"The employer expects civil servants to acquire the necessary software, training, and support by themselves"

(Head of Urban Planning, P324)

Civil servants' digitalization readiness in Finnish municipal land use planning and construction supervision from Senge's systems theory perspective

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Agenda

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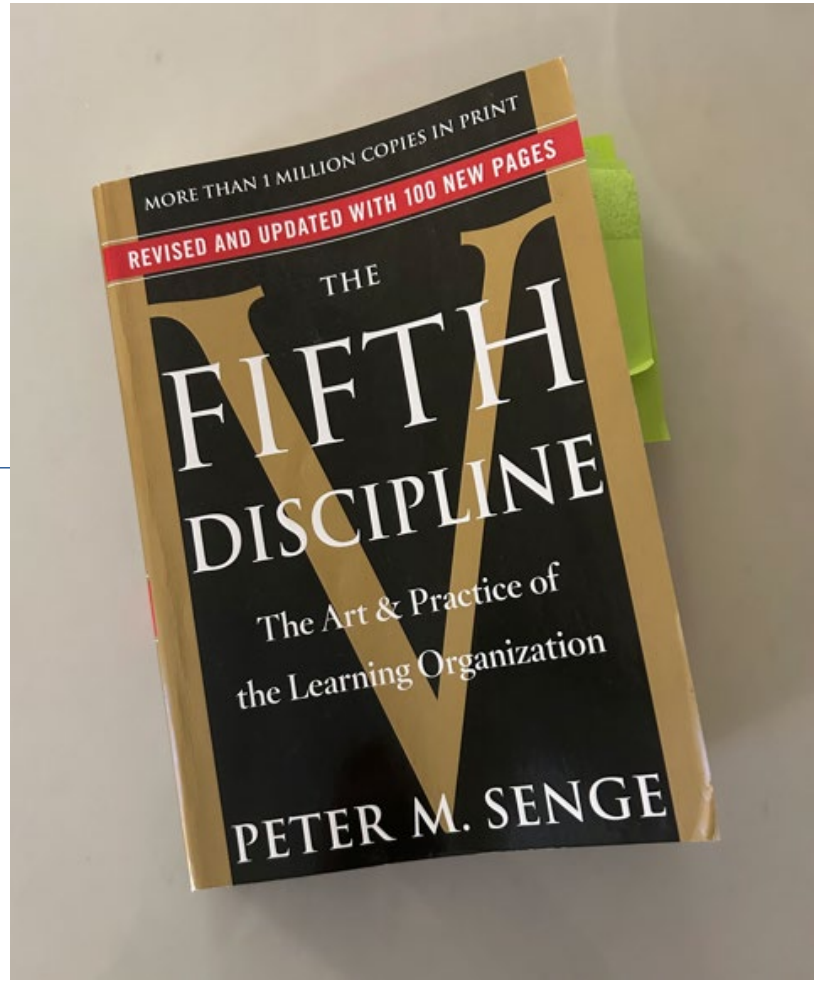
- Research question
- Research context
- Key concepts
- Senge's systems theory of the learning organization
- Data and methods
- Results
- Discussion and conclusions



Research question

How does civil servants' digitalization readiness appear in municipal land use planning and construction supervision from the perspective of Senge's systems theory?

Research context

Research gap: Limited research on digitalization in municipal technical services exists.
Previous studies focused mainly on education, healthcare, and social services.
Need to understand digital readiness in a complex regulatory environment

Technical services in Finnish municipalities

308 municipalities with mandatory technical services

Core functions

- Urban planning (master plans, detailed plans), done with zoning
- Building permits and supervision
- Infrastructure management
- Environmental protection

Strategic importance

- Essential public services affecting citizens' daily lives
- Significant public authority exercise
- Complex stakeholder processes

Mandatory digital transformation by 2029

- Information model-based planning
- National data system integration

Key characteristics

- High digitalization maturity in the Finnish public sector
- Intensive use of specialized digital tools
- Varying organizational resources and structures
- Statutory responsibilities and complex service requirements

European Commission, 2023; Jussila et al. (2016); Nummi et al. (2022); Act on the Built Environment Information System (431/2023)

Key concepts in muncipal context

Digitalization
the utilization of devices, software, digital materials, and remote work in a public organization's internal and external operations *(Kristensen, 2023; Lindgren et al., 2019; Plesner et al., 2018)*

