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LEADERSHIP AND THE INTEGRATION CHALLENGE: A GROUNDED THEORY STUDY OF DIGITAL TRANSFORMATION IN AECO

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SUMMARY*: This study examines how leaders in a large and complex public organization within the Architecture, Engineering, Construction and Operations (AECO) sector perceive the conditions for digitally oriented leadership. Using a grounded theory approach, twenty in-depth interviews with managers and project managers were analyzed through open and focused coding. The analysis identified Lack of integration of digital work systems as the core category summarizing the main barriers to digital transformation. Four interrelated categories - Lack of vision and purpose, Limited usability, Silo organization, and Organizational inertia -were found to constrain leaders' ability to adopt digitally oriented leadership practices. The study contributes a grounded theoretical explanation showing how barriers operating at different leadership levels collectively reinforce the lack of integration of digital work systems, thereby constraining digitally oriented leadership and digital transformation. The study indicates that digital transformation cannot be achieved through technology alone but requires organizational and leadership integration supported by clear strategies, cross-functional collaboration, and adequate digital competence. These findings advance understanding of leadership conditions in digital transformation and offer practical implications for enhancing leadership capacity in AECO organizations.*

KEYWORDS*: Digital transformation, digitally oriented leadership, digital work systems, organizational integration, AECO.*

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1. INTRODUCTION

Digital transformation has emerged as a critical driver of change in the Architecture, Engineering, Construction, and Operations (AECO) sector, offering opportunities to enhance efficiency, quality, and collaboration across the life cycle of infrastructure assets. The adoption of digital tools and work systems has been promoted as a response to persistent sectoral challenges, including fragmented workflows, high transaction costs, and the demand for sustainable, data-driven decision-making (Adepoju et al. 2022; Zulu et al. 2023a). However, despite these advancements, the digital maturity of many AECO organizations remains limited, and the expected benefits of transformation are often constrained by both technological limitations and organizational barriers (Kaszás et al. 2023; Samuelson & Stehn, 2023; Peansupap & Walker, 2005; Ilhan Jones, 2020; Pidgeon & Dawood, 2021). This underscores the need to examine not only technological solutions but also the organizational conditions and leadership practices (Olofsson Hallén et al. 2023) that shape how digital transformation is implemented in the AECO sector, as previous Construction 4.0 research has largely focused on technological applications and solutions (Statsenko et al. 2022).

Digital transformation represents a fundamental shift in how buildings and infrastructure are planned, designed, constructed, and managed. At its core is the transition from traditional, fragmented practices toward integrated, data-driven processes that connect the entire life cycle—from early planning to long-term operation and maintenance. Beyond the introduction of new technologies, this transformation entails changes in collaboration, organizational processes, and business models, with the purpose of improving efficiency, quality, and sustainability (Liu et al. 2019; Zulu et al. 2023b; Samuelson & Stehn, 2023).

A wide range of digital technologies underpin this shift (Statsenko et al. 2022). For this study, these are referred to as digital work systems because they integrate technical, organizational, and user dimensions (Olofsson Hallén et al. 2023). Data-integration tools such as Building Information Modeling (BIM) and Geographic Information Systems (GIS) support coordination and planning (Pérez-García et al. 2021), while real-time monitoring solutions like the Internet of Things (IoT) and digital twins enable predictive maintenance and life cycle optimization (Mirarchi et al. 2020; Pan et al. 2023). Complementary innovations - including artificial intelligence (AI), augmented and virtual reality (AR/VR), robotics, and 3D printing - strengthen analysis, visualization, and automation (Regona et al. 2022; Li et al. 2024; Liu et al. 2022; Statsenko et al. 2022). Research shows that by integrating these technologies into cohesive and transparent workflows, the AECO sector can improve decision-making, reduce costs, shorten delivery times, and achieve more sustainable outcomes (Tana & Chai, 2023; Meng & Xin-shu, 2024; Pan et al. 2023).

However, the benefits of digital transformation cannot be realized through technology alone (Olofsson Hallén et al. 2025; Abbasnejad et al. 2021). Organizational culture and agility are critical for the successful implementation of digital transformation strategies. A culture that supports digital initiatives while promoting teamwork and innovation encourages employees to adopt and effectively utilize new technologies. Such a transformative culture is essential for aligning with digital business models (Mihardjo et al. 2019) and, together with organizational readiness, strongly influences how employees engage with new systems and processes. Several barriers can hinder the successful execution of digital transformation. Structural rigidity is a critical obstacle, as existing hierarchical and bureaucratic structures can stifle innovation and delay decision-making processes, limiting an organization's ability to adopt new technologies and agile practices (Zhang et al. 2022). In addition, the misalignment of digital strategies with overall business objectives can undermine transformation efforts. Without continuous strategic renewal and integration of digital goals into corporate strategies, organizations risk redundancy, stakeholder disillusionment, and fragmented execution (Warner & Wäger, 2019).

Leadership is one of the factors that previous research has highlighted as particularly important in digital transformation, as it shapes vision, culture, and innovation (Cortellazzo et al. 2019; Mihardjo et al. 2019; Gledson et al. 2023). By fostering trust, empowerment, and collaboration, leaders facilitate necessary changes by enabling digital tool adoption and innovative practices (Zulu & Khosrowshahi, 2021; Weber et al. 2022). Supportive leadership further aligns organizational culture with transformation goals, thereby enhancing performance and adaptability (Alasiri & AlKubaisy, 2022; Schiuma et al. 2021). A key competence in this context is digital literacy, which enables leaders to critically understand, communicate, and apply digital technologies in line with organizational goals (Olofsson Hallén et al. 2025; Gledson et al. 2023). Digitally oriented leadership is therefore essential, as it allows leaders to guide teams through technological change, foster collaboration, and strengthen knowledge management (Bayraktar & Jiménez, 2020; Gilli et al. 2023).

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Transformational leadership (Bass, 1999) inspires and intellectually stimulates employees, articulates a compelling vision, and cultivates innovation (Islam et al. 2021). By shaping culture, building trust, and promoting adaptability, transformational leaders engage employees and support the successful implementation of digital initiatives (Holten & Brenner, 2015; Gilli et al. 2023).

Within the AECO sector, transformational leadership is recognized as a critical driver of digital transformation, primarily by fostering innovation, adaptability, and collaboration (Zulu et al. 2023; Senadjki et al. 2023). By inspiring teams and articulating a shared vision, transformational leaders support the development of dynamic capabilities that are essential for adopting advanced technologies such as BIM and Digital Twins (Aghimien et al. 2021). They further enhance stakeholder collaboration by promoting transparency and effective information analysis, thereby strengthening project outcomes and improving asset performance (Ghansah & Lu, 2023). In addition, transformational leadership stimulates innovative work behavior by cultivating supportive relationships, providing resources for creativity, and empowering employees to engage in both incremental and radical innovation (Miller & Miller, 2020; Le, 2020). Finally, by reinforcing employees' psychological capital, transformational leaders increase engagement and adaptability, ensuring organizational competitiveness in an increasingly digitalized industry (Le, 2020).

Successful integration of digital work systems is closely tied to transformational practices at the top management level, where leaders play a decisive role in envisioning digital futures and steering organizations through technological complexities (Karippur & Balaramachandran, 2022; Bhattacharya & Pant, 2023). At the same time, sector-specific barriers remain significant: fragmented digital systems limit efficiency, while decentralized decision-making, leadership ambiguity, and political pressures in the public sector hinder coordination and long-term learning (Ma et al. 2018; Pérez-García et al. 2021; Wright & Pandey, 2010; Sadri et al. 2020; Klein et al. 2021). In addition, inadequate training, conservative organizational cultures, and insufficient leadership engagement further weaken digital leadership capacity (Ferreira et al. 2022; Aghimien et al. 2021; Wang, 2024; Piras et al. 2024). Finally, aligning digital strategies with business models remains a challenge, as technologies must be embedded into broader organizational and customer-oriented frameworks to generate long-term value (Mihardjo et al. 2019).

Despite extensive research on digital tools, implementation strategies, and leadership approaches in the AECO sector, less is known about how leaders in large and complex public organizations perceive the conditions required to lead digital transformation. While recent studies have begun to explore digital leadership in construction firms (e.g., Gledson et al. 2024), there is still limited empirical work on the barriers to enacting digitally oriented leadership and the opportunities leaders identify to support digital transformation. Without such insights, organizations risk underestimating the cultural, managerial, and strategic dimensions of digital transformation, resulting in fragmented initiatives, resistance to change, or failure to capture long-term value.

