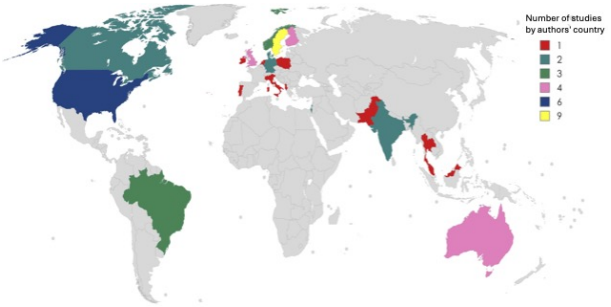

Figure 3: Authors' Country of Affiliation

Software development was the most cited application area, with 27 mentions. The other sectors or domains mentioned were Information Technology (IT) (15 times), Telecommunications (6 times), Automotive (5 times), Embedded Systems (3 times), Government (2 times), Academia (2 times), and Civil Society (1 time).

The answers to the research questions are presented below.

Table 1: Selected Studies

ID	Study	Ref.	Year	Orig.
S1	Enhancing Hybrid OSS Development Through Agile Methods and High Media Synchronicity	[17]	2008	A
S2	Outsourcing and Offshoring with Agility: A Case Study	[48]	2004	I
S3	Evolution of the Agile Scaling Frameworks	[74]	2021	A
S4	Introducing Extreme Programming into a Software Project at the Israeli Air Force	[30]	2005	A
S5	Agile System Analysis and Design	[31]	2006	I A
S6	Agility in Serious Games Development with Distributed Teams: A Case Study	[57]	2008	I
S7	Supporting agility in software development projects - defining a project ontology	[55]	2008	A
S8	The impact of agile practices on communication in software development	[62]	2008	I A
S9	Transparency and Contracts: Continuous Integration and Delivery in the Automotive Ecosystem	[75]	2018	I A
S10	Coordination Between Global Agile Teams: From Process to Architecture	[9]	2010	I A
S11	Charting Coordination Needs in Large-Scale Agile Organisations with Boundary Objects and Methodological Islands	[43]	2020	A
S12	Agile Practices and Organizational Agility in Software Ecosystems	[72]	2021	A
S13	Onshore and Offshore Outsourcing with Agility: Lessons Learned	[47]	2010	I
S14	Participatory Design Activities and Agile Software Development	[44]	2010	A
S15	Three 'C's of Agile Practice: Collaboration, Co-ordination and Communication	[69]	2010	A
S16	A Case Study in Agile-at-Scale Delivery	[10]	2011	I
S17	Agile and resilient approaches to supply chain management: influence on performance and competitiveness	[16]	2012	A
S18	Can Agile Enterprise Architecture be Implemented Successfully in Distributed Agile Development? Empirical Findings	[1]	2022	A
S19	Fostering and Sustaining Innovation in a Fast Growing Agile Company	[53]	2012	I A
S20	Impact of Cloud Adoption on Agile Software Development	[42]	2013	A
S21	Improving Businesses Success by Managing Interactions among Agile Teams in Large Organizations	[51]	2013	A
S22	Post-deployment Data Collection in Software-Intensive Embedded Products	[39]	2013	A
S23	The impact of scrum on customer satisfaction: An empirical study	[15]	2013	I A
S24	Agile in Distress: Architecture to the Rescue	[56]	2014	A
S25	Climbing the stairway to heaven: Evolving from agile development to continuous deployment of software	[59]	2010	A
S26	Complexity-Aware Software Process Management: A Case of Scrum in Network Organization	[50]	2014	A
S27	Industrial Challenges of Scaling Agile in Mass-Produced Embedded Systems	[33]	2014	I A
S28	Inter-team communication in large-scale co-located software engineering: a case study	[7]	2022	I A
S29	Framework for Agile Development Using Cloud Computing: A Survey	[79]	2019	A
S30	An empirical study to design an effective agile knowledge management framework	[71]	2023	A
S31	Knowledge Sharing in a Large Agile Organisation: A Survey Study	[49]	2017	I A
S32	Managing the requirements flow from strategy to release in large-scale agile development: a case study at Ericsson	[37]	2017	I A
S33	Meeting Industry: Academia Research Collaboration Challenges with Agile Methodologies	[67]	2017	I A
S34	Louvre: A framework for metadata curation in data ecosystem	[58]	2019	A
S35	Exploring software development at the very large-scale: a revelatory case study and research agenda for agile method adaptation	[28]	2018	I
S36	FLOSS Project Management in Government-Academia Collaboration	[77]	2018	I A
S37	Agility in Transdisciplinary Research: Lessons Learnt from a Research Sprint on Digital Technologies and Flood Risk Management	[78]	2020	A

