Digitalization in the Water and Wastewater Sector

A survey-based analysis of digitalization in the Swedish water and wastewater sector

Report from Vattenindustrins Internship Program 2026

Anna Hademalm
Elvire Roualle De Rouville
Karl Widlund
Tindra Aminoff

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1. Introduction

Sweden's water and wastewater (WWW)-sector is facing increasing pressure. Ageing infrastructure, climate-related challenges, rising operational costs and growing investment needs all place new demands on utilities. At the same time, nearly 20% of all drinking water produced never reaches the customer, largely due to leakage in distribution networks (Svenskt Vatten, 2024). This represents wasted energy, chemicals, treatment capacity and lost resilience.

Digitalization is often presented as part of the solution, but how far has the sector actually come and what prevents further progress? Many industries have already been transformed by digitalization, yet the water sector has historically lagged behind. Today, Swedish municipalities and water organizations use digital tools to very different degrees. Some have advanced monitoring systems and integrated data platforms; others still rely heavily on manual routines.

This report provides an overview of:

- How digitalization is currently used in the Swedish water and wastewater sector
- What different actors believe about digital development
- Where the biggest gaps and barriers exist
- Examples of digital solutions already in use
- Where future potential is greatest

These insights form the foundation for understanding how digitalization is evolving within the WWW-sector. They illustrate both the enthusiasm and the challenges that accompany technological change, from competence gaps to organization inertia. The goal is to make digitalization in the water sector understandable, accessible and relevant.

Nearly 20% of Swedish drinking water is lost before reaching the customer. Every lost litre has already been abstracted, treated, pumped and monitored. Reducing leakage saves water, energy, chemicals and treatment capacity while improving resilience.

1.1 Limitations

This report is based on multiple sources of information.

- Survey responses from municipalities, consultants, suppliers and entrepreneurs
- Discussions with industry professionals

- Field visits conducted during the internship
- Literature and previous research

The results reflect perceptions, not objective measurements. Respondent numbers vary between groups and interpretation of “digitalization” differ depending on role and responsibility. To enable comparison, several survey responses were grouped into broader categories, which may reduce nuance.

While the survey provides valuable insights, it also reflects the perspectives of limited number of respondents. Therefore, the results should be seen as indictive rather than exhaustive, pointing to trends and areas for further exploration.

2. Survey Data and Stakeholder Groups

Parts of the analysis presented in this report are based on responses collected through a survey distributed within the Swedish WWW-sector. A total of 221 survey responses were received, of which 209 were included in the analysis. Respondents were grouped into four stakeholder categories:

- Municipalities (administrators + utilities)
- Suppliers (technology providers + system integrators)
- Consultants
- Entrepreneurs

A small number of responses (n = 9) originated from other types of organizations, including industry organizations, universities, association and a petrochemical company. Due to the limited number of responses within these categories, they were excluded from the comparative stakeholder analysis. Three respondents did not specify an organizational category and were therefore not included either.

Figure 1 show the distribution of respondents within each stakeholder group.

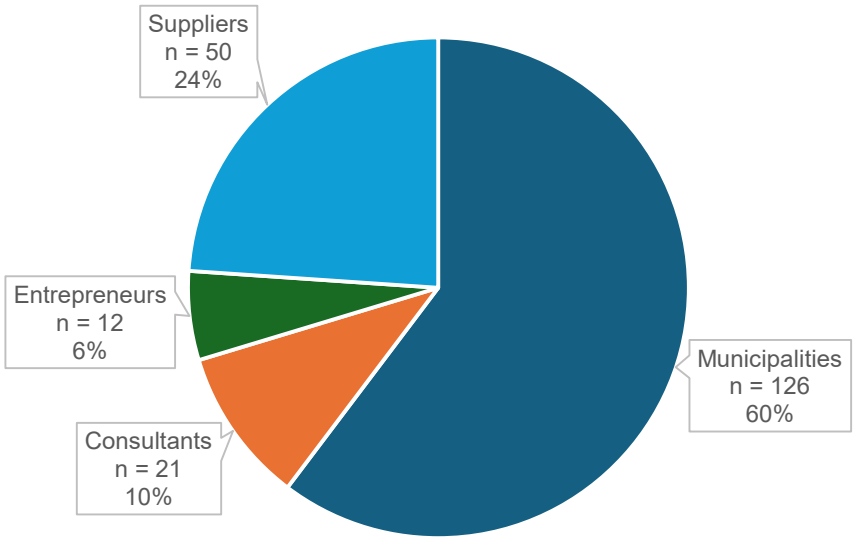

Figure 1. Distribution of respondents within each stakeholder group.

This grouping makes it possible to compare how different parts of the value chain perceive digitalization, barriers and future priorities.

2.1 Indexes Based on Survey Responses

To provide an overall assessment of the current state of digitalization, four indexes were calculated based on survey responses. The indexes are defined as follows:

- The **Digital Maturity Index** measures the current level of digital maturity within the municipal sector.

- The **Perceived Industry Maturity Index** reflects respondents' assessment of the overall digital maturity of the Swedish WWW-sector.
- The **Implementation Index** measures the organizational conditions required for successful digital transformation.
- The **Future Readiness Index** measures preparedness for future digital development.

All index values are presented on a scale from 0 to 100, where:

- 0-39 = Low maturity
- 40-59 = Basic maturity
- 60-79 = Developed maturity
- 80-100 = High maturity

These indexes form the foundation for the analysis in later chapters, and results are presented in chapter 4.2

3. Defining a Digital Water and Wastewater Sector

To be able to discuss how digitalization can help us move forward, we first need to identify where the industry stands today. How far have we come in the digitalization process, and does the level of digitalization vary among different stakeholders?

One of the clearest findings from the survey is that there is no shared definition of a digital WWW-sector. While respondents largely agree on the direction of development, different actor groups emphasise different purposes, technologies, and outcomes. Overall, digitalization is seen as a shift from manual and reactive operations toward integrated, proactive, and increasingly automated ways of managing water and wastewater services. However, perspectives differ depending on each respondent's role in the value chain.

Municipal actors primarily describe digitalization as an operational support function. Their responses focus on creating reliable access to information, replacing analogue routines, and improving day-to-day operations through integrated systems, digital measurements and improved decision support. Concepts such as GIS, monitoring systems, modelling tools and operational efficiency appear frequently.

Suppliers describe digitalization in broader system terms. Their responses emphasise connected infrastructure, integration between systems, real-time data exchange and automation. These respondents more frequently mention AI, predictive maintenance, cybersecurity, and scalable data environments as key building blocks of a future digital water sector.

Consultants position themselves somewhere between strategy and operations. Their responses focus less on individual technologies and more on visibility, coordination, and enabling better decision-making through digital tools. Digitalization is often described as a transition from manual management toward systematic, information-driven operations.

Entrepreneurs generally describe digitalization from a practical implementation perspective. Their responses highlight automation, operational data, remote monitoring and practical improvements in safety and operational performance.

Although the terminology differs, all groups share one common underlying assumption: digitalization is not perceived as an isolated IT initiative but as a broader transformation of how water services are operated, maintained and developed.

A digitalized WWW-sector can be defined as a connected, data-driven and operationally integrated sector that uses digital technologies, information and automation to improve decision-making, operational reliability, resilience and long-term sustainability.

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4. Perceived State of Digitalization

The survey results show a sector that has made significant progress in digitalization but has not yet reached a high level of digital maturity. Digital technologies are already widely used in many operational areas, and attitudes toward digital development are overwhelmingly positive. At the same time, the results reveal a clear gap between current capabilities and future ambitions.