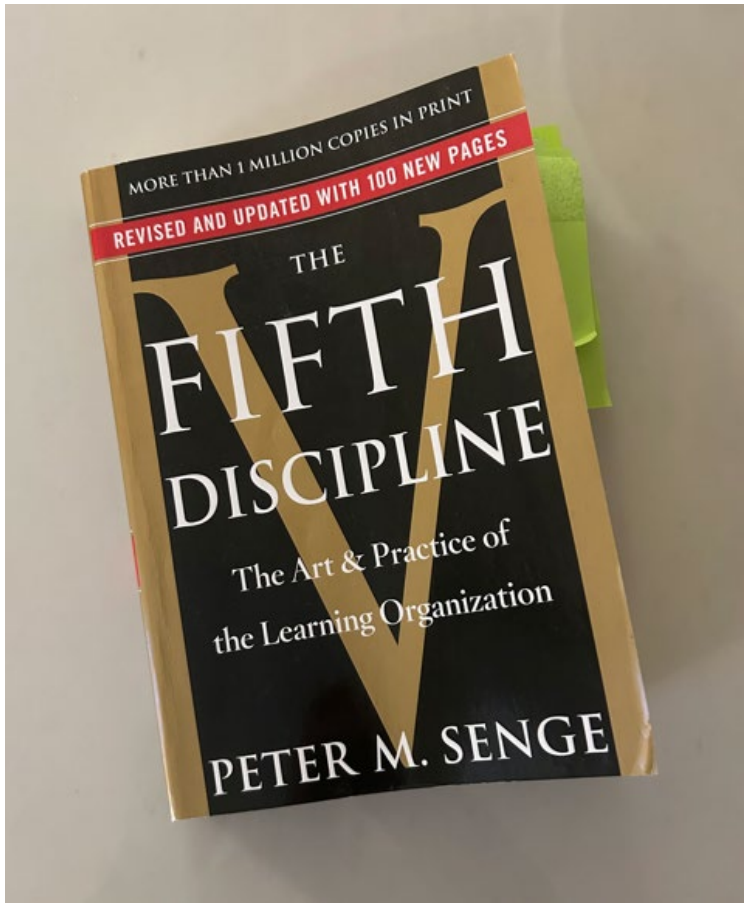
Digital transformation
Continuous systemic change occurring at different paces and levels due to digitalization, affecting organizational tools, working methods, processes, social relations, learning, culture, thinking patterns, and service delivery *(Mergel et al., 2019; Pittaway et al., 2020; Vial, 2019)*

Civil servants' digitalization readiness
Individual's ability and preparedness to utilize devices, software, digital materials, and remote work in their public organization duties *(Deja et al., 2021; Konttila et al., 2019; Trenerry et al., 2021)*

Senge's systems theory of learning organizations in the context of digitalization

According to the widely used Senge's (2006) systems theory, organizations should consider the following to succeed in continuous change:

- 🎓 Personal mastery → Digital mastery
- 🔍 Mental models → Digital mindset
- 🤝 Team learning → Digital team learning
- 🎯 Shared vision → Shared digital vision
- 🕸️ Systems thinking → Digital systems thinking



🎓 Digital mastery

Personal mastery is a continuous process of individual growth and learning toward meaningful goals through self-reflection and awareness of the gap between current reality and personal vision.

Digital mastery application

- Ability to utilize digital tools, software, materials, and remote work
- Regular self-assessment of digital skills and learning needs
- Creative tension between current digital capabilities and goals ("creative digital tension")

Individual level

- Continuous digital learning mindset
- Skills development through experimentation
- Self-directed learning and adaptation

Organizational level

- Enabling continuous digital learning
- Systematic assessment of employee digital capabilities
- Development of digital skills across all organizational levels

Key references: Oberländer et al., 2020; Vallo Hult & Byström, 2022

🔍 Digital mindset

Mental models are deeply ingrained thought patterns that influence how individuals and teams perceive and act, requiring a shift from event-centered thinking to understanding underlying structures and processes.

Digital mindset application
- Self-directed approach to digital solutions, digital literacy, and security awareness
- Willingness to experiment with new technologies and low resistance to digital change

Individual level
- Recognition of personal assumptions about digital tools
- Challenging preconceptions about remote work
- Active engagement with digital learning

Organizational level
- Ongoing dialogue about digital opportunities and challenges
- Leadership fostering experimentation-friendly culture
- Support for innovative digital approaches

Key references: Solberg et al., 2020; Schneider & Sting, 2020; Tagscherer & Carbon, 2023

🤝 Digital team learning

Team learning harnesses group potential through dialogue, where teams become more than the sum of their individuals, with members seeing each other as colleagues learning together.

