International Journal of Information Systems and Project Management (IJISPM)
2025, 13(3), e130303, DOI: 10.12821/ijispm130303

RESEARCH ARTICLE

Sources of project tool misalignment in multistakeholder projects

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Abstract
Inter-organizational collaboration is recognized as one of the key success factors for complex project delivery. Simultaneously, tools and technologies play a growing role in project management and operations, especially as project work is increasingly being conducted in hybrid and remote settings. These tools play a critical role in achieving productive collaboration, and when properly selected, implemented, and aligned, they offer opportunities for increased project productivity. However, the selection of correct tools can be tricky, and at worst, tools can end up hampering project operations. This study empirically identifies key project tool-related challenges and clarifies the role of tools in relation to stakeholder collaboration. The results emphasize two-dimensional alignment for the selection and implementation of tools: by aligning with both project objectives and the teams executing the project, tools are better set to fulfill their role as a link that supports project organization toward its goals and fosters productive inter-organizational collaboration.

Keywords
project stakeholder collaboration; project tools; collaborative tools.

Received: 6 September 2024 | Accepted: 8 April 2025

1. Introduction

Productive inter-organizational collaboration is critical for the success of complex projects (Rönndahl et al., 2025; Tampio et al., 2022). As inter-organizational projects gather many stakeholders to plan and execute, these stakeholders must work effectively together to achieve project success (Ahola, 2018; Saukko et al., 2020). Project research and practice have developed numerous pathways, delivery models, mechanisms, methods, and tools to foster more effective collaboration within project organizations. Efficiently achieving productive collaboration, however, remains a difficult and complex task (Nikulina et al., 2022; Nwajei et al., 2022).

Simultaneously, project tools have become an integral part of project management and play increasingly important roles in achieving productive inter-organizational project operations (Jitpaiboon et al., 2019; Tereso et al., 2019) particularly amidst increasing virtual teams (Swart et al., 2022). Tools typically consist of approaches, methods, and technological solutions that help project actors communicate and collaborate more effectively, monitor project progress, identify bottlenecks, and so on. Tools, however, are developing quickly and are available in abundance (Tampio & Haapasalo, 2024). This, combined with the temporary and nonrecurring nature of projects, makes planning, implementing, and utilizing tools in the inter-organizational project context a challenging process.

Project management research has typically placed greater emphasis on tools as techniques and methods to manage projects and inter-organizational collaboration, while devoting less scrutiny to technological tools (e.g., systems, applications, and software) and their role in the collaboration phenomenon. This may be due to management techniques and approaches having a considerably longer lifetime, whereas tools develop, get replaced, and become outdated in a shorter time span. However, technological advancements in tools offer significant opportunities to increase performance in project-based industries and should not be overlooked. Additionally, the key principles behind technological tools can withstand the test of time.

Project tools and methods are used to operationalize the project's strategy and collaboration (Nwajei et al., 2022). However, there is a trend of expanding the project tool kit beyond a reasonable size, overcomplicating daily operations, and introducing friction to collaboration (Jitpaiboon et al., 2019; Nwajei et al., 2022). Moreover, collaboration can be costly and require substantial effort to achieve (Eriksson, 2015; Walker et al., 2017). Limiting the size of this project tool kit can streamline the process of collaboration, enhance value creation, reduce unnecessary complexity, and maintain focus on key project objectives (Jitpaiboon et al., 2019; Nwajei et al., 2022; Tampio et al., 2022). For example, Tampio and Haapasalo (2024) described the utilization of Smartsheet and Last Planner System (LPS) tools in complex hospital construction project and reported a positive outcome due to a limited few but well-integrated tools that facilitated better results through increased usability and stakeholder commitment.

Considering the above, this study explores the role technological tools play in achieving productive inter-organizational collaboration and how this role is accomplished in inter-organizational project settings. We scope and define technological tools as software, systems, and platforms projects select and implement to support operations and collaboration, in contrast to other tools that are better characterized as managerial methods. Clarifying and understanding this role fosters selecting tools that fit a given project and effectively translate toward increased project productivity. We aim to define the core purpose of project tools in relation to inter-organizational collaboration and investigate the key characteristics and attributes to look for in the planning and selection of project tools that not only avoid hindering collaboration but also actively foster it in inter-organizational project contexts. Thus, the study contributes to the research on achieving inter-organizational collaboration and offers practical implications on evaluation and selection of tools that are aligned with and benefit the project and its objectives. To support these research objectives, we formed the following research questions:

RQ1: What are the key challenges of technological tools in inter-organizational projects?

RQ2: What is the role of these tools in enabling inter-organizational collaboration?

The rest of the paper is organized as follows. First, we cover background literature on project stakeholder collaboration and the role of project tools in enabling and facilitating inter-organizational collaboration. Then, we describe the research method and process used in this study. Next, in the results section, we present the challenges associated with project tools in relation to both objectives (purpose of tools) and people (use of tools). Thereafter, based on the covered literature and our empirical findings, we discuss the roles tools have in inter-organizational collaboration, conceptualize a tool alignment matrix, and explain the key principles in selecting project tools that initiate and enable productive and goal-oriented collaboration. Finally, we discuss the contributions and practical implications and conclude with a discussion of limitations and upcoming research opportunities.