Taken together, the findings suggest that the Swedish WWW-sector is no longer asking whether digitalization is necessary. The challenge has shifted toward implementation, integration and realizing value from existing technologies.

4.1 Perceived Progress and Attitudes

The respondents define digitalization from different operational perspectives but their assessment of the current state of digital development shows relatively limited variation across stakeholder groups, as shown in Figure 2.

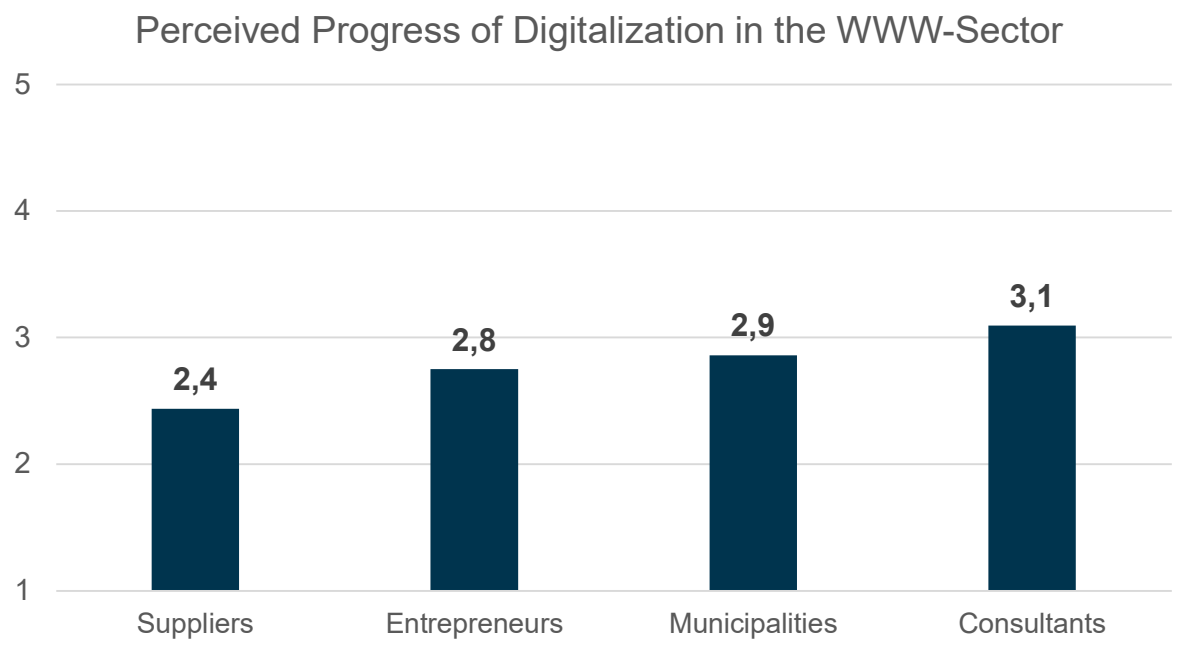

Figure 2. Perceived progress of digitalization in the water and wastewater sector, where 1 = low and 5 = high perceived progress of digitalization.

All groups place the sector within what can be described as a moderate stage (2.4-3.1) of digital development rather than either early adoption or advanced digital maturity. This relatively small spread suggests that respondents broadly share the same perception of where the sector currently stands, even though they describe digitalization differently. This assessment is further supported by observations from the site visits conducted during the project. Many organizations demonstrated substantial progress in areas such as monitoring, automation and digital decision

support, while simultaneously highlighting challenges related to integration, implementation and organizational adoption.

Although respondents differ in how digitalization is defined and where value is created, perceptions of its overall importance show considerably stronger alignment, as shown in Figure 3.

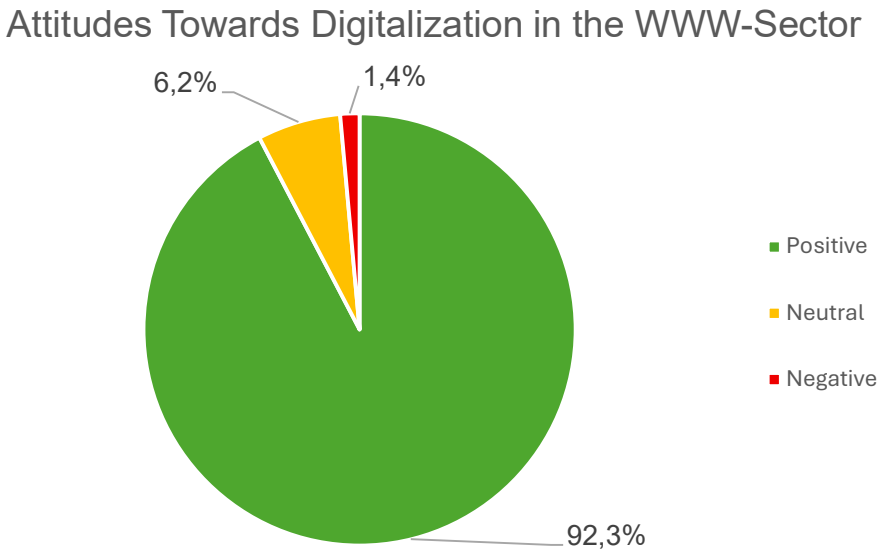

Figure 3. Attitudes towards digitalization in the WWW-sector showing the distribution of answers with the majority being positive.

Figure 3 shows that digitalization is overwhelmingly viewed as either an opportunity or a significant opportunity across all respondent groups. More than 90 percent of respondents perceive digitalization positively, while responses identifying digitalization primarily as a risk or threat are almost absent. Overall, the distribution of response indicates a broadly positive perception of digital development and suggests that digitalization is generally associated with opportunities for improvement rather than uncertainty or threat. This indicates that there is no resistance to a digital change within the sector. Instead, the challenge has shifted from acceptance to execution. As the sector appears united, the remaining challenge is turning that belief into practical and measurable results.

The sector believes that digitalization is important. The challenge is no longer acceptance, but execution.

4.2 Digital Maturity and Preparedness

How digitally mature is the sector today, and how prepared is it for what comes next? Four indexes were used to capture different parts of this picture: *Digital Maturity*,

Perceived Industry Maturity, *Implementation Capacity*, and *Future Readiness*. The resulting index values are summarized in Table 1.

Table 1. Summary of calculated digitalization index values. Values are presented on a 0-100 scale, where 0-39 indicates low, 40-59 basic, 60-79 developed, and 80-100 high maturity.

Index	Municipalities	Consultants	Suppliers	Entrepreneurs
Digital Maturity	51	N/A	N/A	N/A
Perceived Industry Maturity	47	34	33	44
Implementation	47	58	57	52
Future Readiness	71	72	68	70

N/A = Not applicable

The results reveal a clear contrast between where the sector is today and where it expects to be further ahead. Current maturity and *Implementation* remain at basic to moderate levels, while *Future Readiness* is considerably higher across all stakeholder groups.

An interesting finding is that municipalities assess the sectors overall *Perceived Industry Maturity* higher (47) than consultants (34), suppliers (33) and entrepreneurs (44). One possible explanation is that municipalities primarily assess digital maturity based on their own organizational context, whereas the other stakeholders are exposed to a wider range of technologies, projects and organizations across the sector. This broader perspective may lead external actors to adopt a more critical assessment of the sectors overall maturity and to identify a larger gap between current practices and available digital capabilities. As a result, external actors perceive lower overall sector maturity despite being associated with higher levels of digital implementation. This indicates that exposure to a broader range of digital solutions may raise expectations regarding what constitutes a digitally mature organization.

4.3 From Reactive to Proactive

Figure 4 illustrates the average perceived proactivity across all stakeholder groups.