Digital team learning application

- Collaboration in utilizing digital technologies and data
- Peer support and learning in the digital context
- Shared exploration of new digital capabilities

Individual level

- Peer-to-peer collaboration and learning, sharing digital best practices
- Joint problem-solving in the digital environment, collective experimentation with new tools

Organizational level

- Facilitation of peer learning and infrastructure/platforms
- Support for cross-team digital knowledge sharing
- Creating physical spaces for digital collaboration

Key references: Ngereja & Hussein, 2021; Rupčić, 2022

🎯 Shared digital vision

Shared vision occurs when organizational actors pursue common goals through genuine dialogue, addressing what, why, and how to act, with all levels actively participating in vision creation.

Digital shared vision application
- Alignment of organizational views on digital development
- Common understanding of digital service production
- Collaborative approach to digital strategy

Individual level
- Alignment of personal digital goals with organizational vision
- Participation in technology and hybrid work choices
- Active participation in digital development

Organizational level
- Clear communication of digital transformation vision
- Leadership commitment to digital culture
- Strategic technology choices
- HR and IT governance alignment

Key references: Slåtten et al., 2021; Zasa & Buganza, 2022; Lafioune et al., 2023

Digital systems thinking

Systems thinking represents a shared understanding of continuous interaction between internal and external organizational factors, combining all other disciplines for meaningful future creation.

Digital systems thinking application

- Comprehensive understanding of digitalization impacts (digital transformation)
- Recognition of internal-external interactions
- Integration of stakeholder perspectives

Individual level

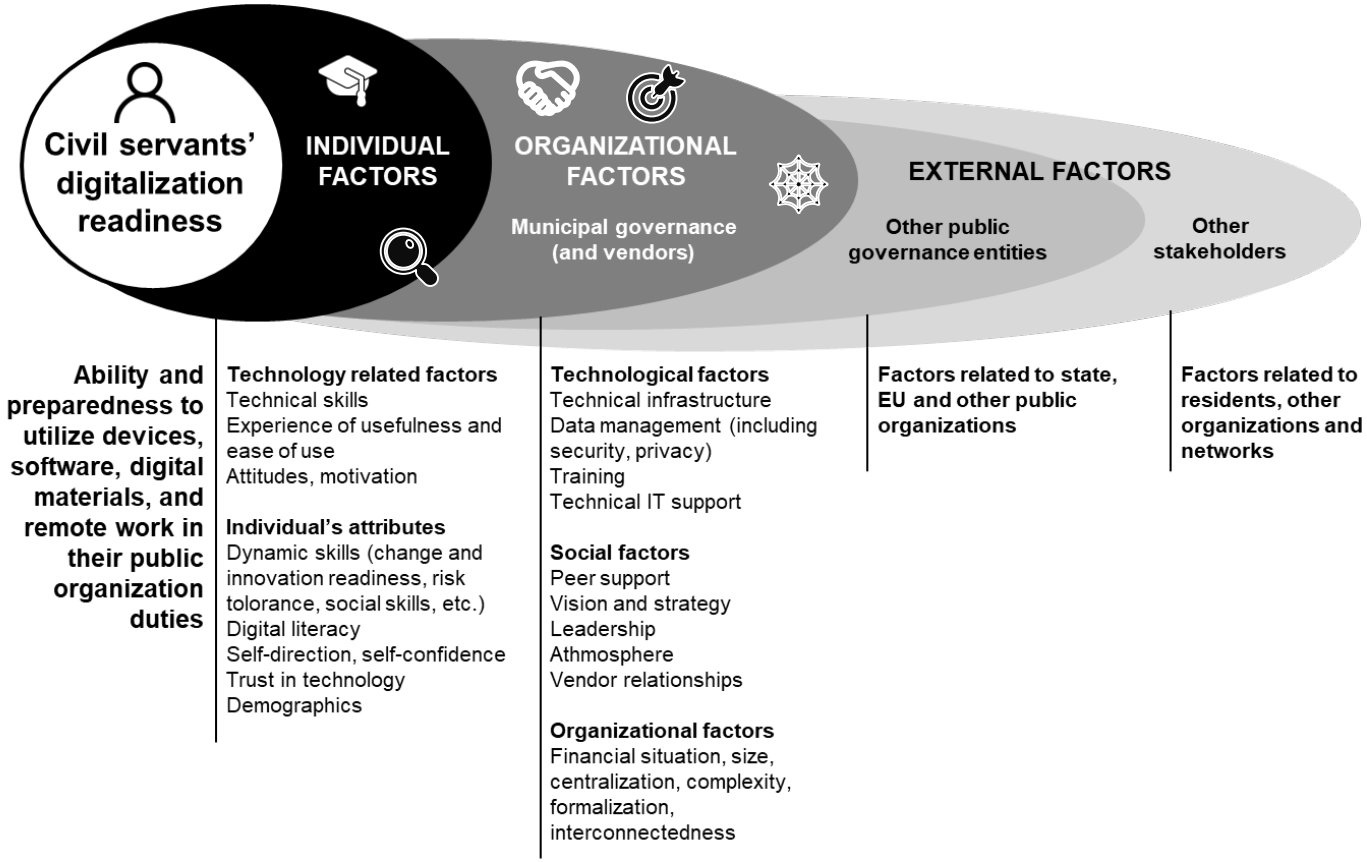
- Understanding organization-wide digital impacts
- Recognition of interdependencies
- Awareness of stakeholder benefits