Previous research has, in summary, primarily addressed technological implementation, BIM adoption, information management, and Construction 4.0 technologies (e.g., Peansupap & Walker, 2005; Pidgeon & Dawood, 2021; Samuelson & Stehn, 2023). However, considerably less attention has been devoted to the organizational and leadership mechanisms that influence the integration of digital work systems.

The aim of this study was therefore to analyze how leaders within the AECO sector perceived motives and barriers for digitally oriented leadership. The study contributes to digital transformation research by developing a grounded explanation of how interconnected barriers that become particularly salient at different leadership levels may collectively constrain the integration of digital work systems and the enactment of digitally oriented leadership.

2. METHOD

2.1 Design of the study

A large public organization was selected as a case for the study. A grounded theory approach was applied (Charmaz, 2024) to develop a theory solidly anchored in empirical data. This qualitative approach is particularly suited to areas that remain largely unexplored, such as the preconditions for leaders in large and complex organizations to lead and support the digital transformation of the construction industry. A grounded theory approach was selected because existing research on digital leadership in construction has primarily emphasized leadership capabilities, digital literacy, business-case perceptions, and transformational leadership behaviors (Zulu et al., 2023a; Zulu et

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al., 2023b; Gledson et al., 2024; Morgan & Papadonikolaki, 2022). Previous work has also mapped Construction 4.0 technologies and their potential applications, thereby strengthening the understanding of the technological landscape of digital transformation in the sector (Statsenko et al., 2022). However, these studies provide more limited insight into how organizational conditions shape leaders' opportunities to enact digitally oriented leadership in large and complex AECO organizations. In particular, less is known about how strategic ambiguity, fragmented organizational structures, leadership mandates, and project-level decision-making interact to enable or constrain digital transformation. An inductive grounded theory approach was therefore considered appropriate for identifying previously unexplored relationships and mechanisms between leadership practices, organizational structures, and digital work systems.

Grounded theory has been widely applied within construction and AECO research to investigate complex organizational, social, and technological phenomena where existing theoretical frameworks provide limited explanatory power. Previous studies have used a grounded theory approach to develop empirically grounded explanations of professional identity formation and professional roles (Dainty et al., 2000; Ofori-Boadu & Ofori-Boadu, 2022), informal social structures and norms among construction workers (Fu et al., 2019), relationship-based processes in project delivery and construction management (Tait, 2021), and the creation of business value through BIM implementation (Munir et al., 2019). Grounded theory has also been applied to develop explanatory models of BIM acceptance (Bastan et al., 2022) and the implementation of Cloud-BIM environments in AEC firms (Olugboyega et al., 2019).

The breadth of these applications demonstrates the suitability of grounded theory for studying emerging and multifaceted phenomena at the intersection of people, organizations, and technology. In the context of digitally oriented leadership, where interactions between organizational structures, leadership practices, and digital work systems remain insufficiently theorized, an inductive grounded theory approach enables the development of empirically grounded explanations of how leaders perceive and navigate digital transformation. By allowing categories and relationships to emerge from participants' experiences, the method supports the development of context-sensitive theoretical insights that can contribute to both theory building and practice within the AECO sector.

To capture a diversity of perspectives, leaders and managers from several different divisions within the organization were included in the study. Although the organization is formally one entity, the different divisions represent distinct operational contexts and organizational cultures. This provided a breadth of insights and experiences, thereby strengthening the empirical foundation for understanding the complex prerequisites of leadership in digital transformation. Grounded theory provides systematic research steps for discovering and generating new hypotheses and conceptual models through an iterative process in which data collection and analysis occur simultaneously. Concepts and categories are generated, refined, and connected through coding and constant comparison, allowing overarching patterns to be identified across micro-, meso-, and macro-levels. The method's purpose is to allow theory to emerge inductively from the data, making it especially valuable for exploring complex, context-dependent, and evolving social phenomena where existing theories are insufficient.

2.2 Context, sampling procedure and participants

The Swedish Transport Administration (STA) was selected due to its organizational complexity and extensive mandate to plan, construct, and maintain national transportation infrastructure. As Sweden's largest public owner, STA must balance conflicting goals, such as safety, efficiency, sustainability, and regional growth, while operating under political directives and professional expertise. Decision-making is further complicated by the involvement of multiple stakeholders at the local, national, and international levels. Furthermore, long-term projects that span decades require addressing uncertainty, shifting conditions, and technological developments. The ongoing digital transformation process adds another layer of complexity by demanding organizational adaptation, new competencies, and the integration of innovative solutions across traditional structures. Figure 1 shows an organizational chart illustrating STA's structure.

In the first step of the sampling procedure, the business areas to be included in the study were identified. The areas selected—Investments, Major projects, and Maintenance—were chosen because of their strong connection to the organization's core mission: planning, designing, building, and maintaining infrastructure. The Investments unit oversees approximately 1,600 road and rail projects, each valued between 0.5 and 90 million euros. Major projects, by contrast, manage around 30 large-scale investment projects in road, rail, and water infrastructure, each

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exceeding 90 million euros. Finally, the Maintenance unit is responsible for the management and upkeep of Sweden's state-owned road and rail networks, ensuring their safety, functionality, and long-term sustainability. At the time of the interviews, BIM was required for all investment projects within these business areas to improve coordination between disciplines during construction. While GIS was used to manage geographic information for planning purposes, from design through follow-up. Other emerging digital technologies and systems, such as AI and automation, were not generally applied to the projects, except on a trial basis.

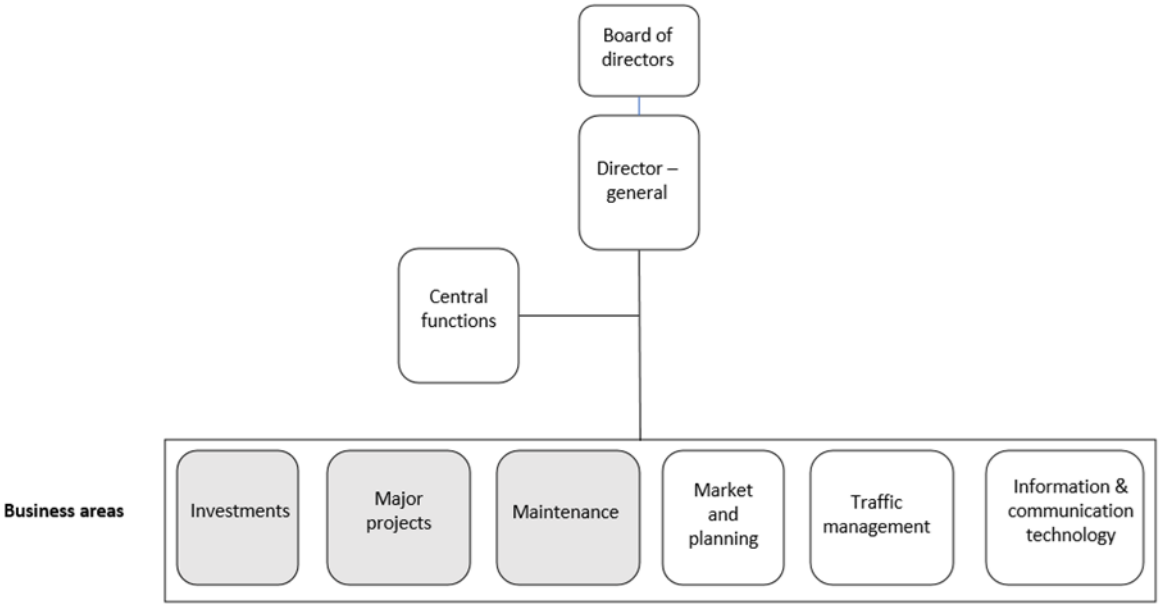

Figure 1: An overview of the organization of the Swedish Transport Administration. The shaded business areas are included in this study.

In the second step, a random selection of interviewees was conducted within these business areas. The selection of managers was made using a random generator and numbered lists of names. The selection of project managers was conducted through purposive sampling, where participants were actively recruited based on specific criteria, such as being project managers with experience with BIM - projects. Table 1 presents an overview of the number of interviewees and their affiliation within the organization.