Figure 4. Average perceived proactivity of WWW-sector by stakeholder group, where 1 = clearly reactive and 5 = clearly proactive.

On a scale from 1 (clearly reactive) to 5 (clearly proactive), the sector scores an average of 2.47, placing it slightly below the midpoint. This suggests that respondents generally perceive the sector as still operating in predominantly reactive

manner, despite ongoing digitalization efforts and increasing use of digital technologies.

At the same time, the broader findings of this study indicate that the sector is moving towards a more proactive future. Many of the digital solutions currently being implemented, such as monitoring systems and automation are specifically intended to enable earlier interventions, predictive capabilities and more proactive management. This relatively low proactivity score can therefore be interpreted as a reflection of the sectors current state rather than its intended direction of development. Taken together, the results indicate a shared belief that digitalization can support the transition from reactive operations towards a more proactive and resilient WWW-sector.

4.4 Technology Use in Water and Wastewater Operations

This section examines the use and development of digital technologies in WWW operations from two perspectives. The municipal perspective reflects technologies currently in use, while the external perspective highlights areas of future development.

4.4.1 Municipality Perspective

The survey results show that digital technologies are already well established in several core operational areas of municipal WWW services, as shown in Figure 5.

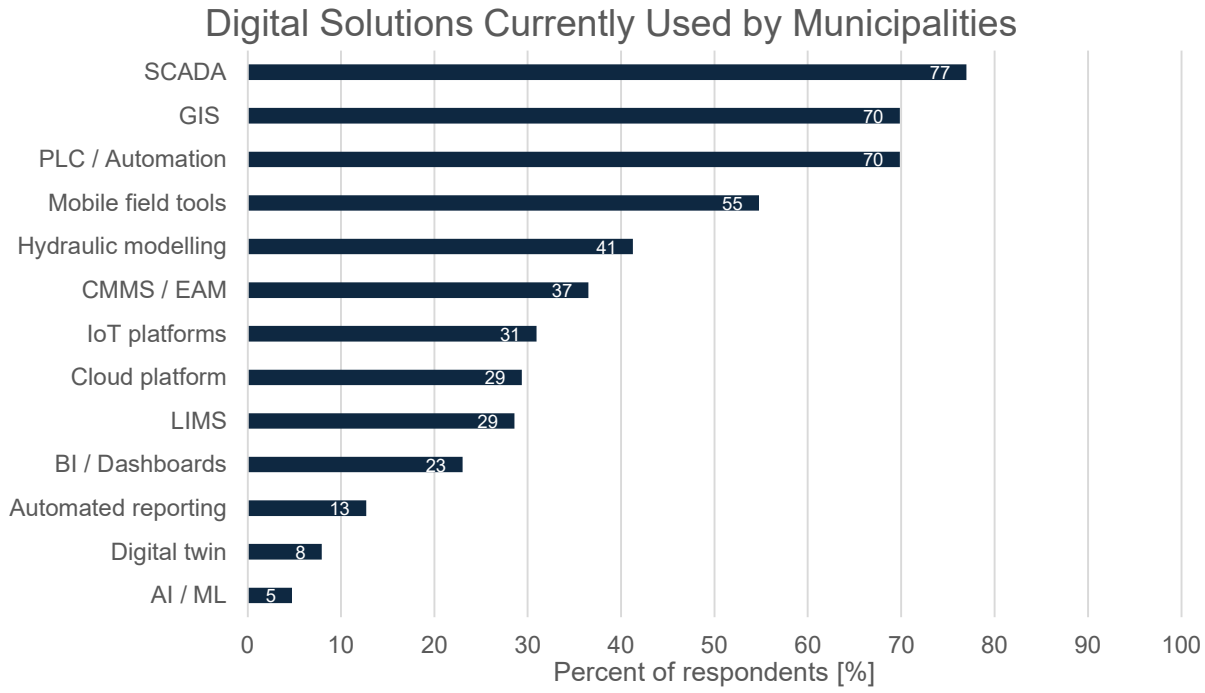

Figure 5. Digital solutions currently used by municipalities. Values represent the percentage of respondents selecting each solution. Multiple responses were allowed (≤3).

SCADA systems, PLC-based automation and GIS were the most frequently used reported technologies, used by approximately 70 to 77 percent of responding municipalities. Mobile field solutions for fieldwork were also widely adopted, indicating that digital tools become integrated into many day-to-day operational activities. Other technologies showed moderate levels of adoption, which suggest that digitalization is gradually expanding beyond traditional operational control systems into areas related to maintenance, monitoring, and data management.

In contrast, technologies associated with advanced analytics and automated decision support remain relatively uncommon. Automated reporting, digital twins, and AI-based solutions were reported by fewer than 15 percent of respondents.

The findings indicate that municipalities have largely completed the first phase of digitalization, characterized by the deployment of operational technologies and digital infrastructure. The next phase appears to involve connecting, integrating, and extracting greater value from the information these systems generate.

4.4.2 External Perspectives

While municipalities show what is already in use, suppliers, consultants and entrepreneurs provide a glimpse of what organizations are asking for next, as shown in Figure 6.

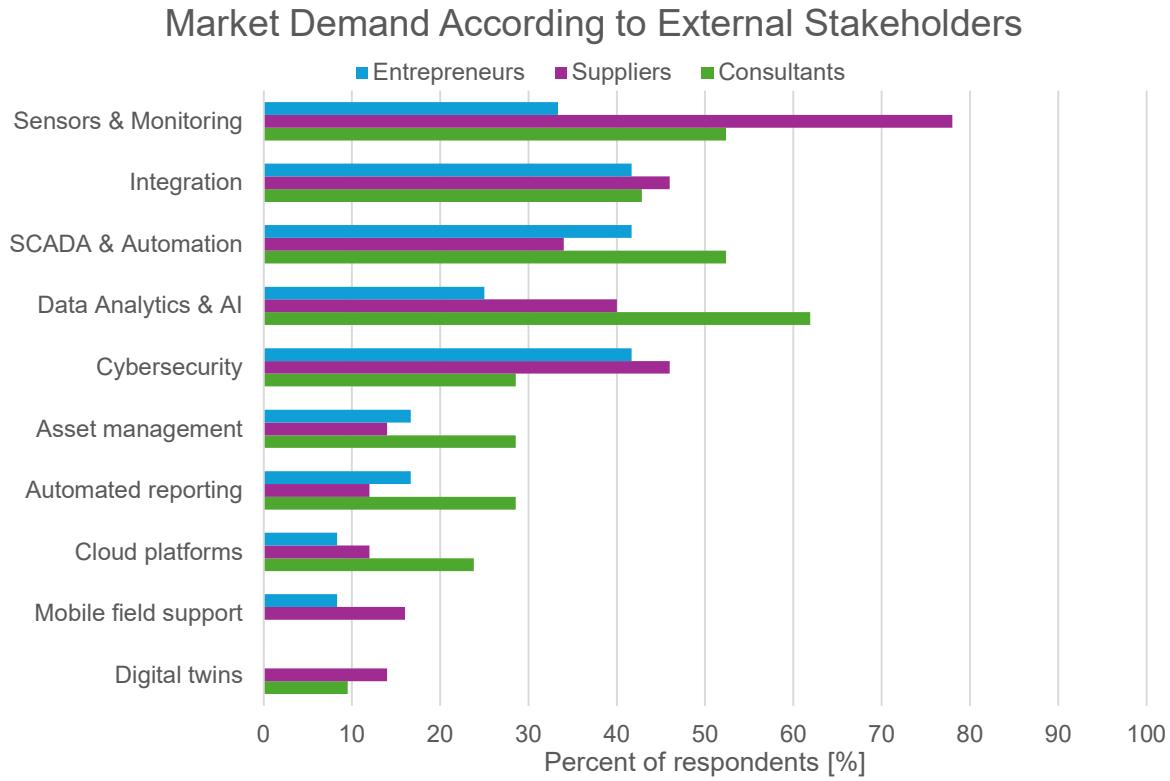

Figure 6. Most frequently requested digital solution areas according to entrepreneurs, suppliers, and consultants. Values represent the percentage of respondents selecting each area. Multiple responses were allowed (≤5).