Organizational level

- Holistic approach to digital transformation
- Continuous data collection and analysis
- Cross-administrative coordination
- Stakeholder engagement (consultants, citizens etc)

Key references: Hoe, 2020; Lafioune et al., 2023; Mergel et al., 2019

Civil servants' digitalization readiness factors in municipal organizations



Support Factors and Mechanisms for Civil Servants' Digitalization Readiness (Pulkkinen et al., 2025)

Applying Cetindamar & Abedin, 2021; Kristensen, 2023; Senge, 2006; Trenerry et al., 2021

Data and methods

148 municipalities, 51 % of mainland Finland

- Online survey targeting all 293 municipalities in mainland Finland
- In the spring 2023
- Response from 148 municipalities (339 individuals)
- Respondents from municipal technical departments (zoning and contruction supervision)
    - Job titles included planner, planning engineer, GIS engineer, building inspector, permit secretary, and technical manager
- Quantitative: Statistical descriptive methods
- Qualitative: Theory-driven content analysis

Main result

Civil servants' digitalization readiness appears to be on average at a good level from the point of view of digital mastery, digital mindset, and team digital learning.

- For example, peer learning of digital skills are perceived as crucial and peer support is generally available. However, providing support creates additional workload for digitally advanced employees

Organizational enabling factors (shared digital vision and digital systems thinking) need development.

- For example, from a systems thinking perspective, key challenges were identified in limited human resources and time constraints, leading to an operational focus on acute service delivery needs rather than strategic development. Two-thirds of employees are unaware of whether their municipality has a digital strategy in place.

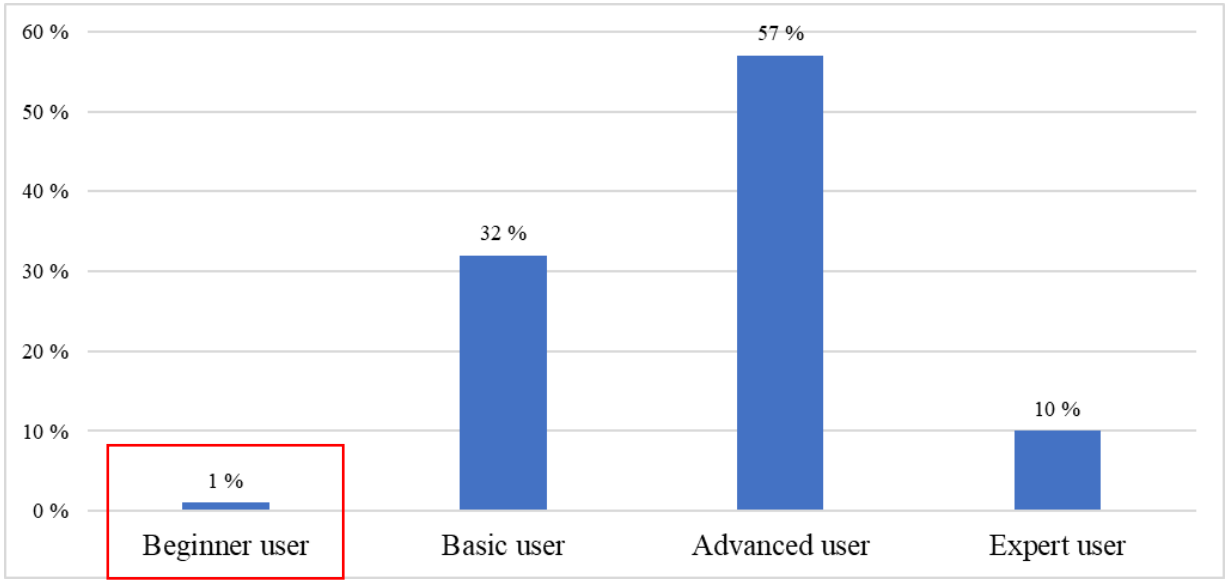
Digital mastery/competence (Likert 1-5)