2. Theoretical background

2.1. Inter-organizational collaboration

Large and complex projects are predominantly carried out in inter-organizational arrangements, as the capabilities required to plan, design, and construct span across organizational boundaries (Ahola, 2018). Inter-organizational projects form a group of diversely skilled organizations and individuals that work together on a complex task over a limited time (Van Marrewijk, 2018). These stakeholders, such as owners, contractors, and suppliers, form and work in networks of relationships (Ali & Haapasalo, 2023; Liu et al., 2021; Rowley, 1997) and engage in interdependent activities to achieve the project objectives together (Saukko et al., 2020). These interdependencies force project stakeholders to work collectively to complete various project tasks (Aapaoja et al., 2013; Heugens et al., 2002; Rankinen et al., 2022).

Productive stakeholder collaboration has become one of the key determinants for inter-organizational project delivery success (Bond-Barnard et al., 2018; Caniëls et al., 2019; Castañer & Oliveira, 2020). Complex projects, such as large infrastructure construction, have long suffered from problems of low productivity, cost overruns, and schedule delays (Baiden et al., 2006). Elevated inter-organizational collaboration is highlighted as a remedy to these persistent problems (Nikulina et al., 2022; Suprapto et al., 2015; Walker & Lloyd-Walker, 2016) and has been shown to lead to positive project outcomes (Bond-Barnard et al., 2018).

The central premise behind inter-organizational collaboration is to unify the entire project organization toward common goals (Hietajärvi et al., 2017; Olsson et al., 2024), foster less opportunistic behavior (Nwajei et al., 2022), and jointly create more value than what the stakeholders can individually (McGahan, 2021; Savage et al., 2010). Collaboration results in trust, motivation to pursue the best outcomes for the project, effective use of the project organization's capabilities, and the ability to make sound decisions, enabling a successful and value-creating project (Tampio & Haapasalo, 2024; Wawak, 2024). Especially in complex projects characterized by uncertainty, technical depth, and the novelty of the desired output, the involvement of numerous stakeholders and their expertise in designing and delivering the project is essential (Romero-Torres, 2020; Van Marrewijk et al., 2008). However, due to the temporary nature of the project, participating stakeholders may lack prior experience working with each other, have insufficient time to develop mutual trust, and use varying operating methods and practices. As a result, achieving productive inter-organizational collaboration is a difficulty (Schein, 2017; Xu et al., 2021).

In literature, there exists no unified and widely agreed-upon definition for what inter-organizational project collaboration is or consists of (Ali & Haapasalo, 2023; Engebø et al., 2020). Rather, it is often seen as an ideal state where joint value creation is maximized by synergizing the competencies of participating stakeholders who work reciprocally toward shared objectives (Hietajärvi et al., 2017; McGahan, 2021; Nwajei et al., 2022). In contrast, traditional project deliveries are built upon bilateral contracts between the project owners and suppliers. How this state of productive collaboration is achieved remains an elusive challenge, and practitioners and researchers have varying views and approaches.

2.2. From cooperation to collaboration

Obscurity and confusion remain regarding inter-organizational collaboration and its related terminology (Ali & Haapasalo, 2023; Pauna et al., 2021). Mattessich and Johnson (2018) describe collaboration as a dynamic and mutually beneficial relationship between two or more stakeholders to achieve common goals. Ali and Haapasalo (2023) depicted four hierarchical levels in stakeholder relationships: cooperation, coordination, control, and collaboration. They conceptualized cooperation as a beginning for alignment of interests while collaboration—the highest level of inter-organizational engagement—as a dynamic process of active engagement and a high degree of mutual understanding. Similarly, this study recognizes collaboration as a desirable organizational capability of a project organization that synergizes stakeholders' capabilities and aligns their interests toward best-for-the-project. Evidently, collaboration is a variable that can be improved through managerial means and methods; in some projects, stakeholders collaborate more extensively than in others.

Collaborative project delivery models and approaches that seek elevated levels of collaboration have emerged as a response to the underperformance and have increased in popularity, especially in complex construction projects such as large infrastructure developments (Engebø et al., 2020; Lahdenperä, 2012). Typically, in large projects, increased levels of collaboration have been pursued and implemented through relational project delivery arrangements to foster and manage inter-organizational collaboration (Pauna et al., 2021). These collaborative arrangements, or delivery models, take a more inclusive approach to involving multiple parties in the project (Bygballe & Swärd, 2019) compared to traditional project deliveries, which are based on dyadic ties and bilateral contracts between the owner and suppliers (Lavikka et al., 2015). These delivery models (e.g., alliancing, partnering, and integrated project delivery) share many fundamental features (Lahdenperä, 2012). They are based on relational contracting (Nwajei, 2021), aim to align individual interests with shared project goals (Hietajärvi et al., 2017), emphasize the early involvement of stakeholders to design and plan the project together (Aapaoja et al., 2013), and use multi-party agreements (Lahdenperä, 2012).

While collaboration is extensively highlighted in collaborative project delivery models, it is not strictly limited to these methods (Nikulina et al., 2022). In all projects, stakeholders collaborate to some extent, and any project could benefit from increased collaboration provided that the value gained outweighs the cost and time invested. Besides formal contractual means, collaboration can be fostered through integrative processes and practices applicable to all projects (Hong et al., 2010; Schein, 2017).