Sensors and monitoring systems, system integration, SCADA and automation solutions represent the strongest areas of demand among all external stakeholder groups. The consistency of these findings suggests that many organizations are currently focused on strengthening the digital foundations required for more data-driven operations.

This indicates that the sector may be entering a new phase of digitalization. The first phase focused on deploying digital tools and control systems. The next phase appears to focus on integrating these systems and creating value from the data they generate. The demand for data analytics, AI-based solutions, and cloud platforms further supports this interpretation. While adoption of advanced analytical technologies remains relatively limited among municipalities, external stakeholders report growing interest in solutions that help organizations transform operational data into actionable insights.

Future progress will depend less on acquiring new technologies and more on the ability to integrate existing systems and create value from the data they generate.

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5. Challenges to Digital Transformation

This chapter examines the barriers that continue to slow digitalization in the Swedish WWW-sector. By comparing responses from different stakeholder groups, the analysis identifies both the most frequently perceived barriers and the underlying organizational gaps that may explain why digitalization progresses at different rates across the sector.

5.1 Current Barriers to Digitalization

While budget constraints and competence gaps emerge as the most frequently cited barriers across all stakeholder groups, a closer examination reveals important differences in how these challenges are experienced depending on the respondent's role in the sector. Figure 7 presents the five most commonly current identified barriers across all stakeholder groups.

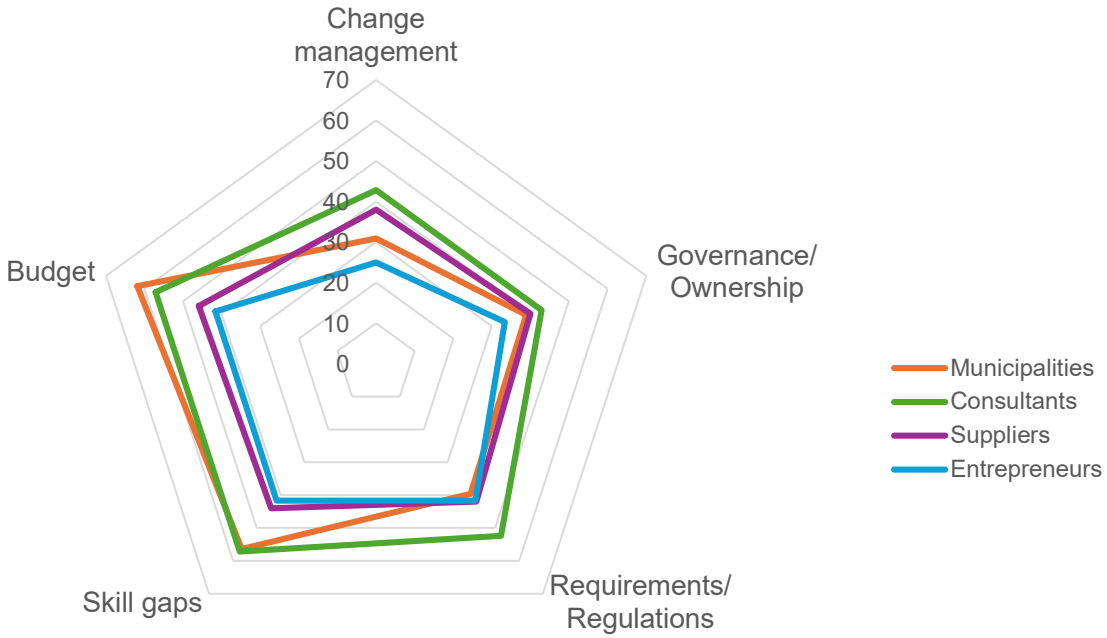

Figure 7. The five most frequently identified barriers to digitalization in the WWW-sector. Values are presented on a 0-100 scale [%].

Figure 7 presents the barriers most frequently identified across all stakeholder groups. Lack of budget emerges as the most important challenge, followed by skill gaps. Notably the most frequently cited barriers are organizational rather than technological. This suggests that the sectors digitalization challenges stem less from the availability of technology and more the capacity to implement, manage and sustain digital transformation initiatives. Budget constraints, competence shortage and weakness in governance appear to be closely interconnected. Organizations with limited digital expertise may struggle not only to implement new technologies but also to develop clear strategies, establish ownership structures and demonstrate the value generated by digital investments.

While municipalities primarily emphasize internal capacity constraints, external stakeholders highlight additional challenges related to organizational and regulatory conditions. Consultants, suppliers and entrepreneurs more frequently identify unclear requirements and regulatory complexity as barriers to successful digitalization. These factors can create uncertainty during planning and implementation, even when digital solutions are technically available.

Taken together, the findings indicate that digital transformation in the Swedish WWW-sector is constrained by a combination of internal capacity limitations and external implementation challenges. Successful digitalization therefore requires not only increased resources and competence, but also clearer requirements, stronger governance structure and a regulatory environment that supports innovation and implementation.

5.2 Governance and Accountability within Digitalization

To assess governance-related aspects of digitalization, respondents were asked about the existence of digital strategy and roadmap, the clarity of ownership and responsibility, and the extent to which benefits from digital initiatives are systematically monitored and evaluated. The results are presented in Figure 8.

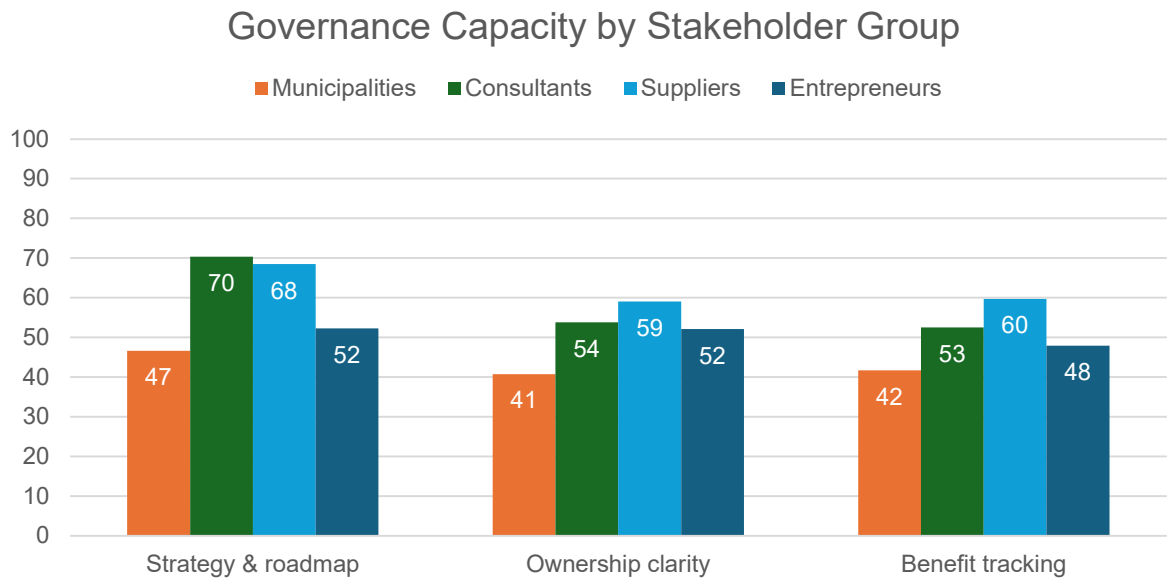

Figure 8. Governance-related digitalization capabilities across stakeholder groups. Values are presented on a 0-100 scale, where higher values indicate stronger agreement.