Table 1: Number of interviewees and their affiliation within the organization.

	Investments	**Major projects**	**Maintenance**
First-line managers	4	1	1
Second-line managers	2	1	1
Project managers	10		

The interviewed first-line managers operate at the forefront of employee interactions, with direct responsibility for supervising the daily operations of project managers and technical specialists within their designated units. Second-line managers provide oversight to first-line managers while maintaining a more indirect involvement in daily project operations, and they are accountable for coordinating multiple units within their respective areas of responsibility. Each included business area comprises up to four executive levels. Both first- and second-line managers were selected based on their extensive knowledge of the core business challenges and opportunities in the context of digital transformation. Project managers, in turn, are responsible for leading and executing projects within their designated units. They were identified as having the most comprehensive understanding of how digital work systems are implemented and utilized in projects; however, they do not hold personnel management responsibilities.

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Once participants were randomly selected, an invitation was sent via email containing a Skype link. Acceptance of the invitation was regarded as consent to participate in the interview, while declining the invitation indicated non-participation. Only two invitees declined, and their places were subsequently offered to two other randomly selected individuals. In two cases, the invitation remained unanswered; in these instances, the interviewer joined the scheduled online meeting in case the invitees intended to participate but had forgotten to accept, which proved to be the case in both instances.

2.3 Data collection

The data collection procedure commenced with a pilot in November 2024. Subsequently, interviews with first- and second-line managers were conducted in November and December 2024, followed by interviews with project managers in February and March 2025. The interviews were conducted online and recorded via the Skype link provided in the invitation. Interview duration ranged from 55 minutes to 1 hour and 20 minutes. Audio files were securely stored on a password-protected server accessible only to the research team and were permanently deleted following verbatim transcription to ensure data confidentiality. Each interview was assigned an identification code to distinguish between different participant groups while maintaining anonymity. The pilot interview is marked with the letter P, codes beginning with M refer to managers (including both first- and second-line managers), and codes beginning with PM refer to project managers. These identifiers are shown after each quotation to indicate the source while preserving confidentiality.

A total of 20 in-depth interviews were conducted, comprising a pilot interview, nine interviews with first- and second-line managers, and ten interviews with project managers. In accordance with the grounded theory approach, the initial interview questions were broad in scope, for example: How would you describe the extent and impact of digitalization on the construction industry? What value or benefits do you think digitalization can bring to the industry? What do you see as the most important drivers of digitalization in the sector? What do you see as the biggest obstacles to digitalization in the sector? Follow-up questions were used to elicit more detailed and nuanced descriptions within the relevant areas of interest.

2.4 Data analysis

In accordance with grounded theory, the data were collected and analyzed in clearly defined steps. Interviews and analyses of existing data were conducted in parallel. Each new interview was based on the previous analysis, which guided the investigation of relevant topics. All data were analyzed manually. Interviews were transcribed verbatim and analyzed line by line.

The first step in the coding process was open coding, which aimed to begin identifying patterns and themes in the data. The codes were closely related to the data; often, they were word by word formulations or interpretations of what was said. Theoretical memos, containing reflections, interpretations, and connections between codes and data, were continuously written alongside the coding process to develop theoretical sensitivity, the ability to recognize and give meaning to relevant data during analysis, and to challenge prior understanding of the research question.

The second step, focused coding, involved selecting the most significant or recurring codes from the open coding phase and comparing them with each other, with the raw data, and with the theoretical memos. This process generated more abstract categories that summarized larger segments of the data and corresponded to clusters of related codes (see Table 2 for examples). These categories were further developed by comparing them with each other, relating them to the original data and theoretical memos, and identifying overarching patterns, working toward the identification of a core category that would integrate the entire theory. The empirically grounded theory was generated from recurring patterns in the data, and the core category was centrally related to four categories and eight sub-categories.

Theoretical sufficiency was implied after conducting 16 interviews. Therefore, the results were validated using data from the last four interviews, which did not reveal any new information about the core category. In order to challenge assumptions and strengthen the validity of the analysis, the research group collaborated continuously on open and focused coding, theoretical notes, categorization, and theory building.

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Table 2: Examples of open and focused codes forming categories related to the core category Lack of integration of digital work systems.

Quotes and examples of open codes	Sub category	Main category
"There is great potential for change, but this requires a clear vision and leadership to drive the change forward." **M3.2** "The vision and strategies, they are not clearly communicated… It is obvious that digitization is necessary, but the purpose of the development is not."**M4.2**	Unknown or unclear vision and strategy	Lack of vision and purpose
"It is important to have a clear purpose for digitizing rather than doing so just for the sake of it." **M4.7** "There is no clear purpose for BIM and I honestly don't know why it should be used." **PM6**	Unknown or unclear purpose	Lack of vision and purpose
"We are spread out over small islands, which makes coordinating the whole difficult." **M3.3** "A flatter, more flexible structure is needed." **M3.2** "Each project establishes its own digital culture and way of working, which may differ from standard templates." **M4.5** "I would say that our organizational structure is one of the biggest obstacles to digitization. It is overly complex, with too many levels and departments." **M4.6**	Barriers for digitalization in a fragmented organization	Silo organization
"Ultimately, it is the project manager who decides how the project will be run and which working methods will be used." **M3.2** "The projects' growing strength dictates the selection of working methods to be incorporated." **M4.5** "As a manager, I have very limited influence over digital development in projects, which frustrates me when I am unable to support my colleagues working in this area." **M3.3**	The project manager's power to drive digital development	Silo organization
"We want to be first, but we're not. We want to be leaders in digitalization, but we're not there yet. There's still a long way to go." **PM5** "The organization has a long way to go in terms of digitization, and we have a lot to learn before we can be considered digitized. We need a clearer plan." **PM6** "I think we are far behind. Many other similar organizations, for example, have been working with GIS for much longer and in a completely different way than we do." **M4.8**	Low digital maturity	Organizational inertia
"Our industry is conservative." **P** "There are certainly challenges to overcome. The industry's long history and traditions can make change difficult." **M4.3** "Change happens slowly. Organizations tend to be comfortable with what they know, so it can be difficult to get everyone to accept and adapt to new digital working methods and tools." **PM8**	Limited readiness for digital transformation	Organizational inertia
"The usability is poor and it breeds frustration." **M4.2** "We have so many systems where we need to enter information, and none of them communicate with each other. There should be one system that does all of this." **M4.2**	Limitations of technology and systems	Limited usability
"Digital systems can be more difficult to understand than mechanical systems, where problems are easier to identify and solve." **M3.1** "Since it is difficult to find the necessary information in the model, it is easier to use the drawings instead." **PM5**	Challenges in human-computer interaction	Limited usability

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2.5 Ethics

Ethical approval was obtained from the Swedish Ethical Review Authority (2023-03239-01) before the start of the study. The invitation email was accompanied by a participant information sheet that described the aim of the study, how personal information would be handled, and that participation was voluntary. Participants gave verbal consent before the interview began. This consent could be withdrawn at any time during the interview without explanation.

3. RESULTS

Lack of integration of digital work systems emerged as the core category, summarizing the main challenges faced by leaders and project managers in the digital transformation (see Figure 2). Interviewees associated this lack of integration with the organization's ineffective implementation of digital work systems, which was reported to hinder their ability to lead digital development. The findings further indicate that barriers experienced at different leadership levels contribute to this lack of integration. While leaders across the organization expressed positive attitudes and expectations toward digitalization and recognized the potential of digital technologies, barriers at different leadership levels constrained the adoption of digitally oriented leadership.

The core category encompasses eight subcategories, which were grouped into four main categories: Lack of vision and purpose, silo organization, organizational inertia, and limited usability. While the categories emerged from leaders' descriptions of digitalization challenges across all leadership levels, the analysis further suggests that certain barriers were particularly associated with specific levels of leadership responsibility. Strategic leadership was primarily associated with a lack of vision and purpose, middle-management leadership with silo organization and organizational inertia, and project leadership with limited usability. Figure 2 illustrates the grounded theoretical relationship identified between leadership levels, the four constraining categories, and the core category. Rather than representing isolated barriers, the model shows how barriers at strategic, middle-management, and project leadership levels collectively contribute to the lack of integration of digital work systems. Table 3 summarizes the main categories, their key characteristics, illustrative evidence, implications for digitally oriented leadership, and their contributions to this lack of integration.