2.3. The relationship between project tools and collaboration

Project tools can be recognized as an extension to a project's strategy, translating it into actionable tasks that support and enable the project's objectives (Nwajei et al., 2022). As such, these tools should not be chosen based on their features alone but how well they support the specific goals and needs of a project (Zhang et al., 2018). This alignment between the tools and core project objectives ensures that tools are not only functional but also relevant, directly contributing to the project's success: the ultimate objective of these tools should not be merely their use but to support the achievement of project goals. Besides this tool-objective fit, tools and technologies must be well-suited to the project organization's people and processes to act as extensions that support individuals in executing project tasks more efficiently and productively (Behn & Silvius, 2025; Morgan & Liker, 2020).

However, choosing the correct tools alone is not sufficient to achieve effective collaboration and tool use. Successful tool implementation requires careful planning, training, follow-up, and leadership (Moore, 2007; Nwajei et al., 2022). Therefore, tools should not be viewed as standalone solutions but as part of a broader system that, together with people and processes, contributes to the formation of collaborative project environment. The relationship between tools and collaboration is bidirectional; tools provide the means to facilitate collaboration, but their success depends on how well they are integrated into the larger project environment.

3. Methodology

3.1. Research method

In this study, we adopted an exploratory approach following inductive logic and employed a cross-sectional qualitative research design (Spector, 2019; Thomas, 2006). Inductive reasoning involves uncovering patterns, themes, and relationships from specific observations, suiting our aim of identifying the key project tool-related challenges and exploring the relationship between tools and inter-organizational collaboration. The cross-sectional research design is a feasible method for exploratory and descriptive research (Maier et al., 2023), as it concerns identifying unknown patterns and relationships (Spector, 2019), as opposed to quantitatively testing them.

The empirical data were gathered through interviews with project-based business professionals. From the interviews, we sought to identify the key challenges related to project tools and inter-organizational collaboration, particularly those arising from the increased use of tools and virtual participation. The interviews followed a semi-structured design (McIntosh & Morse, 2015). The identified challenges were initially grouped into generic categories and then further into two main categories: those related to the purpose of tools and those related to their use. The analysis identified 11 challenges in the first category and 28 challenges in the second, representing key project tool-related challenge areas. From these identified challenges, we further conceptualized the interdependencies between the challenge categories.

3.2. Data collection

This research employed semi-structured interviews as a primary method for collecting empirical data. To reach data saturation (Francis et al., 2010), 23 interviews in total were conducted with project practitioners from various project-based industries. Interviewees were purposively sampled (Palinkas et al., 2015) based on their expertise in distinct project-based industries and project types to gain a broad range of information and insights about the tool-related challenges and the role of tools in inter-organizational collaboration. In addition to representing different industries, the respondents held multiple stakeholder roles in inter-organizational projects, such as client, consultant, advisor, contractor, and various managerial positions.

The interviews (Table 1) were conducted via Microsoft Teams and lasted approximately sixty minutes each. The interviews were recorded and then transcribed to allow for thorough and reliable analysis. We utilized an open-ended interview structure to allow respondents to freely discuss and describe their experiences and insights on the matter at hand. During the interview sessions we aimed to foster an informal and conversational atmosphere to allow for detailed and rich discussion on the topics covered and to overcome potential interviewee bias (Adeoye-Olatunde & Olenik, 2021).

Table 1. Interviewed respondents

No.	Respondent's role	Industry	Organization and project context	Duration
1	Head of development	Construction	Large construction company operating in both residential and non-residential sectors	43 min
2	Director, consulting expert	Information technology	Large multinational IT consulting company	50 min
3	Chief operating officer	Industrial engineering	Consulting company with primary focus on large-scale industrial engineering projects	36 min
4	Planning manager	Healthcare	Large on-going hospital construction project that has adopted alliance delivery model	52 min
5	Area director	Industrial engineering	Consulting company with primary focus on large-scale industrial engineering projects	54 min

No.	Respondent's role	Industry	Organization and project context	Duration
6	Head of project management	Industrial engineering	Large mining industry company	46 min
7	Construction manager	Construction	Construction engineering and consulting company	47 min
8	Head of industrial solutions	Information technology	Software engineering and innovation company that develops custom solutions for industrial clients	52 min
9	Chief business officer	Information technology	Software engineering and innovation company that develops custom solutions for industrial clients	49 min
10	Project manager	Construction	Large construction company operating in both residential and non-residential sectors	52 min
11	Professor	Research	Department of civil engineering of a university, industrialized construction	50 min
12	Project manager	Construction	Large construction engineering and consulting company	74 min
13	Construction manager	Industrial engineering	Consulting company with primary focus on large-scale civil and industrial engineering projects	48 min
14	Construction engineer	Healthcare	Large on-going hospital construction project that has adopted alliance delivery model	53 min
15	Senior consultant	Information technology	Large multinational IT consulting company	44 min
16	Project lead	Engineering consultancy	Architecture, engineering, and consultancy company	49 min
17	Regional manager	Engineering consultancy	Civil and industrial engineering consultancy company	44 min
18	Technical director	Construction	Large construction company operating in both residential and non-residential sectors	60 min
19	Department manager	Industrial engineering	Engineering consultancy company with a focus on construction, energy, and environmental engineering	46 min
20	Professor	Research	Military research and teaching unit of a university, complex procurement projects	48 min
21	Leadership team member	Information technology	Telecommunications company with an ongoing smart campus construction project	48 min
22	Business area director	Retail corporation	Large store group that constructs and operates retail stores	39 min
23	Development director	Information technology	Video game development company	41 min

3.3. Data analysis

The data were analyzed using a qualitative content analysis method (Elo & Kyngäs, 2008). We chose content analysis to inductively derive patterns from interview data (Lindgren et al., 2020), as we sought to identify key challenge areas of project tools by grouping empirical findings into common categories. The content analysis followed an inductive approach with open coding, allowing categories to emerge directly from the data (Elo & Kyngäs, 2008).