Figure 8 reveals a consistent pattern. Strategy and roadmap received the highest scores across all groups, while ownership clarity and benefit tracking generally received lower ratings, particularly among municipalities. The results suggest that organizations are more mature in defining strategic ambitions for digitalization than in establishing governance mechanisms that support implementation.

However, significant differences can be observed between stakeholder groups. Municipalities consistently report lower scores than consultants and suppliers across all governance dimensions. The largest gap is found for strategy and roadmap, where municipalities score below 50, compared with around 70 among consultants and suppliers. This may indicate that municipalities lack a clearly defined long-term digitalization strategy or that existing strategies are not sufficiently communicated and embedded within the organization. As a result, digitalization may be driven more by individual projects, operational needs or local initiatives rather than by a coherent strategic vision.

Benefit tracking receives comparatively low scores across all stakeholder groups. This suggests that the sector may still struggle to systematically measure and communicate the value generated by digital investments. Without clear evidence of benefits, securing funding and organization support for future initiatives becomes more difficult.

The findings also point to a broader governance and accountability challenge. Lower levels of perceived ownership clarity indicate uncertainty regarding who is responsible for driving, coordinating and following up digitalization efforts. The governance results reinforce earlier findings regarding competence and resource constraints within municipalities. Organizations lacking digital expertise may also struggle to establish clear ownership structures, develop strategic roadmaps and track benefits of digital investments.

5.3 Perceived Barriers for Continued Digitalization

The survey included a question regarding what respondents consider to be the biggest obstacles to continued digitalization. Given a few alternatives, participants were able to choose multiple responses. Results are illustrated in Figure 9.

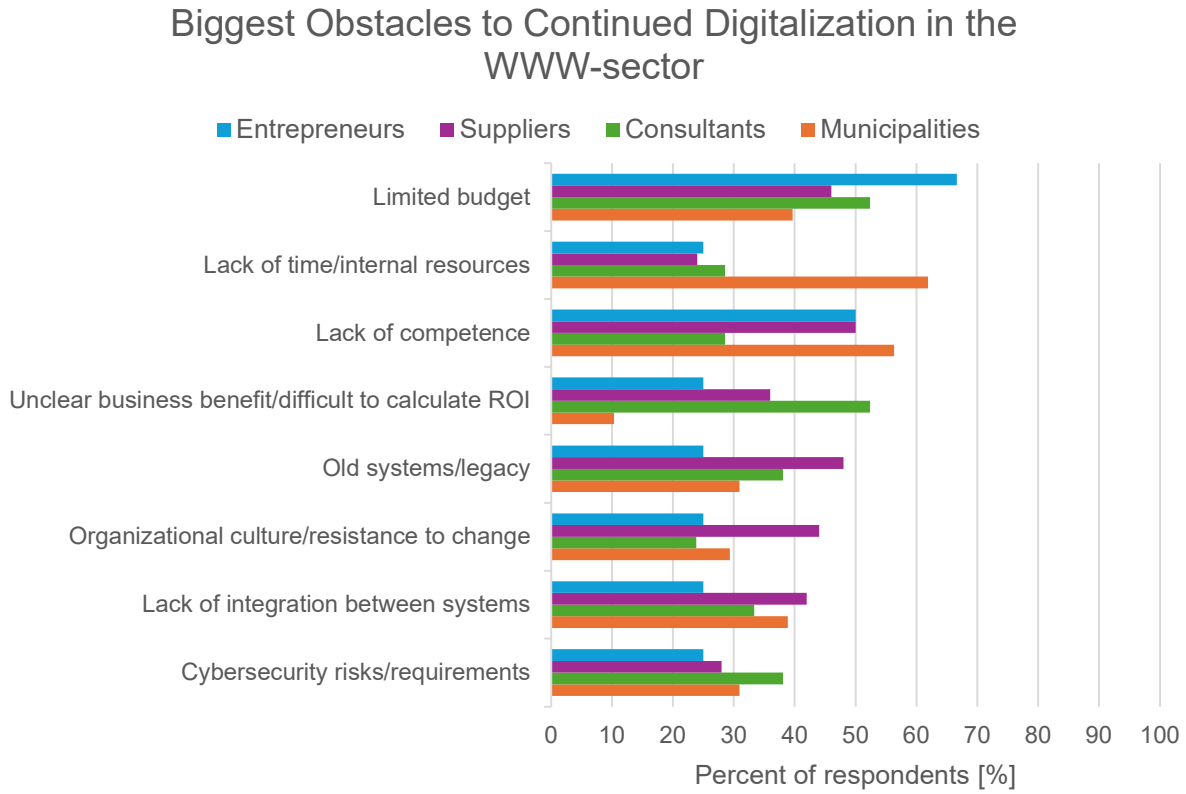

Figure 9. Perceived barriers to digitalization, by stakeholder group. Multiple responses were allowed (≤5). Only the most frequently selected options are shown.

The most consistently identified barrier is limited budget. This suggests that digitalization initiatives are still competing with other operational and infrastructure investments for funding. Despite broad agreement on the importance of digitalization, financial constraints remain a key factor limiting the pace of implementation. This finding is further reinforced by responses regarding funding mechanisms, where substantial share of participants reported that they did not know how digitalization efforts were financed within their organizations. Such uncertainty may indicate that digitalization is not yet fully integrated into strategic investment planning. Additionally, site visits and conversations with sector professionals gave a similar impression; one of the main barriers to digitalization within the WWW-sector is lack of money.

Municipal respondents are more likely to identify lack of internal resources and lack of competence as key barriers to continued digitalization. One possible explanation is that many organisations lack dedicated staff with the time, expertise and mandate to drive digital development. When digital competence is limited, it can be difficult to assess the potential value of new solutions and develop a strong business case. This supports why consultants more frequently identify unclear business benefits as a barrier, which suggests that the challenge is not only financial, but also organizational, as lack of digital capabilities can reduce the sector's ability to recognize and realize long-term value of digitalization.

6. Examples of Existing Digital Solutions

Even though the WWW-sector lacks digital solutions in comparison to other industries, some solutions do exist. However, it is important to acknowledge that most of them have only been implemented on a small scale and/or haven't been tested over a longer period. Most importantly, the degree of implementation varies significantly throughout the sector. The examples mentioned are either based on field visits or discussions with industry professionals.

6.1 Data-driven Treatment Plants

Treatment plants, pump stations, and other process stages are often located in remote areas. Multiple operators may therefore be required to ensure that the plants function as intended, by continuously monitoring equipment and responding to operational issues. Today, data-driven solutions enable real-time monitoring and control of remote sites, reducing the need for operators to be physically present while ensuring reliable and efficient plant operation.

Specific Case Example: ASB

ASB specializes in digitalization and control systems for the water cycle, using SCADA solutions to provide real-time monitoring and control of wastewater treatment plants and pumping stations. Their systems enable operators to access real-time data remotely through computers and mobile devices, while receiving alarms and notifications to support rapid responses to operational issues.