	Competence	n	Training need	n
Devices and Technologies				
Smartphone	4,1	339	1,8	335
Desktop or laptop computer	4,3	335	2,1	330
3D printer, laser scanner or other 3D technology	3,5	19	2,7	18
Robotics/automation	4,0	5	2,4	5
Drone	3,8	4	2,5	4
Tablet computer	4,1	87	1,8	85
Information model-based planning	3,5	19	3,0	18
Information model-based building permits (IFC models)	2,4	5	4,0	5
General Software				
Office software	4,1	341	2,1	341
Remote meeting and instant messaging tools	4,0	337	2,1	338
Intranet	3,6	267	2,2	267
Case management software	3,2	236	2,7	235
AI applications	2,9	8	2,3	12
Social media used in my work	3,6	63	2,1	62
Industry-specific Software				
Planning software for zoning	3,7	151	2,8	149
Geographic information system	3,6	176	2,9	175
Map service for external use	3,8	145	2,5	141
Permit system for permit processing	4,2	153	2,5	154
Map interface for permits	4,0	140	2,6	140
Geographic information program for permits	4,0	128	2,6	127
Average	3,7		2,5	

Digital mastery/competence (Likert 1-5)

	Competence	n	Training need	n
Municipal service				
Land use planning	3,8	179	2,3	179
Construction supervision	4,0	129	2,3	129
Participates in both	3,7	34	2,4	34
Gender				
Male	3,9	151	2,3	151
Female	3,9	167	2,3	167
Age				
20-29 years	4,1	15	2,1	15
30-39 years	4,1	76	2,1	76
40-49 years	3,9	96	2,3	96
50-59 years	3,8	88	2,3	88
60 years or more	3,7	58	2,5	58
Work experience in the field				
Less than 1 year	4,0	10	2,1	10
1-4 years	3,9	48	2,1	48
5-9 years	4,0	62	2,3	62
10 years or more	3,8	219	2,4	219
Highest education level				
Vocational education or college	3,9	56	2,4	56
Lower university degree	4,0	148	2,2	148
Higher university degree	3,8	131	2,4	131
Main job role				
Manager/supervisor	3,7	60	2,4	60
Specialist/planner	3,9	217	2,3	217
Supporting tasks	3,9	42	2,1	42
Other	4,0	11	2,2	11

Digital mindset



Beginner user I approach digital tools used at work with caution or skepticism. I prefer to try new tools with guidance, I don't fully trust my digital skills. I often need external help

Basic user I know basic functions of digital tools and software. I have a neutral attitude towards digital work tools. I mainly trust my digital skills and know how to seek help when needed. I rarely learn new things

Advanced user I can use most IT solutions and utilize most of their functions. I learn more from time to time, rarely need technical help

Expert user My digital competence is very strong. I may have IT education or work experience. I can use digital work tools and utilize their functions in versatile ways. I often and willingly learn new things, help others

Additionally: Over half of the respondents assessed their competence in **information security, cybersecurity, and data protection** as either good or excellent. Almost all respondents were able to evaluate their information security and data protection competence. Only one in ten assessed their competence in these areas as weak or satisfactory.

