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Digitalization in Local Government: A Socio-Technical Case Study of a City Planning Department in a Swedish Municipality

Aina El Masry * and Diana Chronéer

Correspondence of Computer Science, Electrical and Space Engineering, Luleå University of Technology, 97187 Luleå, Sweden; diana.chroneer@ltu.se

* Correspondence: aina.el.masry@associated.ltu.se; Tel.: +46-722010267

Abstract

This study examines the governance of digitalization in municipal administration, with a focus on city planning services, specifically spatial planning, building permits, and geodata management, in a large Swedish municipality. Digitalization is understood here not as the adoption of isolated technologies, but as organizational and process-oriented transformation enabled by digital systems such as GIS platforms, case management systems, and digital planning information. While national policy frameworks set ambitious digitalization goals, previous research shows that local authorities often face significant obstacles, including fragmented processes, technical limitations, and complex governance structures. These challenges create a persistent gap between strategic ambitions and daily work practices. This study employs a qualitative case study approach drawing on semi-structured interviews with employees in technical, operational, and strategic roles, as well as an analysis of policy documents and internal process descriptions. Using a socio-technical perspective, the analysis applies the Technology–Organization–Environment (TOE) framework to examine how digital systems, organizational structures, and external institutional demands interact in practice. The findings highlight substantial challenges related to system integration, data quality, uneven digital competencies, and the ongoing disconnect between strategic goals and operational realities. The study emphasizes the need for clearer governance structures, stronger cross-functional collaboration, and work practices that bridge technical and organizational dimensions. Building on the empirical analysis, the study proposes a conceptual framework that extends the TOE framework by identifying three interrelated structural mechanisms: technological lock-in, organizational inertia, and institutional uncertainty. This framework contributes theoretically by deepening the understanding of socio-technical digitalization dynamics in local government. Practically, it provides municipalities with an analytical tool to assess and reflect on their digitalization conditions.

Keywords: city planning; digitalization; TOE

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1. Introduction

Over recent decades, digitalization has become a central driver of transformation in the public sector. This study conceptualizes digitalization not as the mere implementation of discrete IT systems, but as an organizational and process-oriented transformation enabled by digital technologies. These technologies are understood as socio-technical components embedded within work processes, organizational structures, and governance arrangements. Recent work increasingly frames municipal digitalization as a long-term socio-technical

challenge, shaped by legacy infrastructures, institutional constraints, and cross-unit coordination, rather than simply a question of adopting individual technologies [1–3].

This study focuses on the digitalization of local government services within municipal city planning, including spatial planning, building permit processing, and geodata management. These services represent a particularly data-intensive and legally regulated domain, making them analytically well-suited for examining the socio-technical dynamics of digitalization. Expectations for digitalization extend beyond the introduction of new technological tools; they encompass deeper changes in work practices, governance models, and organizational configurations. Research on public-sector digitalization emphasizes that such change is shaped by complex interdependencies among technology, organizational structures, professional roles, and governance relationships, not by a linear or purely technology-driven trajectory [4]. However, digitalization initiatives often fail to deliver anticipated benefits, instead encountering practical obstacles, limited adoption, and organizational disengagement, phenomena collectively referred to as the "e-government paradox" [5]. This paradox highlights the persistent gap between the transformative potential attributed to digitalization and the realities of its implementation in everyday administrative practice.

In Sweden, the national government has set a clear ambition to foster a sustainable and efficient digital society, assigning municipalities a central role in achieving this vision [6]. Within the domain of city planning, Boverket (the Swedish National Board of Housing, Building, and Planning) and other national authorities have been tasked with advancing the digitalization of planning and construction processes, including the development of national guidelines for digital detailed plan information [7]. As a result, municipal planning organizations face extensive demands to modernize their processes and technical infrastructures, while simultaneously ensuring legal certainty, transparency, and efficiency in the exercise of public authority [6,7]. Sweden provides an analytically relevant context for studying public-sector digitalization, as municipalities bear substantial responsibility for planning and building processes under a robust legal framework. At the same time, they are expected to implement evolving national digitalization initiatives related to planning information, geodata, and interoperability. The combination of high legal accountability, strong local implementation responsibility, and increasing national standardization pressures makes municipal city planning a particularly suitable setting for examining socio-technical digitalization dynamics. This context also underscores the tension between local autonomy and national coordination, a tension that influences how digitalization is interpreted, prioritized, and enacted within municipal organizations.

Additionally, research indicates that the city planning process is particularly challenging to digitalize. It is shaped by extensive legal requirements, complex geodata management, multiple parallel IT systems, and strong professional traditions. Digital building permit and planning processes are often marked by socio-technical tensions, where new digital tools fail to align with established workflows, professional roles, or organizational structures [8]. Studies of municipal building permit processes further reveal that digitalization frequently creates friction between system logic and professional practice, especially when technological solutions are poorly adapted to the actual working methods of administrators [9,10]. Similar complexities are evident in spatial planning, where digital tools, GIS platforms, data management practices, and legal obligations interact within a socio-technical ecosystem that is difficult to coordinate and govern [11].

Despite a growing research interest, empirical studies on digitalization in municipal city planning, particularly in permitting-related processes, remains limited, both internationally and in Sweden. While recent scholarships on public-sector digitalization and digital government have increasingly explored themes such as platform governance, interoperability, data-driven administration, and organizational digital transformation, much of

this literature focuses on national strategies, smart city initiatives, or technology adoption at an aggregate level. There is less attention to how digitalization is enacted and managed within the everyday practices of municipal planning organizations. Empirical research that simultaneously integrates technical, organizational, and institutional dimensions within the same local organizational context is still scarce, especially within the Nordic and broader European municipal planning domain. Consequently, there is a lack of empirically grounded explanations for why digitalization initiatives in municipal city planning often progress slowly and in a fragmented manner, despite advances in digital government research [8,12].

Existing studies tend to focus on national policy frameworks, digital strategies, technical solutions, or isolated digitalization projects, rather than on how digitalization is experienced and negotiated in the daily work of professionals involved in detailed planning, building permits administration, and geodata management [4,5]. As a result, there is limited understanding of how technical, organizational, and external institutional factors interact in practice, or why digitalization often progresses incrementally or inconsistently within municipal planning processes. This gap underscores the need for research that examines digitalization as a socio-technical phenomenon embedded in the everyday operations of municipal planning departments, where legal mandates, professional norms, and technological infrastructures intersect.

However, research on digital planning and urban development shows that municipal work is shaped by organizational constraints and complex socio-technical relationships, meaning that digital tools are not always seamlessly integrated into existing work practices [11]. In the area of building permits, studies show that digital case-processing systems frequently create friction between system logic and the professional working methods of administrators, particularly when the technological solutions are poorly aligned with the operational realities of municipalities [8–10]. Similarly, research on digital building permit processes remains fragmented and predominantly technology-oriented, offering limited empirical insights into how digitalization is experienced and managed by municipal staff.

At the same time, research on public-sector digitalization focuses on overarching system or policy level, which risks overlooking important organizational and professional dynamics embedded in daily work [13]. As argued by [4], this perspective leaves central questions insufficiently explored, specifically how digitalization is implemented, interpreted, and adapted within municipal practice.

Similar limitations are evident in research on digital detailed planning and geodata. As [11] observes, digital tools in city planning are frequently introduced without adequate consideration of the organizational and social dimensions of change, increasing the risk that implementation stalls before intended outcomes are achieved. This challenge is especially pronounced in municipal organizations where planning, building permits and geodata are often managed as separate functions with distinct work logics, while technical systems must simultaneously comply with legal requirements, political priorities, and professional norms [13].

Collectively, these findings highlight a lack of research that integrates technical, organizational, and external institutional factors in analyses of digitalization within the municipal community development process. Few studies adopt a holistic perspective on how digitalization is experienced by different professional roles within the same organization, despite the fact that successful digitalization in practice depends on the interaction between planning architects, building permit administrators, GIS specialists, managers, and digitalization units [8,12]. There is also a shortage of empirical studies examining how national digitalization requirements and collaborative initiatives are translated into local practice, as well as mechanisms that contribute to digitalization becoming "stuck" or developing in a fragmented manner within planning, building and geodata domains [13].

This research gap means that knowledge about how digitalization is implemented within municipal city planning organizations remains limited, as does the understanding of the obstacles and opportunities that emerge from the interaction between technology, organizational conditions, and external governance signals [8,12]. Against this background, the present study addresses these gaps by empirically examining digitization efforts within the City Planning Department in the studied municipality, drawing on the perspectives of multiple professional roles. The study explicitly explores how technical, organizational, and external institutional factors interact, analyzing these dimensions through a socio-technical and Technology–Organization–Environment (TOE)-inspired analytical framework [14].

In this study, these dimensions are treated as conceptually interconnected rather than independent. Technical constraints determine which workflows are feasible, organizational conditions influence the coordination and embedding of integration and standardization efforts, and external requirements shape both priorities and the stabilization of change. Integrating all three dimensions is therefore essential for explaining slow and fragmented digitization as an interaction effect rather than as the result of isolated barriers.

Furthermore, by combining multi-actor interviews with document analysis, this study captures digitalization processes at strategic, organizational, and operational levels. Theoretically, the study contributes by integrating a socio-technical perspective with the TOE framework, enabling a more comprehensive understanding of how digitalization unfolds within municipal urban planning activities. In doing so, the study not only demonstrates that digitalization initiatives often "get stuck" in practice, but also identifies the underlying mechanisms that produce such obstacles. Building on the identified research gap, the study aims not only to pinpoint technical, organizational, and external challenges, but also to develop a conceptual framework that municipalities can use as an analytical tool to map and interpret their own digitalization conditions. By relating local technical, organizational, and institutional challenges to the structural mechanisms and reinforcing relationships identified in this study, municipalities can gain a deeper understanding of why digitalization initiatives stall and where coordinated interventions may have the greatest systemic impact.

Furthermore, the city planning activities in the studied municipality represent an analytically relevant case, as they integrate detailed planning, building permits, geodata provision, and digital development in a large Swedish municipality. This context provides a unique opportunity to examine the complexity of digitalization in an environment where technical systems, legal frameworks, organizational structures, and external requirements intersect. It also offers a rich empirical setting for analyzing how digitalization is interpreted, negotiated, and enacted across professional roles and administrative domains.

To analytically capture the interaction between technical systems, organizational conditions, and external institutional requirements, this study, building on earlier discussion, adopts the TOE framework as a structuring analytical lens. The TOE framework is particularly well-suited for examining digitalization in municipal organizations, as it explicitly accounts for how technological conditions, organizational arrangements, and external regulatory and institutional factors collectively shape digitalization processes. However, since the TOE framework does not inherently explain how these conditions interact over time in complex socio-technical settings, it is complemented by a socio-technical perspective that emphasizes the co-evolution of technology, work practices, and organizational structures.

Against this background, the aim of this study is to explain how digitalization in municipal city planning is shaped by the interaction between technical, organizational, and institutional conditions. By empirically examining digitalization efforts from the perspectives of multiple professional roles within the same municipal organization, the study seeks to identify and theorize the underlying structural mechanisms that help ex-

plain why digitalization initiatives often progress slowly and in a fragmented manner in practice. Through this approach, the study contributes to digital government and public-sector digitalization research by moving beyond descriptive accounts of barriers and offering a theoretically grounded explanation of socio-technical digitalization dynamics in local government.

To enhance readability, the manuscript is structured as a cumulative argument: it first establishes definitions and scope, then specifies the research gap, and subsequently presents the theoretical lens and research design. The Section 4 culminates in the conceptual framework (Table 2), while the Discussion interprets the framework's implications rather than reiterating descriptive findings.

The following research questions guide this study:

1. How do different professional roles at the City Planning department perceive the technical challenges in the digitalization work?
2. How do organizational structures, processes and competencies affect the department's ability to digitalize?
3. How do external requirements, such as legislation, national guidelines, and political signals, shape the digitalization work at the City Planning department?
4. How do socio-technical tensions arise in the intersection of digital systems, work processes and professional roles within the department?

The research questions are organized through the TOE lens. RQ1 addresses the Technology dimension, RQ2 the Organization dimension, and RQ3 the Environment dimension. RQ4 examines cross-dimensional socio-technical tensions that arise at the interfaces between systems, work practices, and professional roles. Together, these questions provide the empirical foundation for the conceptual framework and the three structural mechanisms synthesized later in the paper.

This study employs a qualitative case study based on semi-structured interviews and a document analysis of internal and national policy documents. The qualitative approach enables an in-depth exploration of how digitalization is interpreted, negotiated, and enacted across professional roles, and how technical, organizational, and institutional conditions collectively shape the digitalization trajectory within the municipal planning context.