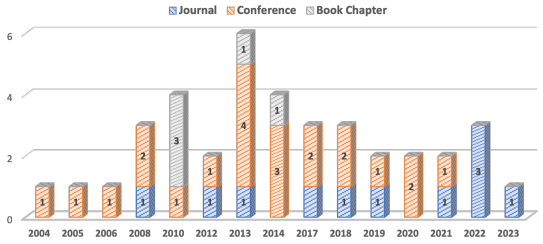

Figure 4: Publication Vehicle by Year

3.3.1 RQ1: What are the contexts of organizational collaborative relationships described? Three contexts of organizational collaborative relationships were identified.

Intra-organizational relationships – which occur within the organization – can take place (i) between sectors or departments (S8, S11, S17, S25, S31, S32) or (ii) among internal teams, stakeholders and Research & Development units (S12, S28).

Inter-organizational relationships – which occur among two or more organizations or actors from other organizations and ecosystems with which the organization maintains a collaborative relationship – involve (i) partnership or consortium between organizations (S2, S6, S9, S10, S13, S15, S17, S21, S25, S26, S27, S31, S34), (ii) partnership, cooperation, collaboration or consortium between Academia and Industry (S8, S27, S33, S36), or (iii) partnership among Industry-Government-Academia (S37).

Collaborative relationships that occur in both intra- and inter-organizational contexts involve collaboration among (i) internal and external teams, stakeholders, customers, networked organizations or ecosystems (S1, S9, S11, S20, S25, S26, S34), (ii) internal and external teams, stakeholders, and customers (S1, S2, S3, S6, S7, S8, S9 S10, S13, S18, S20, S21, S22, S25, S27, S29, S31, S32, S34, S35), and (iii) internal teams, stakeholders, and customers (S4, S5, S11, S14, S15, S16, S17, S19, S23, S24, S28, S29, S35).

3.3.2 RQ2: What is the focus of the collaborative relationships described? Below, the different actors involved and the managerial focus of collaborative relationships are listed.

The S1 study involves hybrid teams (volunteers and employees) and focuses on team coordination, collaboration, and media synchronicity. The S34 study involves volunteer contributors and focuses on management and relationships in the data ecosystem. The S37 study involves government, academia, and civil society and focuses on collaborative management between interdisciplinary projects. The S33 study involves academia and industry and focuses on stakeholder relationships and collaboration. The S36 study involves academia, industry, and government and focuses on collaborative relationships and external partnerships. The S17 study involves organizations and suppliers and focuses on supply chain management and supplier relationships. The S23 study involves teams and customers and focuses on customer relationships. The S12 study involves development and research teams and focuses on team management and collaboration to drive agility and innovation.

Concerning software development teams, studies were identified focusing on the relationship between teams and clients (S4, S16, S27), on the exchange of knowledge and innovation (S19), on the relationship and involvement with the client after the implementation of the system (S22), on the coordination, collaboration and interaction among teams (S15) and, also, on the participation of clients and users in agile development and design activities (S14).

For distributed or outsourced teams, studies were found focusing on software development and inter-organizational relationships (S2, S6, S9, S13), requirements management in large-scale agile development organizations (S32), management and collaboration (S18), and collaboration and knowledge sharing (S7).

Studies involving people, teams, and organizations focus on the relationships and collaboration management among third-party service providers in networked organizations (S26), internal and inter-organizational relationships aimed at continuous improvement (S25), and the collaborative work and relationships management in the cloud (S20, S29).

Finally, we found studies involving large-scale software development teams and presenting different focuses: management, coordination, and scalability (S3, S35), relationship and interaction among teams (S21), communication (S5, S8, S28), architecture for management and coordination of large teams (S10, S24), communication and coordination (S11), and collaborative relationships and knowledge sharing (S31).

