Opinion paper

Digital Vision for the Nordics

Shining a light on the future digital landscape

Atos

Contents

Foreword

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The Nordics are an absolute powerhouse of digital technologies. More than this, their progressive social agenda means they have made many of the digital leaps in innovation ahead of other countries.

There is much to learn from the region, particularly how well they navigated the recent COVID-19 pandemic. When Atos published its report into the imperatives for society and business post COVID-19, I was not surprised to see that they dovetailed with the Nordics vision and policies – frictionless working, technology mastery and sustainable by purpose.

As leaders in decarbonized digital, we're a perfect partner for Nordic enterprises and governments and believe we can learn from each other as we tackle the next stages of the digital revolution.

Digital transformation doesn't stop, and we believe – thanks to strong, stable politics and societies – that the Nordic region can trial innovations for the better of society and become a global leader. Particularly in sustainable industry and through the creation of a model for better data equity between government, private sector and citizens, benefiting all parties.

In this paper we aim to deliver a vision on how to use emerging digital trends to improve enterprise competitiveness and effectiveness as well as to enable a connected and inclusive society.

We have highlighted for the Nordic region:

- The importance of sustainability by design
- The need to embrace emerging technologies and take advantage of the excellent network connectivity
- The continued focus on protecting society and their way of life with digital as an enabler of progress.

We have no doubt that the Nordics will continue to be digital leaders within Europe. Our strong Nordic values and entrepreneurial spirit will have a positive impact on innovation.

Nordics at the heart

By 2030

the Nordic Region will become the most sustainable and integrated region in the world according to the Nordic Council of Ministers

28,5 million

The population Finland, Estonia, Sweden, Denmark and Norway reached in 2021

Top 15

Finland, Sweden, Denmark and Norway are in the Global 2021 IMD Digital Competitiveness Ranking, which measures the capacity and readiness to adopt and explore digital technologies as a key driver for economic transformation in business, government, and wider society

Top 20

Finland, Estonia, Sweden, Denmark and Norway are in the Global 2021 IMD World Talent Ranking, which captures the capacity of an economy to develop as well as attract talent to strengthen its competitiveness

70%

of people in the Nordics had basic or above basic digital skills in 2019

1 A competitive Nordic Region https://pub.norden.org/politiknord2020-728/#45618
2 Eurostat: https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/map?lang=en
3 IMD: https: //www.imd.org/centers/world-competitiveness-center/rankings/world-digital-competitiveness/
4 IMD https://www.imd.org/centers/world-competitiveness-center/rankings/world-talent-competitiveness/
5 Eurostat: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20200207-1

Top 5

Finland, Sweden and Denmark are in the top 5 EU in digital adoption rates, with an average of 98% in 2020

Top 20

Finland, Estonia, Sweden and Denmark are in the top 20 in the Digital Economy and Society Index in 2021. DESI summarises indicators on Europe's digital performance and tracks the progress of EU countries

6 McKinsey & Company: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/europes-digital-migration-during-covid-19-getting-past-the-broad-trends-and-averages
7 European Commission: https://digital-strategy.ec.europa.eu/en/policies/desi

Nordics at the heart

Top 10

Helsinki (Finland), Copenhagen (Denmark) and Oslo (Norway) are in the top ten in the 2021 IMD Smart City Index

Number 2

Stockholm (Sweden) is ranked number 2 in the Sustainable Cities Index of 2018

5 European Awards

The European Commission has long recognised the important role that local authorities play in improving the environment, and their high level of commitment to genuine progress. Cities in the Nordics have all been awarded the European Green Capital Award: Stockholm (Sweden) 2010, Copenhagen (Denmark) 2014, Lahti (Finland) 2021 & Tallinn (Estonia) 2023