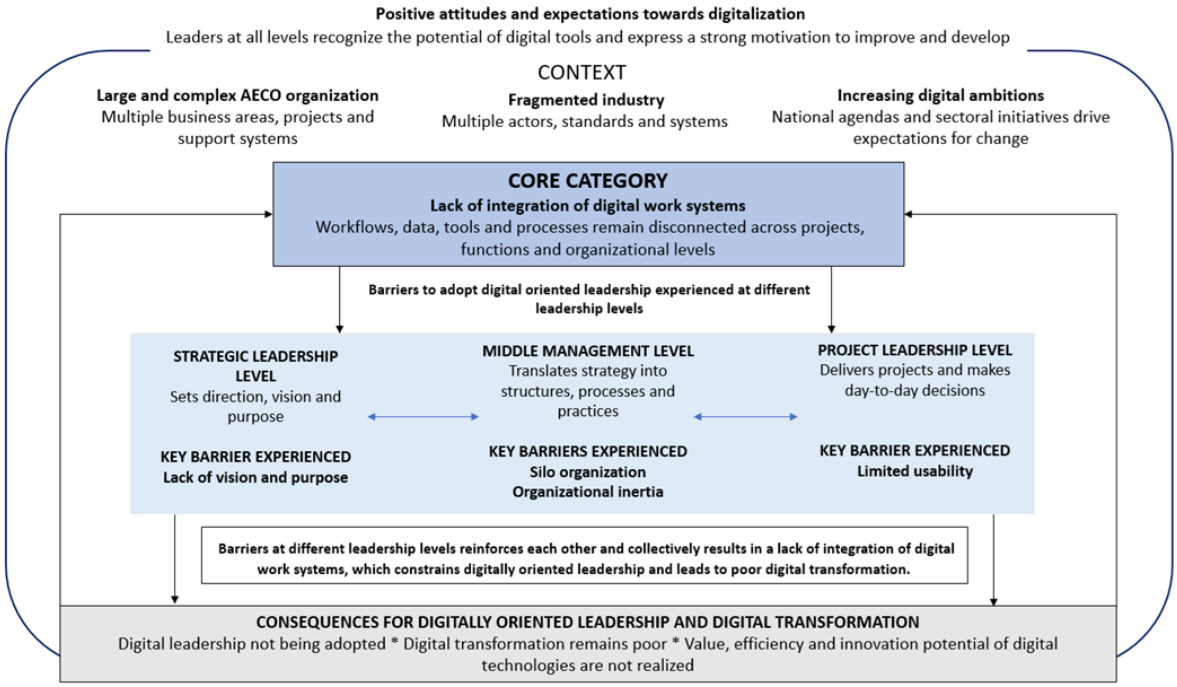

Figure 2: Grounded theory model of barriers to digitally oriented leadership across leadership levels and their contribution to the lack of integration of digital work systems.

Interviewees generally expressed very positive attitudes toward digitalization, seeing tools such as BIM and GIS as key steps toward more efficient, modern, and high-quality work processes. BIM, in particular, was described

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as “only positive,” “the future,” and “irreversible”. Many leaders expressed curiosity and enthusiasm about the possibilities offered by digitalization, highlighting its potential to improve communication, clarify information, and facilitate complex tasks. AI was also seen as promising, with great potential to streamline operations.

Table 3: Summary of the four main categories, their key characteristics, illustrative evidence, implications for digitally oriented leadership, and contribution to the lack of integration of digital work systems.

Main category	Key characteristics	Contribution to lack of integration of digital work systems	Illustrative evidence	Implications for digitally oriented leadership
Lack of vision and purpose	Unclear digital vision, weak strategic direction, unclear purpose of digital initiatives	Digital initiatives are implemented inconsistently because actors lack a common understanding of goals, priorities, and expected outcomes.	Leaders described uncertainty regarding digital goals, poor communication of strategy, and limited understanding of why digital work systems should be adopted.	Reduces leaders’ ability to create commitment, align stakeholders, and establish a shared direction for digital transformation.
Silo organization	Fragmented organizational structures, weak cross-functional coordination, and strong local decision-making authority	Different parts of the organization adopt digital work systems unevenly, creating fragmented and disconnected ways of working.	Leaders described projects developing their own digital cultures and working methods, while project managers exercised considerable influence over technology adoption.	Limits leaders’ ability to coordinate organization-wide digital transformation and establish common digital practices.
Organizational inertia	Low digital maturity, conservative organizational culture, and limited readiness for change	Existing routines, norms, and capabilities hinder the widespread adoption and integration of digital work systems across the organization.	Participants described slow change processes, resistance to new ways of working, and a perceived gap between digital ambitions and organizational capabilities.	Restricts leaders’ capacity to implement and sustain digital transformation initiatives.
Limited usability	Technical limitations, poor interoperability, inadequate tools, and challenges in human-computer interaction	Digital work systems are bypassed, underutilized, or replaced by parallel manual processes, reducing integration across workflows.	Participants reported difficulties accessing digital models, fragmented systems, insufficient software, and a preference for traditional drawings over digital models.	Limits leaders’ ability to encourage and sustain the use of digital work systems in everyday practice.

“BIM is fantastic.” M4.7 “Overall, this is a positive change. The more control we have over our facility, the better it is for us as owners and managers.” P “There are so many positive things to say about a digitized industry compared to a traditional one.” M3.4

Critical voices were in the minority, focusing on costs, technical complexity, and adapting digital tools to simpler projects. Some were skeptical due to incomplete understanding of the benefits of digitalization.

“I think it's a very positive development, but of course there may be some negative aspects to it.” M4.7 “Implementing digital tools and methods is complicated and expensive.” PM5 “We are quite tired of digitalization as a concept and see it as a buzzword.” M3.1

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Despite the overall positive attitude, a core challenge emerged: the lack of integration of digital work systems. Leaders described how organizational and technological barriers made it difficult to translate positive intentions into coordinated digital practices across projects and organizational units. As a result, digital tools often failed to support new work methods and, instead, outdated practices were forced into new technologies. Inconsistent information, fragmented processes, and a lack of continuity across the building life cycle made it difficult for leaders to exercise digitally oriented leadership, coordinate digital tools, monitor progress, and ensure consistent application across projects.

"Currently, consultants design 3D models and deliver them to us as PDF drawings. We review these PDFs and include them in a request for proposal tender to a contractor, who may also choose to work with 2D PDF drawings. This makes it difficult to achieve an integrated workflow. Copies of the drawings are made, which increases the risk of errors." P

One interviewee illustrated ideal integration using an example from the automotive industry, exemplifying that fully integrated and version-controlled digital information flow is essential to avoid errors and inefficiency:

"In the automotive industry, working with the wrong version is a nightmare scenario. You need to have an integrated flow of information that travels along the value chain from customer to factory, between suppliers, etc. Everyone must work with the same model, and it is extremely important that changes to the model are implemented everywhere at the same time, without any intermediaries. There must be a digital master of the product to be built, and no unregistered copies in the form of PDFs are allowed." P

Due to the lack of integration, digitalization was often perceived as an additional burden on leadership. Leaders were expected to drive digitalization while focusing primarily on core responsibilities such as planning, designing, and managing infrastructure.

"As a leader, my main focus is on the core business, not digital development. Development and implementation should occur elsewhere in the organization, and the core business and projects should focus on their respective areas." M4.2

Nonetheless, leaders recognized several concrete benefits of digitalization. Digital tools were reported to improve quality through early detection of conflicts and errors, enhance efficiency by better using resources, and support collaboration and communication across projects. Visualization via BIM was seen as particularly valuable for planning and informed decision-making.

"It turned out to be a really good design. We don't often see that in projects. There have been a lot of quantity errors, missing codes, and overlooked details. This BIM project was different. The documentation was complete and accurate, with only minor deviations." PM7 "There is a risk of designing something and then discovering on site that it is not feasible. That costs a lot of money. If BIM had been used during the planning and design stages and everyone had been involved in checking it, errors and collisions would probably have been reduced. This would create a great deal of value." PM10 "BIM is an important communication tool, especially during consultations with internal or external stakeholders. It allows you to clearly show, follow up on, and track the various things you do throughout a project." PM3

Despite their positive attitudes toward digitalization, several leaders emphasized that realizing the potential of digital tools required actively testing and evaluating systems and working methods in practice. Without such efforts, the anticipated value was perceived to remain unrealized. The identified categories, detailed below, represent the main barriers to leaders embracing digitally oriented leadership.

