Digital Transformation Pulse: Connected Industry

The current state of digital transformation among three of Sweden's leading export industries: manufacturing, mining and forestry. Based on a study with Ericsson, Telia and Arthur D. Little.

ERICSSON

in partnership with:

Arthur D Little

Telia

Executive Summary

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Swedish companies must make the necessary investments in digital competence and infrastructure now, or risk falling behind their international competitors.

A new era
The fourth industrial revolution is happening right now as the rapid emergence of new technologies changes the nature of industrial operations.

Challenging the competition
Other nations are closing in on Sweden's global digital leadership, even surpassing Sweden in individual areas, and the country is lagging behind in digital investments.

Transforming industries
Productivity and sustainability are key priorities for critical industries in Sweden, like manufacturing, mining and forestry.

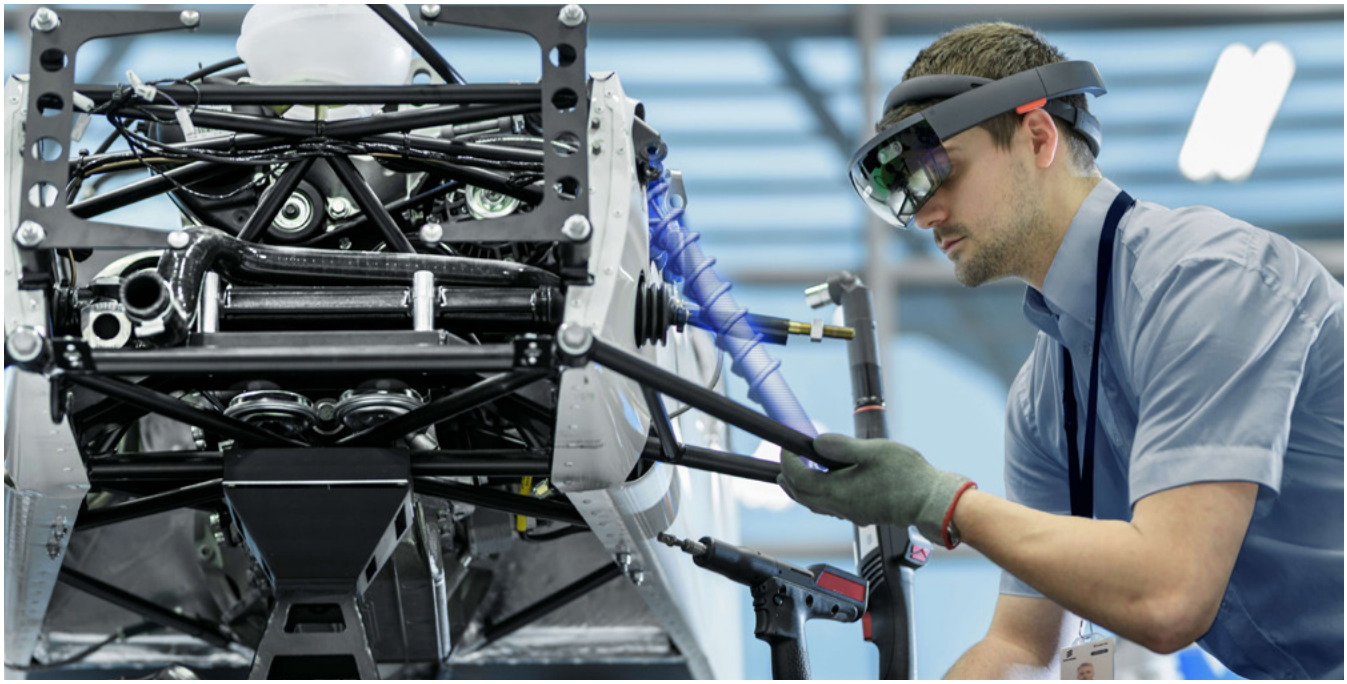
Investing in innovation
Investments in digital technologies will be necessary to meet these challenges, for example in areas like automation, digital operations and performance monitoring.

Scaling up
Swedish companies are struggling to fully implement digital technologies, with more than 50 percent of such initiatives still in the planning and piloting stages, but are right on the threshold of scaling up.

Delivering access
Accessing digital competence is both a success factor and a challenge to scaling up digitalization. Forty-four percent of industry managers surveyed for this report say obtaining the right digital competencies is key to the digital transformation of their companies.

Boosting connectivity
Half of industry managers consider connectivity a limiting factor, making next-generation, high performance connectivity solutions another essential component of accelerating the implementation of new digital solutions.

About the report



Calls for action

- Make digital transformation a strategic priority.
- Dare to invest in emerging digital technologies.
- Put people at the center of your digitalization strategy.
- Build a future-proof digital infrastructure.

The fourth industrial revolution, driven by the emergence of new technologies and reengineered processes, is changing the nature of industrial operations. It also opens the door to unprecedented business opportunities as disruptors continue to introduce new products and services while new industries are rapidly created. The pandemic has further amplified the need to digitalize due to the seismic shifts currently happening across various industries.

Ericsson, Telia and Arthur D. Little have come together to better understand the current state of the digital transformation in three key Swedish industries: manufacturing, mining and forestry. This study identifies success factors and learnings which can help companies accelerate their digitalization. We have analyzed existing data and research, surveyed 100 industry managers about the current state of digital transformation in their companies' operations as well as conducted in-depth interviews with several key opinion leaders.

Our hope is that this report will serve as both inspiration and a guide to help business leaders and industry professionals identify areas where emerging technologies can deliver real business benefits. It may also provide new insights into how to implement and scale these initiatives in operations, allowing companies to truly unlock the opportunities created by the fourth industrial revolution.

Three key Swedish industries

The manufacturing, mining and forest industries are critical to the Swedish economy. These sectors together employ over 620,000 people in Sweden,[1] contribute SEK 650 billion to the economy[2] and account for around two-thirds of Sweden's exports by value.[3]

[1] Statistiska centralbyrån. (2020). Arbetskraftsinsats (ENS2010) efter näringsgren SNI 2007. År 1980–2019.

[2] Statistiska centralbyrån. (2020) Nationalräkenskaper, kvartals- och årsberäkningar.

[3] Statistiska centralbyrån. (2019). Stronger exports than imports of goods.

Current state of digital transformation

Swedish industry must accelerate digital transformation to maintain its global leadership.

What is a dedicated mobile network?
A dedicated mobile network, also known as a mobile private network (MPN), is when cellular network resources are deployed for an organization's exclusive use. Most dedicated mobile networks today are 4G LTE networks with 5G-ready capabilities. These networks are capable of:

- delivering high-speed connectivity with low latency and high uptime
- handling high densities of connected devices
- being adapted for specific use cases and business models
- supporting accurate location tracking
- competitive total cost of ownership, for example compared to Wi-Fi

Sweden has long been at the forefront of digital development – but other countries are quickly catching up. According to the World Economic Forum's Network Readiness Index (NRI), which assesses countries' digital abilities, Sweden ranks number one overall.[4] However, other countries are aspiring to global technological leadership, spurred on by the pandemic. Breaking down its performance in the NRI, Sweden is outperformed in every individual dimension (see Figure 1). Additionally, while having previously invested heavily in digitalization, for example through rapid fiber and mobile network expansion and the "PC reform" in the 1990s, Sweden is now lagging behind in terms of digital investments.

Other countries are financing major projects in areas such as automation and artificial intelligence (AI), especially the US and China. In Europe, with the support of the EU's Recovery and Resilience Facility, Germany and France recently announced digitalization programs totaling EUR 5.45 billion.[5] In order to hold on to its global digital leadership, Swedish exporters can't settle for benchmarking against other local players. Instead, companies must also look to the global arena, where the real race for competitiveness is happening.