3.3.3 RQ3: How is management approached in the studies? Tables 2 and 3 summarize the types of management and the involved management themes. Management performance is mentioned at different levels, either explicitly or contextually. For example, study S1 deals with conflict management involving relationships among hybrid teams in open-source software development (teams of developers hired by companies and volunteer developers). The other aspects involving management are described generically or implicitly, for example, when the study deals with team coordination.

Table 2: Types of Management

Management Type	Studies
Conflict or Negotiation Management	S1, S2, S6, S12, S13, S36
Coordination Management	S1, S2, S6, S8, S9, S10, S11, S12, S15, S16, S17, S18, S19, S21, S22, S24, S26, S28, S32, S34, S35
Relationship Management	S1, S2, S8, S9, S11, S12, S13, S17, S26, S28, S29, S35, S36, S37
Product Management	S6, S8, S9, S10, S12, S13, S17, S19, S21, S22, S25, S32
Project Management	S2, S6, S8, S9, S11, S13, S14, S15, S16, S20, S23, S29, S31, S32, S35, S36
Continuous Integration Management	S16, S18, S32
Responsibility Management	S9, S16
Quality Management	S6, S12, S17, S28, S34
Requirements Management	S20, S32
Risk Management	S6, S13, S16, S37
Agile Project Management	S12, S13, S16, S37
Portfolio Management	S16, S32, S35
Operational Management	S6, S20
Program Management	S18, S19, S32, S35
Data Curation Management	S34
Document Management	S6, S20, S36
Contract and Collaboration Management	S9, S36
Configuration Management	S9, S20, S25

Table 3: Management Themes

Management Themes	Studies
Strategy	S2, S6, S8, S9, S10, S13, S17, S18, S19, S24, S25, S26, S27, S28, S30, S31, S32, S34, S35, S36, S37
Resources	S1, S6, S7, S8, S9, S11, S12, S15, S16, S18, S21, S26, S27, S29, S32, S35
Communication	S1, S2, S6, S8, S9, S10, S11, S12, S13, S16, S18, S21, S22, S25, S26, S28, S29, S32, S34, S35, S36, S37
Organizational Changes	S3, S4, S5, S12, S13, S16, S19, S22, S25, S28, S35, S37
Knowledge	S7, S11, S12, S16, S19, S21, S30, S31, S35, S36, S37
Innovation	S12, S19, S25
Process	S5, S13, S17, S21, S25, S26, S32, S35, S36, S37
Research & Development	S12, S25, S28, S36
Supply Chain	S9, S16, S17, S26
Artifacts	S16, S26, S29, S34
Technical Management	S19, S28, S32, S36
Architecture	S10, S18, S24, S27

3.3.4 RQ4: What motivates the use of agile methods and practices? Table 4 summarizes the reasons identified, which were supported by arguments about the use of agile approaches (in particular, about the advantages, benefits, treatment of challenges, and critical success factors related to agile management) and how they can be used in collaborative relationships. For example, study S1 highlights the importance of communication, collaboration, coordination, and interactivity in relationships among hybrid open-source software development teams. The choice to use agile approaches is based on evidence from the literature on how they help to improve the mentioned areas.

Table 4: Movement Toward Agile

Movement Toward Agile	Studies
Collaboration, Communication, Coordination, and Interactivity	S1, S2, S3, S5, S7, S8, S9, S12, S13, S14, S15, S19, S20, S21, S22, S24, S25, S27, S31 S28, S29, S30, S31, S32, S33, S34, S35, S36, S37
Quality, Innovation, and Value	S1, S3, S4, S7, S8 S12, S13, S14, S16, S19, S20, S23, S24, S29, S34, S28, S30, S37
Adaptation and Response to the Environment/Market	S1, S2, S3, S8, S9, S10, S11, S12, S13, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S27, S28, S29, S30, S34
Efficiency, Effectiveness, Efficacy, Productivity, and Competitiveness	S2, S3, S6, S7, S9, S10, S11, S13, S19, S16, S17, S21, S22, S23, S24, S25, S26, S27, S28, S29, S37
Innovation	S4, S12, S19, S23, S28
Teamwork	S1, S2, S3, S7, S10, S11, S12, S13, S15, S18, S19, S21, S24, S25, S26, S27, S28, S29, S31, S32, S33, S35, S36, E37
Process and Management Improvement	S1, S2, S3, S5, S6, S7, S9, S10, S11, S12, S13, S14, S15, S16, S18, S19, S20, S21, S24, S25, S26, S27, S28, S29, S31, S32, S33, S34, S35, S36, S37
Agile method popularity or success	S1, S3, S7, S10, S11, S12, S13, S19, S23, S24, S25, S27, S35

3.3.5 RQ5: What agile principles and values impact the relationships described? Table 5 summarizes the results based on the associated agile principles and values.