2. Background

This section begins by positioning municipal city planning as a domain of digitalization, then outlines key Swedish national initiatives influencing this work, and finally introduces the socio-technical and organizational conditions that underpin the TOE-structured results and the conceptual framework synthesized later in Table 2. Recent national assessments of digital government in Sweden have underscored persistent coordination challenges and uneven implementation capacity across municipalities [13].

2.1. Digitalization in Municipalities and the City Planning Domain

This study focuses on municipal city planning as a distinct digitalization domain comprising spatial planning, building permit processing, and geodata management. Unlike many other municipal services, these activities are both legally regulated and highly data-intensive, relying on seamless end-to-end information flows across multiple professional units. Consequently, digitalization in city planning depends not only on the introduction of new systems, but on how data, responsibilities, and work practices are coordinated across planning, permit, and geodata functions, a challenge that aligns with the coordination issues highlighted in national assessments [13].

International research demonstrates that municipal digitalization often unfolds in a fragmented manner, with different departments developing digital solutions in parallel

rather than through coordinated efforts. This creates what [4] describe as "islands of innovation", where local initiatives remain disconnected from broader strategies or system landscapes. As a result, municipalities frequently struggle to realize the expected benefits of digitalization, such as increased efficiency, improved service quality, or enhanced accessibility. In the city planning domain, such fragmentation is evident in parallel system landscapes for permits, planning, and geodata, which complicates end-to-end case handling and standardized information exchange [8,13].

A central challenge is the so-called e-government paradox, where substantial investments in digital solutions do not necessarily translate into high usage or improved processes. As [5] argue, organizational structures, insufficient change management, professional resistance, and inadequate adaptation to local conditions often explain why the anticipated benefits of digitalization fail to materialize.

While research consistently frames public-sector digitalization as an organizational transformation rather than a purely technical implementation [4], several studies indicate that municipal digitalization remains fragmented and difficult to embed in everyday practice. This underscores the need to examine the specific conditions shaping digitalization within municipal city planning operations.

City planning and building permit management are core components of the municipal community development process, where planning information and permit case handling represent key municipal responsibilities [7,12]. These activities are characterized by complexity, as they combine the legally regulated exercise of authority with extensive technical information management, professional assessments, and collaboration with external actors. Unlike many other municipal service areas, the planning and building process is governed by detailed legislation, with municipalities holding both a far-reaching planning monopoly and responsibility for the legally secure application of the Planning and Building Act (PBL). This means that digitalization must be integrated into a context where decisions must be traceable, transparent, and legally sustainable.

Digital tools and geographic information systems (GISs) have been recognized in research as central components of contemporary planning practice [8,15]. However, their adoption often occurs gradually and at uneven rates across municipal administrations. For example, studies show that digital building permit processes continue to exhibit varying levels of digital maturity, limited standardization, and persistent manual management of many process elements [8]. Even when technical solutions are available, their integration with municipalities' actual workflows is frequently limited, thereby constraining potential efficiency gains.

Similar findings emerge from European studies of municipal building permit processes, where digital case-management systems often generate organizational tensions rather than straightforward efficiency improvements. As demonstrated by [9,10], digital building permit systems can conflict with established working methods and professional judgement, leading to duplicated work and uncertainty among administrators.

City planning in a municipal context is also characterized by extensive information flows among internal and external actors. Planning architects, GIS specialists, building permit administrators, legal experts, developers, and citizens all participate in different stages of the process. This necessitates interoperable systems and standardized data flows that support collaboration across organizational boundaries. Studies in urban technology highlight that the lack of such interoperability poses a central challenge for digital planning and digital consultations, as systems are often developed in isolation without consideration for the entire end-to-end process [8].

In the Swedish context, the state has clearly identified digitized detailed plans, digitally accessible planning information, and standardized geodata as key development areas.

The Swedish National Board of Housing [7] observes that many municipalities are still in the early stages of transitioning to digital and machine-readable planning information, resulting in substantial variation in how digitalization is implemented across municipalities and administrative units [7]. Recent research on digital building permits further indicates uneven maturity and continued fragmentation in digital permit processes across European contexts [12].

Finally, research demonstrates that city planning and building permit management are domains where digitalization extends far beyond the mere implementation of technical systems. Instead, it involves transforming complex socio-technical processes, coordinating diverse professional logics, and managing large volumes of geodata within a legally regulated environment. These factors make the city planning process one of the most challenging municipal operations to digitize, while also being central to sustainable societal development [12].

In Sweden, the digitalization of municipal city planning is further influenced by national strategies and sector-specific initiatives aimed at standardizing planning information, strengthening interoperability, and increasing digital capacity across municipalities. These initiatives provide an important institutional context for understanding how local digitalization efforts unfold, and how municipal organizations navigate the interplay between national expectations, local conditions, and existing socio-technical structures.

Over the past decade, the Swedish public sector has intensified its digitalization efforts, with municipalities playing a pivotal role in translating national goals into practical operational development. The national digitalization strategy [6] articulates a vision of "a sustainably digitalized Sweden" emphasizing data-driven administration, interoperability, standardization, and efficient digital services as foundational components of a modern public system. The strategy places particular emphasis on strengthening the digital capabilities of municipalities in complex domains such as community development, where digitalization is expected to enhance quality, accessibility, and efficiency.

In the planning and construction sector, modernization has been advanced through national mandates assigned to the National Board of Housing, Building and Planning, the National Land Survey of Sweden and DIGG. One of the most central initiatives is the development of digital and uniform planning information. According to Boverket [7], standardized and machine-readable planning information is crucial for enabling automated processes, improving geodata provision, and increasing efficiency in both detailed planning and building permits administration. However, the authority also notes that many municipalities remain in the early stages of implementation, resulting in significant variations in both the scope and quality of digital planning information.

The Swedish government's investment in the Smart Built Environment program, one of Formas' strategic innovation initiatives, aims to promote a more digitalized and industrialized construction sector. This is achieved through the standardization of data flows, the development of digital working methods, and increased interoperability among stakeholders. While the program has produced technical specifications and national guidelines, several evaluations indicate that municipalities' ability to absorb and implement these results varies significantly, often due to differences in local organizational structures, levels of digital maturity, and resource constraints [16]. Program reports highlight extensive progress in digitalization, standardization, and collaboration within the built-environment sector but also stress the need for continued dissemination and practical implementation support.

Digital building permit applications, case management systems and e-services have also been developed through both state and municipal initiatives. However, research clearly demonstrates that digitalization in these areas is strongly influenced by organiza-

tional and professional factors. As [8] notes, digital building permit processes continue to exhibit uneven digital maturity and weak alignment between new systems and existing workflows. Similarly, Refs. [9,10] show that digital building permit systems often generate socio-technical tensions when the technology is not adapted to administrators' practical working methods or established professional logics. These tensions can result in duplicated work, reduced efficiency, and uncertainty among staff, underscoring the importance of understanding digitalization not merely as a technical upgrade but as a transformation deeply embedded in professional practice.

Sweden has established robust national frameworks for digitalization in public construction and planning sector. However, the practical realization of these ambitions varies significantly among municipalities. Although national strategies and policy directives provide clear overarching guidance, research indicates that implementation is shaped by internal organizational structures, access to expertise, and local priorities and conditions [13,17]. This highlights the need for studies that examine how national digitalization requirements are managed within municipal context and how they are translated into everyday work processes.

Recent research on public-sector digital transformation further emphasizes that municipal digitalization outcomes are shaped by socio-technical dynamics rather than technology adoption alone. In particular, legacy systems and inherited information infrastructures create long-standing dependencies and integration constraints, making interoperability costly and risky. Meanwhile, organizational arrangements and routines tend to reinforce incremental rather than transformative change in service delivery and administrative processes [1,3,18].

A second line of research identifies interoperability governance as a central bottleneck for end-to-end digital public services. For standardized data exchange to occur across units and partner organizations, legal, organizational, semantic, and technical layers must align effectively [19–22]. Evidence from Swedish municipalities further suggests that digital transformation strategies often prioritize internal efficiency and incremental improvement, which can inadvertently perpetuate fragmentation and create "islands of innovation" rather than fostering coordinated cross-unit transformation [2,23].

2.2. Socio-Technical Conditions in Municipal City Planning

Planning, building permits and geodata represent particularly challenging domains to digitize because they function as socio-technical systems, where technology, people, processes, and legal requirements are tightly interwoven [15]. In these fields, digitalization is not merely a technical transformation; it also demands substantial adjustment to work practices, professional judgement, data structures, and forms of collaboration. Consequently, digitalization within urban development must be understood as an ongoing interaction between technical components and social, organizational, and institutional factors.

Digital tools and GIS play central roles in planning and building permits. However, research shows that the adoption of new digital solutions is strongly influenced by their integration with existing workflows and professional cultures [8]. According to [8], digital building permit processes in many municipalities remain characterized by fragmented systems, limited interoperability and uneven levels of digital maturity. As a result, digital tools often function as isolated "technical islands" that are insufficiently connected to other parts of the process.

Similar findings are presented by [9,10], who demonstrate that digital case management systems frequently conflict with established professional logics in building permit processing. The work of the permit officers relies heavily on legal assessments, documentation and context-specific analyses. When digital systems fail to support these needs, they

risk generating duplicated work or creating new bottlenecks. Such socio-technical tensions arise when system functionalities do not align to the actual operational requirements.

In the Swedish context, Ref. [7] emphasize that digitalization demands standardized data flows, shared data models, and collaboration both within municipal organizations and among municipalities, consultants, and other external actors. When such structures are absent, digital tools often become ineffective or remain underutilized [8]. This underscores the socio-technical nature of digital planning: data standards, work processes and organizational interfaces are just as critical as the technology solutions themselves [8].

Geodata management constitutes a particularly critical component of this socio-technical ecosystem [7]. Municipalities manage extensive volumes of geographic information, which must be accurate, up-to-date, interoperable, and accessible for both internal and external digital processes. Research in geomatics and planning has repeatedly shown that insufficient system integration and reliance on manual routines for geodata create substantial barriers to automation, digital detailed planning and coordinated planning processes [7]. These findings underscore the need for a holistic approach, where technical and organizational components are analyzed together.

Overall, research demonstrates that digitalization in planning, building permits and geodata is fundamentally socio-technical in nature. Technology, data structures, legal frameworks, professional roles, and organizational arrangements are mutually interdependent. Therefore, digitalization cannot be reduced to the implementation of new systems; rather, it must be understood as a transformation within a complex context where technical solutions must be aligned with professional practices and organizational conditions [14].

2.3. Organizational Challenges in Municipal Digitalization

In this study, organizational challenges refer to internal conditions that shape how digitalization is governed, coordinated, and embedded in everyday work practices. These challenges are analytically distinguished from (i) purely technical limitations, such as system functionality or narrow interoperability issues, and (ii) external institutional requirements, including national regulations and guidelines. However, these dimensions often interact in practice. This section therefore focuses on coordination structures, resource allocation, competencies, legacy arrangements, and political steering as organizational conditions that influence digitalization outcomes in municipal urban planning.

Analytically, these organizational challenges stem from coordination and governance issues within the municipal organization. They concern how responsibilities are distributed across units, how cross-unit processes are owned and maintained, and how competence and resources are allocated over time. Their relationship to digitalization is direct: when responsibilities and processes are fragmented across organizational boundaries, data and case information cannot flow seamlessly between systems and professional groups. This fragmentation reinforces duplicated work, local workarounds, and partial system adoption rather than integrated digital workflows [13].

A recurring organizational issue is the persistence of silos, where departments or professions groups operate in parallel with limited coordination. This is particularly evident in municipal public construction activities, where planning, building permits, geodata, digitalization and IT support are often housed in separate organizational units. As [13] describe, insufficient integration between these units leads to fragmented processes and difficulties in implementing digital working methods that require continuous data exchange and shared routines. In practice, this results in discontinuous data flows between planning, building permits, and geodata functions, duplicated registrations across systems, and unclear responsibility for end-to-end process integration. Within municipal urban planning, these challenges are especially pronounced at the interfaces between plan-

ning, permitting, and geodata, where common data definitions and process ownership are critical.

Resource constraints represent another central organizational challenge. Municipalities often face limitations in both financial and human resources when implementing large-scale digitalization initiatives, particularly those involving complex technical systems such as GIS platforms or digital building permit solutions. As demonstrated by [9], even when digital tools are formally available, limited project-management capacity, insufficient technical expertise, and time constrains among administrators can significantly hinder their full and effective use. This creates a gap between formal implementation and actual practice, often referred to as the "digital translation gap." In practical terms, this gap is evident in delayed integration efforts, limited capacity for testing and training, and incremental rather than coordinated process redesign, factors that reinforce fragmented digitalization. These factors reinforce fragmented digitalization, frequently leading to the postponement of integration tasks between planning, permit, and geodata systems, thereby preventing the stabilization of end-to-end digital processes [9,10].