Digital transformation: Still a key strategic imperative

In the Swedish manufacturing, mining and forestry sectors, three in four industry managers state that digital transformation is of high importance to their company's strategic agenda. However, it is still surprising that a quarter of companies do not consider digitalization to be of high importance. Moreover, our study shows that there is a disparity between small and medium-sized enterprises (SMEs) and large enterprises.

Managers at larger companies consider digital transformation more strategically important than managers at smaller ones (see Figure 2). Additionally, our research indicates that smaller companies are on average in earlier stages of implementing their digitalization initiatives than larger companies. SMEs, which employ 65 percent of all staff in the private sector,[6] therefore risk falling behind as they fail to secure the necessary competencies, resources and capabilities needed to succeed with their digitalization. It's not surprising that most companies consider digital transformation to be of such high importance.

[4] Network Readiness Index. (2020). Network readiness index 2020.

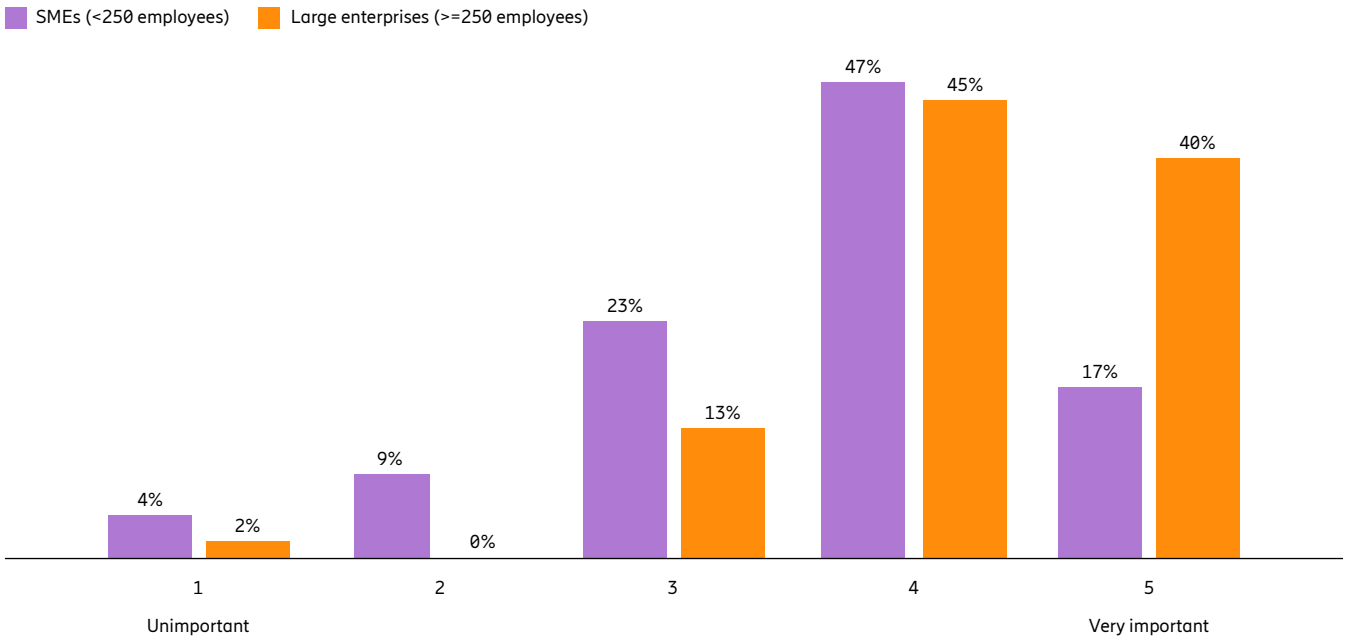
[5] Teknikföretagen. (2021). Regeringen missar digitaliseringen i budgetpropositionen. Regeringen missar digitaliseringen i budgetpropositionen (teknikforetagen.se).

[6] Tillväxtverket. (2021). Basfakta om företag. Statistik basfakta om företag – Tillväxtverket (tillvaxtverket.se).

Figure 1: Sweden's ranking in NRI 2020, overall and by category

	Overall	Technology	People	Governance	Impact
01	Sweden	Switzerland	Denmark	Norway	Singapore
02	Denmark	Sweden	South Korea	Denmark	Switzerland
03	Singapore	Netherlands	Finland	Netherlands	Sweden
04	Netherlands	United States	Sweden	Sweden	Netherlands
05	Switzerland	Denmark	Singapore	Finland	Denmark

Figure 2: The strategic importance of digitalization of operations



Innovations in mobile technologies, social platforms, data science and cloud computing are rapidly changing customer expectations and how operations are performed. Digital transformation is rapidly becoming essential to attracting the customers, competences and capital necessary to build competitiveness and value for the future.

A study by Arthur D. Little showed that early adopters of digital technology can have an EBIT advantage of 46 percent over followers while also gaining in efficiency, market share, price leadership and customer loyalty. Private equity players have recognized this advantage. According to an Arthur D. Little survey, 43 percent of private equity companies say that digital maturity has become a more important factor in acquisition decisions since the start of the pandemic.

Warning signs: Swedish companies lack digitalization strategies

Despite consensus on the importance of digitalization, many Swedish companies in manufacturing, mining and forestry lack a clear strategy for digitalizing their operations. Industry leaders admit that digitalization is often done on a case-by-case basis without an overarching plan or direction. Many players struggle to adopt emerging technologies like Cloud/Edge, data analytics, AI and mobile interfaces – technologies which will be critical to succeed with digital transformation. For example, only 30 percent of respondents report using mobile interfaces, like for real-time access to instructions and manuals, and just 24 percent say they are harnessing AI in their operations today (see Figure 3).

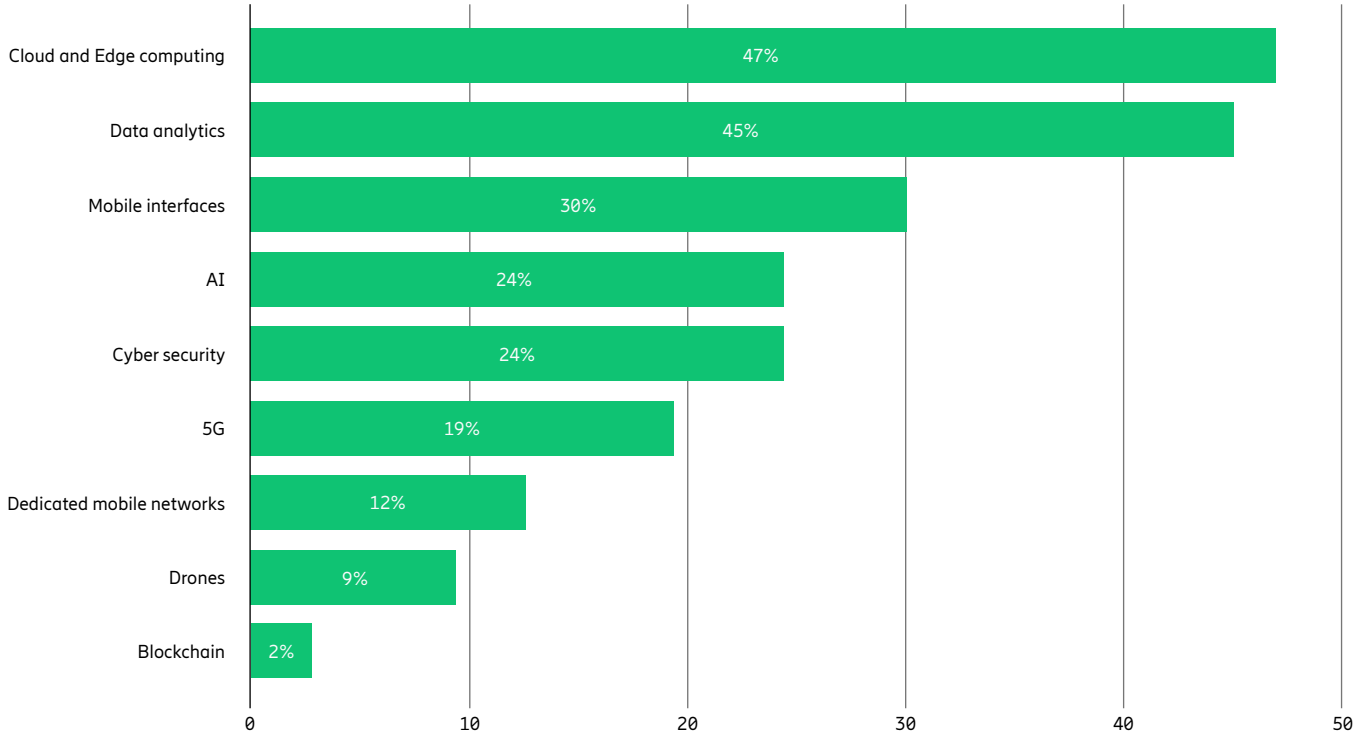
Impeding infrastructure: Connectivity needs an upgrade