The analysis began with reviewing the interview recordings and transcripts to re-familiarize us with the gathered data. From the transcripts, all challenges and issues related directly and indirectly to project tools, including their selection, implementation, and use were coded into descriptions of the challenges. At this stage, identical and near-similar codes were aggregated, resulting in 39 tool-related challenges. Next, the challenges were grouped into higher-order categories, resulting in nine categories named using content-specific words. In the final step, two common factors emerged from the identified challenges that were used to split the challenges into two main categories: the challenges related to the purpose of tools and the challenges related to their use.

During the analysis, as we coded the challenges and grouped them into second-order categories, it became evident that the identified categories are highly interdependent. For this reason, we conceptualized the connections and interdependencies between the challenges to provide a comprehensive view of the investigated phenomenon of tool-related challenges.

4. Results

The project-tool category focuses on the purpose of tools; their alignment with the project and its direction, forming a more strategic basis for tool selection. The people-tool category focuses on the use of tools; the challenges related to usage and utilization of tools, focusing on a more operational perspective. The challenges are listed in Tables 2 and 3 and their implications described in the following subsections.

Table 2. Identified project-tool related challenges

Key challenges	Categories	Relation
Tools are often misaligned with project objectives	Tool misalignment	Project-tool related (purpose of tools)
Tools alienate the focus from project goals to tools themselves		
Goals, objectives, and key practices need to be planned, defined and agreed upon first, and tools implemented on top		
Some tools do not provide any significant value to project at hand		
Lack of clarity on why a certain tool is needed or used		
Project tools do not synergize well and structured unsystematically	Tool totality	
Structure of tools and systems as an entirety should be planned and agreed upon early in the project		
Tools require a degree of governance and ownership		
Inter-organizational context challenges tool integration, both technically but also organizationally		
More tools selected than what would suffice	Haphazard selection	
Tools often have uncertain value provided and costs incurred		

Table 3. Identified people-tool related challenges

Key challenges	Categories	Relation
Number of tools in a single project unnecessarily large	Prevalence of tools	People-tool related (use of tools)
Number of tools make operations unnecessarily complicated		
Increased number of tools require extensive training		
Understanding and managing many tools gets complicated		
Tools often have a wide array of functions that remain underutilized		
Number of tools for a given project difficult to balance		
Over involvement with tools can become burdening		
Achieving high utilization of tools requires training	Thorough implementation	
Once tools implemented, utilization can remain insignificant		

Key challenges	Categories	Relation
Tools are often haphazardly implemented		
Lack of facilitation and leadership for collaborative tools		
Fragmented communication channels scatter information	Fragmented information flow	
Scattered information hinders operations		
Too much unnecessary data and information		
Achieving commitment to use selected tools is difficult	Commitment to tools	
Collaborative tools require commitment to participation		
Initial trust a prerequisite for virtual collaboration		
All feasible stakeholders should be involved with collaborative tools		
Commitment to selected tools diminish over time		
Motivation to virtual collaboration requires as project progresses		
Agreed upon communication and tool use practices need to be upheld and require documentation	Common rules and practices	
Virtual communication challenges mutual understanding and increases potential for misunderstandings		
High threshold to use tools curtails utilization	User experience	
Tools are often difficult to use with inferior user experience		
Virtual spaces diminish the richness of collaboration		
Collaborative tools often unintuitive to use		
Tools lack accessibility, e.g.., from mobile devices		
Tool's flexibility and usability key to achieve high utilization		

4.1. Challenges and implications of project-tool relationship

The first three challenge categories revolve around the project-tool relationship. These describe the fit between the tools and the project. In other words, these categories consider how well the tools support the project and its objectives, along with the challenges related to this support. Project-tool-related challenges consider the strategic nature of planning the project's set of tools, while the people-tool category considers more operational challenges faced during the use of tools. Tools are selected and implemented to support the project and its purpose: the project's requirements and objectives dictate which types of tools are needed and provide value to the project. However, achieving this project-tool fit can become challenging for various reasons in inter-organizational projects.

4.1.1. Tool misalignment

Tool misalignment relates to how well individual tools and the overall toolset fit the specific project needs. A certain tool may have a significantly better strategic fit and benefits in one project while being obsolete and unnecessary in another. Despite this, projects often suffer from using tools that provide little value to their core needs and functions. Project tools should align with key project objectives and tasks and directly support their achievement. This requires defining and clarifying what the project seeks and simultaneously understanding the purpose for which the potential tools exist for.

The project's strategy, goals, and requirements dictate what kinds of tools have merit in a specific project. The project objectives should define the selection of tools—not the other way around, where tools are selected and then adjusted to align with the requirements. One interviewee summed up this view:

> "Tools and technologies are not the goal, but the means to achieve the goals."