Competence and change management also play a decisive role. Planning architects, building permit administrators, and GIS specialists often operate with distinct professional logics, experiences, and educational backgrounds, which influence how digital solutions are interpreted and integrated into daily work [15]. According to [8], digitalization in the building permit process often stalls when the system functionality fail to align with professional needs or when staff lacks adequate training to use advanced digital tools. These challenges are particularly pronounced in domains where legal and technical assessments are central, as digital solutions must support both standardized procedures and complex case-specific judgements [8,9]. In practice, this results in uneven adoption of digital workflows across professional groups, reliance on informal workarounds, and a persistent gap between system capabilities and everyday use. These issues become especially apparent when digital workflows require shared routines across planning, permits, and geodata, but competence and training remain unevenly distributed [8,13].

Furthermore, municipal digitalization is shaped by organizational history and existing IT landscapes [4]. Many municipalities rely on older case-management systems, non-standardized data structures, or technical solutions that have evolved locally over a long period of time [13]. These legacy systems create lock-in effects that hinder the introduction of more modern and interoperable solutions [4,13]. Similarly, Ref. [4] describe how municipalities often develop "islands of innovation", locally tailored solutions that are not scaled up or integrated organization-wide, ultimately impeding long-term digitalization. In practice, this results in dependence on vendor-specific platforms, limited interoperability with newer standards, and path-dependent configurations that restrict workflow and data standardization. Such constrains limit the municipality's ability to harmonize data and coordinate workflows across the full planning–permit–geodata chain [4,13].

Political governance also significantly influences organizational conditions for digitalization in municipal contexts. Digitalization efforts depend heavily on political priorities, investment decisions, and overarching strategic direction. A lack of long-term commitment or frequent shifts in priorities can disrupt digitalization initiatives, making it difficult to establish stability and structure in implementation. In practice, this is evident in shifting priorities across budget cycles, interruptions in long-term digitalization programs, and uncertainty regarding investments needed to standardize data and processes. These dynamics complicate the maintenance of cross-unit digitalization programs, which require multi-year coordination and sustained investment in data and process standardization [13].

Existing research demonstrates that digitalization in municipal urban development is shaped by organizational conditions such as siloed structures, limited resources, uneven

competencies, historically evolved IT environments, and political steering. This underscores that digitalization cannot be understood as a purely technical endeavor; rather, it constitutes an organizational change process that demand coordination, governance, and adaptation to local conditions. In practice, these organizational conditions influence how technologies are selected, configured, and integrated into everyday municipal work, thereby directly affect digitalization outcomes. This aligns with the "Organization" dimension in the TOE framework applied in this study.

However, while prior studies identify recurring organizational challenges, fewer contributions explain why such barriers persist over time despite repeated investments and local initiatives. For this reason, mechanism-oriented explanations are increasingly called for, particularly those that demonstrate how legacy infrastructures and platform fragmentation generate lock-in, how organizational routines and distributed responsibilities reproduce inertia, and how governance dynamics and shifting political priorities create discontinuity in long-term programs [1,3,23].

In the city planning and permitting domain, these persistence dynamics are further amplified by high documentation demands, legal constraints, and multi-actor dependencies, which make process standardization and data harmonization particularly challenging. Recent research on digital building permits and permitting digitalization similarly reports uneven progress, constrained by process complexity, standardization challenges, and interoperability requirements across systems and stakeholders [24,25]. Against this backdrop, our mechanism-based framework explains persistent slow change through the reinforcing interaction between technological lock-in, organizational inertia, and governance-induced discontinuity.

2.4. Theoretical Lens: Technology–Organization–Environment (TOE)

The TOE framework, developed by [14], serves as a theoretical lens for understanding how organizations adopt and implement new technologies. It posits that digitalization is shaped by three central dimensions: the technical context, the organizational context, and the external environment. Together, these dimensions form the conditions that either enable or constrain technological development within an organization.

The technical dimension encompasses the organization's existing IT infrastructure, digital tools, data structures, and the degree of technical compatibility between systems. In municipal urban planning activities, this includes GIS platforms, case management systems, digital planning information, and geodatabases. Research indicates that many municipalities continue to face challenges such as fragmented systems, limited interoperability, and uneven digital maturity, all of which pose significant barriers to integrated digitalization [8]. According to [8], technical limitations in digital building permit processes often prevent digital solutions from being fully utilized, causing them to function as isolated components rather than as parts of a coherent workflow.

The organizational dimension includes structures, competencies, leadership, culture, and internal work processes. Municipal planning, building-permit administration, and geodata management involve multiple professional groups, each with distinct logics and responsibilities. This often results in siloed structures and insufficient coordination complicating the introduction of digital working methods that require shared routines and continuous information exchange. Ref. [13] identify organizational boundaries and variations in competence as central obstacles to digital planning, while [9,10] demonstrate that building-permit administrators frequently perceive digital systems as poorly aligned with their professional practices, creating tensions and reducing the benefits of digitalization.

The external dimension in the TOE includes legislation, political decisions, national strategies, and sector-specific standardization requirements that shape the organization's

room for maneuver. In Sweden, municipalities are influenced by several national initiatives, such as the national digitalization strategy [6]. These initiatives create strong incentives for digital transformation but also require municipalities to adapt internal processes, data structures and systems to national standards and guidelines. Depending on the municipality's organizational conditions, this can generate both opportunities and constraints [6,7].

The TOE framework is particularly relevant for studies of municipal digitalization because it provides a structured model for analyzing how technological, organizational, and external factors interact in complex processes such as planning, building permits and geodata management [14]. The framework complements socio-technical perspectives by examining not only the interplay between technology and human practice but also the broader institutional and political context in which municipalities operate. This makes the TOE especially well-suited for analyzing the conditions that shape digitalization in municipal urban planning organizations, where technical systems, professional workflows and national requirements intersect in a dynamic, and often tense-filled, environment.

3. Method

3.1. Data Collection and Empirical Material

The data collection in this study is based on two complementary data sources: semi-structured interviews and document analysis. By combining these methods, i.e., method triangulation, the study achieves a deeper and more contextualized understanding of digitalization processes within the City Planning Department of the studied municipality in Sweden. Triangulation is particularly valuable for examining complex organizational phenomena, as it enhances the credibility of the findings by illuminating the same processes from multiple perspectives [26].

The primary empirical material consists of semi-structured interviews (see Supplementary Material File S1) with employees representing diverse roles and organizational units. The interview guide outlined key themes and example questions while allowing for follow-up probes and adjustments in sequencing based on the respondent's role and responses. Interviews were chosen because they enable an in-depth exploration of individuals' experiences, interpretations, and perceptions of digitalization in everyday municipal work. Semi-structured interviews are especially well-suited for research aiming to understand how actors interpret organizational change, system use, and professional practices [27]. The interview guide was designed to capture technological, organizational, and external aspects of digitalization, directly aligning with the TOE framework guiding this study.

Although the same semi-structured interview guide was used across all interviews to ensure comparability, it was applied flexibly in accordance with established qualitative interviewing practice. Questions were adapted in wording and depth to suit each respondent's role, and non-applicable items were shortened or omitted to avoid prompting speculation outside their area of responsibilities. For respondents without technical expertise, technically oriented questions were reframed to elicit experiential accounts, such as how systems, data, or integrations influenced workflows, coordination, and service delivery, rather than detailed descriptions of system architecture. Conversely, respondents with technical roles were encouraged to elaborate on these topics at a more technical level, with follow-up probes used to clarify system- and data-related conditions. This flexible application of the guide was documented in interview notes and reflected in the coding log during analysis.

The selection of interviewees was based on strategic sampling, aiming to include roles that represent different aspects for the socio-technical environment within municipal city development activities. Following Patton's principle of selecting information-rich cases, interviews were conducted with planning architects, building permit officers, GIS

specialists, digitalization coordinators and managers. The five interviews covered three role categories: technical (n = 1; GIS specialist), administrative/operational casework (n = 2; planning architect and building permit officer), and managerial/coordination (n = 2; digitalization coordinator and manager).

To ensure transparency while preserving anonymity, respondents are described at the role level rather than through personal demographic details. The sample thus encompasses operational casework, technical geodata work, coordination functions, and managerial governance responsibilities across the planning–permit–geodata chain. In the Section 4, quotations are attributed using anonymized role-based identifiers (R1–R5). Respondents' professional experience in the municipal domain ranged from several years to over a decade. This sample size was deemed sufficient to achieve thematic saturation while still capturing variation in experiences across role categories. The interviews were conducted in December 2025, lasted between 45 and 75 min and took place either on-site or via digital meetings. All interviews were recorded with informed consent and transcribed verbatim. In the Section 4, verbatim quotes are presented with anonymized role-based identifiers (R1–R5) to enhance transparency while maintaining confidentiality.

As a complement to the interviews, a qualitative document analysis of both internal and external steering and support material was conducted. This analysis served to contextualize the interview material and enhance the credibility of the findings by comparing formal governance signals with practical experiences, in line with established principles for qualitative document analysis [28].

The analyzed material included internal documents such as digitalization strategies, business plans, process maps, system overviews for GIS and case management systems, IT architecture documents, and policy documents related to planning and construction activities. Additionally, external steering and guidance documents were examined, including the national digitalization strategy for the public sector, the Swedish National Board of Housing, Building and Planning's guidelines for digital planning information, and national geodata standards. The selection of documents was guided strategically by their direct relevance to ongoing digitalization efforts.

The document analysis was conducted iteratively and in parallel with the interview analysis. Rather than generating independent empirical themes, the documents served to contextualize and validate themes emerging from the interview material. This approach made it possible to identify both alignments and discrepancies between formal digitalization ambitions and the practical realities of municipal operations.

Triangulation was implemented through a structured comparison between interview-derived themes and the document material. After preliminary themes were developed from the interviews, a document review matrix was created, linking each theme to relevant internal and external documents (e.g., digitalization strategies, business plans, process maps, system overviews, and national guidance/standards). For each theme, documents were examined to identify (i) stated objectives and priorities, (ii) described procedures, roles and responsibilities, and (iii) technical requirements or standards. Convergences and divergences between formal intentions and reported practices were documented and used to refine theme definitions, thereby strengthening the credibility of interpretations. Divergent accounts were treated as analytically valuable, highlighting gaps between policy-level ambitions and operational conditions rather than being dismissed as inconsistencies.

3.2. Analytical Approach

The empirical material was analyzed using a thematic approach inspired by [29]. Thematic analysis was selected for its systematic method of identifying and interpret-

ing patterns in qualitative data and is particularly well-suited for examining complex organizational phenomena.

The analysis began with inductive, open coding of the interview transcripts. The material was reviewed repeatedly to identify recurring statements related to the implementation of digitization. In the subsequent step, the initial codes were organized into broader themes through an iterative thematization process. These themes were refined through repeated comparisons between codes, transcripts, and emerging interpretations to ensure strong empirical grounding. Throughout the process, a coding log was maintained to document code definitions and theme revisions, and analytic memos were used to support key interpretative decisions.

To strengthen rigor and traceability, interpretations were continuously tested against the material in three ways. First, we compared how themes manifested across respondent roles (technical, administrative/operational, managerial/coordination) to avoid overgeneralizing single-perspective accounts. Second, we actively sought disconfirming segments and revised theme boundaries when statements did not align with early interpretations. Third, the developing themes were systematically compared with the document material, including process maps, system overviews, architecture documents, strategies, and national guidance), using the theme–document matrix. Both convergences and divergences were documented and used to refine the analysis.

To maintain alignment between interpretations and respondent expertise, coded segments were tagged by respondent role category (technical, administrative/operational, managerial/coordination). This enabled a cautious interpretation strategy: technical mechanisms were considered credible primarily when grounded in accounts from respondents with technical responsibilities and corroborated by the document material, while non-technical accounts were used to capture experienced effects, workarounds, coordination challenges, and operational consequences. Role tagging was applied solely at an analytical level and did not involve any personal identifiers, in accordance with data minimization principles.

In the later stages of the analysis, the TOE framework [14] was integrated as an analytical grid to structure and interpret the emerging themes. The framework did not guide the initial coding; instead, inductively generated themes were subsequently mapped onto the technological, organizational, and environmental dimensions. When a theme did not clearly align with the framework, the transcripts were revisited to verify its empirical basis and determine whether the theme required refinement, subdivision, relabeling, or reassignment. This iterative process of moving between empirical material and theoretical interpretation reflects the abductive logic of this study [30].

In the final stage, interview-based themes and document-derived insights were synthesized into a coherent analytical structure that underpins the results chapter. During this stage, more general mechanisms were identified: technological lock-in, organizational inertia (i.e., resistance to change rooted in established routines, structures, and resource allocations), and institutional uncertainty. These mechanisms emerged inductively from the empirical material and cross-theme patterns. The overall process is summarized in Figure 1, which provides a simplified overview of the main analytical stages. Although the figure is presented as a linear sequence for clarity, the practical work involved repeated returns to earlier stages, such as revisiting transcripts and refining codes or themes. Figure 1 also illustrates the triangulation step, in which interview-derived themes were systematically compared with the document material using the theme–document matrix.