A common element to companies succeeding with digitalization initiatives is that they have invested in the necessary digital infrastructure, like connectivity. Utilizing emerging digital technologies, Cloud/Edge computing, results in more connected devices, e.g. sensors, machines and equipment, which communicate with each other in real time and produce larger data volumes. It is therefore vital to have reliable connectivity with high uptime, high capacity and low latency which seamlessly covers entire facilities.

Meeting these connectivity requirements often means complementing (or even replacing) existing solutions, like Wi-Fi and mobile connection broadband, with next-generation connectivity services, like dedicated mobile networks.

Encouragingly, many Swedish exporters are already looking at these technologies to accelerate their digital transformation and capture the benefits of Industry 4.0. For example, 4 out of 10 businesses surveyed for this report have either already implemented dedicated mobile networks in their operations or are planning to do. This demonstrates that some Swedish digital leaders are driving the Industry 4.0 revolution by using the next generation of connectivity technologies today.

Figure 3: Presence of emerging digital technologies in companies' operations



Manufacturing industry

Swedish manufacturing is embracing the fourth industrial revolution.

Key takeaways

- Manufacturing is a crucial Swedish industry that employs roughly 10 percent of the country's workforce and contributes 13 percent of its GDP.
- Priorities for the Swedish manufacturing industry include productivity, flexibility and sustainability. Digital transformation will be essential to meet these needs.
- Next-generation connectivity solutions, such as dedicated mobile networks, are required for the large number of connected machines and equipment installed in modern, smart factories.
- Automation and performance monitoring are the most common digital solutions, with over 60 percent of companies either having implemented them or planning to do so.
- Acquiring digital competence, establishing external partnerships and building the required digital infrastructure are key success factors for digital transformation in manufacturing.

Scania is testing a dedicated 5G network for its production. Source: Scania

Sweden is among the global leaders in manufacturing with several internationally renowned companies. However, Swedish manufacturers are facing several challenges stemming from international trends like tougher global competition, changing customer expectations and increased environmental concerns.

Key priorities: productivity, flexibility and sustainability

Productivity is a key priority for the Swedish manufacturing industry. Manufacturing value added has decreased with a compound annual rate of over 2 percent since 2010. The industry is facing significant pressure from hypercompetition while labor productivity has stagnated.[7]

Flexibility and sustainability are two other priorities for Swedish manufacturing. Demand for customization of existing production processes is increasing the need for flexibility. The industry is also working hard on becoming more environmentally sound, e.g. reducing water, energy and material usage. The manufacturing industry is currently responsible for 70 percent of Sweden's water consumption[8] as well as a substantial part of the country's energy consumption.

[7] The World Bank. (2021). Manufacturing, value added (percentage of GDP).

[8] Industrinyheter.se. (2020). Hållbarhet inom tillverkningsindustrin kräver vattenhushållning.

Smart factories: Leveraging digital transformation

With Industry 4.0, Swedish manufacturers are aiming to leverage high-tech industrial innovation to increase productivity, flexibility and sustainability and build truly smart factories:

- Automation is being used to replace manual labor, increasing productivity per operator. This also helps optimize the use of resources, such as reducing scrap material, by decreasing variations in processes.
- Performance and condition monitoring is enabling predictive maintenance, which in turn reduces downtime and maintenance costs in production, and by extension increases productivity.
- Immersive media, like VR and AR, can provide operators with instructions and feedback in real time, making it possible to train people more efficiently, reduce quality issues and provide customized information for each product being produced, thus increasing flexibility.

Connectivity: At the heart of smart manufacturing

The emerging digital technologies which characterize modern, smart factories heavily rely on wireless connectivity. Performance and condition monitoring means deploying a large volume of connected sensors, equipment and machines. Autonomous vehicles and robots require precise location tracking. Robots working side-by-side with humans require reliable, low-latency connections to sensors and other safeguards. Delivering on the needs of these types of applications has proven a challenge for some of the wireless networking solutions used today, based on current standards for Wi-Fi and public networks. Instead, next-generation connectivity technologies, like dedicated mobile networks, are needed. These types of networks are more reliable and secure, can handle a higher density of connected devices and will be able to provide more precise location data.

"The key to attracting top digital talent is to demonstrate real digital leadership. One way to do this is investing in state-of-the-art smart factories."
Erik Josefsson, CEO R-evolution, Hexagon