4.1.2. Tool totality

Tool totality relates to how well the tools of a project act as an operable and productive whole. While a project's technological systems, tools, and platforms have their individual purposes, they also together form a "totality." This concept of totality emphasizes that tools are inevitably interconnected and should be considered and planned as a complementary whole, in addition to their individual specifications and fit. Failing to consider tool totality may create various inefficiencies in project operations. The interviewees especially noted frequent overlaps in project tools' functionalities. For example, certain types of documentation are conducted in separate tools when a single one would suffice. Or how a new tool may be implemented for a specific function, even though an existing tool or platform already has this functionality but is not utilized. Alternatively, a new collaborative tool is introduced to foster collaborative capabilities, but a substitute tool is already in place but underutilized. Such issues are emphasized in an inter-organizational context, as stated by an interviewee:

> "When you have constructors, designers, client organization, and operators, and everyone has their own tools and systems... ...it works, but it leads to overlapping work."

The structure of tools and systems as a totality should be planned and agreed upon early on. Neglecting tool totality may lead to a situation where tools fail to enhance operations and collaboration as intended, becoming a source of friction and burden instead.

4.1.3. Haphazard selection

Haphazard selection refers to the eager selection of project tools without thoroughly considering whether a particular tool is truly necessary or provides significant value to the project. This exacerbates issues related to misalignment and tool totality. Respondents identified several causes for hasty tool selection. The potential of existing project tools may go unrecognized and underutilized, leading to the introduction of new tools even when similar or substituting functionalities already exist within current tools. Additionally, positive experiences from prior projects might suggest that a tool will be useful, but its benefit to the present project may be uncertain. While overlapping challenges are particularly problematic in inter-organizational environments, they are not exclusive to such contexts, as one interviewee noted:

> "At worst, there are overlapping tools even in a single organizational entity."

Moreover, the overall costs versus benefits may not be fully considered. Beyond direct costs, new tools require time and effort for implementation and training of project stakeholders. Due to these additional costs and the resources needed to properly utilize a new tool, only tools that provide significant value or are directly required should be selected.

4.2. Challenges and implications of people-tool relationship

The latter six challenge categories focus on the project-tool relationship. Whereas the project-tool fit describes a more strategic alignment with the tools and goals, the people-people relationship considers a more operational perspective. It consists of challenge areas that individually and collectively affect the usability of tools in daily project operations.

4.2.1. Prevalence of tools

Prevalence of tools relates to the number of tools implemented in a project and used by the project participants. There are numerous tools available for various project needs and functions, increasingly being developed and implemented in project-based practice. As the number of these tools increases beyond a certain threshold, they begin to challenge project operations, as perceived by a respondent:

> "Today there are so many tools that it is beginning to hamper the work itself."

Having fewer tools has positive consequences in other domains of challenges. Managing and understanding the tool totality becomes easier and makes successful implementation more straightforward and less costly. Tools are more likely to be well-utilized, and usability improves as the set of tools remains limited and easier to grasp. On the other hand, a certain number of tools are required to satisfy the project's needs and requirements. Balancing the advantages of additional functions and tools with the disadvantages related to the prevalence of tools remains a challenging yet critical task.

4.2.2. Thorough implementation

Thorough implementation concerns the challenges and measures necessary to successfully implement a tool. Selecting suitable and well-aligned tools is not sufficient; tools only deliver significant productivity benefits and other sources of value when they are properly and thoroughly implemented and utilized.

The variability and number of stakeholders involved make thorough implementation more challenging yet simultaneously emphasize its importance. Without proper implementation, tools may be perceived difficult to use, remain underutilized, and fail to achieve the purpose for which they were selected. The following separate statements from two respondents underscore the importance of implementation in realizing tool benefits:

> "Technology is not the issue and has not been for a long time. The issue is the use of technology and humans using it."

> "Tools are only as good as the users are at using them."

4.2.3. Fragmented information flow

Fragmented information flow refers to the scattering of information in a project environment. Information and data are crucial project resources needed for planning, development, operations, and informed decision-making. Information flow is a key factor for productivity in inter-organizational projects, but information needs to be reliable and easily accessible, as remarked by an interviewee:

> "Data is only as good as it is correct, information is only as good as it is available."

Achieving this state requires taking multiple factors into consideration. Communication channels and practices, both formal and informal, should be jointly planned and agreed upon with key stakeholders to ensure that the practices are committed to and followed. Interviewees noted that communication is often well structured and begins as intended, but as the project progresses, slippages occur, and information begins to silo into smaller circles, challenging its accessibility. Interviewees also noted that an abundance of information and data can become burdensome if not properly structured.

4.2.4. Commitment to tools

Commitment to tools refers to the level of commitment required by participants to stay motivated and consistently use the selected tools as the project progresses. Tools must be consistently used to provide the benefits for which they were selected and implemented.

Commitment is the sum of many parts. To some extent, commitment can be built through agreements and contracts, but interviewees saw such enforcement as short-lived. Rather, they emphasized building real commitment through team cohesion and internalizing the reason the tools were set up in the first place. This requires leadership, proper training, and having an unambiguous set of selected tools. Furthermore, all stakeholders required to use certain tools should be involved to grasp the benefits, while stakeholders who are not needed should be excluded to maintain efficiency. This was summarized by one interviewee:

> "Tools and systems integrate eventually. The challenge lies in achieving a lasting commitment to use and keep using the tools and systems."