6.2 Leakage Detection and Distribution Network Management

Water distribution networks represent one of the areas where digitalization can generate substantial operational benefits. Water losses caused by leakage increase production costs, energy consumption, and chemical use while reducing the resilience of the drinking water supply. Digital technologies such as smart water meters, pressure sensors, acoustic leak detection, and continuous network monitoring allow municipalities to detect abnormal conditions much earlier than traditional inspection methods (Islam et al. 2022). Reducing water losses not only conserves water resources but also lowers operating costs throughout the entire treatment and distribution process. By strengthening the digital monitoring of distribution networks, leakage management is expected to become increasingly proactive rather than reactive.

Specific Case Example: SmartBall

SmartBall is a free-swimming inspection platform designed to detect leaks in pressurized water pipelines without taking them out of service (Xylem, n.d.). Using acoustic measurements, it detects and locates leaks along the pipeline.

6.3 Smart Stormwater Management

Stormwater systems have traditionally been designed to transport excess water and reduce flood risks. However, digital technologies create opportunities to manage stormwater more proactively. Water level sensors, flow measurements, weather forecasts, and remote monitoring enable operators to continuously assess storage capacity and anticipate future inflows. Such information allows municipalities to optimize stormwater ponds before major rainfall events while retaining water that may later be reused for non-potable purposes. Instead of functioning solely as drainage infrastructure, stormwater facilities can therefore become active components of integrated water resource management.

Specific Case Example: Mölndals creek

Mölndals creek has historically had several floods. Numerous measures have, and are currently, therefore being made to prevent future floods (Mölndals stad, 2026). This includes dredging lakes but also building embankments and lines to manage water storage and water flow. Management of these solutions involves both digital data as well as automated steering. Digital data enables fewer site visits for manual intervention than what would be required without it.

6.4 Groundwater Management

Groundwater management plays an important role not only in relation to water use, but also in the construction of large buildings and infrastructure projects. Changes in the groundwater table can in the worst-case scenario lead to settlements and damage to constructions. The possibility of digitally monitoring and managing groundwater levels to ensure that projects run safely is therefore beneficial. Risks are identified in an early stage and can therefore be addressed.

Specific Case Example: Smeyers

The Belgian company Smeyers manage their groundwater with real-time monitoring of their dewatering pumps (Cardeña, 2026). Their specific case required the possibility of stopping pumps during faults or overloads, considering groundwater being contaminated with PFAS. The risk of human error was therefore minimized, at the same time as manual intervention was reduced.

6.5 Data Collection and Analysis with AI

Data management within the water and wastewater sector plays an important role in support of decision-making processes. However, identifying the data relevant to a specific project or geographical area often requires reviewing large volumes of documents, which can be time-consuming. By using AI to analyse and sift through these documents, relevant information can be identified and compiled efficiently, reducing the time and personnel required.

Specific Case Example: Sweco Smart Water

Sweco Smart Water is an AI-service aimed at municipalities, which offers to collect and analyze historical data. The municipality provides the service with specific documents, after which the service can sift through them.

6.6 Collaborative Digital Solution: Water Reuse and Irrigation

A problem for one stakeholder could be a solution for another. While many digital solutions improve efficiency within a single municipality or facility, some of the greatest potential benefits arise when information and decision-making are shared across multiple stakeholders.

One example of cross-sector collaboration is the reuse of treated wastewater or stormwater for irrigation. Instead of discharging water directly into receiving waters, municipalities can make treated water available for agricultural users, golf courses, parks, or industrial facilities where drinking water quality is not required.

Specific Case Example: Golf course

During a site visit to a golf course, it was observed and explained how water from a nearby watercourse, containing significant levels of contaminants, was used to irrigate the entire golf course. Pumps and sprinklers were remotely managed from a distance, reducing time and effort to maintain high-quality grass. Thus, a problem for the municipality, in this case contaminated water, was being treated by filtration through the soil at the golf course. At the same time, the golf course had no need to buy treated water to irrigate their grass. A win-win situation.

Digitalization plays an important role in enabling such solutions. Sensors, online water quality monitoring, flow measurements, and automated control systems provide continuous information about water availability and quality. This allows water to be allocated safely while ensuring that predefined quality requirements are maintained. Digital platforms can also support communication between water producers and end users, enabling more efficient planning of water distributions during periods of drought or high demand.

7. Future Developments and Digitalization Outlook

The previous chapters have described the current state of digitalization in the Swedish WWW-sector and identified the barriers that continue to slow progress. This chapter looks ahead.

Across all stakeholder groups, the survey results indicate strong confidence in continued digital development. Expectations of increased investments, growing use of digital technologies, and higher levels of automation suggest that digitalization will remain a strategic priority during the coming years.

At the same time, the findings indicate that future progress will depend on more than technology alone. Challenges related to competence, governance, system integration, and organizational capacity continue to limit the sector's ability to fully realize the value of digital solutions. As a result, future success will depend not only on what technologies are adopted, but on how effectively they are implemented, integrated, and scaled across the sector.

7.1 Future Priorities and Emerging Technologies

To better understand the future direction of digitalization, respondents were asked both which areas should receive greater attention, and which technologies they expect to have the greatest impact during the upcoming five years. The results are presented in Figure 10.

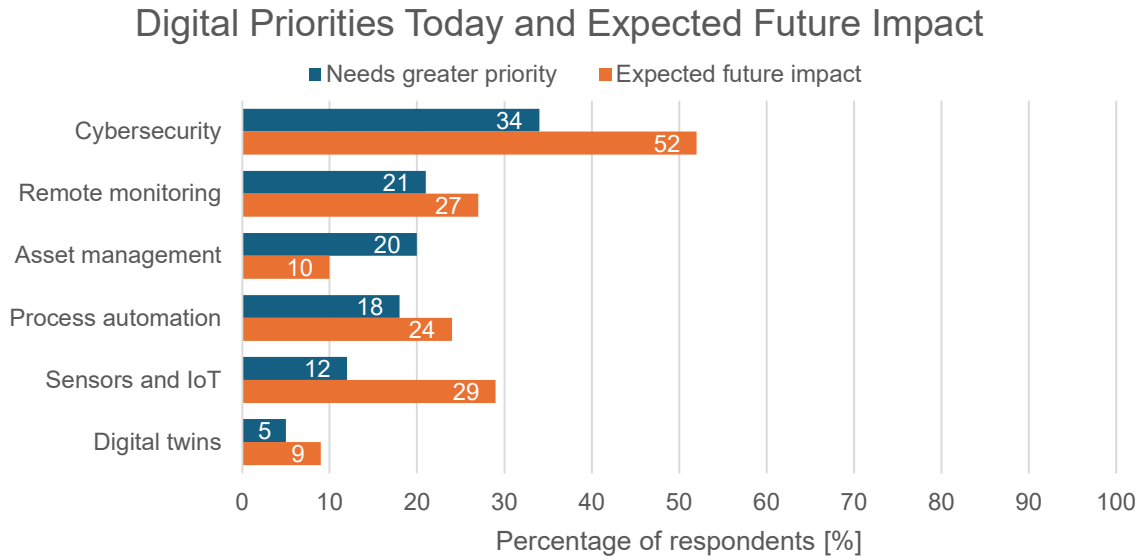

Figure 10. Digital areas identified as requiring greater priority compared with their expected impact over the next five years. Values represent the percentages of respondents selecting each area. Only areas with comparable categories across both survey questions are included. Multiple responses were allowed (≤3).

Several response categories could not be directly compared between the two questions and are therefore shown separately in Table 2.

Table 2. Remaining areas identified as current priorities or as having high expected future impact.

Priority today	Expected future impact
System integration 35%	AI & data analytics 56%
Data quality 26%	Predictive maintenance 30%
SCADA & OT modernization 24%	
AI 18%	
Change management 15%	
Data analytics/BI 14%	

Figure 10 reveals an important distinction. The technologies expected to shape the future are not necessarily the same technologies that require the most immediate attention. Stakeholders expect future value to be generated by AI, data analytics, predictive maintenance, and intelligent monitoring. However, they simultaneously recognize that these technologies depend on stronger foundations, particularly system integration, cybersecurity, and high-quality data.