Figure 4: Planned or present use cases in companies' operations

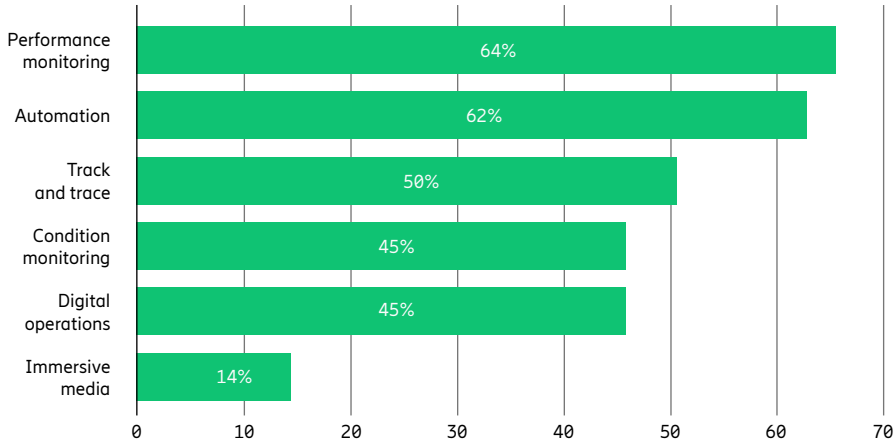


Figure 5: Stage of deployment of most common use cases

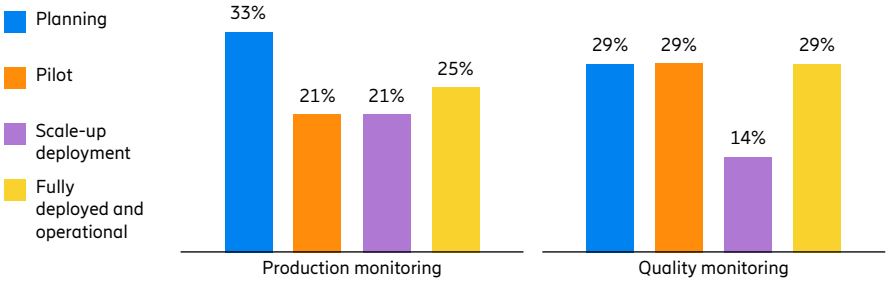
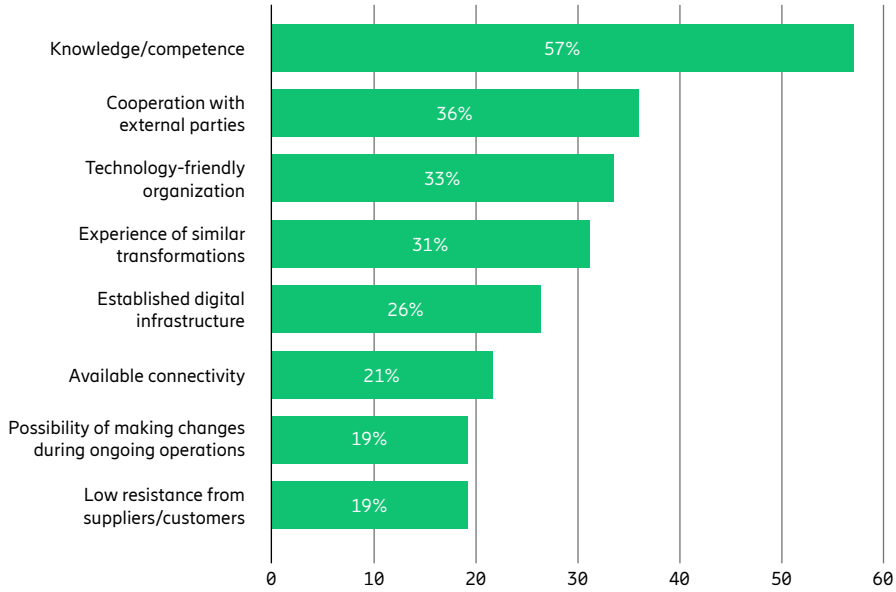


Figure 6: Most important success factors for digital transformation



[9] Statistiska centralbyrån. (2020) Nationalräkenskaper, kvartals- och årsberäkningar.

[10] Statistiska centralbyrån. (2020). Arbetskraftsinsats (ENS2010) efter näringsgren SNI 2007. År 1980–2019.

[11] Statistiska centralbyrån. (2019). Utgifter för egen FoU efter bransch.

Snapshot: Industry use cases

There are many ongoing digitalization initiatives in the Swedish manufacturing industry, with Scania testing a dedicated 5G network for its production, SKF making major investments in data analytics and preventive maintenance, and Sandvik as an early adopter of robotics in its material handling, transport and logistics.

5G-ready networks from Hitachi Energy
Hitachi Energy has installed a dedicated 5G-ready network at its transformer factory in Ludvika. This will enable the company to implement more digital solutions, like connected tools and handheld computers, and provide a platform for innovation to test new technologies. The goal is to upgrade the system with 5G technology over time, resulting in increasingly reliable connectivity with higher capacity and lower latency.

Digital twins from Electrolux
Electrolux is currently creating digital twins of all its global factories, enabling optimization and replication of successful concepts, as well as conducting several AI-based initiatives. Digital twins allow manufacturers to digitally replicate their entire manufacturing footprint, predicting and preventing potential production pain points, without risking interruption to their physical production.

The Bearing Assist app from SKF
SKF has created the Bearing Assist app, which helps its customers mount and replace bearings. Many manufacturers struggle with installing bearings correctly, leading to reduced lifetimes and more frequent maintenance. By using the app, manufacturers can ensure that their staff have access to accurate, updated installation instructions, decreasing downtime and reducing costs for maintenance and replacement parts.

Where it's happening: automation and performance monitoring
The Swedish manufacturing industry is well underway with its digital transformation. Our study shows that almost two-thirds of manufacturing companies have either already implemented use cases within automation and performance monitoring or are planning to do so (see Figure 4). When evaluating specific use cases within these categories, industry managers considered production automation to be the most valuable for their business. This high prevalence of implementation initiatives in the manufacturing industry indicates that the industry is actively working towards increasing digitalization, with a focus on automating manual work and using performance monitoring to analyze and optimize production.

Post-pilot: Scaling initiatives remains a challenge
Despite a large number of ongoing digitalization initiatives, many companies are still in the early stages of implementation. In our study, more than 50 percent of industry managers state that digital solutions for production and quality monitoring (the two most common use cases) are still in the planning or pilot stages. For less common, more advanced use cases like automated vehicles and virtual reality, the difficulty to scale up is even clearer, with no respondents reporting having reached full deployment. With more and more international examples of companies moving digital technologies into full deployment, like so-called "dark factories" in China, Swedish companies need to move passed the pilots and scale up initiatives in order to stay competitive.

Success factors: competence, partners and infrastructure
Industry managers identify several key success factors to accelerating digital transformation. The most important ones include securing the right digital competences in both management and operations, including empowering existing staff with new skills in areas like 5G, AI, robotics and cyber security; creating new positions like CDOs and data scientists and establishing strong partnerships to ensure access to state-of-the-art technology.

To enable these new digitalization initiatives, reliable and resilient connectivity must be in place. Manufacturing executives must make sure that their companies are equipped with the competences, partnerships and infrastructure needed to succeed in their digitalization efforts.

> "Sustainability is a critical issue for the entire manufacturing industry. Companies must quickly become greener and leveraging digitalization is essential to achieve this."
> **Erik Josefsson,**
> **CEO R-evolution, Hexagon**

Mining industry

Swedish mining is scaling up its digital transformation efforts.

Key takeaways

- The Swedish mining industry is a major source of exports and makes up 90 percent of Europe's iron ore production.
- Key priorities for Swedish mining companies include sustainability, productivity and safety. Digital transformation is critical to deliver on these priorities.
- Connectivity is particularly challenging in mines and the industry is looking to next-generation connectivity solutions, like dedicated mobile networks, to accelerate digitalization.
- Automation and digital operations are the most common types of emerging digital technologies in the industry, with two out of three companies either having implemented them or planning to do so.
- Developing digital infrastructure, including reliable connectivity, and securing access to digital competences are key success factors to accelerate digitalization and scaling up ongoing initiatives.

Boliden installed the first 5G network in an operational underground mine. Source: Boliden/Tomas Westermark

The Swedish mining industry is a major source of exports and is responsible for the vast majority of iron ore production in Europe. However, the global competition is fierce, and the industry is facing several challenges which need to be met for Swedish mining companies to continue to prosper.

Key priorities: productivity, sustainability and safety

Productivity is a key priority for the Swedish mining industry. Not only are labor costs high, but mines are typically underground and relatively small. This puts Swedish mining companies on an unequal footing with their global peers, who have lower operating costs and larger surface mines for better economies of scale. World-class productivity is therefore essential. Additionally, sustainability and safety are other focus areas.[12] Mining companies have been working proactively for a long time to become both safer and more environmentally sound. This includes preventing workplace injuries as well as continuing to reduce emissions and other environmental effects.

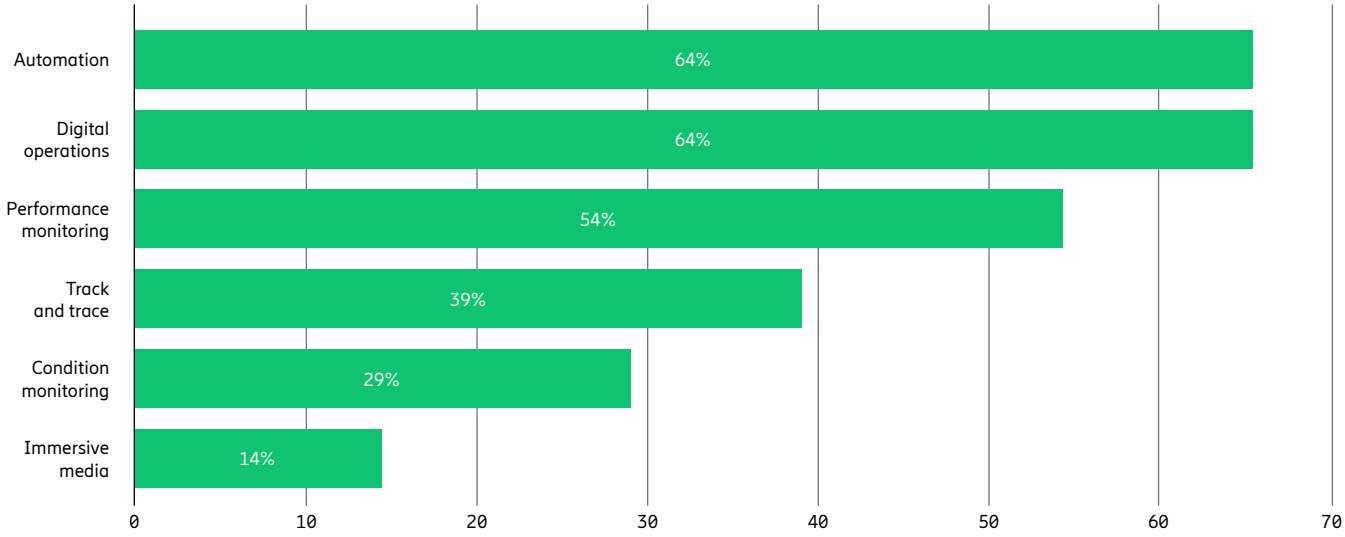
Smart mining: Meeting challenges with digital technologies