3.3.6 RQ 6: What agile methods are mentioned? Some studies present models and other mechanisms to help with relationships, thus more than one approach is cited in the same study. For example, the S3 study presents the evolution of large-scale frameworks used to help with the challenges involved in collaborative relationships in large organizations and multiple teams. Scrum is the most mentioned method, whether in its standard form (S1, S2, S6, S8, S9, S10, S11, S12, S13, S16, S18, S19, S21, S22, S23, S26, S29, S31, S32, S33, S34, S35, S37) or variations such as Scrumban (S26, S31), Meta-Scrum (S35), ScrumWorks Pro (S20), CloudApp SCRUM (S20), Enterprise Scrum (eScrum) (S3), Large-Scale Scrum (LeSS) (S3, S32), Scrum of scrum (SoS) (S4, S24, S28, S35), and Scrum at Scale (S@S) (S3). The second most cited agile method is Extreme Programming (XP) (S2, S4, S5, S6, S8, S10, S11, S14, S15, S16, S19, S22, S36), including the variation Industrial XP (S27), followed by Kanban (S16, S11, S31), Disciplined Agile Delivery (DAD) (S3, S27, S34), Scaled Agile Framework (SAFe) (S3, S27, S11), Feature-Driven Development (FDD) (S2, S13), and Lean (S12, S17). Other agile methods mentioned only once are all cited in S03, as can be seen at [34].

Table 5: Agile Principles and Values

Agile Principles and Values	Studies
Collaboration and Communication	S1, S2, S3, S5, S6, S7, S8, S9, S10, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S30, S31, S33, S32, S34, S35, S36, S37
Value Delivery	S1, S6, S8, S9, S12, S17, S22, S23, S26, S27, S29, S33
Flexibility and Adaptability	S2, S3, S4, S5, S6, S9, S11, S12, S13, S14, S16, S17, S18, S19, S20, S23, S24, S26, S27, S28, S29, S32, S33, S34, S35, S36, S37
Participation and Empowerment	S1, S2, S5, S6, S7, S9, S10, S12 S13, S14, S15, S17, S18, S19, S20, S21, S22, S25, S27, S29, S30, S31, S32, S33, S34, S35, S36, S37
Quality and Technical Excellence	S1, S4, S3, S5, S6, S10, S12, S13, S14, S17, S19, S22, S24, S26, S27, S32
Customer and Stakeholder Satisfaction	S2, S3, S4, S5, S7, S8, S13, S15, S17, S19, S20, S22, S33, S34
People Respect	S2, S4, S13, S15, S19, S28, S32, S35
Agile Work Structures	S1, S2, S3, S4, S7, S8, S10, S11, S13, S15, S17, S20, S22, S23, S24, S25, S26, S28, S29, S35, S37
Organizational Culture Change	S4, S5, S6, S11, S16, S19, S32, S35
Sustainability and Stability	S3, S4, S11, S12, S15, S32, S35, S36

3.3.7 RQ7: What management benefits are mentioned? Table 6 presents the benefits of agile management or agile methods during organizational collaborative relationship management.

3.3.8 RQ8: What management challenges were mentioned? Table 7 presents the challenges associated with agile management or agile methods while managing organizational collaborative relationships.

4 Discussion

This study identified the importance of collaborative relationships in different organizational contexts, encompassed by the complex and tangled web of relations involving organization members, stakeholders, and other actors in the business ecosystem, such as suppliers and partners. Analyzing relationships from a systemic, interrelated, and interdependent perspective places software development in the context of General Systems Theory, allowing for an integrated