Team digital learning

Key findings from qualitative analysis

Role of peer support
- Critical component in developing digital competencies
- Primary support from team colleagues, software administrators, assistants, managers
- Enables learning of specialized software and digital materials
- Example: "Received guidance from colleagues in using planning and GIS software" (P7)

Informal learning dominance
- Majority of workplace learning occurs outside formal training
- Aligns with previous research findings (e.g., Ryky, 2023)
- Varies significantly between municipalities
- Challenge: "I am the support person. Better support is sought elsewhere" (GIS Manager, P1)

Specialized knowledge context
- Technical sector requires domain-specific expertise
- Peer support limited to same field colleagues
- Digital competence development within departments
- Example: "Information model-based planning being implemented, working group established, colleagues guide each other" (Master plan designer, P166)

Peer support paradox
- Expectation for mutual teaching and support
- Creates challenges for advanced users
- Time allocation issues for expert users
- Example: "Those who have learned best support and guide others. This takes considerable time from them" (Planning engineer, P4)

Research implications
- Informal learning critical but needs structural support
- Balance needed between peer support and work duties
- Domain-specific digital learning requires targeted approaches
- Organizational support mechanisms crucial for sustainable development

Shared digital vision

Key findings from qualitative analysis

- **Most municipalities lack a clearly shared digital vision**, as evidenced by two-thirds of employees being uncertain whether a digitalization strategy even exists, and only 15 percent affirming the existence of one.
- Although internet connectivity is widely regarded as good or excellent (81 percent) and 96 percent of respondents have access to remote work options, **practical support for digitalization often falls short**, with employees sometimes bearing responsibility for procuring software and training.
- From Senge's learning organization viewpoint, the absence of a well-communicated shared vision and a cohesive strategy indicates that system-wide learning and development are not fully realized. This can lead to duplicative or incompatible software purchases and uneven skill-building efforts.
- Managers and supervisors are generally positive about digitalization, but limited resources and unstructured training place the burden on individual employees to seek out the necessary tools and expertise. This approach risks creating disparities within teams and undermines long-term organizational learning and efficiency.
- Strengthening strategic guidance and ensuring appropriate support—from clear technology roadmaps to robust onboarding—would help municipalities create a more cohesive digital culture, where employees, supervisors, and leadership pursue common goals and continuously improve together.

Digital systems thinking

Key findings from qualitative analysis

- Using digital tools and materials is **an everyday practice in service production**. However, limited staffing and time constraints are viewed as the main barriers to systemic thinking, as the **focus often shifts to handling immediate issues**.

- Employees also require digital readiness when interacting directly with **customers**
  "We recently received excellent results in our customer satisfaction survey, so clients also appreciate our digital-age service. I wouldn't want to go back to the old paper era." (H307)

- **Collaboration with consultants and software providers** was generally reported as functional, although some respondents found the providers' support and training to be inadequate.

- Issues related to outsourcing pose ongoing problems.
  Many municipalities face rising software costs, inconsistent remote work policies across different units, and limited familiarity with specialized tools due to outsourcing:
  "We don't currently draft our own plans; it's all done by an external service provider. As a result, we hardly use the planning software ourselves, so we never really learn it." (P337)

- The role of technical services within municipalities is increasingly reduced to that of a mere buyer organization, potentially narrowing its overall contribution to municipal development:
  "It feels like urban planning is turning into nothing more than a purchasing organization." (P121)

Discussion and conclusions

- Extends existing digital readiness research in administrative sciences (often centered at the organizational level) by highlighting the civil servants' perspective

- Key theoretical contribution in holistic lens: Senge's (2006) systems theory accounts adaptation for individual, organizational, and external factors shaping digital readiness. Emphasizes continuous learning, reflecting how digital changes impact tools, processes, mindsets, and service delivery

Main findings

- Employee digital skills: Only ~1% self-identified as beginners, but many lack formal training and rely on peer support, underscoring the need for structured organizational backing.
- Digital vision & strategy: Two-thirds of employees remain unaware of any municipal digitalization strategy, suggesting communication gaps or the absence of formal strategies.
- Age factor: Older employees report lower self-assessed digital competence and higher training needs, aligning with prior studies.
- Organizational support: Incomplete or ad hoc training, limited resources, and unclear strategic direction hinder full realization of digital potential.

Discussion and conclusions

Implications

- Minimum baseline of support: Municipalities should provide essential infrastructure, training, and leadership to nurture digital readiness.
- Leverage points: Small, well-timed interventions can yield significant improvements, but identifying these requires systemic thinking and recognition of feedback loops.
- Workforce appeal: Strong digital support can bolster recruitment and retention in an industry facing skills shortages.

Future research

- Explore how organizational structures and external pressures (e.g., legislation, software providers) shape digital readiness over time
- Use systems theory to map feedback loops, evaluate long-term effects of training investments, and identify the most effective pathways to harness digital transformation benefits.

Thanks for your time!

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