4.2.5. Common rules and practices

Common rules and practices relate to the interpersonal nature of inter-organizational projects. As these projects gather participants across inter-organizational boundaries, establishing common ground becomes crucial for joint collaborations. Respondents highlighted that it is key to mutually agree upon tools and tool usage with stakeholders during the early project stages and to ensure that these agreements hold as the project progresses.

> "Tools alone don't suffice. They require structures, standards, and unified practices to get properly utilized."

4.2.6. User experience

User experience relates to the challenges encountered during the daily use and usability of project tools. Interviewees highlighted how project tools are often difficult and burdensome to use. Such challenges are further accentuated when the number of tools used in daily project operations is high, and when there has been inadequate training for tool usage. Usability was also recognized as a motivating factor for the recurring use of tools across the project. Interviewees noted that project participants are more willing to utilize tools that they find easy to use and intuitive, emphasizing user experience as a key factor for higher utilization.

The role of usability is especially important in more complex tools, such as those requiring virtual and real-time collaboration with other participants. Tools, both individually and as a set, should feel intuitive to use to ease deployment and utilization. The relationship between user experience and utilization is well summarized by one interviewee:

> "When considering virtual tools or software, if they are difficult to use, then not everyone can and will use them."

4.3. Interdependencies between the challenges

The identified nine key challenge categories are highly interrelated and have distinct interdependencies (Figure 1). Challenges in one category often give rise to further issues in other categories. However, not all challenges stem from preceding challenges; they arise from various causes. While no challenge category can be completely eliminated by addressing the preceding category (e.g., having a limited number of tools does not eliminate the challenge of thorough implementation), disregarding a group of challenges can escalate subsequent challenges. Conceptualizing and understanding these interdependencies in a project can highlight areas that have the highest impact on the successful implementation and utilization of tools.

Notably, individual challenges in the project-tool category seem to lead to issues in the people-tool category. This correlation is reasonable, as the former involves planning and forming project tools that occur before their utilization. For this reason, proper planning and evaluation is emphasized.