Table 6: Management Benefits

Benefits Related to Management	Studies
Enables cohesion and the search for common and collective objectives	S1, S9, S36
Efficient management of large-scale projects	S21, S29
Increased sense of ownership	S19
Dependency management between tasks and subtasks during the project	S8
Enables the removal of impediments and the achievement of goals	S12
Better control of projects and activities	S10, S12, S15
Better understanding of priorities	S13
Risk minimization	S13
Provides better access to the team for suppliers, partners and employees	S20
Team management improved	S24, S26
Better management of resources and distribution of responsibility	S24
Help in solving problems in a shared way	S13
Decision-making process improved	S36
Easier monitoring of activities and increased interaction	S36
Interaction management among teams or involved parties	S21, S26, S35
Accountability improvement	S3
Knowledge management support	S30
Synchronization among teams improved	S1, S36
Supply chain efficiency and effectiveness improved	S17
Coordination improvement	S3, S10, S11, S12, S15, S18, S24, S26, S27, S31, S35

Table 7: Management Challenges

Management-related challenges	Studies
Decision-making in large projects	S28, S35
Insufficient guidance	S3
Risk management	S17, S24, S37
Role conflicts at the management level and ambiguity of some agile roles	S6, S8
Stakeholder management	S8, S25, S28
Coordination across organizational boundaries and among teams and agile teams	S2, S11, S13, S28
Resource management	S8, S10
Emotional and functional conflict management	S1, S9, S36
Use of established or traditional management methods	S5
Proper management of the skills/capabilities/creativity of distributed teams	S20
Effective project management	S20
Conflicts among internal management processes and the differences in pace and objectives of each institution	S36
Challenge of defining explicit roles for each project employee	S4, S8
Project and task management	S24
Complexity of the software process	S26
Requirements management	S32
Product backlog management with complex requirements and little documentation	S6
Security, legal, contractual and liability issues management	S9, S11, S36
Flow of information or communication management	S3
Understanding team autonomy	S32
Coordination of transparent communication, trust, collaboration and rapport among teams	S32
Interaction management among agile teams	S21, S35
Geographically distributed, outsourced, hybrid or internal and external teams management	S2, S6, S9, S10, S11, S13, S18, S21, S28

analysis. Furthermore, it helps to understand better the impacts and effects arising from software process management, recognizing that complexity must be managed and minimized (S26). Due to the search for agility, work environments have been increasingly open to collaboration, not limited to internal departments and sectors of organizations. High interactivity and connectivity with partners and customers' ecosystems is now part of the reality of many organizations that do not work alone [25]. It has been observed that collaborative relationships are increasingly frequent [11].

Thus, it is possible to understand that collaboration is a powerful management tool, fundamental in transforming individuals, often with conflicting interests, into collaborative and integrated groups [73]. This transformative process is challenging because organizational objectives differ for the actors involved [23]. For this reason, collaboration is a critical organizational competence, depending on concepts that deal with joint action to overcome problems and achieve common goals [20].

Table 4 shows that the search for using agile methods focuses on improving collaboration as a competitive advantage, mainly by strengthening customer relations and focusing on people [52]. Thus, collaboration, communication, coordination, and interactivity have become the primary motivations for adopting agile practices. The results of the research on collaboration and agility are in line, which points to increased collaboration as one of the benefits of agile methods [26, 69]. Besides, using agile approaches can reduce complexity and indirect costs when centered on system architecture, making coordination and collaborative relationships more effective internally and among organizations (S10).

From this perspective, there is recognition that agile methods – which focus on people, interactions, and continuous adaptation – are suitable for facing the challenges imposed by the complexity of the environment, in addition to promoting greater efficiency and collaboration (S6, S9, S13). For this reason, the other motivations identified are related to this perspective as a way to improve organizational performance and achieve the benefits cited in the literature on agile methods.

Despite the potential benefit of collaboration, the results of this study reveal that there are many challenges in collaborative activities [20, 73]. In large-scale agile transformation, for example, the multiplicity of actors and partners presents a challenge for management (S2, S6, S8). Table 7 shows that most management challenges are related to the large-scale context. For example, managing relationships involving different partners from different organizations with different organizational structures is a challenge that deserves attention at all management levels. Also included in this context are the management of geographic boundaries, time zone differences, language, and organizational culture.

The organization's collaborative capacity is another essential aspect of organizational relationships. It involves building and managing network relationships based on mutual trust, communication and commitment that the various actors must have [8, 73]. It can be seen, for example, that trust helps to resolve problems in a shared manner (S13), trust and commitment enable the achievement of common goals (S1, S9), and effective communication improves knowledge sharing (S8, S31).

Finally, the data identified also highlight that agile practices apply to other collaborative contexts other than software development. Indeed, it produces knowledge through academia-industry collaboration or in different government, industry, and academia

partnerships. Surprisingly, agile is used in various contexts, such as solving complex problems like environmental flood risks (see S37).