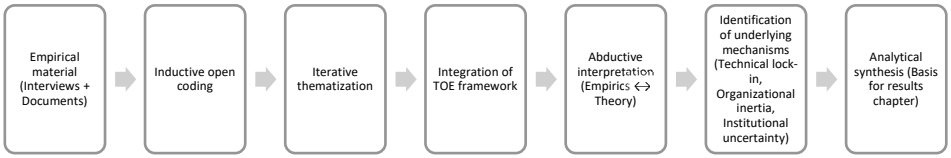

Figure 1. Analytical approach and thematic analysis process (simplified overview).

3.3. Ethical Considerations

This study was conducted in accordance with the Swedish Research Council's guidelines for good research practice [31] and the relevant provisions of the GDPR. All participants were provided with detailed information about the purpose, research procedures, and data processing methods. Participation was entirely voluntary and commenced only after obtaining informed consent.

To ensure confidentiality, all empirical material was anonymized during transcription, and any identifiable information was redacted. Data were stored in secure, access-restricted environments and managed in strict accordance with the principles of data minimization and purpose limitation. Additionally, the municipality where the study was conducted was anonymized to further reduce the risk of identifying individual participants or organizational structures.

3.4. Research Quality and Methodological Limitations

The quality of this study was ensured using the criteria for qualitative research proposed by [32]: credibility, transferability, reliability, and confirmability. Credibility was strengthened through method triangulation and iterative analytical process. Transferability was supported by providing a detailed description of the empirical context, enabling readers to assess the applicability of the findings to other settings. Reliability was enhanced through transparent reporting of the research design, data collection, and analytical procedures [33]. Confirmability was promoted through continuous reflexivity and explicit documentation of connections between data, codes, and themes. In the Section 4, we further enhance credibility and confirmability by making micro-level operational manifestations explicit under the Technology, Organization, and Environment themes.

As with all qualitative case studies, this research has limitations related to generalizability. The findings are analytically rather than statistically generalizable [33]. While the interview sample is limited (n = 5), strategic sampling across distinct role categories, combined with document triangulation, was used to strengthen credibility and ensure sufficient variation for the study's within-case analytical aims. Interview-based data are interpretive and reflect the subjective experiences of respondents, meaning that the researcher's interpretations form an integral part of the knowledge production process. Additionally, the study is based on a single case, which limits variation in organizational contexts. These limitations were addressed through triangulation, reflexive engagement with the material, and transparent reporting of the research process.

4. Results

4.1. Overview of the Analytical Themes and TOE Framework

The analysis of the interview material, triangulated with complementary document analysis, revealed several recurring patterns that together highlight the key conditions, obstacles, and development needs in the City Planning Department's digitalization efforts. To structure these patterns, the results are organized according to the TOE framework [14]. The TOE model provides a systematic structure for understanding how technical, organizational, and external factors interact in digitalization processes, an interplay that was evident across both the interviews and the analyzed documents. Several contemporary

studies in the public sector have likewise emphasized the TOE framework as a central analytical tool for examining the conditions shaping digital transformation in government agencies and municipal operations [34].

Within the Technology dimension, three themes emerged that illustrate the technical conditions influencing the digitalization process:

1. Fragmented systems and lack of integration describe how parallel and partially incompatible systems create bottlenecks and generate extensive manual work for transferring information;
2. Challenges in data standardization and data quality reflect issues related to divergent data models, inconsistent working methods, and varying adherence to national standards;
3. System support misaligned with work processes highlights how existing IT systems are often perceived as poorly adapted to the organization's actual needs, resulting in digital solutions being experienced as constraining rather than enabling.

The organizational dimension encompasses four themes related to internal structures, resources and working methods:

1. Unclear governance, division of responsibilities, and prioritization describe insufficient coordination of digitalization issues, unclear mandates, and a lack of shared strategic direction;
2. Skills shortage and uneven digital maturity highlight how differences in knowledge and experience across units affect the organization's capacity to implement development initiatives;
3. Time and resource constraints in core operations reflect how digitalization projects are frequently deprioritized in favor of legally mandated and time-critical casework;
4. Fragmented working methods and lack of uniform processes illustrate how variations in routines and practices hinder the implementation of common digital solutions.

Within the Environment dimension, three themes were identified that reflect the external requirements and contextual factors influencing the municipality's digitalization work:

1. National requirements and regulatory changes capture how new standards, guidelines, and legal obligations, particularly those issued by the Swedish National Board of Housing, Building and Planning, shape both the pace and direction of digital development;
2. Technical and legal dependencies on external actors highlight how the municipality's development capacity is constrained by suppliers' system architectures, national specifications, and legal frameworks governing data sharing;
3. Political expectations and external pressure show how political ambitions and increasing demands from external stakeholders for digital services create pressure for change that is not always aligned with internal organizational conditions.

To enhance the empirical transparency of the findings at the micro level, the results below specify how each theme materializes in day-to-day case handling. Across interviews, the reported challenges consistently recur as observable operational symptoms: duplicate registrations across systems; repeated document uploads and version checks; manual GIS lookups to verify plan status and spatial conditions; re-entry of the same metadata in parallel tools; ad hoc bridging via email or spreadsheets; and rework loops when requirements, templates, or responsibilities change during an ongoing case. These micro-level manifestations are used below to illustrate concrete bottlenecks and coordination breakdowns in planning, permitting, and geodata work.

Document analysis played a central role in triangulating the results, in line with the methodological guidance described by [28], which emphasizes the complementary, and at times corrective, function of documents in qualitative research.

Together, these themes provide a coherent picture of the complexity of digitalization in city planning activities, where technical limitations, organizational conditions and external requirements interact in ways that make progress dependent on both coordinated governance and long-term capacity development.

In the following Section 4, each dimension and its associated themes are presented in detail, illustrated with empirical quotations and supplemented by insights from the document analysis. The Section 4 is structured to make the derivation of the conceptual framework explicit. Sections 4.3–4.5 present the empirically grounded TOE themes, supported by evidential quotes and document triangulation. Section 4.6 then consolidates cross-dimensional patterns that cut across the TOE categories. Finally, Section 4.7 synthesizes the TOE-structured themes and the cross-dimensional patterns into the conceptual framework (Table 2) and its three interacting mechanisms. These mechanisms serve as the study's overall explanatory constructs and are presented together in Table 2 to increase clarity and readability.

4.2. Deriving the Three Mechanisms: Analytical Pathway from Interview Data to Conceptual Synthesis

This section illustrates the analytical process through which this study progresses from raw interview material to the three structural mechanisms presented in Table 2. First, interview transcripts were subjected to inductive coding (open coding), generating role-tagged codes that captured constraints, workarounds, dependencies, and governance conditions. Second, these codes were iteratively clustered into empirically grounded themes through constant comparison across transcripts and against the document material. Third, the final themes were mapped onto the Technology–Organization–Environment (TOE) dimensions (Sections 4.3–4.5). Fourth, cross-dimensional patterns were identified (Section 4.6) by examining how themes co-occurred and reinforced one another across the TOE categories. Finally, these patterns were abstracted into three higher-order structural mechanisms (Section 4.7).

To ensure transparency in the analytical pathway, three illustrative examples show how interview statements were translated into mechanisms:

1. The statement "We work in five systems that do not talk to each other" (R2) was coded as interoperability fragmentation and clustered under the Technology theme "fragmented systems and lack of integration" (Section 4.3.1). Together with recurring evidence of accumulated dependencies, this theme was abstracted into the mechanism technological lock-in in Table 2.
2. The statement "Nobody knows who owns the digitalization issues" (R4) was coded as unclear mandate/ownership and clustered under the Organization theme "Unclear governance and division of responsibilities" (Section 4.4.1). When combined with persistent routines and a lack of protected capacity, this theme contributed to the mechanism organizational inertia.
3. The statement "New requirements from the Swedish National Board of Housing, Building and Planning are constantly coming" (R5) was coded as shifting external requirements and clustered under the Environment theme "National requirements and regulatory changes" (Section 4.5.1). Together with supplier and legal dependencies, this theme formed the basis for the mechanism institutional uncertainty.

These examples are illustrative; the same coding–theme–cross-pattern–mechanism logic was applied across the full interview dataset and systematically checked against the

document corpus through the theme–document matrix to derive the complete framework presented in Table 2.

4.3. Technology Dimension: Technical Preconditions and System Landscape

The technology-related themes below provide the empirical foundation for the mechanism of technological lock-in introduced in Section 4.2.

4.3.1. Fragmented Systems and Lack of Integration

The analysis reveals that fragmented systems and insufficient integration represent one of the most significant technical barriers to digitalization within the City Planning department. Interview data depict a technical environment characterized by parallel systems, unclear data flows, and limited end-to-end interoperability. Fragmentation was repeatedly described as a consequence of multiple coexisting platforms and the absence of transparent information pathways. As one respondent summarized:

"We work in five systems that don't talk to each other" (R2, Building permit officer).

This statement captures how the current system landscape generates both practical and strategic challenges. In day-to-day work, administrators must navigate multiple information sources simultaneously, often repeating steps, performing manual checks, and entering identical data in more than one system in order to complete cases. These redundancies not only increase workload but also introduce risks of inconsistency and error.

At the micro level, fragmentation translates into repeated task sequences, including:

- Entering the same case information into multiple systems;
- Switching between systems to verify that the "latest" version of a document or plan;
- Performing manual checks because integrations are missing or unstable.

This results in concrete rework loops, where updates made in one system fail to propagate automatically, requiring manual copying and verification elsewhere. A recurring breakdown point is the GIS–case management interface: spatial information and plan-related metadata are retrieved separately and then manually interpreted and re-entered in the case workflow. This process reduces traceability and increases the risk of inconsistency.

A particularly pressing issue is the lack of seamless integration between the GIS and the case management system. Several respondents highlighted that GIS and case management functionalities do not interact smoothly. As a result, geodata, plan information, and case-related documents fail to transfer reliably between systems. This gap undermines the feasibility of digitally supported processes, such as automated plan reviews, digital case assessments, or validation of drawing documents. When integrations are unstable or absent, manual interventions become necessary, disrupting digital workflow and preventing organization from fully realizing the benefits of digitalization.

Document triangulation further reveals a fragmented system landscape. The GIS overviews demonstrate that data models and information structures differ across systems, complicating interoperability and making integrations technically complex. The system maps depict a patchwork of platforms developed at different times and for different purposes, lacking standardized interfaces or shared data repositories. The IT-architecture documents also show that the absence of a cohesive integration strategy leads to ad hoc system changes rather than aligned, long-term technical development. Collectively, these documents indicate that technical fragmentation is deeply embedded in the organization's digital infrastructure, not a temporary or isolated issue.

Overall, system fragmentation poses both operational and strategic challenges. Operationally, it creates manual workloads, increases error risks, fosters data inconsistencies, and limits automation. Strategically, it hinders the municipality's ability to implement advanced

digital services and data-driven processes, as stable integrations and uniform data models are essential for scaling technological innovations. The lack of integration also impedes compliance with national requirements, such as digital planning standards and geodata regulations, which rely on seamless information flows that the current system environment cannot fully support. Fragmented system architecture thus becomes a structural factor that shapes the organization's digitalization capacity at all levels and across all stages of the urban development process.

4.3.2. Challenges in Data Standardization and Data Quality

The analysis reveals that deficiencies in data standardization and quality represent one of the most pervasive technical barriers to digitalization within the City Development department. Interviews depict a daily reality where digital information is managed inconsistently across departments, projects, or individual administrators. This variability leads to inconsistencies and uncertainty in the data used throughout planning and construction processes. Respondents frequently cited challenges related to inconsistent drawing practices, with one interviewee noting, "Everyone draws in their own way" (R1, Planning Architect).

Inconsistent metadata, such as missing or non-standardized information about object types, geometries, attributes, and versioning, was another recurring issue. These inconsistencies directly compromise data quality and hinder the integration of information across systems. Similar challenges arise from the use of different map bases, where departments rely on varying geodata sources, update intervals, and coordinate systems. Consequently, the same geographic information may appear differently depending on the context, making it difficult to ensure decisions are based on consistent and up-to-date data.

The lack of standardization also creates a heavy reliance on manual checks. When data quality varies across systems and projects, automatic validation becomes impossible. Administrators must manually verify that drawings adhere the correct structure, that geometries align with map data, and that metadata fields are accurately populated. This process is time-consuming, increases the risk of errors, and undermines the potential efficiency gains that digitalization promises.