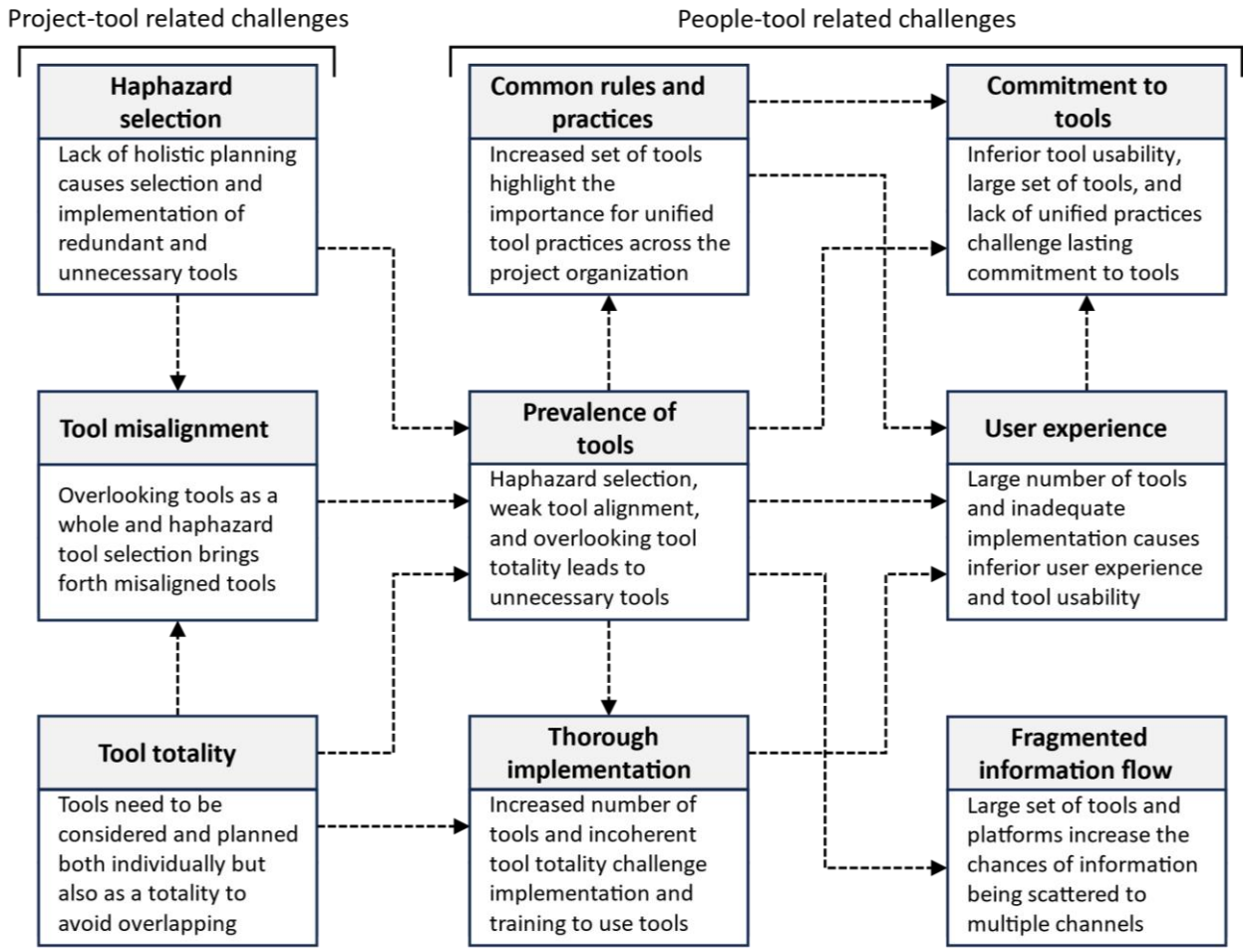

Fig. 1. Conceptualized interdependencies of identified tool-related challenges

5. Discussion

An abundance of technological tools aimed at enhancing project management and operations is readily available, constantly evolving, and are likely to keep increasingly accelerated by the advancements in artificial intelligence. However, despite technological advancements, tools have often failed to translate into successes in project performance (Mir & Pinnington, 2014). They are frequently difficult and costly to implement (Nikulina et al., 2022), and without careful attention, they may end up burdening inter-organizational project operations (Nwajei et al., 2022). Project context is what makes this challenging, as tools are selected in the early stages but have long-lasting consequences across latter stages.

Technological tools are implemented to provide the infrastructure for project work and collaboration, but their effectiveness is heavily influenced by the organizational environment in which they are deployed (Behn & Silvius, 2025). Because technological aspects are highly interconnected with organizational characteristics, technological problems often manifest as organizational challenges, and vice versa. Based on our findings, these technological tool-related failures predominantly arise from organizational mishaps.

Typically, enhanced collaboration is pursued in complex projects to cope with uncertainty and achieve more value jointly (Engebø et al., 2020; McGahan, 2021). Project tools can have both direct and indirect roles in enabling inter-organizational collaboration (Tampio & Haapasalo, 2024). Tools with a direct role are specifically designed and implemented to facilitate collaboration. These can include, for example, project management software, communication platforms, and document-sharing systems, which provide structures and environment for stakeholders to coordinate efforts, share information, and manage tasks efficiently.

On the other hand, tools with an indirect role contribute to collaboration more subtly, but their impact can be just as important if not greater. For instance, a well-integrated data management system can streamline information flow, reducing misunderstandings and fostering trust among team members, thus stimulating collaboration within a project organization. After all, lasting collaborative culture within the group is built through positive and shared experiences (Schein, 2017). Consequently, all tools can have a similar indirect role by creating the necessary conditions for a productive and cohesive work environment (Tampio & Haapasalo, 2024). However, our results find that this indirect role gets easily overlooked and can have a significant negative impact on collaboration when tools are not carefully selected and properly implemented to a specific project environment. To foster productivity and limit negative impact, tools need to be purposeful and adequately usable. That is, aligned with the project's objectives and their users.

The results of this study highlight two distinct relationships that must be aligned to ensure that tools contribute to productive and value-driven collaboration (Figure 2). The first, project-tool alignment, refers to the fit of a tool to support the specific requirements of a project. It emphasizes that tools should be selected and adapted to meet the project's requirements. Based on the empirical data, this ultimate purpose of tools—to support project's primary objectives—can get lost, which shifts the focus from the project to tools.

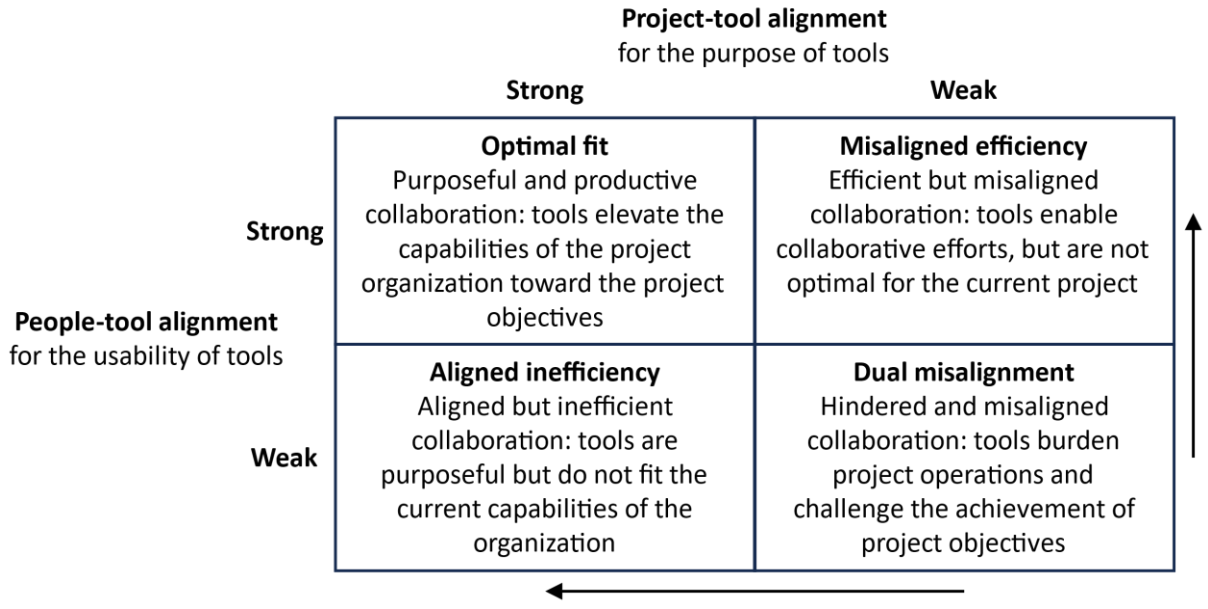

Fig. 2. Project tool alignment across project-tool and people-tool relationships

The second, people-tool alignment, concerns the operability of tools by the project team and other stakeholders. Even the most strategically aligned tools are futile if the team cannot use them effectively. Tools must fit to the organization to prove effective (Liker & Morgan, 2006; Zhang et al., 2018). Focusing solely on the strategic alignment between the tools and project objectives overlooking their usability can lead to inferior utilization in practice. The other way around, collaborative efforts may not produce the outcomes desired. Together both alignments ensure that tools are not only strategically aligned with project goals but are also operationally feasible, enabling the project team to utilize them effectively.