4.1 Limitations and Threats to Validity

We followed established guidelines for secondary studies [46, 61]. We sought to maintain quality, rigor, and criticality in all its phases, especially in selecting and analyzing papers, as this makes it possible to demonstrate excellent reliability.

Possible limitations of the study include not having evaluated the quality of the studies identified, the use of keywords in the search expression and the choice of digital databases. The search for studies was conducted in six databases, which increases the chance of finding relevant studies. Moreover, Scopus is a metadatabase that indexes content from other databases, providing broader coverage of results. Extensive expressions such as 'agile' and 'collaboration' were avoided, which may have limited the identification of relevant studies. The search expression was tested and evaluated until studies that met the mapping objective were found. The defined search expression was the broadest, but it is essential to highlight that the study was conducted in a specific context, which may limit *generalizability* to other contexts.

Another limitation is that we did not investigate the managers' perceptions of the benefits and challenges identified in agile transformations. This aspect will be the subject of future work.

The threat to *descriptive validity* refers to the objectivity and accuracy of observations. A data collection form was defined to assist in data extraction. Additionally, the study followed a rigorous protocol to address and minimize both descriptive validity and *repeatability validity*.

Studies were read and filters were applied according to defined criteria to mitigate the threat to *theoretical validity*. Nevertheless, there is still the possibility of researcher bias in data extraction and classification. To address this, another researcher audited the extraction performed.

Finally, the threat to *interpretative validity* arises from the coherent and reasonable interpretation of the results obtained from the data. It is essential to recognize that researcher bias can lead to interpretive tendencies. Another researcher audited the data extraction to minimize this bias. The result presented represents the consensus view of both.

5 Final Considerations

Through a systematic literature mapping, 37 studies were identified that provide relevant knowledge about organizational collaborative relationships. The evidence indicates that agile methods and practices can speed up interactive processes and enable communication, leading to greater involvement and interaction with customers and other stakeholders. Furthermore, agile methods help to strengthen organizational collaborative relationships, improving the achievement of joint goals. Through collaborative practices between different organizational actors and partners, the exchange of knowledge and experiences is facilitated, positively reflecting on the improvement of knowledge transfer processes, leading to the creation of innovative products and aiding the effectiveness of agile management (S19, S31).

However, the results show that organizational management is essential for collaboration through agile practices – explicitly emphasized in studies S6, S8, S9, S12, S18, S21, S28, S32, and S33. Thus, strategies must be created to promote and encourage a collaborative environment based on the definition of common goals and objectives among the parties involved. Besides, adequate infrastructures are needed for communication and coordination, which is essential for collaborative processes. The commitment and support of senior management are necessary for organizational collaboration. Investments in tools, mechanisms, infrastructures, and architectures that improve communication, coordination and cooperation are required. It is also essential to provide adequate education, training, technologies, and architectures capable of supporting collaboration and agile methods – which studies S6, S10, S18, S21, S28, and S35 emphasize. From the results described, it is possible to see how organizations are dynamic, complex, interrelated systems constantly interacting with the environment, influencing and being influenced.

The evidence found in this study can help improve critical management areas such as coordination, communication, and collaboration, support decision-making, enable agile adoption, and promote better interaction using agile methods. Management should focus mainly on planning strategies that minimize the challenges encountered, considering that the critical areas mentioned are interdependent. Therefore, it is necessary to look at the challenges highlighted in an integrated manner. For example, management should consider communication as a key aspect for the smooth running of the software process. It is interdependent and related to coordination, collaboration, and cooperation. It must be managed based on strategies that ensure adequate communication flow and transparent collaborative relationships (S18, S21).

Communication among teams, customers, and stakeholders must be clear (S2) and open (S19). Good communication conveys common goals, facilitating organizational alignment between internal and external strategies (S25). Transparency in relationships must also be prioritized, as it favors and creates positive synergies regarding efficiency and trust among the different players (S9). An essential part of the management strategy applied to agile implementations is the active promotion of cultural values that support team communication, such as mutual trust, transparency, and tolerance for admitting mistakes (S28).

For future work, we will begin a new research phase involving a field study with managers to deepen our understanding of the challenges they face during agile transformation and propose ways to overcome them.

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