In its efforts to improve productivity and develop safer and more environmentally sound mining operations, the Swedish mining industry has been quick to embrace digital transformation as a part of its strategic agenda.

[12] STRIM. (2019). Strategic research and innovation roadmap.

[13] Jasonarson, I. (2020). Digitalization for Energy Efficiency in Energy Intensive Industries.

Figure 7: Planned or present use cases in companies' operations



In fact, 75 percent of Swedish mining companies now have a digital strategy, significantly more than in other industries.[13] Swedish miners have also shown their commitment to execute on those strategies by investing in emerging digital technologies and deploying digital solutions in different parts of their operations:

- Automation and remote operation are reducing the number of operators needed inside mines, cutting downtime during shift changes, moving the work to safer environments and lowering operating costs.
- Remote condition and performance monitoring is helping to reduce equipment downtime, optimize mining operations and discover safety risks earlier.
- Track and trace solutions are mapping personnel throughout the mines, both before and during emergencies, and are increasing traceability through the supply chain.

Connectivity: The key to smart mining

Regardless of which technologies are deployed, smart mining relies on a solid foundation of wireless connectivity. However, current solutions aren't enough. Half of mining industry managers see connectivity as a limitation to their company's digital transformation.

Automation and remote operation of mining vehicles requires reliable, seamless wireless connectivity throughout the mine. Remote condition and performance monitoring will lead to a dramatic increase in the number of connected units. Track and trace solutions require precise location data. None of these applications can be powered by traditional Wi-Fi or public networks, especially in underground mines. Next-generation connectivity technologies like dedicated mobile networks are necessary to enable digital transformation in mining.

Where it's happening: automation and digital operations

The Swedish mining industry is well underway with its digital transformation. Two-thirds of mining managers say their companies have either implemented use cases in automation and digital operations or are planning to do so (see Figure 7), with automated vehicles considered to be the most valuable technology for their business.

Mining: One of Sweden's industrial pillars

Sweden's history of ore mining and metalmaking stretches back to the 12th century, when iron was first produced from iron ore. Today, there are 15 metal mines in operation which directly employ around 7,000 people.[14] The industry represents roughly SEK 42 billion, or 11 percent of Sweden's exports, making it the country's third-largest export category.[15] Sweden accounts for over 9 percent of the iron ore produced in Europe.[16]

"The survival of Swedish mining depends on our willingness to embrace new technologies to develop more efficient and safer mining operations, especially with our cost disadvantage to industry peers and tough regulatory environment."
Peter Burman, Program Manager Mine Automation, Boliden

[14] Stockholm Environment Institute. (2019). The Swedish mining sector in sustainable futures.

[15] Statistiska centralbyrån. (2019). Stronger exports than imports of goods.

[16] Statens geologiska undersökning. (2020). Ore production and trends.

"Connectivity is key to the digital transformation of Swedish mining companies. Everything starts with the networks."
Peter Burman, Program Manager Mine Automation, Boliden

Digging deeper: From pilots to real value

While Swedish mining companies have shown great commitment to digital transformation, many initiatives are still in the early stages. Half of all mining professionals in this study say initiatives related to production automation and automated vehicles (the two most common use cases) are still in planning or pilot phases (see Figure 8). Still, Swedish mining companies have come a long way compared to international competitors and seem to be on the threshold of largescale deployment of new digital solutions. Now is the time to strengthen investments in order to stay ahead of the competition and capitalize on the true value of digital technologies.

Key success factors: competence and infrastructure

According to the industry professionals surveyed for this report, there are several key factors to successfully accelerating the digital transformation of mining operations. The most important factors include securing access to the right competences in emerging digital technologies, like 5G, AI, robots and cyber security, both in management and operations, and creating and recruiting for new roles like CDOs and data scientists. Underpinning everything is the need for a robust digital infrastructure with reliable and resilient connectivity (see Figure 9). Executives should therefore prioritize these factors when looking to accelerate their company's digitalization and, by extension, bolster productivity, sustainability and safety in their operations.

Figure 8: Stage of deployment of most common use cases

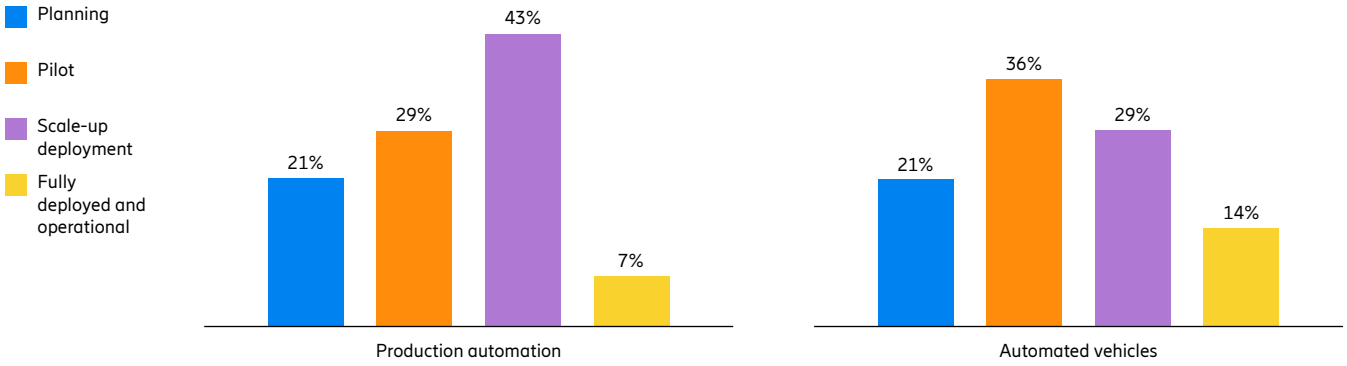
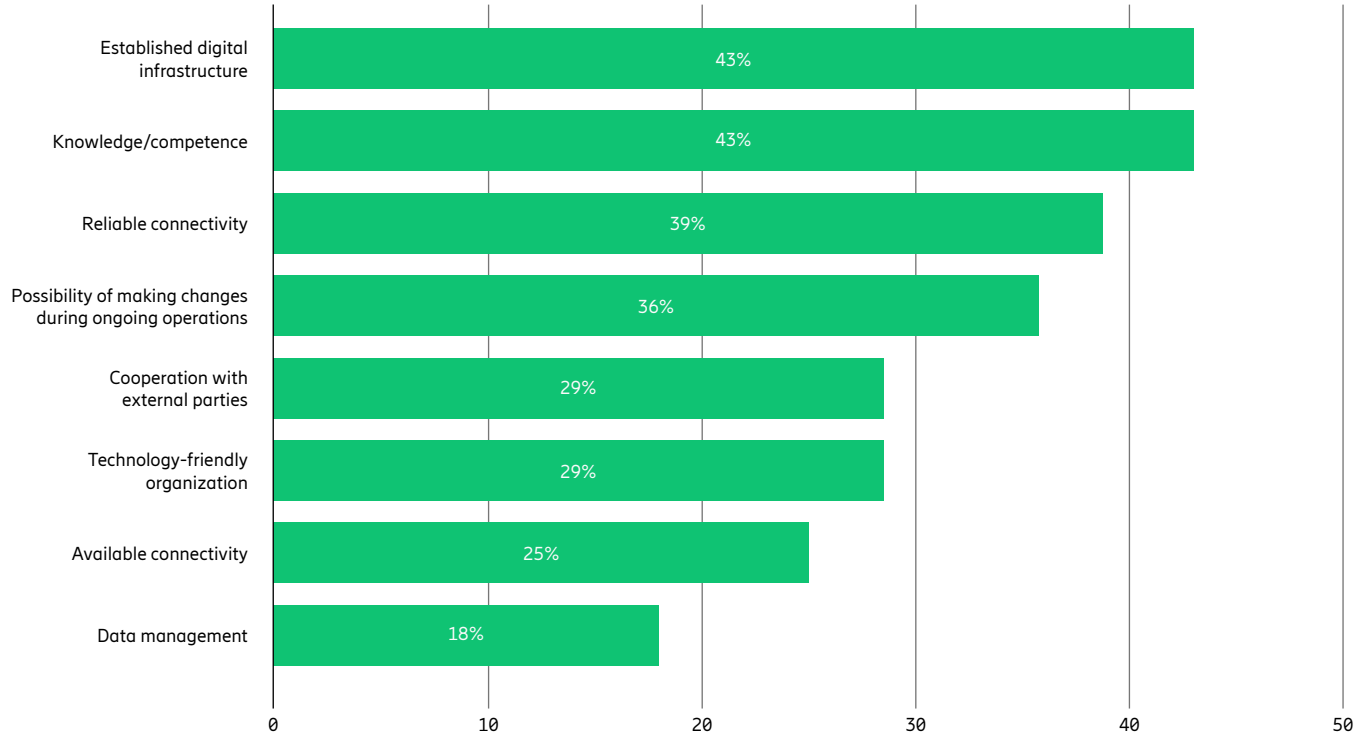