3.1 Lack of vision and purpose

In this category unclear vision and strategy refers to a situation where the goals, direction, and plans of an organization's initiatives are not well communicated, understood, or defined. Unclear purpose refers to a situation where the underlying reason or intent behind an action, project, or initiative is not clearly defined, communicated, or understood. The interviewees associated these challenges primarily with the strategic leadership level, where organizational priorities, long-term direction, and digital ambitions were perceived to originate. However, the findings suggest that the consequences of unclear vision and purpose were experienced across leadership levels, influencing leaders' ability to support and coordinate digital transformation efforts.

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3.1.1 Unclear vision and strategy

Based on the informants' perspectives, the organization lacked a clearly defined and actionable vision and strategy for digitalization. Although management's ambitions and efforts to foster engagement were recognized, many reported that the goals and strategic direction remained vague, overly abstract, or insufficiently communicated throughout the organization. One leader explained that even though there are strategic ambitions, it is still difficult to understand how the vision and strategies are to be put into practice:

"It is difficult to see how the vision and strategies should be implemented in practice." M3.3

Informants emphasized that effective digital transformation required management to clearly articulate the rationale behind the organization's digital transformation strategy—its intended goals, expected benefits, and relevance to daily operations—supported by concrete and practical actions.

Absent such clarity, digitalization risked being perceived as a top-down imposition, thereby undermining commitment, leadership effectiveness, and the integration of digital tools into everyday work practices. According to the interviewees, the absence of a clearly communicated vision made it difficult for leaders at different organizational levels to create commitment, align stakeholders, and establish a shared direction for digital transformation.

"The vision and strategies are not clearly communicated." M4.7

The consequences of this ambiguity were particularly evident in leaders' attempts to create commitment and engagement around digital transformation:

"For me, having goals and direction is incredibly important. It's important to know what our goals are and where we are going. I also want to foster commitment and understanding around these, but it's still a bit vague. As a leader, I want to convey this to the group to generate commitment and enthusiasm around these aspects." M4.7

3.1.2 Unclear purpose

The purpose of the organization's digitalization efforts was perceived as unclear, creating broader uncertainty about whether an overarching rationale had been formally articulated. Several interviewees emphasized that understanding why digitalization was taking place—beyond the idea that it was simply something that "should be done"—was essential. As one leader explained:

"It is important to continuously think about the purpose and why you digitalize, and not digitalize for the sake of digitalization." M4.7

They described that introducing digital tools alone was not sufficient; without a clear explanation of their benefits or the strategic objectives behind their implementation, employees struggled to use the tools effectively, which in turn affected how the tools were applied in practice. Respondents likened the situation to "juggling many balls" without a comprehensive understanding of the overarching picture, highlighting the pressure to use BIM, GIS, and other digital work systems without clear guidance.

The informants believed that the challenge lay partly in formulating a clear purpose and partly in communicating it throughout the organization. In a large, complex organization with many goals and stakeholders, creating a common narrative became particularly difficult. In some projects, the purpose was written into templates and guidelines, but there was no guidance on how, when, or why to apply it. Consequently, the responsibility for formulating a purpose fell on individual project managers, which often led to digital solutions being overlooked or deprioritized.

The interviewees described that when the overarching purpose was ambiguous, the division of labor was affected, with uncertainty about who was responsible for specific requirements or what outcomes were expected. Several leaders explained that this made it difficult to foster commitment and accountability among employees, which in turn hindered the practical advancement of digitalization initiatives. The findings further suggest that an unclear purpose weakened leaders' ability to justify digital initiatives and motivate employees to adopt new digital work systems. As a result, digitalization efforts were implemented inconsistently, with projects often developing their own interpretations of priorities and requirements.

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“The problem is that our templates state that we should purchase BIM for projects. However, it is unclear why, when and how this should be done. It is up to each project manager, who often rejects and removes it from the procurement process. We are not good at understanding what we should use it for.” PM7

In summary, the subcategories illustrate how a lack of vision and purpose constrained digitally oriented leadership by limiting leaders’ ability to communicate direction, create commitment, and align organizational actors around common digital goals. While these challenges were primarily associated with the strategic leadership level, their consequences were experienced throughout the organization, contributing to fragmented implementation of digital initiatives and ultimately to the lack of integration of digital work systems.

3.2 Silo organization

Organizational silos were identified as a fundamental barrier to digital transformation, as different aspects of fragmentation were described as limiting coordination, reducing knowledge sharing, and weakening leaders’ ability to establish common strategies. For managers, perceived silos created inefficiencies and fostered competing “digital cultures,” making it harder to implement coherent practices across the organization. The informants described these challenges across leadership levels, but they became particularly visible where leaders were expected to coordinate activities, processes, and priorities across organizational boundaries. Two sub-categories related to silo organization were identified: Barriers for digitalization in a fragmented organization and The project manager’s informal power to drive digital development.

3.2.1 Barriers for digitalization in a fragmented organization

The fragmented structure of the organization, described as consisting of “silos” or “islands,” was considered a major cause of the ineffective implementation of digital work systems. According to the interviewees, this fragmentation hindered coordination between departments and the creation of a unified digital workflow. Furthermore, internal divisions and hierarchical decision-making processes were perceived to slow innovation and reduce employee influence, making it more difficult to adapt to new ways of working.

The core issue stemmed from fragmentation within the organization. Several departments still relied heavily on traditional, paper-based systems and lacked the capacity to receive or manage digital models. This fragmentation was perceived to create significant difficulties during the handover phase, leading to inefficiencies and additional costs associated with converting digital files into usable formats. Moreover, the absence of clear routines and established processes for handing over and integrating digital deliverables into ongoing operations further reflected this fragmented structure.

"The maintenance organization has not worked in that way and is still largely paper-based. They are very difficult to deliver digital models to." PM1

The organization's size and complexity were described as exacerbating these problems:

"STA is a large and complex organization. It can be difficult to get all parts of the organization to collaborate and use BIM effectively, and it can be difficult to get all actors to understand and accept BIM as part of the way of working." PM6

The interviews indicated that each project, especially large infrastructure initiatives, tended to develop its own digital culture and working methods, which were perceived as limiting standardization across departments. Several interviewees also noted that support functions were seen as having limited authority to enforce uniform procedures, which, in their view, made coordination even more challenging in an already fragmented environment.

To solve these problems, a more cross-functional and process-oriented approach was proposed. Interviewees expressed that there was a clear need for a flatter, more flexible organizational structure that enabled better collaboration between departments, promoted innovation, and ensured that digital initiatives covered the entire life cycle, from planning to maintenance. Without such changes, informants believed that the full potential of digitalization efforts would remain untapped. From a leadership perspective, organizational fragmentation was perceived to limit leaders’ ability to coordinate digital transformation efforts across functions and establish common digital practices. As a result, different parts of the organization often adopted digital work systems unevenly, contributing to fragmented and disconnected ways of working.

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“An organization built on silos itself becomes an obstacle to digitization. Even though we depend on each other, the processes and flow between them are lacking. Digitization must cover the entire process, from planning to maintenance. What we plan to build must also be managed at some point. I believe we need to think of it as a process that reflects the entire life cycle.” M4.7

3.2.2 The project manager's informal power to drive digital development

The informants expressed that, within the fragmented organization, considerable informal authority had been placed on projects regarding the implementation and development of digital work systems. The project managers concurred with the managers that they often held the practical authority to decide whether digital work systems would be used, even when these decisions deviated from organizational templates or formal expectations.

"The project manager has quite a lot of power in this. Ultimately it is the project manager's decision whether BIM is used or not." PM1

Several managers described a lack of mandate to influence developments as a source of frustration, while the decision-making process within projects was perceived to depend heavily on the knowledge, priorities, and commitment of individual project managers.

"We are the small organizations within the large organization and therefore need to define things for ourselves." PM3

It was felt that, in many cases, projects had become increasingly autonomous entities, giving them substantial influence over the implementation of digital initiatives. For a joint initiative or new direction to succeed, the entire management team — “from the General Director down” (P) — was perceived to need a shared commitment and direction.