Document triangulation supports these findings. The Swedish National Board of Housing, Building and Planning's guidelines for digital planning [7] outline requirements for standardized data models, unambiguous object classes, and validation rules. While these guidelines aim to enable national interoperability, they also demand changes in municipal working methods and internal information management. Within the Swedish context, the Geoprocess framework provides national specifications and information models that define how geodata should be structured, named, and validated to facilitate efficient and interoperable data exchange between stakeholders. These specifications emphasize the need for uniform data models to ensure seamless interaction between GIS platforms, municipal case-management systems, and national digital services.

Complementing this framework, the HMK documents (Handbok i mät- och kartfrågor), published by Lantmäteriet, offer national guidelines for data quality, surveying, and geodata management. These documents highlight that municipal geodata often exhibit significant variation in positional accuracy, completeness, and attribute quality, barriers that impede automated digital workflows and cross-system data reuse.

Reviews of municipal IT architecture documentation further reveal that insufficient system integration exacerbates these challenges. When data is transferred between systems lacking shared structures or standards, the risk of inconsistency and information loss increases, reinforcing existing standardization issues.

Overall, the analysis demonstrates that challenges related to data standardization and quality are both technical and organizational, compounded by a fragmented system environment. Inconsistent metadata, varying map data, and divergent data models hinder the development of robust digital processes and prevent the implementation of automated checks and validations. As a result, the potential benefits of digitalization remain unrealized, while workloads increase. Standardization challenges thus represent not only a technical obstacle but a structural factor affecting every stage of the city development process. Addressing these issues sustainability will require technical solutions, revised work routines, and continuous skills development.

4.3.3. System Support That Does Not Match the Work Processes

The analysis reveals that a central technical obstacle to digitalization within the City Planning Department is the misalignment between the digital systems and the organization's actual work processes. A recurring theme in the interviews is the perception that the systems dictate the working methods rather than adopting to them. Respondents described how digital tools often force administrators to conform to the system's logic, creating inefficiencies and, in some cases, conflicting with the Planning and Building Act's requirements for documentation, assessment, and decision justification. As one respondent noted, the administrative system "is built for something else" (R2, Building Permit Officer), reflecting the disconnect between system design and the complexity of planning and building operations.

A persistent issue is the lack of end-to-end digital processes. Interviewees highlighted that critical elements, such as review, applicant dialogue, plan analysis, geodata coordination, and decision-making, still occur outside the systems, relying on email, manual checklists, PDFs, or physical paperwork. This fragmentation disrupts the digital workflow at multiple points, leading to information loss, poor traceability, and duplicated efforts. In practice, employees must navigate between systems, manual routines, and alternative information channels to complete their tasks, reducing efficiency and impeding the adoption of standardized working methods. Document triangulation supports these findings. Internal process maps illustrate detailed workflows with numerous decision points, information transfers, and parallel activities that are not reflected in system functionality. This indicates a lack of digital support that aligns with the entire process and mirrors how work is actually performed. System overviews reveal that several core functions, particularly those related to GIS integration, automated validation, digital review, and case management, are either limited, missing, or marked as future development areas. The roadmap documents for digital working methods further show that while there is an ambition to create more coherent digital processes, many of the required functionalities remain at the conceptual or in-project phase rather than being implemented and embedded in practice.

In conclusion, the analysis demonstrates that current system support fails to accommodate the complex, iterative, and legally governed work processes inherent in planning and construction activities. When digital systems do not align with professional needs or process structures, digitalization becomes fragmented and labor-intensive. Processes are broken into manual steps, parallel information sources, and locally developed workarounds to compensate for system deficiencies. As a result, digitalization cannot be fully realized: system support neither enables end-to-end digital workflows nor foster uniform working methods. This misalignment has broader consequences. It leads to poorer data quality, difficulties in implementing national standards, and limited opportunities to develop automated services and data-driven decision-making. System support is therefore not merely a technical issue but a structural factor that fundamentally shapes the organization's digitalization capacity.

4.4. Organizational Dimension: Structures, Competences and Processes

The organizational themes below provide the empirical foundation for the mechanism of organizational inertia introduced in Section 4.2.

4.4.1. Unclear Governance and Division of Responsibilities

The analysis reveals that one of the most significant organizational barriers to digitalization within the City Planning Department is unclear governance and a fragmented division of responsibilities for digital initiatives. Interviews describe a situation where digitization lacks a clearly defined owner, leading to uncertainty about mandates, priorities, and accountability. As one respondent noted: "Nobody knows who owns the digitalization issues" (R4, Manager), highlighting the absence of a shared direction. Additionally, different departments interpret the purpose and scope of digitalization in varying ways, resulting in inconsistent levels of ambition and divergent expectations. Across interviews, digitalization was understood differently among units, further reinforcing fragmented expectations and unclear responsibility boundaries.

At the operational level, unclear ownership and governance create everyday coordination challenges without a designated recipient. Respondents describe how issues such as integration failures, ambiguous data definitions, or process bottlenecks are "passed around" because it is unclear who has the authority to decide, prioritize, or allocate resources for resolution. This lack of clarity leads to tangible delays: problems are documented but remain unresolved, local workarounds become standard practice, and improvement efforts rely on individual initiative rather than structured organizational support. In practice, staff spend time on informal troubleshooting, repeated clarifications, and ad hoc agreements on "how we do it here", which perpetuates fragmented practices and complicates standardization across units.

Furthermore, priorities were often perceived as ambiguous. Digital initiatives tend to be deprioritized in favor of legally mandated and time-sensitive operational tasks. While digital development is recognized as important, it is frequently sidelined when core case-handling demands take precedence. Document triangulation supports these findings. Business plans identify digitization as a strategic priority but provide few concrete details regarding responsibility, follow-up, or prioritization of digital projects. The language is broad and dispersed across multiple organizational levels, reflecting interview accounts that digitalization issues "fall between the cracks". Similarly, the digitalization strategy emphasizes the need for holistic and cross-functional development but fails to specify who is responsible for driving, coordinating, or monitoring progress. This pattern is repeated in unit-level steering documents, where digitization objectives are often vaguely defined and lack clear connections to roles or processes.

Overall, the analysis demonstrates that unclear governance and division of responsibilities represent a structural limitation affecting digitalization at all levels. Strategically, ambiguity weakens prioritization and complicates the establishment of a long-term development path. Tactically, it results in departments developing their own interpretations and approaches, reinforcing organizational fragmentation. Operationally, employees lack clear guidance on how to apply digital tools, processes, and working methods in practice. Collectively, these conditions create an environment where digitization risks remaining a series of isolated efforts rather than evolving into a coherent and strategically governed process.

4.4.2. Lack of Skills and Uneven Digital Maturity

The analysis reveals that a lack of skills and uneven digital maturity across units and professional roles present a central organizational challenge for the City Planning

Department's digitalization work. Interviews depict an organization where digital competence is unevenly distributed, both in terms of technical knowledge and the ability to understand how digital working methods reshape processes and roles. A recurring issue is the absence of "bridge-building" competence that connects technology with operational practice, making it difficult to integrate development initiatives into everyday workflows.

This variation in digital maturity is also reflected in how digital systems are used. Some administrators noted, "We do the best we can with the systems we have" (R1, Planning Architect), illustrating how inconsistent competence influences daily system use. Others expressed uncertainty about using advanced functions or interpreting digital information, particularly in GISs and automated controls. At the organizational level, these disparities result in uneven digitalization processes, with development occurring at different speeds depending on local knowledge, habits, and resources. Consequently, digital tools and processes are implemented inconsistently, and the impact of digitalization varies significantly between units.

Document triangulation further clarifies this issue. The business plans emphasize enhanced competence in digital working methods but lack concrete strategies for systematically developing these skills over time. The City Planning Department's digitalization strategy similarly underscores the importance of competence development and digital maturity, yet responsibility for implementation and follow-up remains poorly defined and dispersed across multiple organizational functions. Internal steering documents acknowledge that digitalization requires changes in working methods and ongoing competence support, but no structured mechanisms exist to provide such support within or across departments. This ambiguity means that competence development tends to be sporadic, project-dependent, or reliant on individual initiative rather than part of a long-term competence strategy.

Research provides strong theoretical support for these findings. Studies consistently show that digital competence and maturity are critical for successful digitalization in the public sector. According to [4], a lack of digital competence is one of the primary reasons why digital initiatives fail to deliver meaningful change, as staff often lack both the technical understanding and the confidence to adopt new digital ways of working. Additionally, Ref. [35] argue that digitalization demands not only technical skills but also a "digital mindset", an understanding of how digital technology transforms processes, roles, and value creation. The OECD Guidelines for Digital Government [36] similarly stress that digital competence must be developed systematically and cannot rely solely on individual commitment, given the public sector's inherent in digital habits across professions.

Overall, the analysis demonstrates that skills shortages and uneven digital maturity are deeply rooted organizational challenges that hinder digitalization across the department. Insufficient and inconsistently distributed competence leads to uncertainty in using digital tools, inconsistent working methods, and varying local capacity to implement digital change. It also limits the organization's ability to introduce new systems or adopt data-driven processes, as the skills required to interpret, adapt, and optimize digital solutions remain inadequate. The findings underscore that digitalization is not merely a technological issue but fundamentally depends on the organization's ability to build and sustain a broad, enduring digital competence base. This is essential for transitioning from isolated initiatives to a more coherent and strategically anchored digitalization process.

4.4.3. Time and Resource Constraints

A recurring organizational challenge identified in the analysis is the severe time and resource constraints inherent in the City Planning Department's core operations, which significantly hinder systematic and long-term digitalization efforts. Interviews reveal that

administrators and managers consistently prioritize operational and legally mandated activities, such as building permit processing and detailed development planning, over development work. As a result, digitalization is often viewed as an additional task rather than as an integrated component of the organization's core processes.

The interviews highlighted a persistent lack of time for development work, with operational demands routinely overshadowing digitalization initiatives. One respondent succinctly captured the dilemma: "We don't have time to develop the way we work in the future when we barely have time for today's." (R4, Manager). This challenge is compounded by the absence of dedicated resources, such as protected time, defined roles, or financial support, for digitalization. Instead, digital initiatives were frequently driven by individual commitment rather than sustained by stable structures and allocated resources. This creates a precarious situation where projects risk stalling due to staff turnover, high workload, or shifting organizational priorities. Consequently, digitalization efforts tend to be sporadic and short-lived, rather than strategically planned and implemented for long-term impact.

Document triangulation supports these findings. While business plans identify digitalization as a strategic priority, they provide few concrete details regarding resource allocations, timelines, or designated roles for executing this work. The digitalization strategy underscores the need for systematic development, but fails to specify how time and resources should be balanced between operational casework, development activities, and ongoing maintenance. Steering documents and internal planning materials further reveal that most units operate with limited personnel resources relative to their caseloads, forcing development initiatives to be sidelined by the pressures of day-to-day operations. This structural overload makes it difficult for digitalization projects to gain momentum and undermines their sustainability.

These results align with international research, which identifies time and resource constrains as one of the most pervasive barriers to digitalization in the public sector. According to [37], resource limitations relegate digitalization projects to the status of add-ons rather than core operational components, thereby reducing both the quality and pace of digital progress. Similarly, Ref. [4] argue that public-sector organizations frequently lack structures to protect development work from being eclipsed by routine operations, fostering an "innovation as extra work" mindset that hinders the stable integration of digital initiatives. The OECD's international reviews of digital governance [36] also emphasize that insufficient time and resources systematically undermine municipalities' ability to implement digital reforms, as such transformations require sustained investments in capacity and expertise.

The analysis demonstrates that time and resource constraints are not merely practical hurdles but structural factors that fundamentally shape digitalization capacity. When development work lacks organizational prioritization and protection, digitalization becomes dependent on fleeting opportunities, individual enthusiasts, and occasional lulls in operational demands. This limits the organization's ability to pursue strategic goals, implement process changes, and embed digital solutions into daily workflows in a sustainable manner. Resource constrains also exacerbate other organizational challenges, such as unclear governance and uneven digital maturity, as limited time hinders competence-building, shared understanding, and the establishment of common frameworks.

To summarize, time and resource constraints represent a central obstacle rooted in the organization's structural conditions rather than as a temporary challenge. For digitalization to transition from isolated projects to an embedded organizational logic, the City Planning Department must create protected time, dedicated resources, and a long-term perspective, conditions that the current environment does not yet fully provide.

4.4.4. Fragmented Working Methods and Organizational Silos

The analysis demonstrates that the absence of uniform processes and the prevalence of fragmented working methods represent a significant organizational barrier to digitalization within the City Planning Department. Interviews reveal that administrators and managers often employ different approaches, even when handling similar cases or tasks within planning and construction processes. This inconsistency applies to the use of digital systems, case documentation, process interpretation, and the management of digital information. Workflows vary substantially across units, creating coordination challenges and impeding system-supported standardization. As one respondent noted: "Everyone does it their own way" (R2, Building Permit Officer). This variation results in uneven digitalization outcomes: some units adopt more digital and systematic methods, while others continue to rely on manual routines, local documentation practices, or ad hoc solutions.