Figure 9: Most important success factors for digital transformation



Snapshot: Industry use cases

There are many examples of large-scale collaborative digitalization initiatives in the mining industry, such as LKAB's Sustainable Underground Mining project; Boliden's electrification, automation and 5G projects; and the recently completed EUR 16 million Sustainable Intelligent Mining Systems (SIMS) project (European Commission, 2020).

5G-enabled communication and positioning from Boliden, Ericsson and Telia
Boliden together with Ericsson and Telia, successfully installed a 5G-enabled industrial communication and positioning system based on dedicated mobile network technology, making it the first 5G network in an operational underground mine. The infrastructure was built to support a variety of application areas, like real-time people interactions, safety, collection of sensor and process data, process control and remote operation, supporting automation and IoT solutions in mining operations.

Dedicated mobile networking from Zinkgruvan Mining
Zinkgruvan Mining has also implemented a dedicated mobile network in its operations, covering over 48km of transport routes and tunnels down to a depth of 1,300m. The network enables robust, high-performance connectivity with the high accessibility necessary for IoT solutions, accurate location information, push-to-talk communication and remote operation. This has many concrete benefits, such as saving operators one hour every shift when travelling back and forth to the drilling machines by instead controlling them remotely.

Ventilation optimization from ABB
ABB has developed a ventilation optimization system using wireless communication and sensor technology. Mine ventilation is essential for a safe working environment but is complicated and energy intensive. At the same time, operations may only be active in a small part of the mine at any given time. Using digital twins of the ventilation systems, ABB optimized the use of its fans to reduce energy consumption, extend the lifetime of the system and ensure a safe working environment.

Forest industry

How the Swedish forest industry can reap the benefits of digitalization.

Key takeaways

- Sweden is a global leader in forestry and the third-largest exporter of forest products worldwide.
- Sustainability, productivity and attracting talent are priorities in the Swedish forest industry.
- For certain digital applications within the forest sector, connectivity is a crucial requirement.
- Next-generation connectivity solutions, such as dedicated networks, are important developments to accelerate the digital transformation in the industry.
- Digital operations, such as remote asset management and monitoring, are the most common type of use case of emerging digital technologies in forest, with 70 percent reporting that they have implemented them or are planning to do so.
- Creating technology-friendly organizations, building digital infrastructure and ensuring the availability of connectivity are key success factors for the digital transformation of the forest industry.

Stora Enso is using drones to photograph and map forests.

Sweden is a global leader in forestry and the third largest exporter of forest products worldwide. The industry is an important source of Swedish exports and a major source of employment, especially in non-metropolitan areas. The forest industry in Sweden has been successful and is on the forefront when it comes to sustainability performance.

The forest industry plays an important role in the transformation to a circular society and it is crucial to continuously drive development to meet new market demands for green products in a sustainable way. In this business environment, international competition and labor scarcity are challenges that need to be managed.

Key priotities: sustainability, productivity and attracting talent

Productivity is a key priority for an industry like forestry with large production flows. The saw, pulp and paper mills and forest operations are constantly focusing on improving economies of scale, increasing productivity and lowering energy consumption.[17]

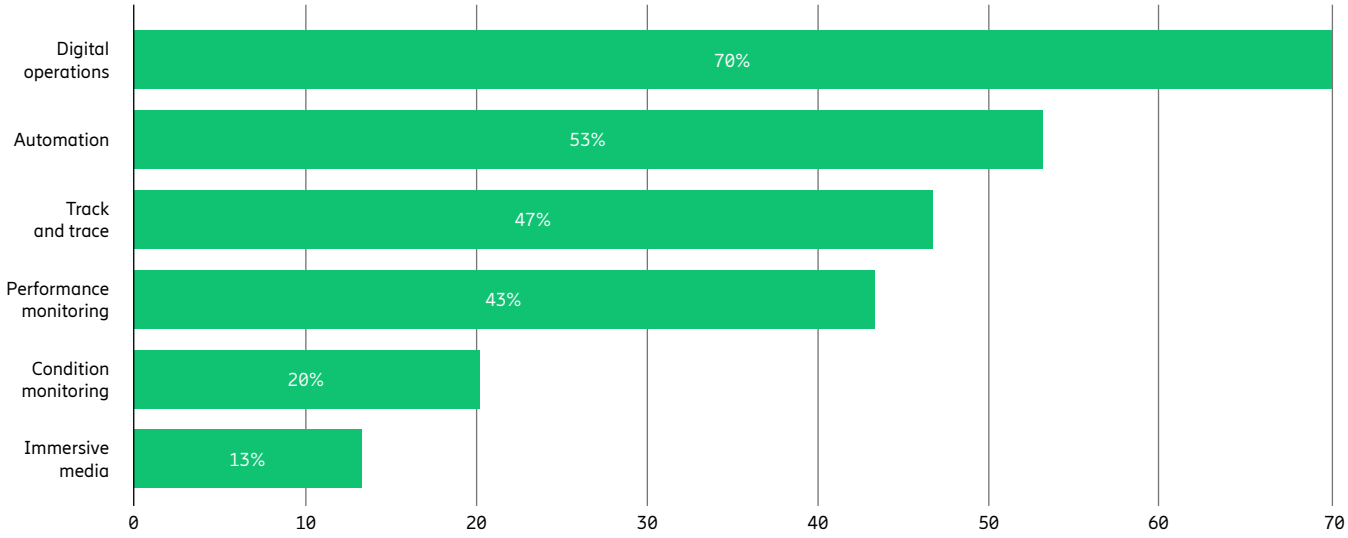
Attracting talent is another focus area. Roughly half of the industry's current employees are expected to retire in the next decade and new recruitment is challenging due to megatrends like urbanization. Efforts are made to generate interest in the industry among younger generations.