“It’s important that all managers and leaders are on board to drive real change, especially the project managers, who hold significant power to either implement or block initiatives.” P

It also emerged that conflicts sometimes arose between the working methods preferred by technical experts and the digital working methods chosen by project managers. Some managers reported that employees felt constrained by project management decisions and that their ideas and needs were not always considered, which could negatively impact trust.

“As the project manager, I have considerable power over how projects are implemented. The technical experts may have a different opinion, but ultimately, it is the project manager's decision that determines whether or not BIM is used.” PM3

Furthermore, project managers described that digital tools such as BIM were sometimes excluded due to concerns regarding costs and perceived value. Several interviewees argued that the benefits of BIM did not always justify the additional expense, particularly when the models were not actively used. There was also a perception that BIM primarily benefited consultants rather than clients, making implementation less attractive. In projects with tight budgets, maintaining digital models was often viewed as an unnecessary expense, especially if the level of digital detail did not contribute directly to project performance. Consequently, BIM was frequently excluded unless its value could be clearly demonstrated.

“BIM is not chosen for projects in order to keep costs down.” PM1

The findings suggest that local decision-making authority became particularly influential in a fragmented organizational context where common digital practices were weakly established. From a leadership perspective, this reduced the ability to coordinate digital transformation across projects and increased the likelihood that digital initiatives would be interpreted and implemented differently throughout the organization.

To sum, the subcategories illustrate how silo organization constrained digitally oriented leadership by limiting coordination, reducing cross-functional collaboration, and reinforcing local rather than organization-wide decision-making. While these challenges were experienced across leadership levels, they became particularly visible where leaders were expected to coordinate activities across organizational boundaries. Consequently, digital work systems were implemented unevenly across the organization, contributing to the lack of integration of digital work systems.

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3.3 Organizational inertia

One recurring challenge for interviewed leaders was the organization's inertia. Ambitions for digitalization were not matched by internal capacity or readiness for change. This inertia manifested in several ways, which emerged as two sub-categories: Low digital maturity and Limited readiness for digital transformation. A recurring theme in the interviews was the perceived gap between digital ambitions and organizational capability. Although the organization was described as willing to pursue digital transformation, leaders frequently experienced difficulties translating intentions into coordinated and sustained action. This category was particularly associated with middle-management leadership, where managers were expected to coordinate work across organizational boundaries, translate strategic priorities into operational practices, and support collaboration between projects and functions. These aspects highlighted why strategic goals were often perceived as difficult to implement and sustain.

3.3.1 Low digital maturity

The organization's digital maturity was generally perceived as low, with many informants expressing that the organization is behind both private sector actors and other public authorities in the digitalization journey. Although it was perceived that there was a clear ambition to lead digital development, particularly through initiatives like mandating BIM and GIS for certain projects, these efforts were expressed to be not yet fully supported by internal capabilities or consistent implementation.

"We want to be first, but we're not. We want to be leaders in digitalization, but we're not there yet. There's still a long way to go." PM5

Informants described outdated systems, manual processes, and a lack of detailed 3D modeling as barriers to effective digital coordination. There was also a sense that other sectors, particularly the building industry and consultants, have come much further in integrating digital tools into daily operations.

"I think we are far behind. Many similar organizations have worked with GIS for much longer and in a completely different way than we do." M4.8

Internally, the organization was seen as lacking knowledge of and familiarity with digital methods. Several informants highlighted a gap between intention and execution. While there was optimism that digital processes would improve in the future, the current situation was characterized by fragmentation, inertia, and limited organizational readiness for digitalization.

"The organization has a long way to go in terms of digitalization, and we have a lot to learn before we can be considered digitized. We need a clearer plan." PM6

Low digital maturity was perceived to restrict leaders' ability to implement digital initiatives effectively, as ambitions for digital transformation were not always matched by organizational capabilities, knowledge, or experience.

"On a scale of 1 to 5, I would give the organization a 1 for how digitally mature it is." M3.2

3.3.2 Limited readiness for digital transformation

The organization was perceived as being limited in its readiness for digital change, facing several challenges related to culture, structure, and habit. Many described the organization and the industry as a whole as tradition-bound and conservative, where change occurs slowly. According to the interviewees, many employees showed a strong comfort with established ways of working, and in parts of the organization they observed a noticeable resistance to adopting new digital tools and methods. The findings suggest that fragmented organizational structures shifted substantial responsibility for digital transformation to the project level. As a result, project managers became key actors in determining whether digital work systems were adopted, adapted, or rejected in practice.

"Our industry is conservative." P "There are certainly challenges to overcome. The industry's long history and traditions can make change difficult." M4.3

At the same time, the organization was perceived as open to ideas and discussions. The interviewees mentioned this openness as a strength in the change process. However, the willingness to change varied among different groups and individuals. Some employees were curious and eager to experiment with new approaches, while others

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preferred established methods. According to the leaders, this uneven engagement made it difficult to secure broad commitment and to position digital initiatives as an integrated part of the organization rather than as isolated efforts. As a result, leaders experienced a gap in understanding and commitment that hindered their ability to drive digital transformation effectively.

Although there was a general organizational willingness to change and an awareness of the organization's important role as an owner and role model, implementation of digital work systems was often described as tentative and fragmented. The findings suggest that organizational readiness was not only influenced by willingness to change, but also by the organization's ability to translate ambitions into coordinated action.

According to the interviewees, difficulties in implementation, decision-making, and follow-through contributed to the persistence of existing routines and slowed the adoption of new digital practices.

"The organization is good at testing new things but struggles to implement them and manage the results. Often, we struggle and have difficulty making decisions and moving forward." M3.3

The subcategories above illustrate how organizational inertia hindered digitally oriented leadership by limiting the organization's ability to implement, sustain, and establish digital transformation initiatives. While these challenges were experienced across leadership levels, they became particularly visible where leaders were expected to translate strategic ambitions into operational practice. Consequently, digital initiatives were often implemented unevenly or remained isolated efforts, contributing to the lack of integration of digital work systems.

3.4 Limited usability

From a leadership perspective, usability was described as crucial, as limited usability not only reduced efficiency but also weakened employee engagement in digital transformation. When systems were difficult to use or poorly aligned with work practices, the interviewed leaders faced resistance and a struggle to realize intended benefits. The interviewees described these challenges across leadership levels, but they became particularly visible in project environments where leaders and employees interacted directly with digital work systems in their daily work. Although leaders were expected to promote and support the use of digital work systems, they often perceived that they lacked the tools, resources, or organizational conditions required to address the underlying usability issues. Limited usability can be divided into two subcategories: Limitations of technology and systems, and Challenges in human-computer interaction.

3.4.1 Limitations of technology and systems

Many of the challenges and limitations regarding the use of the organization's digital systems were related to technological inadequacy and a lack of system compatibility. According to the interviewees, a recurring theme was that, rather than facilitating processes, the technology often became an obstacle. For instance, it was believed that the organization had committed to system solutions that hindered overall digitalization, making work more difficult rather than more efficient in practice.

Several informants expressed the view that although the goals and ambitions of digitization were clear, the concrete tools needed to achieve them were often lacking. One mentioned example was that the software used was not powerful or modern enough, resulting in some deliverables being unopenable and preventing the use of digital models due to practical difficulties.

"I received the digital deliveries but couldn't open them. We didn't have the right software." PM9

Insufficient access to essential tools was also seen as hindering the adoption of effective digital working methods. In some cases, teams relied on semi-manual workflows because they used design tools before they were fully developed—or even available.

"Even if the aims and objectives were clearly defined, they would not be achieved without the necessary digital tools." PM10

One particularly common source of frustration was the lack of integrated digital work systems. Many informants described having to deal with a large number of systems that did not communicate with each other, creating a fragmented working environment and increasing the administrative burden. Staff spent considerable time entering

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information into several different systems, which took them away from their core activities and prevented them from focusing on their areas of expertise.

"We have so many systems where we need to enter information, and none of them communicate with each other. There should be one system that does all of this." M4.2

Overall, informants described the need for more coordinated, user-friendly, and powerful digital tools, both to increase efficiency and to enable meaningful digital transformation. From a leadership perspective, these technological limitations were perceived to constrain leaders' ability to encourage and sustain the use of digital work systems. Rather than enabling digitally oriented leadership, the systems themselves became a source of frustration and resistance. Consequently, digital work systems were often underutilized or bypassed, contributing to the lack of integration of digital work systems.