The interviews clarify that these differences do not arise from resistance to change but from the lack of clear, shared process guidelines that all units can adopt as a common framework. Without standardized routines, local solutions emerge that may function effectively within individual departments but cannot be scaled or integrated into broader digitalization efforts. This fragmentation poses obstacles to the implementation of digital tools, as systems typically assume users follow consistent workflows and manage data in standardized ways. In practice, digitalization must adapt to local practices rather than the organization aligning its processes with digital working methods. Consequently, development efforts lose momentum, coherence, and the potential for cross-departmental alignment.

Document triangulation confirms this variation. Internal process maps for detailed planning, building permit handling, and geodata supply differ in detail and are updated inconsistently across the organization. They often lack explicit connections to digital systems and data flows, rendering them ineffective as governing documents for digital development. Instead, they serve as general descriptions open to interpretation. System overviews further reveal that different units use digital tools in varying ways and to differing extents, reinforcing inconsistencies in working methods. While roadmap documents for digital working methods express an ambition to create more uniform and automated processes, these plans remain in early stages, lacking concrete implementation steps. As a result, practical variation continues to dominate daily operations.

Research supports these findings. According to [4], the absence of standardized processes is a primary reason why public-sector digitalization fails to deliver scalable or sustainable results. Digital technologies require stable and predictable workflows to be effectively implemented. Similarly, Ref. [38] argue that digitalization efforts often falter when organizations attempt to adapt technology to fragmented processes rather than designing common, stable processes around which technological solutions can be built. These studies underscore that process variation and informal working methods not only reduce efficiency but also directly limit digitalization potential.

Overall, the analysis shows that fragmented working methods and the lack of uniform processes pose a structural organizational challenge, hindering both the implementation and effectiveness of digitalization. Inconsistent working methods lead to irregular system use, divergent data management practices, and underutilized digital tools. This makes it difficult to introduce shared digital solutions, develop automated workflows, or ensure traceability and quality in digital information. The lack of uniformity also exacerbates other organizational challenges, such as uneven competence and unclear governance, as process variation complicates the establishment of shared training, common routines, or coordinated digital development. The result is a digitalization process that progresses asymmetrically and in fragments, rather than coherently and strategically.

4.5. Environmental Dimension: External Requirements, Regulations and Dependencies

The environmental themes below provide the empirical foundation for the mechanism of institutional uncertainty introduced in Section 4.2.

4.5.1. National Requirements and Regulatory Changes

The analysis reveals that national requirements and regulatory changes are among the most significant external factors influencing the City Planning Department's digitalization efforts. Interviews indicate that employees face persistent pressure from national reforms, particularly those led by the Swedish National Board of Housing, Building, and Planning (Boverket). These reforms focus on digital planning information, evolving data standards, and broader state digitalization ambitions. As one respondent noted, "New requirements from Boverket are constantly coming" (R5, Digitalization Coordinator), highlighting the frequent need to adjust working methods, data models, and system support, often with little advance notice.

Operationally, shifting national requirements lead to recurring reprioritization and short reconfiguration cycles. Respondents reported that new templates, standards, or guidelines are often introduced before stable routines and system support are established. This creates rework and uncertainty about which version to apply in ongoing cases. At the micro level, this results in interrupted improvement efforts, additional manual compliance checks, and delayed architectural consolidation due to unclear future requirements. Document analysis supports this interpretation, showing that while policy-level ambitions are clear, operational guidance on sequencing, responsibilities, and resource allocation is often lacking, making adjustments more reactive than strategic.

Uncertainty about national timelines further complicates planning. Respondents expressed concerns about shifting deadlines, particularly for digital detailed plans, automated plan reviews, and national specifications. Timelines were described as fluid, frequently revised, or lacking clear direction, which creates ambiguity in local planning and internal prioritization.

Document triangulation reinforces these findings. The Swedish National Board of Housing, Building and Planning's guidelines for digital and uniform plan information (2021) outline detailed requirements for structure, semantics, metadata, and file formats that municipalities must adopt. While these guidelines aim to foster interoperability among municipalities, government agencies, and system suppliers, their regular updates require municipalities to navigate a dynamic regulatory landscape where standards may evolve as national data flows mature.

The Government's Digitalization Strategy [6] further underscores these pressures. It calls for the public sector to become "innovative, collaborative, and digitally cohesive," pushing municipalities to adopt new digital requirements and work in more data-driven, standardized, and efficient ways. The strategy's principle that information should "only need to be provided once" necessitates common data models, integrated systems, and structured information management at the municipal level.

Research supports the significance of these external pressures. According to [39], regulatory changes in the public sector often create "compliance pressure", forcing organizations to adapt systems and processes to national standards even when internal capacity is limited. The OECD similarly notes that digitalization in public authorities is frequently driven by externally formulated goals rather than local needs, compelling organizations to implement digital solutions faster than their internal structures can accommodate. The Swedish National Board of Housing, Building and Planning's requirements for digital detailed plans exemplify this dynamic, as evolving standards demand continuous competence development, data model adaptation, and system updates at the municipal level.

The analysis demonstrates that uncertainty surrounding national timelines particularly impacts the City Planning Department's ability to plan strategically. Respondents described challenges in prioritizing local digital initiatives when the scope or timing of upcoming national requirements remain unclear. This creates a dual burden: municipalities must stay flexible and ready to adapt processes and systems quickly while maintaining daily operations. The result is a strained balance between meeting compliance requirements and advancing internal digital development, all within constrained resources.

In summary, national requirements and regulatory changes act as a powerful external driver that both enables and complicates digitalization. On the one hand, national standards create essential conditions for interoperability, data quality, and digital collaboration. On the other, frequent changes introduce complexity, demand rapid internal adaptation, and generate uncertainty that undermines long-term planning. This theme illustrates that digitalization in municipal city planning is not solely an internal organizational process but is profoundly shaped by external political, legal, and technical conditions beyond the municipality's control.

4.5.2. Technical and Legal Dependencies on External Actors

The analysis demonstrates that the City Planning Department's digitalization efforts are heavily influenced by technical and legal dependencies on external actors, particularly system suppliers, national authorities, and the legal frameworks governing data access and sharing. Interviews reveal that suppliers often dictate the pace of development through their product roadmaps, priorities, and system limitations. As one respondent noted, "We are too dependent on suppliers" (R3, GIS Specialist), highlighting how this dependency places the municipality in a reactive position, where progress hinges on external updates rather than internally driven initiatives.

A recurring theme is the department's reliance on APIs and integrations that are either underdeveloped, unstable, or controlled by external parties. One respondent emphasized, "We are vulnerable because of all the integrations" (R3, GIS Specialist). Interviewees described situations where planned automations or data flows could not be implemented due to limitations in external APIs, such as missing functionality, inadequate documentation, or inconsistent long-term management. This issue affects multiple aspects of city planning, particularly when exchanging geodata between systems or connecting case management systems to external data sources. As a result, the organization cannot fully develop its digital capacity internally but must instead adapt its processes to the capabilities enabled by external actors.

Legal constraints present another significant challenge. Interviews indicate that legal barriers complicate data sharing, both between the municipality and external actors and across internal departments. One respondent explained, "Not being able to share data makes our work more difficult" (R4, Manager). Challenges arise from confidentiality requirements, intellectual property rights, and the municipality's legal obligations as a data custodian. Uncertainty in interpreting regulations, such as GDPR, public access principles, and geodata licensing models, creates caution that slows digital progress and collaboration. As one respondent described, legal barriers can feel "excessively large" and "difficult to interpret" (R5, Digitalization Coordinator), reflecting both genuine regulatory constraints and organizational ambiguity in managing them.

Document triangulation supports these findings. The HMK documents (Handbook on Surveying and Mapping Issues) outline the legal and technical requirements for geodata handling and sharing, obliging municipalities to comply with detailed and evolving standards. DIGG's guidelines on open data, information security, and digital interoperability highlight both the opportunities and constraints of data sharing, particularly regarding

legality, standardization, and long-term management. Additionally, contract documents reveal that licensing models, data rights, and supplier terms further restrict how the municipality can use, reuse, and distribute digital information and system functionalities, reinforcing the dependencies described in interviews.

Research confirms that such dependencies are common in public-sector digitalization. According to [40], public authorities often face "vendor lock-in", where reliance on external technical solutions limits their ability to innovate internally. Similarly, Ref. [41] describe how legal requirements around data sharing can create "compliance paralysis", where uncertainty about regulatory interpretation leads to cautious decision-making that slows digital initiatives. The OECD [36] also notes that dependencies on external APIs and national digital infrastructures shape local digitalization conditions, forcing municipalities to adapt internal processes to externally driven technological changes.

Overall, the analysis shows that technical and legal dependencies on external actors pose a significant obstacle to the municipality's digitalization capacity. Dependence on suppliers restricts the scope for action and slows development; reliance on external APIs undermines system stability and integration; and legal uncertainties limit data sharing and information management. These factors interact and reinforce one another, meaning that the organization's digital progress is shaped not only by internal ambitions but often primarily by external actors and regulations beyond its control. The result is a digitalization environment where external requirements, technical limitations, and legal frameworks collectively define the municipality's operational flexibility, making progress highly contingent on factors outside its direct influence.

4.5.3. Political Expectations and External Pressure

The analysis reveals that the City Planning Department's digitalization efforts are profoundly influenced by political ambitions and strong external pressure from citizens, businesses, and regional stakeholders. Interviews highlight that political goals are often expressed in highly ambitious terms, sometimes perceived as difficult to reconcile with the organization's practical and technical realities. Several respondents referenced political statements such as "We should be Sweden's best digital municipality" (R4, Manager). While these visions serve as powerful motivators for change, they also create internal pressure, as they are not always accompanied by adequate resources, clear priorities, or realistic timelines. Employees described how expectations of rapid progress generate a sense of constant urgency, where digitalization is expected to deliver quick results despite organizational and technical constraints.

Beyond political demands, the department faces significant external pressure from citizens and stakeholders. Respondents noted that businesses expect faster case processing, greater digital transparency, and expanded self-service options. Citizens demand clearer information, enhanced digital map functionalities, and streamlined building-permit processes. Meanwhile, regional partners, such as those in geodata, infrastructure, and urban development, require data sharing, interoperability, and common digital standards. This collective external pressure extends far beyond internal efficiency, necessitating substantial organizational, technical, and competence-related transformations.

Document triangulation supports these findings. The municipality's political goals emphasize digitalization as a strategic priority, often framed in terms of innovation, openness, and modernization. These goals position the municipality as a leader in digital development, committed to delivering efficient digital services and adopting data-driven practices. However, the documents provide limited concrete guidance on how these ambitions should be operationalized. The municipality's overarching strategy further underscores digitalization's central role in societal development and service quality, portraying it as a tool to

enhance transparency, decision-making, and process efficiency. These strategies also reflect the growing expectation from residents and market actors that digitalization is the norm, further intensifying external pressure.

Research confirms that political ambitions and external expectations are powerful drivers of public-sector digitalization, but also significant sources of complexity. Previous studies show that politically formulated goals often create strong incentives for organizational change but may not align with the structural and implementation capacities required, leading to challenges in execution [42]. Additionally, Ref. [4] argues that politically driven digitalization goals are frequently based on high expectations for innovation and rapid transformation, creating what she terms "performance pressure" in public authorities. This pressure arises when organizations are expected to deliver digital solutions at a pace that outstrips their internal capacity. Furthermore, Ref. [40] highlights that public-sector digitalization is increasingly shaped by the interplay between political visions and stakeholder demands, forcing authorities to balance internal capabilities with external expectations.

Overall, the analysis demonstrates that political expectations and external pressure represent a powerful environmental dimension that both propels and complicates digitalization. Political visions provide direction and legitimacy for digital development but also impose demands that are difficult to fulfill without corresponding organizational resources. External expectations, from citizens, businesses, and regional partners, further amplify the need for rapid digital advancement, increased transparency, and more sophisticated digital services. This collective pressure means that digitalization cannot be viewed solely as an internal organizational process; it must be understood as an activity continuously shaped by external actors, demands, and expectations that influence both the organization's ambitions and the pace of its digital transformation.

4.6. Cross-Dimensional Patterns

The analysis demonstrates that the digitalization challenges facing the City Planning Department cannot be fully understood by examining each dimension of the TOE framework in isolation. Instead, the findings reveal recurring cross-cutting patterns that span the technical, organizational, and external dimensions (as presented in Table 1). These interconnected patterns offer critical empirical insights into why digitalization efforts often advance slowly and in a fragmented manner, despite strong political commitments and a clear intent to modernize municipal operations.