Sustainability is something the Swedish forest companies have worked on for decades. The climate benefits, in terms of net storage of CO2 in well-managed forests and the substitution effect of replacing fossil-based products with renewables, are extensive.

Still, sustainability remains a key priority. For example, the industry has implemented greener methods for harvesting forests and development is continuously increasing the value that comes from using the whole tree in the production of renewable products. In saw, pulp and paper mills, energy consumption has been a focus for years.

[17] Moelven. (2021). Det digitala sågverket – teknik för ett nytt århundrade.

Figure 10: Planned or present use cases in companies' operations



Even though the production flows are large, minor improvements can still have a considerable impact.

Smart forest: digitalization across the value chain

As optimization of traditional technologies and methods deliver diminishing returns, actors throughout the forest value chain are increasingly looking to digitalization for ways to meet the industry's challenges:

- Companies are attempting to optimize forest management and harvesting using digital monitoring and analysis methods, which enable them to better choose which trees to plant and where, decrease asset losses due to pests and natural disasters, and find more gentle ways to harvest.[18]
- Track and trace, remote monitoring and data analysis can help optimize transport flows and thereby reduce emissions.
- Monitoring technologies can reduce downtime in saw, pulp and paper mills while automation can both increase productivity and reduce recruitment needs.

Next-generation connectivity: An essential enabler

Use cases in remote monitoring, automation and track and trace all require reliable connectivity, making the current digital infrastructure a roadblock. While sensors and other technologies can be installed across the value chain, the coverage from public mobile networks is limited in some of the places where forest industry companies operate. To accelerate digital initiatives, the industry needs access to robust and secure connectivity even in sparsely populated areas.[19]

Similarly, in saw, pulp and paper mills, even though it is not a major obstacle today, reliable and seamless connectivity is crucial for future generation of monitoring systems and automation. Industrial forest sites also typically cover large areas, both indoors and outdoors, with extreme conditions, for example in terms of temperature. Traditional Wi-Fi and public networks simply can't deliver the necessary performance in these conditions.

Instead, next-generation connectivity solutions, like dedicated mobile networks and solutions for low-power wide-area (LPWA) IoT, are key to ensuring reliable connectivity for digital solutions, whether it is for mission-critical machinery or massive deployment of sensors.

Where it's happening: Digital operations, automation and track and trace

Swedish forest industry has already started its digital transformation. In fact, 70 percent of companies have either implemented solutions for digital operations, such as remote asset management and remote monitoring, or are planning to do so, making it the most common type of use case. Roughly half have also done so within automation and track and trace (see Figure 10). While the industry may often be seen as conservative, most companies have at least a few ongoing digitalization initiatives. This indicates that forest companies are actively searching for ways to capture value from emerging digital technologies.

Forest industry : a key source of Swedish exports

The forest industry plays a significant role in Sweden's industrial base, representing about 2 percent of the GDP, 11 percent of the industry value added and 20 percent of the national R&D spend. Sweden exports 85 percent of forest products, with the largest segments being paper (50 percent), sawed wood products (20 percent) and pulp (17 percent).[20]

"The pulp industry has come a long way in optimizing operations, but now, thanks to emerging technologies, we are seeing opportunities that are beyond what we could imagine ten years ago."
Magnus Viström, Innovation manager, SCA

"To realize the full potential of digital technologies and enable more effective and sustainable forestry, we need to bring reliable connectivity to more places – even our deepest forests."
Christian Brolin, CDO, Södra

[18] Feng, Y. Ady, J. (2020). Forestry 4.0: a framework for the forest supply chain toward Industry 4.0.

[19] Stora Enso. (2021). Internet of Things: what's it got to do with forestry?

[20] Swedish Forest Industries. (2020). Facts and figures.

"We are currently running several important digital transformation projects in our plants which all require robust connections over large areas, both indoors and outdoors. In scaling up these initiatives, Wi-Fi technology alone is simply not up to the job."
Christian Brolin, CDO, Södra

Harvesting the results: Companies have yet to scale up

Despite many initiatives to implement emerging digital technologies in the forest industry, solutions are typically still not fully deployed and operational. The most common use cases in the industry are remote asset management and monitoring. However, over half of industry managers state that these use cases are still in the planning or pilot stages (see Figure 11). While this may be better than in many other countries, it indicates that Swedish companies still have much work to do in scaling up these initiatives and truly delivering value in their operations.

Key success factors: culture and infrastructure

Deployment of new digital technologies may already be underway, but there are steps companies can take to accelerate the digital transformation of their operations. Industry professionals surveyed for this report point out a number of factors that can help lower barriers and scale up initiatives. The most important ones are to transcend the conservativeness of the industry by building more technology-friendly organizations and to establish robust digital infrastructure, including reliable and resilient connectivity (see Figure 12).

Changing the culture of companies can be especially difficult and executives must secure the required senior management commitment to digitalization as well as buy-in from all parts of the organization in order to succeed. Additionally, it is essential to clearly describe the desired values and behaviors while also aligning the strategy and processes of the company to support and reward these behaviors.

Figure 11: Stage of deployment of most common use cases

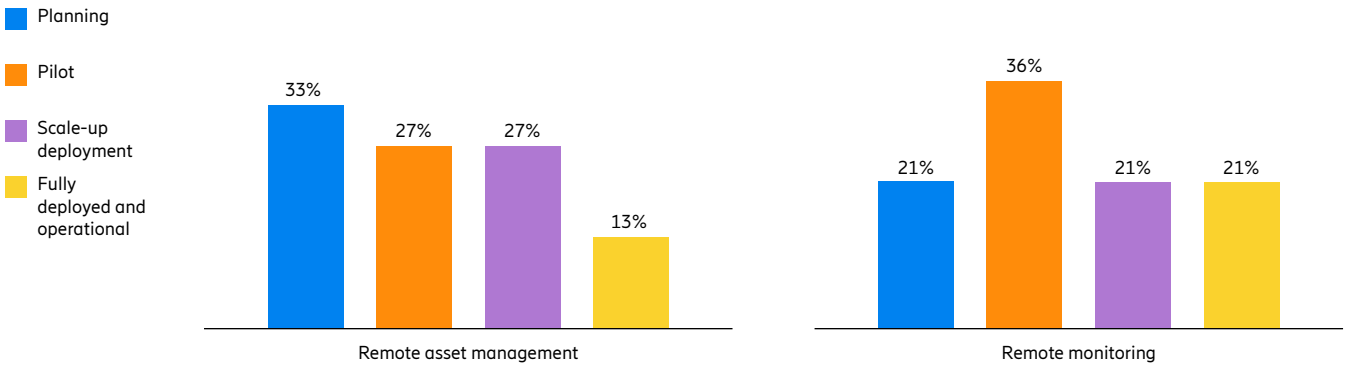
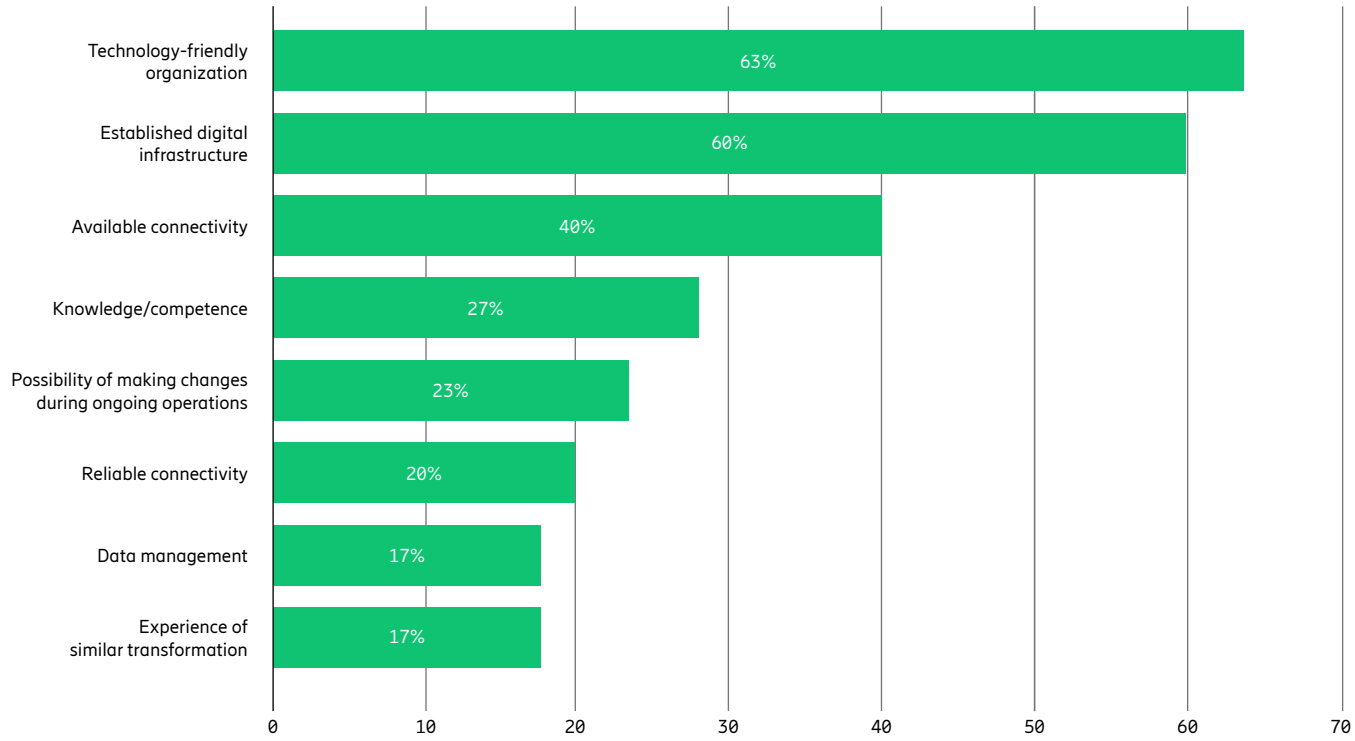