3.4.2 Challenges in human-computer interaction

Several leaders described how digital work systems such as BIM were experienced as difficult to access, particularly for employees who did not work closely with the technology on a daily basis. According to the interviewees, the systems were often perceived as unintuitive and time-consuming, which made it challenging to get broader groups of employees to adopt and use the tools. Drawings, by contrast, were seen as easier to understand and more closely connected to practical work, while BIM models were described as difficult to navigate.

"It is difficult to navigate in a BIM model and know how to move around and view things." PM6

According to the interviewees, this limited the possibilities to review, quality assure, and monitor projects effectively, thereby creating obstacles for leaders who sought to advance digital ways of working. A recurring problem expressed was that the models could be difficult to interpret, meaning users often reverted to drawings.

"It is difficult to find the information you need in the model, then it is easier to use the drawings instead." PM5

Additionally, some systems were considered overly sophisticated and not very user-friendly, resulting in frequent requests for assistance from various support functions. Some tasks still required manual intervention, as not everything was automated.

Overall, there seemed to be some uncertainty about when it was most effective to rely on digital solutions compared to manual methods. The interviewees perceived that criticism of the systems was less about the technology itself and more about insufficient user support, maintenance, and implementation—factors seen as fostering negative attitudes even toward effective tools. The findings suggest that usability challenges reduced both leaders' and employees' willingness to rely on digital work systems in practice. As a result, traditional work methods continued to coexist with digital solutions, limiting the integration of digital work systems across projects and reducing leaders' ability to promote digitally oriented ways of working.

"It's not that I don't want to use digital models in my projects, but I choose not to because of difficulties in using them." PM1

Taken together, these subcategories illustrate how usability challenges constrained the practical adoption of digital work systems across the organization. While these challenges were experienced by leaders at multiple levels, they became particularly visible in operational and project settings where digital work systems were used in everyday practice. Although leaders generally supported digitalization, limitations in technology, interoperability, and human-computer interaction reduced their ability to translate positive intentions into integrated digital practices, thereby contributing to the lack of integration of digital work systems.

4. DISCUSSION

The purpose of this study was to analyze how leaders within a large and complex public organization in the AECO sector perceive motives and barriers for digitally oriented leadership. The results show that while attitudes toward digitalization were generally positive, leaders experienced significant challenges in exercising digitally oriented leadership due to a lack of integration of digital work systems. This core finding highlights a paradox: although digital tools such as BIM and GIS are viewed as promising and even necessary for the sector's development, their implementation is hampered by unclear strategies, fragmented structures, and organizational inertia. Consequently,

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leaders often perceive digitalization as an additional burden rather than a natural part of their role, which limits the potential for realizing long-term value.

Existing research on digital leadership has primarily emphasized leaders' digital literacy, transformational leadership behaviors, and their ability to foster innovation, trust, and employee engagement (e.g., Cortellazzo et al., 2019; Bayraktar & Jiménez, 2020; Gilli et al., 2023). In contrast, the present study highlights how structural and organizational conditions constrain leaders' ability to enact digitally oriented leadership. This organizational perspective is consistent with earlier research showing that the implementation of digital technologies in construction depends not only on technological characteristics, but also on organizational, managerial, workplace, and individual conditions (Peansupap & Walker, 2005). Rather than focusing solely on leadership competencies, the findings emphasize the importance of integration across leadership levels, organizational units, and digital work systems.

A central contribution of this study is that barriers to digital transformation were not experienced uniformly across the organization. Instead, different barriers became particularly salient at different leadership levels. Strategic leaders struggled to establish a shared vision and purpose, middle managers faced challenges related to organizational fragmentation and inertia, while project leaders encountered the practical consequences of limited usability. The findings, therefore, suggest that digitally oriented leadership is shaped not only by individual competencies but also by leadership-level-specific organizational conditions. Although the individual barriers identified in this study—such as unclear strategic direction, organizational fragmentation, inertia, and usability challenges—are well established in previous research, the grounded theory model integrates them into a relational explanation across leadership levels. The theoretical contribution therefore lies primarily in the proposed relationship between these barriers and how they may collectively contribute to the lack of integration of digital work systems. This multi-level perspective is consistent with Samuelson and Stehn (2023), who identified the fragmented and project-based structure of construction as an important condition affecting digital transformation and emphasized that change needs to be considered across multiple organizational levels. The present study extends this perspective by providing empirical insight into how barriers associated with different leadership levels may collectively reinforce a common organizational outcome: the lack of integration of digital work systems.

The results indicate that the organization's digital transformation can be characterized by a "technology-driven" rather than a "need-driven" logic. New digital work systems may be adopted because they are perceived as innovative or because they follow industry trends, while the underlying organizational needs remain insufficiently analyzed. This "technology push" approach risks reinforcing fragmentation and inefficiencies, as tools are introduced without alignment to existing processes or strategic objectives. Similarly, Munir et al. (2019) demonstrated that value generation from BIM-based processes depends on a clear rationale that translates organizational objectives into information requirements and subsequent information management activities. The present study complements this perspective by showing how a lack of clear vision and purpose may constrain leaders' ability to establish a shared direction for digital transformation. Previous research highlights the importance of aligning digital initiatives with organizational goals to generate value and avoid redundancy (Warner & Wäger, 2019; Kaszás et al. 2023). A need-driven approach, by contrast, would start with a clear articulation of the problems to be solved and the outcomes to be achieved, and only then identify which digital systems are most suitable.

One finding of our study is the imbalance of power between formal and informal roles in digitally oriented leadership. Although line managers in the studied organization were responsible for digital transformation, they had limited authority to influence decisions. Project managers, on the other hand, had significant informal power regarding the use of digital tools, yet they often avoided adopting a digitally oriented leadership role due to cost concerns. This may create a leadership vacuum that slows down transformation. Previous studies have emphasized that mandate and authority are essential for leaders to act as change agents in digital contexts (Holten & Brenner, 2015; Weber et al., 2022). Within the AECO context, Abbasnejad et al. (2021) similarly identified BIM leadership and top management support as key driving enablers that influence other organizational conditions during BIM implementation. Without sufficient authority, leaders may be held accountable for outcomes beyond their control, reducing motivation and reinforcing organizational inertia.

The results from our study highlight the importance of distinguishing between technological and organizational integration. Technological integration refers to the interoperability of digital technologies and systems, whereas organizational integration involves establishing standardized processes, routines, and collaborative practices

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(Barbu et al. 2024). The absence of both forms of integration was reported as a central barrier. This finding is consistent with previous research identifying persistent difficulties in integrating people, processes, systems, and information across disciplines and project stages (Ibrahim, 2013; Pidgeon & Dawood, 2021). The present study extends this perspective by showing how leadership-related barriers at different organizational levels may contribute to and reinforce this lack of integration. This is also consistent with earlier research stressing that digital tools alone cannot achieve transformation unless embedded in coherent workflows and supported by organizational change (Ma et al. 2018). Integrating across the asset life cycle may be seen as essential to avoiding disruptions, duplicated work, and costly errors.

The organization was perceived to lag behind both private actors and other public authorities in terms of digital maturity. While ambitions seemed to be high, actual implementation remains limited and uneven across units. As described by several interviewees, conservative practices and a tradition-bound culture contribute to organizational inertia, which makes change slow and incremental. This observation is consistent with studies pointing to the gap between awareness of digital opportunities and readiness to act upon them (Zulu et al. 2023; Wang, 2024). Jäkel et al. (2024) similarly conceptualized digital maturity in construction as a multidimensional organizational development process involving not only technology, but also organizational structures, processes, competencies, and strategy. Digital maturity requires not only advanced tools but also skills, resources, and organizational willingness to experiment, learn, and institutionalize new practices. Despite expressing positive attitudes toward digitalization, many leaders interviewed in our study viewed digitally oriented leadership as an additional burden rather than a natural part of their role. This paradox can be explained by the negative feedback loop identified in the interviews: unclear strategies create ambiguity, which reduces leaders' capacity to act, leading to frustration and disengagement. As a result, digitalization efforts are delegated to individual projects, reinforcing fragmentation and further weakening organizational learning. Breaking this cycle requires that digitally oriented leadership is integrated into core managerial responsibilities rather than being treated as an external or optional task. Transformational leadership, which emphasizes vision, empowerment, and innovation, has been identified as particularly relevant in this regard (Bass, 1999; Gilli et al., 2023). The results point specifically to the importance of senior leadership adopting a transformational leadership approach to digitalization.