Project-tool alignment should be prioritized foremost in tool selection. If a tool does not directly contribute to the project and its objectives, there is little to do to strengthen the alignment. People-tool alignment and the usability of tools, however, can be improved more easily. Thorough implementation, additional training, and further development are all opportunities to improve the people-tool fit. Process-people-technology logic (Morgan & Liker, 2020), where tools and technologies empower people working on the processes toward defined objectives, is concealed within the two alignments: together they aim to ensure that the technological tools effectively link and support people executing the project toward defined project outcomes.

5.1. Theoretical contributions and practical implications

The study contributes to the discussion on inter-organizational collaboration phenomenon by examining the role of project tools play in it. In the context of collaboration literature, technological tools have been overshadowed by delivery models and organizational methods and often recognized simply as integration mechanisms to elevate team effectiveness. However, this study highlights the dualism of direct and indirect implications (Tampio & Haapaasalo, 2024) technological tools have on the collaborative environment, opening avenues for expansion particularly in the realm of these indirect, secondary effects that can have significant collaboration and operations hindering ramifications. Moreover, the proposed alignment matrix offers a novel conceptualization emphasizing the interplay between organizational and technological factors of collaboration phenomenon (Nwajei et al., 2022).

While collaboration is a well-established concept in relational delivery models such as alliancing, partnering, and integrated project deliveries, its importance and applicability extends to all types of projects. Regardless of the delivery model, stakeholders must collaborate to certain extent, and all projects stand to benefit from increased collaboration—provided that the value gained outweighs the costs involved. Through aligned and intuitive tools, project management can foster natural collaboration that benefits stakeholder cooperation. The right tools can significantly enhance stakeholders' collaborative capabilities, that in turn, can translate into better project outcomes. However, as technological tools provide the necessary infrastructure for collaboration, carelessly selected and implemented tools can instead become a significant burden on stakeholders working on the project. Project-tool and people-tool alignments work as a simple yet profound heuristic to aid in selection of tools that fit to the specific project environment. Tools must first be aligned to support project objectives but also suitable to the specific project organization.

Moreover, tools should be considered as a fundamental component of collaboration. Our results argue that all tools have an indirect yet meaningful impact on collaboration in the project environment. A data management system, for example, can significantly streamline transparent information flow or hamper it, affecting stakeholder collaboration. The analysis of challenges particularly emphasizes the impact that too many tools can have on collaboration. Project operations should not be complicated any more by tools that do not serve a definitive purpose. Quality of tools should be prioritized over quantity to strive toward lean and effective tool sets that support project goals. A streamlined set of well-chosen tools is more likely to be used effectively, leading to higher levels of commitment and long-term utilization across different stages of the project. Usability is a critical factor in the lasting success of collaboration tools. The ease with which stakeholders can use a tool affects not only their willingness to adopt it but also their ability to collaborate effectively throughout the project. This usability is determined by both the attributes of individual tools and how well they function together as a

cohesive system. When tools are simple, intuitive, and well-executed, they foster a collaborative environment that is both efficient and sustainable.

5.2. Limitations and future research

This research has two main limitations. First, due to the nature of cross-sectional research design and the lack of longitudinal analysis (Maier et al., 2023), the interdependencies between the challenges lack validation for causality. However, as the interdependencies were depicted to showcase the interconnected nature of tool challenges, rather than systematically analyze the causalities, this is not a major limitation, and further validation is left for future studies.

The second limitation considers the type of data collected. Interviews as a data collection method are subject to bias. However, we sought to limit interview bias by fostering an informal and conversational atmosphere during the interviews, through use of a semi-structured interview design to not steer respondents in certain directions, and by collecting data from broad range of project-based industries.

During this research we came across a few emergent and interesting research opportunities. Firstly, further analysis of the causalities between key tool challenges could benefit prioritization and ranking of most impactful areas. With limited time and other resources during the project, focus on the most impactful elements is key towards efficiency. Second, the relation between technological challenges and organizational issues provides avenues for further theorization. The two are closely intervened, but on a more theoretical level were merely scratched in this study. And third, further exploration of the two alignments proposed offers multiple opportunities. These could include validation and further conceptualizations, for example identifying key attributes that engender higher levels of alignment across both dimensions.

6. Conclusion

This study set out to explore the role technological project tools have in inter-organizational collaboration. The study identified nine key project-tool related challenges based on empirical data collected. The study found that technological tools can have significant direct and indirect roles in establishing and promoting collaboration and productive project work through by their direct and indirect implications. Particularly the indirect implications can easily get overlooked and have significant negative effects hindering project operations. Misalignment of tools was depicted as the main cause for challenges, and a tool alignment matrix, that aims to ensure tool alignment with project objectives and people executing the project, was conceptualized.

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