Figure 12: Most important success factors for digital transformation



Snapshot: Industry use cases

There are several digitalization initiatives in the forest industry throughout the value chain, like the Swedish Forestry Industries working together with leading forestry companies like BillerudKorsnäs, Holmen, SCA and and Sveaskog in the Mistra Digital Forest program to develop digital solutions for sustainable and efficient forestry, industry leaders like SCA and Stora Enso using digital technologies to map and analyze forests and Biometria developing solutions to aid in the measurement and transport of timber.

Forest management software from Stora Enso
Stora Enso, a leader in the digitalization of forest management, has developed geospatial software that uses drones to photograph forest regions and AI to model and analyze entire areas. This provides highly detailed information to forest owners, down to individual trees and their condition, and enables forests to be inspected remotely instead of on-site.

Remote loader operation from SCA
SCA, together with actors like Telia, Volvo and Biometria, is working on a project to enable remote operation of loaders at timber terminals. Timber terminals are often situated in far-away locations and have low utilization rates, meaning operators often must spend a lot of their time waiting. This will allow one operator to manage loading and unloading at several locations, increasing their productivity significantly and making it possible to work from less remote areas.

Smart meters and machine sensors from Moelven
Moelven has achieved full connectivity across its 630,000sq m industrial compound and uses smart energy meters and machine sensors to reduce energy consumption by 21 percent per cubic meter produced. Additionally, the company is beginning to use vibration measurement and imaging technologies to identify failing equipment before breakdowns. Moelven has also created a patented technology using digital computer modelling to mark logs that come into production, ensuring traceability all the way through the saw line.

Insights for executives

Accelerating digital transformation

- Dare to invest in promising use cases and do not get stuck in "pilot purgatory"
- Build digital competence from the top: train board members and executives
- Enter partnerships with digital leaders to access new competencies and resources
- Implement next-generation connectivity solutions in facilities with Cloud/Edge and cyber security capabilities

The manufacturing, mining and forest industries are facing challenges related to productivity and sustainability. To digitally transform operations is key for companies to succeed in meeting these challenges.

However, many are struggling to move past the planning and pilot stages with their digitalization initiatives. Still, our report shows that Swedish industry has come a long way compared to other countries and is on the threshold of scaling up digitalization projects in many different parts of their operations.

Now is the right time to intensify investments to truly capture the value of emerging digital technologies and stay ahead of the competition. Companies must build both internal digital competencies and external partnerships, create more technology-friendly organizations and establish a future-proof digital infrastructure, including next-generation connectivity solutions. Only then can they expect to capture the real benefits of the fourth industrial revolution.

Based on these learnings, we have identified four areas companies need to work on to succeed in their digital transformation journey:

Make digital transformation a strategic priority

The fourth industrial revolution is already here, making digital transformation a key strategic imperative. A study by Arthur D. Little showed that early adopters of digital technologies can have an EBIT advantage of 46 percent.

Digitalization will be crucial to achieving strategic objectives, not only related to productivity but also sustainability, which is quickly becoming a critical challenge for all industries. However, 24 percent of companies still do not consider digitalization to be strategically important. Company boards and executive teams need to both improve their own digital competence and make digital transformation a priority for the entire company.

Dare to invest in emerging digital technologies

Swedish companies have yet to take advantage of the possibilities created by new digital technologies, such as AI, 5G and autonomous robots/vehicles. It is inevitable that all projects won't succeed.

Boards and executives must make their organizations more agile, dare to take more risks and run more innovation projects in parallel. The greatest returns do not come from short-term, incremental innovation. The big winners in the fourth industrial revolution will instead be the ones who entirely reinvent how they create value.

Put people at the center of your digitalization strategy

Succeeding with digital transformation requires businesses to attract, develop and partner with the right talent.

Attracting this digital talent requires showing a clear digital ambition, for example by investing in world-class production facilities, as well as creating new roles to attract their interest, such as data scientist or, on a more senior level, CDO. All staff need to at least attain a cursory understanding of digital technologies and solutions, including executive management teams. As only 5 percent of board members in non-tech

companies have digital competencies,[21] this will need to start at the top. There is a clear correlation between the digital competences of business leaders and company performance.[22] Digital transformation is ultimately done by people and they must therefore be at the heart of any digitalization strategy.

Our study shows that companies still struggle to scale up their digitalization initiatives. To accelerate these processes, they need to open up their value chains, build partnerships with digital leaders and embrace open innovation to access new competencies and resources. This includes collaborating across industries to find inspiration and identify best practices, for example between the industries explored in this report. A good example of building partnerships and new ecosystems is Combient Group, which is bringing together 32 leading Nordic companies in a collaboration on digital transformation. By sharing knowledge, experiences and insights, companies and industries can achieve far more together than they ever could by themselves.

Build a future-proof digital infrastructure

A robust, secure and resilient digital infrastructure built on high-performance connectivity solutions is key to accelerating digital transformation. Half of the companies today consider connectivity to be a limiting factor for their digitalization. However, the challenge is to build an underlying network which both safeguards data integrity and sensitive business information while also providing the scalability and flexibility needed to leverage new digital technologies in operations.

For example, the network must allow both for use of cloud services and applications relying on access to public networks. Meanwhile, automation, remote operation and monitoring of connected machines and vehicles might require Edge capabilities, like dedicated mobile networks onsite, to protect sensitive data and live up to required personal safety standards. Working with strategic partners to plan, build and manage digital infrastructure to meet these needs should be a strategic priority for executives at Swedish exporters.

[21] Amrop. (2018). Digitalization on Boards 2nd edition.

[22] Amrop. (2021). Digitalization on Boards 4th edition.

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www.teliacompany.com

Ericsson
SE-164 80 Stockholm, Sweden
Telephone +46 10 719 0000
www.ericsson.com

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