BIM emerged as the most widely mentioned digital tool, overshadowing other technologies such as AI, automation, and digital twins. This dominance is partly due to the fact that BIM was mandated by the studied agency for use in all projects and is closely linked to concrete results, such as design documentation and construction planning. Additionally, the development of other digital work systems has not progressed as far within the studied organization. In this respect, BIM functions as both a technical system and a symbolic representation of digitalization in the AECO sector. However, focusing too heavily on BIM can limit understanding of digital transformation and obscure the potential of other technologies. There is a risk that BIM has become synonymous with digitalization in the AECO sector, overshadowing broader integration efforts. Ilhan Jones (2020) argued that the digital transformation of the built environment requires moving beyond a narrow focus on BIM toward the convergence of multiple digital technologies and systems.

Taken together, the findings indicate that the barriers identified in the studied organization were interconnected rather than isolated, highlighting the importance of alignment between leadership practices, organizational structures, and digital work systems. Addressing these barriers may require moving beyond technology-driven initiatives toward need-driven strategies supported by clear strategic direction, stronger leadership mandates, enhanced digital competence, and more integrated organizational processes across the asset life cycle.

4.1 Method discussion

The choice of grounded theory was guided by the aim of the study to explore relatively uncharted aspects of digitally oriented leadership in the AECO sector. Since there is little empirical research examining how leaders in large public organizations perceive the conditions for digital transformation, an inductive method was considered appropriate. Grounded theory allowed for the systematic development of concepts based on empirical data, which is valuable when existing frameworks offer limited guidance. Although other approaches, such as case study methodology, could have generated valuable insights, grounded theory offered more rigorous procedures for developing a conceptual model directly from the data.

The sampling strategy combined random and purposive techniques to ensure representation of both managers and project managers, thereby capturing perspectives from different organizational levels. While this strengthened the

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richness of the material, the focus on a single public organization limits the transferability of the findings. The STA is a highly complex, politically governed environment. While the identified challenges may resonate with other public as well as larger private organizations, contextual differences must be acknowledged.

A specific limitation was thus that the study was conducted within a single large public AECO organization. Although this context provided a valuable opportunity to study digital transformation in a complex setting, organizational conditions, governance structures, and leadership mandates may differ from those found in private-sector firms. While several of the identified challenges, such as organizational fragmentation, unclear mandates, and difficulties integrating digital work systems, have been reported in previous AECO research, caution is warranted when transferring the findings to private-sector organizations. Differences in governance, market conditions, decision-making authority, and competitive pressures may influence both leadership practices and digital transformation processes.

Data collection and analysis were conducted according to grounded theory principles, with interviews and coding performed iteratively. Open and focused coding, supported by constant comparison, allowed emerging insights to shape subsequent interviews and facilitate the identification of recurring patterns. Although the collaborative involvement of several researchers in coding and memo writing enhanced credibility, preunderstandings of digitalization and leadership may have influenced interpretations. To mitigate this risk, analytic transparency was emphasized through systematic documentation of coding steps, theoretical memos, and category development.

Theoretical saturation was considered to have been reached after conducting 16 interviews, with the final four confirming the previously identified categories. While this supports the adequacy of the sample size, additional interviews might have provided more nuance, especially regarding perspectives from outside the included business areas.

The research quality was strengthened by using verbatim transcripts, applying systematic coding, and including quotations that illustrate the link between the data and the interpretation. Transferability was promoted by providing a detailed account of the organizational context, which enabled readers to assess its relevance to other settings. Dependability was supported by clear documentation of the analytic process. Confirmability was enhanced through ongoing discussions within the research team that challenged assumptions and interpretations.

Some limitations with the grounded theory should be acknowledged. First, grounded theory is inherently interpretive, so the developed categories and conceptual model cannot be fully separated from the researchers' perspectives. To reduce the risk of researcher bias, coding, memo writing, category development, and theoretical discussions were conducted collaboratively within the research team. Nevertheless, alternative interpretations of the data remain possible. Additionally, the findings are bound to the context and time period in which they were collected, reflecting digital transformation in the studied organization at a specific stage. Therefore, the contribution should be understood as a theoretically informed interpretation that can inform future research and practice in similar contexts rather than as a universally generalizable framework.

Finally, the study is based on leaders' and project managers' self-reported perceptions and experiences. Consequently, the findings reflect how participants interpreted and made sense of digital transformation rather than direct observations of organizational practices.

4.2 Future research

The grounded theoretical model developed in this study provides several opportunities for future research. First, the framework should be examined in other organizational contexts to assess how the identified relationships between leadership conditions, organizational structures, and digital work systems manifest across different AECO settings. While the present study was conducted within a large public-sector organization, future research could explore whether the same categories emerge in private-sector firms, smaller organizations, or multinational construction companies operating under different governance and market conditions.

Second, the categories identified in this study may provide a basis for quantitative research. Future studies could develop and validate measurement instruments for the identified categories and investigate their relationships with outcomes such as BIM adoption, digital maturity, digital work system integration, project performance, and leaders' engagement in digitally oriented leadership. Such studies could assess the relative importance of different

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barriers and examine whether the relationships proposed in the grounded theory model are supported in larger samples.

Third, several specific research questions emerge from the findings. For example, how do different leadership levels influence the integration of digital work systems during digital transformation? Which organizational conditions most strongly enable or constrain digitally oriented leadership? How do leadership mandates, organizational structures, and digital work system usability interact to influence the adoption and sustained use of digital technologies? Future studies could also investigate how leaders actively address or overcome the barriers identified in this study.

Fourth, comparative studies across sectors could contribute to a broader understanding of digitally oriented leadership. Many of the challenges identified in this study, such as organizational fragmentation, competing priorities, and difficulties integrating digital work systems, are not unique to the AECO sector. Comparative studies involving sectors such as manufacturing, healthcare, transportation, or public administration could help identify which barriers are sector-specific and which reflect more general challenges associated with digital transformation in complex organizations.

Finally, the findings highlight the value of longitudinal research. Digital transformation is an ongoing process rather than a discrete event, and the barriers identified in this study may change over time as organizations gain experience with digital technologies and adjust organizational structures and leadership practices. Longitudinal studies could therefore examine how the identified categories evolve during different phases of digital transformation, how leaders' roles and responsibilities change over time, and whether increasing integration of digital work systems alters the relationships proposed in the present framework. Such research would contribute to a more dynamic understanding of digitally oriented leadership and organizational transformation.

5. CONCLUSIONS

This study analyzed how leaders in a large and complex public AECO organization perceive motives and barriers for digitally oriented leadership. Using a grounded theory approach, the analysis identified Lack of integration as the core category summarizing the main challenges of digital transformation. The proposed grounded theory highlights how a lack of vision and purpose, silo organization, organizational inertia, and limited usability reinforce one another across leadership levels and collectively contribute to the lack of integration of digital work systems. Rather than identifying these barriers as isolated challenges, the main theoretical contribution lies in explaining their proposed relationship across leadership levels and their collective contribution to the core category. This provides a theoretical explanation of why positive attitudes toward digitalization do not necessarily translate into digitally oriented leadership or successful digital transformation.

Three overarching conclusions can be drawn from the studied case. First, the findings reinforce the view that digital transformation cannot be realized through technological investments alone. The findings suggest that successful digital transformation may require both technological and organizational integration, supported by clear strategies, cross-functional collaboration, and alignment with organizational needs. Second, leadership emerges as a paradoxical factor: while it is viewed as critical to transformation, leaders may lack the mandate, resources, and authority to drive change, while project managers hold strong informal power but may not use it to advance digital initiatives. Third, the dominance of BIM as the most visible digital tool illustrates both opportunities and limitations - its benefits are evident, yet its symbolic role risks overshadowing broader integration efforts and the potential of complementary technologies.

For practice, the study highlights the need for organizations to clarify strategic goals, strengthen leadership mandates, and build digital competence across all organizational levels. The findings suggest that integrating digitally oriented leadership into core managerial responsibilities, rather than treating it as an additional burden, may support digital transformation. For research, the proposed relationships between barriers across leadership levels provide a basis for further empirical testing and refinement in other organizational and sectoral contexts.

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