The first clear pattern is that technical challenges are exacerbated by organizational ambiguity. Issues such as poor system integration, inconsistent data flows, and misaligned system support become significantly more problematic when digitalization lacks clear ownership and departments interpret its goals differently. The interviews reveal that many technical obstacles are not inherently technical but organizational: unclear responsibilities, priorities, and governance structures hinder coordination with suppliers, resource allocation, and process changes. Mechanistically, this pattern demonstrates how ambiguous end-to-end ownership and coordination increase the cost and risk of integration, reinforcing organizational inertia and prolonging technological lock-in [4,43].

A second pattern is that external demands create internal pressure and force reactive responses. National reforms, such as the Swedish National Board of Housing, Building, and Planning's digital planning requirements and broader state digitalization strategies, require municipalities to rapidly adapt their data, processes, and systems. Interviewees noted that uncertainty about timelines, evolving standards, and frequent revisions generate a sense of constant urgency, while internal resources remain constrained. This pushes the organization into a reactive mode, undermining long-term planning. Mechanistically, shift-

ing requirements force short reconfiguration cycles, amplifying institutional uncertainty and displacing efforts toward long-term consolidation [44,45].

Table 1. Summarizes the cross-dimensional patterns that emerge from the interaction of the TOE themes and that serve as the empirical bridge to conceptual synthesis.

TOE Dimension	Emergent Themes	Examples of Emerged Empirical Patterns
Technology	Fragmented systems and lack of integration	Parallel IT systems, limited interoperability, duplicate data entry, manual information transfer
	Lack of data standardisation and data quality	Inconsistent metadata, heterogeneous map data, manual quality checks
	System support misaligned with work processes	Systems dictate workflows, limited functionality, lack of end-to-end process support
Organization	Organisational silos and unclear responsibilities	Siloed structures, unclear roles, limited cross-departmental coordination
	Limited change and implementation capacity	Time constraints, resource limitations, competing priorities
	Competence and resource challenges	Lack of digital competence, dependence on key individuals
Environment	National regulations and requirements	Legal requirements, national standards, governmental guidelines
	External governance and dependencies	Regulatory pressure, dependence on system vendors
	Institutional uncertainty and unclear mandates	Conflicting steering signals, unclear accountability

A third cross-cutting pattern is that national standards drive substantial demand for skills development. Requirements for structured digital planning, interoperable data models, and integrated geodata necessitate new technical and process-related competencies that many employees currently lack. The interviews highlight that standardization mandates from the Swedish National Board of Housing, Building and Planning, DIGG, and HMK not only require technical adjustments but also demand changes in working methods, roles, and professional skills. This compounds existing organizational barriers, such as uneven digital maturity and insufficient competence. Mechanistically, standards only become actionable when competence-building and shared routines are established; otherwise, they deepen disparities in digital maturity and contribute to inertia [34]. This underscores that national digital reforms rely heavily on local organizational capacity to achieve their intended effects.

The fourth prominent pattern is that system integration demands both organizational and technical investments; the absence of either causes digitalization to stall. The interviews show that even when technical solutions are available, successful integration depends on the organization developing common processes, defined roles, and coordinated requirements. Without these structures, integration projects struggle to advance or remain confined to pilot phases. Document analysis confirms that integration challenges are not purely technical but stem from historical decisions, fragmented processes, and inadequate cross-departmental coordination. Mechanistically, integration falters when governance and capacity are insufficient to stabilize interfaces, data routines, and process ownership, simultaneously reinforcing lock-in and inertia [44,45].

Overall, these cross-cutting patterns reveal that digitalization in municipal city planning cannot be reduced to isolated technical, organizational, or external factors. Instead, it is shaped by the interplay between these dimensions, where technical obstacles are magnified by organizational constraints, external requirements create internal tensions, and successful digitalization hinges on aligned development across structures, systems, skills, and political frameworks. Digitalization is not a linear process but a complex, interdependent one, where changes in one dimension inevitably impact the others. This insight is critical for informing the governance, planning, and implementation of future digital initiatives.

These cross-dimensional patterns form the immediate analytical foundation for the conceptual framework in Section 4.7, where they are synthesized into three structural mechanisms and their reinforcing relationships.

4.7. Culminating Synthesis: Conceptual Framework and Derived Mechanisms

Building on the TOE-structured results (Sections 4.3–4.5) and the cross-dimensional patterns identified in Section 4.6, this section presents the study's culminating synthesis: the conceptual framework (Table 2). Table 2 introduces the framework by abstracting the TOE themes and cross-dimensional patterns into three interacting structural mechanisms and their reinforcing relationships. The framework does not merely summarize themes; rather, it derives three higher-order mechanisms that explain why the observed challenges persist and mutually reinforce one another over time. Each mechanism is explicitly anchored in the underlying TOE themes and their empirical indicators, providing a transparent analytical pathway from the interview material to the conceptual contribution.

To ensure traceability, the mechanisms presented in Table 2 should be understood as abstractions directly derived from the empirical theme structure. They are not superimposed on the results but emerge from recurring co-occurrences and interdependencies observed across the TOE themes, consolidated in the cross-dimensional patterns.

The framework is not designed as a prescriptive implementation model but as an analytical tool. Its purpose is to explain how recurring empirical patterns give rise to relatively stable structures that either constrain or enable digitalization over time. This holistic and explanatory approach aligns with socio-technical research, which emphasizes that public-sector digitalization arises from the interplay of technological systems, organizational arrangements, and institutional frameworks, collectively shaping both the limitations and opportunities for change [40]. Thus, this study demonstrates that digitalization challenges cannot be viewed as isolated issues but as manifestations of interacting structural mechanisms that form a self-reinforcing digitalization context.

Table 2 presents the conceptual framework by linking empirically derived themes to three structural mechanisms—technological lock-in, organizational inertia, and institutional uncertainty, while explicitly illustrating the reinforcing relationships among them.

Technological lock-in

The first structural mechanism, technological lock-in, describes how historically developed system architectures, fragmented IT landscapes, and inconsistent data standards create path dependencies that make technical change both costly and challenging. Empirical evidence, such as limited system integration, persistent issues with data standardization and quality, and misalignment between system support and work processes, demonstrates how existing technical solutions tend to perpetuate established workflows rather than enable new, integrated digital processes.

Similar patterns of technological lock-in have been observed in prior research on digitalization in planning and construction. Early system choices and localized adaptations often constrain future development trajectories [46]. More broadly, digitalization studies reveal that legacy systems and entrenched technical structures frequently persist despite the

availability of new technological possibilities, thereby inhibiting transformative change [43]. In municipal city planning, these effects are compounded by past procurement decisions, the absence of unified data models, and divergent technical requirements across organizational units. Together, these factors reinforce and stabilize existing technical arrangements over time.

Table 2. Conceptual framework: three interacting mechanisms derived from TOE themes and cross-dimensional patterns.

Structural Mechanism	TOE Dimension (s)	Core Structural Condition (Synthetic Description)	Empirical Basis (Derived from Table 1)	Reinforces	Is Reinforced by
Technological lock-in	Technology	Historically developed system architectures, fragmented IT landscapes, and inconsistent data standards create path dependencies that make technical change costly and difficult over time. Existing systems tend to reproduce established workflows rather than enabling integrated digital processes.	Fragmented systems and lack of integration; challenges in data standardization and data quality; system support misaligned with work processes	Organizational inertia	Institutional uncertainty
Organizational inertia	Organization	Stable organizational structures, unclear governance, fragmented responsibilities, and uneven digital competence reduce the capacity to coordinate and implement cross-functional digital change, even when technical solutions are available.	Unclear governance and division of responsibilities; skills shortages and uneven digital maturity; time and resource constraints; fragmented working methods	Institutional uncertainty	Technological lock-in
Institutional uncertainty	Environment	Evolving national regulations, standards, political expectations, and dependencies on external actors create uncertainty about future requirements, discouraging long-term investments and coordinated change efforts.	National requirements and regulatory changes; technical and legal dependencies on external actors; political expectations and external pressure	Technological lock-in	Technological lock-in

Organizational inertia

The second mechanism, organizational inertia, describes how organizational structures, governance arrangements, roles, and routines tend to resist change, even when the need for digitalization is acknowledged and technical solutions are available. Empirical patterns, such as unclear governance and division of responsibilities, uneven digital competence, time and resource constraints, and fragmented working methods demonstrate how organizational capacity for coordinated digital transformation is constrained in practice.

Mechanistically, these organizational conditions explain why coordinated change is repeatedly sidelined, even when viable technical solutions exist, thereby reinforcing inertia as a persistent barrier [37]. Public organizations are often characterized by professional silos, localized practices, and administrative traditions that hinder cross-functional coordination and the adoption of new digital workflows [47]. In the municipality under study, these conditions mean that digitalization initiatives risk remaining isolated and dependent on individual efforts rather than becoming institutionally embedded.

Institutional uncertainty

The third structural mechanism, institutional uncertainty, encompasses the impact of evolving national regulations, standards, political expectations, and dependencies on external actors. Municipal digitalization operates within a highly regulated and dynamic institutional environment, where new requirements, such as those for digital planning information, geodata standards, and digital building permits, are frequently introduced before stable solutions are fully implemented.

Institutional theory underscores how such regulatory and normative frameworks shape perceptions of legitimate and feasible organizational action [4]. Previous research further demonstrates that the complexity and interdependence among actors, regulations, and technical systems generate uncertainty, which can impede public-sector digitalization initiatives [48]. The empirical findings confirm that ambiguity surrounding future requirements and responsibilities prompts municipalities to adopt cautious investment strategies, closely monitor national developments, and delay long-term technical and organizational commitments.

Reinforcing relationships between mechanisms

A key contribution of this framework is its explicit identification of the reinforcing relationships among the three structural mechanisms. As illustrated in Table 2:

- Technological lock-in strengthens organizational inertia by restricting the feasibility of new work processes and coordinated change;
- Organizational inertia intensifies institutional uncertainty by undermining the organization's ability to interpret, coordinate, and implement external requirements;
- Institutional uncertainty reinforces technological lock-in by delaying strategic investments in system architecture and data infrastructure, thereby prolonging reliance on existing technical solutions.

Collectively, these mechanisms create a self-reinforcing socio-technical system in which digitalization progresses slowly and unevenly. This is not due to isolated barriers but rather to the interplay of relatively stable structural conditions. This perspective directly addresses calls in prior research for empirically grounded explanations of how technical, organizational, and institutional factors interact over time to shape digitalization outcomes [37,43].

5. Discussion

The purpose of this study was to analyze and explain how the conditions for digitalization in municipal city planning are shaped through the interaction between technical, organizational, and institutional factors. Building on the framework derived in the Results (Table 2), the Discussion focuses on interpreting the mechanisms and their implications, rather than reiterating descriptive findings. This discussion explores why the observed challenges persist and how they become self-reinforcing over time. Table 2 serves as the study's primary analytical tool: it links the TOE-structured themes to three interacting structural mechanisms, technological lock-in, organizational inertia, and institutional uncertainty, and clarifies the feedback relationships through which digitalization tends to remain slow and fragmented in practice. Accordingly, the Discussion focuses exclusively on interpreting the implications of these mechanisms and their feedback relationships, rather than repeating descriptive findings.

The practical value of the framework becomes clearer when it is used not only as an explanatory account of why digitalization is slow, but also as a diagnostic and prioritization tool that municipalities can apply to determine where to intervene. Instead of treating the identified challenges as a list of isolated obstacles, Table 2 can be used to assess which of the three mechanisms dominate in a given context, how the mechanisms reinforce one another,

and which coordinated intervention packages are likely to have the greatest impact. In practica, the framework can be operationalized through a simple four-step logic.

1. Identify Symptoms: Organizations first identify observable operational symptoms (e.g., duplicate registrations, manual checks, local solutions, integration problems, unclear ownership, recurrent reprioritization) and relate them to the TOE themes reported in Sections 4.3–4.5.
2. Interpret Through Mechanisms: These themes are then interpreted through the mechanism that best captures the underlying logic:
    - Technological lock-in, when legacy architectures, fragmented platforms, and weak interoperability make change costly and risky;
    - Organizational inertia, when mandates, process ownership, routines, and resource allocation systematically crowd out coordinated change;
    - Institutional uncertainty, when shifting national requirements, vendor roadmaps, and legal ambiguity delay long-term commitments.
3. Map Reinforcing Relationships: The reinforcing relationships are made explicit, for example, when uncertainty about standards and vendor roadmaps postpones architectural investments and common data models (thereby prolonging lock-in), or when unclear end-to-end ownership prevents integrations from stabilizing and scaling up (thereby reinforcing inertia).
4. Design Coordinated Interventions: Finally, organizations select interventions as coordinated packages rather than isolated fixes, ensuring that at least one reinforcing link or two interacting mechanisms are addressed simultaneously.