Cybersecurity stands out as the digital area requiring the greatest priority. As water utilities become increasingly digitalised, sensors, IoT devices and connected control systems are being integrated into the monitoring and operation of critical infrastructure. These technologies can provide significant benefits through real-time monitoring, early detection of leaks and operational optimisation, but increased connectivity also introduces new vulnerabilities (Regeringen, 2025). FOI (2024) also highlights cybersecurity risks associated with digitalization, information flows and cyber-physical systems in Swedish drinking water production.

At the same time, sensors and IoT receive relatively low current priority despite their expected future impact. One possible explanation is that these technologies are already moving into practical implementation, which is also consistent with discussions with municipalities and consultants during the internship. As more sensors and connected systems are introduced, cybersecurity is therefore likely to become increasingly important for ensuring secure and reliable water infrastructure.

The high priority given to cybersecurity in our results suggests that the sector is already aware of this growing need.

The findings suggest that the next phase of digitalization will be less about deploying new systems and more about creating the conditions needed to fully utilize the systems already in place.

7.2 Future Outlook and Investment Readiness

To assess expectations regarding future digital development, respondents were asked how they believe investments in digitalization will evolve over the next three years. Figure 12 show a clear and consistent pattern.

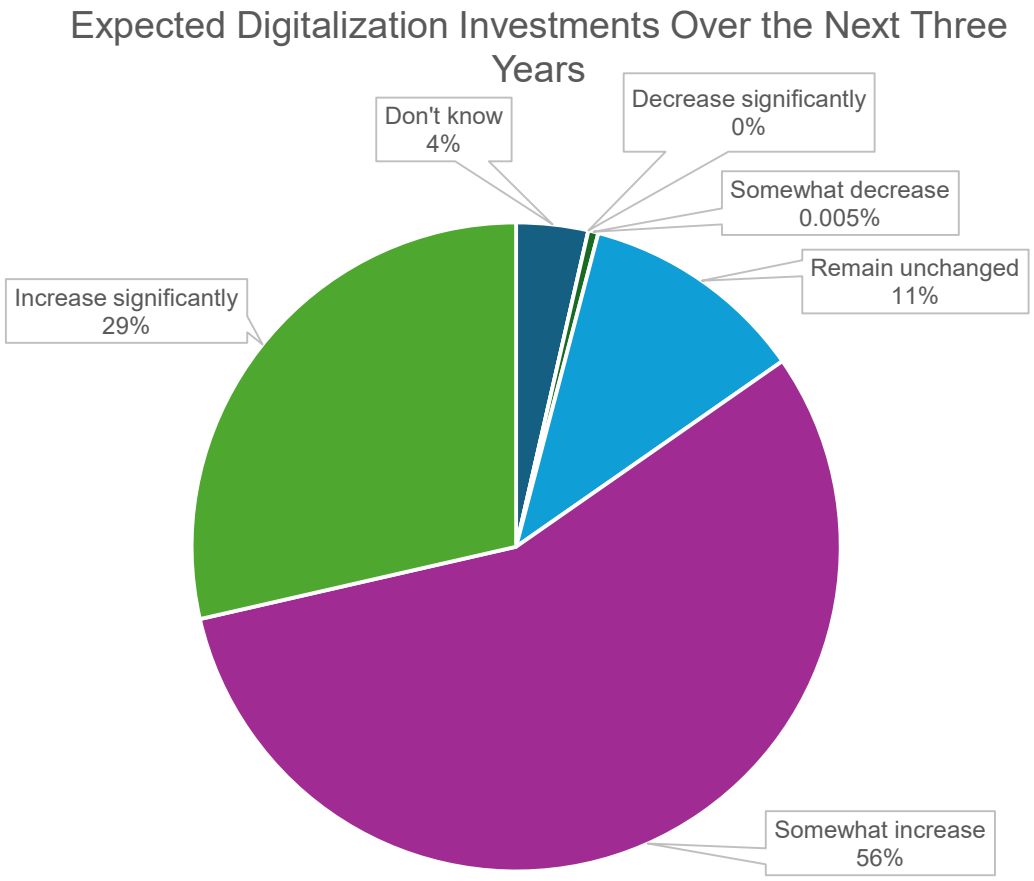

Figure 12. Shared stakeholder expectations regarding future investments in digitalization within the Swedish WWW-sector over the next three years. Values represent the percentage of respondents selecting each response alternative.

Across all stakeholder groups, the majority expect investments in digitalization to increase. No respondents expected investments to decrease significantly. The overall picture is one of strong confidence in continued digital development.

Respondents were also asked to assess a series of statements regarding future developments in the sector, presented in Table 3 as compiled averages of responses in each stakeholder group, including interval.

Table 3. Available statements from survey, along with the average level of agreement as well as the intervals.

Statement	Level of agreement, average (interval)
Competence shortages will become a greater barrier than technology	72% (57-79%)
More processes will be monitored and optimized remotely	79% (73-85%)
Data quality and governance will be more important than AI itself	72% (59-78%)
Better integration between existing systems will create more value than new point solutions	73% (66-77%)
Cybersecurity will take a larger share of digitalization budgets.	74% (71-77%)

Four findings stand out:

- **Competence shortages may become a greater barrier than technology itself.** While stakeholders generally agreed that technology will continue to develop, many respondents viewed access to skilled personnel, knowledge transfer, and workforce development as potential constraints on future digitalization efforts.

- **Remote monitoring is expected to become a defining feature of future water operations.** This statement received the highest level of agreement across all stakeholder groups, suggesting a widespread expectation that operational processes will become increasingly data-driven, automated, and managed remotely.

- **Attention is shifting from acquiring new technologies to making better use of existing digital infrastructure.** Respondents expressed strong agreement that improved system integration and data governance will be critical for creating value from digitalization. This indicates that future efforts may focus more on connecting systems and utilizing data effectively than on implementing additional standalone solutions.

- **Cybersecurity is becoming a strategic priority.** Stakeholders expect cybersecurity to account for a growing share of future digitalization investments. This finding also aligns with observations from interviews and field visits, where increasing connectivity and digital dependence were frequently associated with greater cyber risks and vulnerabilities.

Taken together, the sector can be described as characterized by optimism and readiness for continued development. Stakeholders expect investments to grow and largely agree on the areas that will become increasingly important in the future. However, the results also indicate that organizational capacity, competence, and system integration may become as important as technology itself.

The future of digitalization will not be determined by technology alone, but by the sector's ability to turn technology into operational value.

7.3 Collaboration and Scaling Digitalization

One of the clearest findings of this study is that access to technology is no longer the primary constraint on digitalization within the WWW-sector. Many of the solutions expected to shape the future of the sector are already available and, in some cases, successfully implemented. However, the survey results suggest that organizations vary considerably in their ability to adopt, integrate, and scale these solutions. As a result, many successful digitalization initiatives remain limited to individual municipalities, treatment plants, or projects, preventing wider sector-wide benefits.

The WWW-sector is often characterized by a strong vision of collaboration and openness, with many actors emphasizing the importance of collective development and knowledge sharing. However, the results suggest that these ambitions are not always translated into coordinated action. Although successful initiatives are frequently communicated within the sector, mechanisms for replication and large-scale implementation remain limited, resulting in benefits that often stay confined to individual organisations. To achieve broader impact, successful solutions must also be documented, replicated, and scaled across organizations.