When applied to municipal urban planning, this means that integration and standardization efforts should not be approached as purely technical improvements. The case reveals that system fragmentation and limited interoperability often coincide with weak cross-departmental ownership and a lack of dedicated capacity for process transformation. Meanwhile, evolving national standards and timelines encourage reactive rather than strategic sequencing. A key practical implication is that "integration-focused" initiatives are unlikely to succeed unless they are combined with explicit end-to-end process ownership across planning, permitting, and geodata workflows; a mandated data-governance function (including shared definitions, metadata practices, and validation rules); and a proactive approach to external dependencies through incremental compliance planning that translates national requirements into locally implementable decision points.

In this way, the framework supports three concrete types of decision-making:

- Governance decisions: clarifying ownership of processes, data standards, and integrations;
- Capacity decisions: prioritizing skills development and change support for the working methods required by emerging standards;
- Investment and sequencing decisions: determining what should be stabilized now (e.g., minimum common data structures and interfaces) versus what should be postponed under conditions of high uncertainty.

By making the feedback loops visible, the framework also clarifies why isolated interventions often fail to deliver lasting impacts: standardization without mandate and time becomes project-like; integration without data quality remains fragile; and compliance without architectural commitments stays reactive. The practical value of the framework, therefore, lies in enabling municipalities to diagnose, prioritize, and coordinate their efforts in ways that address both the underlying mechanisms and the reinforcing relationships that otherwise slow and fragment digitalization.

These findings also have clear implications for policy and public governance. National digitalization initiatives and standards in the planning and building domain are

more likely to achieve consistent local implementation when they are accompanied by guidance that aligns with municipal capacity constraints and cross-unit coordination needs. In practice, this suggests that policy should emphasize interoperable data requirements alongside actionable guidance on process ownership, data-governance routines, and minimum integration steps that municipalities can stabilize early. The results also identify procurement and supplier governance as policy-relevant levers, since vendor dependencies significantly influence the local feasibility of integration and standardization. Finally, predictable communication of timelines, updates, and compliance expectations can reduce planning uncertainty and enable municipalities to sequence investments more strategically across planning, permitting, and geodata functions.

A key analytical insight is that the empirical themes should not be viewed as isolated "barriers" to be removed one by one. Instead, they function as symptoms of deeper socio-technical structures. From a socio-technical perspective, digitalization unfolds within a complex web of legacy infrastructures, professional routines, legal accountability, and external steering signals. In such contexts, stepwise adaptations and workarounds become rational responses, while transformative end-to-end redesign becomes difficult to coordinate and sustain. This helps explain the e-government paradox described in prior research: investments can increase, yet everyday practices often remain dependent on manual coordination and partial system use, because the conditions required for integrated change remain unchanged [5,40].

Technological lock-in offers a mechanism-level explanation for why technical issues persist even when their practical consequences are well-understood. When core digital infrastructures evolve through accumulated local adaptations, dependencies multiply across systems, data models, and responsibilities, turning even "simple" change initiatives into broader coordination challenges. The core issue is not merely the existence of multiple systems, but that earlier architectural choices and locally adapted configurations constrain what is feasible today. In such environments, integration and standardization are not "add-ons"; they require coordinated changes in data models, interfaces, responsibilities, and sometimes procurement boundaries, making change both costly and risky [46,49].

Within this lock-in dynamic, data standardization and data quality become critical, as they determine whether automation and reuse are possible. When data definitions, metadata practices, and validation routines vary across units, the organization becomes reliant on manual checks and local interpretation. This increases operational workload and reduces the feasibility of scalable digital workflows, thereby reinforcing fragmentation. Inconsistent data practices make integrations more brittle and raise the coordination costs of change [50]. Standardization, therefore, functions not only as a technical requirement but as a socio-technical reconfiguration that demanding shared routines and sustained competence-building to become embedded in practice [43].

System–process misalignment further strengthens the lock-in mechanism by normalizing partial digitalization and parallel routines. When systems fail to reflect the logic of professional work, staff either adapt their work to the system or develop workarounds, such as email coordination, manual checklists, or duplicated registrations. While these practices maintain short term functionality, they stabilize the mismatch over time [40,51]. In this study, such workarounds reduce the likelihood of transitioning to coherent end-to-end processes, as everyday case production becomes dependent on compensatory routines rather than integrated system support [4].

Organizational inertia explains why recognized needs, such as clearer governance, more uniform processes, competence development, and protected time for change, do not automatically lead to sustained transformation. In this study, inertia is not primarily resistance to technology but rather stability produced through routines, professional boundaries,

and resource-allocation patterns. When digitalization lacks protected mandates and time, development work becomes structurally "extra work" and is consistently overshadowed by legally regulated, time-critical operations. Over time, this institutionalizes a logic where short-term throughput dominates as the performance criterion, while cross-unit redesign is postponed despite its strategic value [36,37].

From a socio-technical perspective, inertia is also reproduced through the normalization of workarounds. Because compensatory routines enable everyday work system shortcomings, they reduce the immediate pressure for coordinated process and governance reform. This helps explain why digitalization initiatives remain localized and person-dependent rather than becoming institutionalized across the organization [4,51–53].

Finally, institutional uncertainty explains why external requirements can simultaneously act as both a driver and a delaying mechanism. Evolving national standards, shifting timelines, vendor and network dependencies, and legal ambiguity create a cautious implementation logic, where long-term investments are postponed in favor of short-term adaptations [38,41,48]. In such contexts, it becomes rational for municipalities to delay major architectural commitments until requirements stabilize, resulting in a reactive rather than strategic approach. This uncertainty is further amplified by dependencies on external actors, particularly suppliers and shared digital infrastructures. When critical functionality is tied to supplier roadmaps and integration ecosystems, municipalities lose control over pace and sequencing of change. This creates a structural asymmetry: while municipalities remain accountable for service outcomes and legal certainty, parts of their change capacity lie outside the organization. The consequence is a "waiting mode", where long-term integration is postponed due to the perceived risk of early lock-in, yet postponement itself reinforces fragmentation [41,48]. The framework thus shifts the discussion from merely describing barriers to explaining persistence: the challenges are reproduced through feedback relationships rather than arising from isolated shortcomings.

Concretely, the analysis identifies three reinforcing relationships. First, technological lock-in reinforces organizational inertia: fragmented architectures and inconsistent data practices increase the cost and risk of coordinated process redesign, making workarounds and incremental fixes rational short-term responses [46,49]. Second, organizational inertia amplifies institutional uncertainty: unclear governance, uneven competence, and chronic time pressure reduce the municipality's capacity to interpret, prioritize, and implement evolving external requirements in a coherent manner [36,37,41]. Third, institutional uncertainty reinforces technological lock-in: shifting national standards, vendor roadmaps, and legal ambiguity encourage cautious investment strategies and delay long-term architectural commitments, prolonging dependence on legacy systems and partial integrations [39,48]. Together, these feedback relationships explain why digitalization tends to remain slow and fragmented, even when the need for change is widely recognized.

Beyond explaining the empirical findings of this case, the study contributes to research on public-sector digitalization by deepening the understanding of how technical, organizational, and institutional factors interact through underlying and mutually reinforcing mechanisms. By integrating a socio-technical perspective with the TOE framework and operationalizing this integration through a conceptual framework, the study demonstrates that these dimensions should not be treated as separate analytical categories. Instead, they constitute interwoven elements of a dynamic system that shapes the conditions for digitalization over time. In this way, the study refines and extends established models of public-sector digitalization, which have often treated technical, organizational, and institutional factors as relatively discrete domains of influence.

Finally, from a practical perspective, the framework presented in Table 2 suggests that municipalities should avoid addressing integration, standardization, competence develop-

ment, and governance as separate initiatives. Since the underlying mechanisms reinforce one another, single-issue interventions risk being absorbed by the system. Integration projects will fall short if process ownership and time allocation remain unclear; competence development initiatives will yield uneven results if workflows are not standardized and system support remains incomplete; and compliance-driven change will continue to be reactive if architectural commitments are repeatedly delayed due to uncertainty. A key practical implication is therefore to coordinate architectural work and data standards with clear process ownership and dedicated capacity for cross-unit redesign. At the same time, municipalities should actively manage supplier and regulatory dependencies as integral components of the same change effort.

Limitations and Future Research

As with all qualitative case studies, this study has methodological limitations that should be considered when interpreting its findings. The analysis is based on a single municipal urban-planning context and relies on semi-structured interviews combined with document analysis. As a result, the findings are analytically rather than statistically generalizable. Interview data are inherently shaped by interpretation and professional role, meaning that experiences may vary across occupational groups. Additionally, the availability of documents may influence which aspects of digitalization are most prominently represented. Furthermore, the study captures digitalization at a specific point in time, whereas public-sector digitalization typically unfolds over much longer periods.

To enhance transferability and further develop the framework from a conceptual contribution into a practical tool, future research should pursue four specific avenues. First, the framework should be validated through comparative multi-case studies across municipalities of varying sizes and levels of digital maturity, as well as in other municipal domains (e.g., environmental permitting or social services), to determine whether the same three mechanisms consistently recur. Second, the framework should be operationalized into a diagnostic tool by developing measurable indicators for each mechanism (e.g., integration fragility, prevalence of workarounds, clarity of mandates, availability of protected capacity, regulatory volatility, and vendor dependency). This tool should then be pilot-tested in multiple departments to assess its usability and inter-rater reliability. Third, intervention-oriented longitudinal studies should evaluate the impact of coordinated change packages, such as combining end-to-end process ownership with data-governance routines and an integration roadmap, on data quality, manual work, and integration stability over time.

6. Conclusions

This study examined how digitalization in municipal urban planning is shaped by the interplay among technological, organizational, and environmental conditions within a Swedish municipal context. Using a qualitative case-study design, based on semi-structured interviews with key professional roles (including planning, building permits, geodata/GIS, management, and coordination) and triangulated with internal and national documents, the study applied a socio-technical perspective and the Technology–Organization–Environment (TOE) framework to explain why digitalization initiatives often progress slowly and in a fragmented manner within urban-planning services.

The findings reveal that digitalization challenges are not primarily driven by isolated obstacles, but by interdependent relationships that reinforce one another across the TOE dimensions. Technologically, a fragmented system landscape, limited integration, inconsistent data standards and data quality, and misalignment between systems and work processes constrain the development of end-to-end digital workflows and increasing reliance on manual routines and local solutions. Organizationally, unclear governance

and ownership, uneven digital competence, limited internal development capacity, and fragmented working methods reduce the municipality's ability to coordinate process transformation, standardization, and sustainable change. Environmentally, shifting national requirements, evolving timelines and specifications, vendor dependencies, and legal uncertainty create a context in which the organization often responds reactively rather than strategically, complicating long-term sequencing of investments and change initiatives.

A central contribution of this article is the conceptual framework, which extends the TOE perspective by theorizing three interacting structural mechanisms that explain the persistently slow and fragmented digitalization in municipal urban planning: technological lock-in, organizational inertia, and institutional uncertainty. Technological lock-in captures how legacy architectures, accumulated dependencies, and inconsistent information structures make change costly and risky. Organizational inertia explains how stable routines, professional boundaries, governance ambiguities, and resource-allocation patterns hinder coordinated transformation even when needs are recognized. Institutional uncertainty captures how continuous external change, such as evolving standards, regulatory expectations, vendor roadmaps, and legal interpretation, reduce predictability and encourage cautious commitments, delaying architectural and organizational consolidation. Importantly, the framework highlights that these mechanisms are mutually reinforcing: lock-in sustains solution-based approaches that stabilize inertia; inertia weakens the ability to interpret and implement external requirements coherently; and uncertainty delays crucial investments and standardization, prolonging lock-in.

In practice, the framework can serve as an analytical and prioritization tool for municipalities to diagnose dominant mechanisms in their own digitalization contexts and to design coordinated intervention packages rather than isolated solutions. Specifically, integration and standardization efforts are unlikely to have lasting effects unless they are combined with:

- Explicit end-to-end process ownership across planning, permitting, and geodata workflows;
- A strengthened data-governance function, including shared definitions, metadata practices, and validation routines;
- Systematic skills development linked to evolving working methods;
- Proactive management of external dependencies and compliance requirements through locally actionable decision points.

Overall, this study contributes to research on digital governance and public-sector digitalization by providing an empirically grounded and theoretically integrative explanation of socio-technical digitalization dynamics in municipal urban planning. By shifting the analytical focus from lists of barriers to interacting mechanisms and feedback relationships, the article offers both a stronger explanatory basis for understanding persistent fragmentation and a structured foundation for more integrated and reflective digitalization strategies in municipal practice.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/buildings16061185/s1, File S1: Digitization in Municipal City Planning: A Qualitative Interview Study. Table S1. Overview of TOE dimensions, emergent themes, and examples of empirical patterns. Table S2. Conceptual framework for digitalization in municipal city planning.

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