The findings suggest that future progress will require stronger collaboration across organizational boundaries. Municipalities with the resources to test new solutions can act as demonstration sites and share experiences, helping to reduce implementation risks and accelerate adoption throughout the sector. Shared digital platforms can further support this process by improving information exchange between municipalities, consultants, suppliers, and contractors. Examples include shared GIS databases, digital asset registers, and project documentation systems. By enabling better data sharing and coordination, these platforms can improve planning, operation, and maintenance throughout the infrastructure lifecycle.

Ultimately, the greatest benefits of digitalization are likely to emerge when organizations move beyond isolated initiatives and adopt coordinated approaches that strengthen the sector.

Digital technologies create value when they are implemented, shared and scaled, not when they remain isolated within individual projects.

7.3.1 Limitations to System-Level Digitalization

Scaling digital solutions across organizations involves more than connecting technology. Regulation, commercial interests, cybersecurity, and governance all shape what is possible in practice.

Water reuse is one example. EU Regulation 2020/741 sets quality and risk-management requirements for the reuse of treated water, helping ensure that reuse is safe but also increasing the need for monitoring and documentation (European Parliament & Council of the European Union, 2020). For smaller municipalities, meeting these requirements can demand significant resources.

Sharing data across organizational boundaries brings another set of challenges. Public and private actors need clear agreements on who owns the data, who can access it, and who is responsible when something goes wrong. Public procurement rules can further limit how municipalities and private companies' structure collaborative projects (Lag 2016:1145). At the same time, suppliers may be reluctant to share data or solutions that provide a competitive advantage.

Technical integration remains equally important. Different data formats, communication protocols, and system architectures can make otherwise mature systems difficult to connect. Greater connectivity also increases cybersecurity risks. For critical water infrastructure, a more connected system can create both greater value and greater vulnerability, helping explain why cybersecurity ranks among the sector's highest future priorities.

Ultimately, successful collaboration depends on more than compatible systems. It requires clear ownership, shared incentives, trust, and sufficient organizational capacity. These challenges echo the governance and competence gaps identified in Chapter 5 and underline that the barriers to system-level digitalization are as much organizational as they are technical or regulatory.

7.4 Competence and the Next Generation Workforce

Technology is only one part of digital transformation. Equally important is the availability of people with the skills required to implement, manage, and continuously improve digital solutions.

Throughout the study, competence shortages emerged as one of the most frequently discussed long-term challenges. Many organizations depend heavily on experienced personnel, while increasing digitalization requires new competencies in areas such

as automation, data management, cybersecurity, and analytics. At the same time, the sector appears to be undergoing a generational transition. As experienced professionals retire, organizations face the dual challenge of preserving valuable operational knowledge while simultaneously introducing new digital competencies.

This transition also creates an opportunity. New generations of professionals often enter the workforce with experience of digital tools, data-driven decision-making, and interdisciplinary collaboration. Successfully attracting and retaining these competencies will therefore be critical for future development.

Strengthening links between the sector, universities, and educational programs can play an important role in supporting this transition. Internship programs, student projects, and early exposure to the water sector may help increase awareness of the career opportunities available within the industry. Ultimately, future digitalization depends as much on people as on technology.

The future of digitalization will depend not only on new technologies, but on the people who can implement, manage and improve them.

7.5 Where Can Digitalization Create the Greatest Value?

Based on both the survey results and broader industry observations, future digitalization efforts should focus on areas where digital technologies can address some of the sector's most significant operational challenges.

One of the clearest examples is water distribution and wastewater collection networks. Ageing infrastructure, leakage, limited visibility, and increasing resilience requirements create a strong need for improved monitoring, control, and decision support. Given that a significant share of treated drinking water is lost before reaching consumers, even relatively small improvements in network performance can generate considerable operational, environmental, and economic benefits.

Technologies such as leak detection, smart metering, pressure monitoring, predictive maintenance, and digital asset management can support a transition from reactive maintenance toward more proactive network management. These applications are also closely aligned with stakeholders' expectations regarding increased monitoring, automation, and data-driven decision-making.

However, realizing this potential requires stronger digital foundations. Throughout the survey, respondents consistently identified system integration, data quality, and cybersecurity as key priorities for future development. These are not valuable solely in themselves. They are valuable because they create the conditions needed for more advanced applications such as predictive maintenance, AI-supported analysis, and intelligent network management.

The findings therefore suggest that future digitalization should be viewed as a two-step process. First, organizations must strengthen the digital foundations through better integration, data governance, and cybersecurity. Second, these capabilities can be used to address some of the sector's most significant challenges, particularly within drinking water distribution and wastewater collection networks, where the potential value of digitalization appears especially high.

The greatest value of future digitalization may not come from new technologies, but from applying existing technologies to strengthen the performance, resilience and sustainability of critical water infrastructure.

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8. Conclusion

The findings of this study show that the Swedish WWW-sector has entered a new phase of digitalization. Digital technologies are already widely used in many operational areas, stakeholders express overwhelmingly positive attitudes toward digital development, and investments are expected to increase in the coming years.

At the same time, the results reveal a consistent gap between ambition and implementation. While stakeholders demonstrate high levels of future readiness and confidence in the potential of digital technologies, current levels of digital maturity and implementation remain moderate. The challenge facing the sector is therefore no longer whether digitalization is necessary, but how digital solutions can be implemented, integrated, and scaled to deliver measurable value.

The survey results also suggest that the sector is moving from a phase focused on deploying digital systems toward one focused on utilizing data. Municipalities have largely implemented foundational technologies such as SCADA, GIS, and automation systems, while future priorities increasingly revolve around system integration, data quality, cybersecurity, analytics, and predictive capabilities. In this sense, the next stage of digitalization is less about acquiring new technology and more about making better use of existing digital assets.

Future progress will depend on several factors. Stronger integration between systems, improved data governance, and continued investment in cybersecurity are essential foundations for more advanced applications such as AI, predictive maintenance, and automated decision support. At the same time, competence development and knowledge transfer will be critical as the sector undergoes a generational transition and seeks to strengthen its digital capabilities.

The study also highlights the importance of collaboration. While many organizations have launched successful digital initiatives, the greatest benefits are likely to emerge when solutions are shared, scaled, and coordinated across organizational boundaries. The sector's strong tradition of cooperation provides a valuable foundation for this development.

Ultimately, the future of digitalization in the Swedish WWW-sector will be determined not by the availability of technology, but by the sector's ability to transform technology into operational improvements, better decision-making, and long-term societal value.

The findings suggest that the next phase of digitalization will be defined not by the deployment of new systems, but by the ability to integrate information, utilize data, and apply digital technologies where they create the greatest operational benefit. For many organizations, this opportunity may be greatest within drinking water

distribution and wastewater collection networks, where digital solutions can support improved resilience, reduced losses, and more proactive asset management.

Recommendations for the sector:

1. Build the foundation first

Prioritize data quality, governance, cyber security and system integration before implementing more advanced digital solutions. Reliable data, clear ownership structures, and connected systems are essential prerequisites for creating long-term value from digitalization efforts.

2. Prioritize digitalization where the operational value is greatest

The largest opportunities for digitalization are likely to be found in drinking water distribution and wastewater collection networks. Improved monitoring, leak detection, predictive maintenance and data-driven asset management have the potential to reduce water losses, strengthen resilience and improve the utilization of existing infrastructure.

3. Scale successful solutions through collaboration

Use pilot projects, knowledge sharing, and cross-municipal cooperation to reduce implementation risks and accelerate the adoption of proven digital solutions across the sector.

4. Invest in people as much as technology

Address competence gaps by strengthening recruitment, education, knowledge transfer, and continuous professional development. Digital transformation requires both technological and organizational capacity.

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