76%

women are employed in the Nordics region in 2020

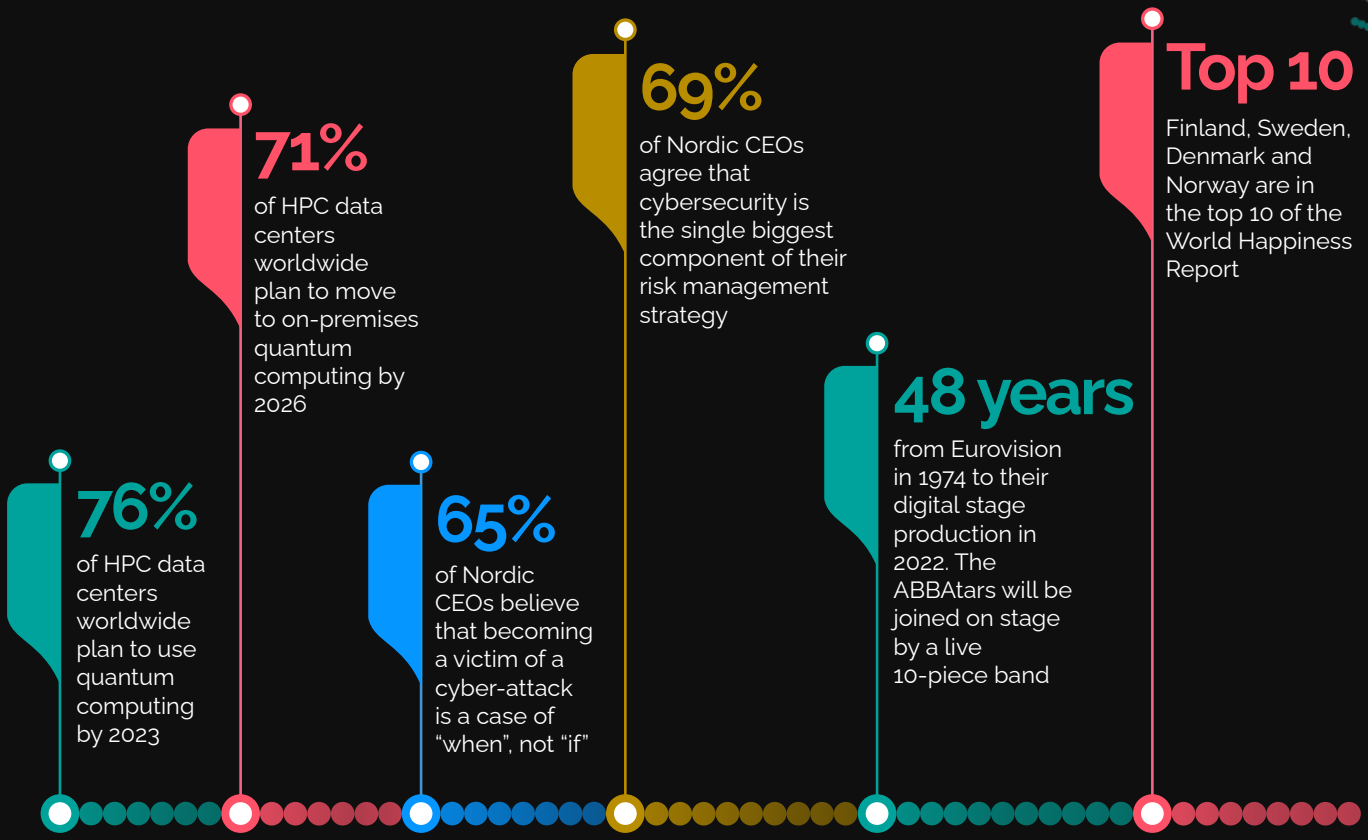
Top 5

Finland, Estonia, Sweden and Denmark are ranked in the top 5 of the 2021 Women in Digital Scoreboard

49%

Average overall share of renewable energy in gross final energy consumption in Finland, Estonia, Sweden, Denmark and Norway in 2019

1 IMD: https://www.imd.org/smart-city-observatory/home/
2 Arcadis: https://www.arcadis.com/campaigns/citizencentriccities/images/%7B1d5ae7e2-a348-4b6e-b1d7-6d94fa7d7567%7Dsustainable_cities_index_2018_arcadis.pdf
3 European Commission: https://ec.europa.eu/environment/europeangreencapital/winning-cities/
4 Eurostat: https://ec.europa.eu/eurostat/databrowser/view/LFSI_EMP_A__custom_1699922/default/table?lang=en
5 European Commission: https://digital-strategy.ec.europa.eu/en/news/women-digital-scoreboard-2021
6 Eurostat: https://ec.europa.eu/eurostat/databrowser/view/t2020_31/default/table?lang=en



7 Atos & IQM: https://atos.net/en/2021/press-release_2021_11_19/atos-and-iqm-study-finds-76-of-global-hpc-data-centers-to-use-quantum-computing-by-2023
8 Atos & IQM: https://atos.net/en/2021/press-release_2021_11_19/atos-and-iqm-study-finds-76-of-global-hpc-data-centers-to-use-quantum-computing-by-2023
9 Atos FSI realization for change survey
10 Atos FSI realization for change survey
11 Sky News https://news.sky.com/story/abba-through-the-years-from-eurovision-in-1974-to-their-digital-stage-production-in-2022-12398320
12 World Happiness Report: https://worldhappiness.report/ed/2021/

Jussi Jalasjoki
Chief Operating Officer, Manufacturing - Benelux & Nordics, Atos

Accelerating the Nordics digital revolution

It is a mistake to believe that digital and society are not intertwined. There are no longer any boundaries between the way we live, work, and play and the digital environment that surrounds us. This is perhaps why the Nordics are leaders in many indicators on digital: they focus on using digital to create policies and environments that work for and support their populations.

Connectivity and digital skills are high across the region as digital is seen as a trusted enabler of economic and social progress. Added to this, the Nordics are known for their political stability and high levels of security and equality.

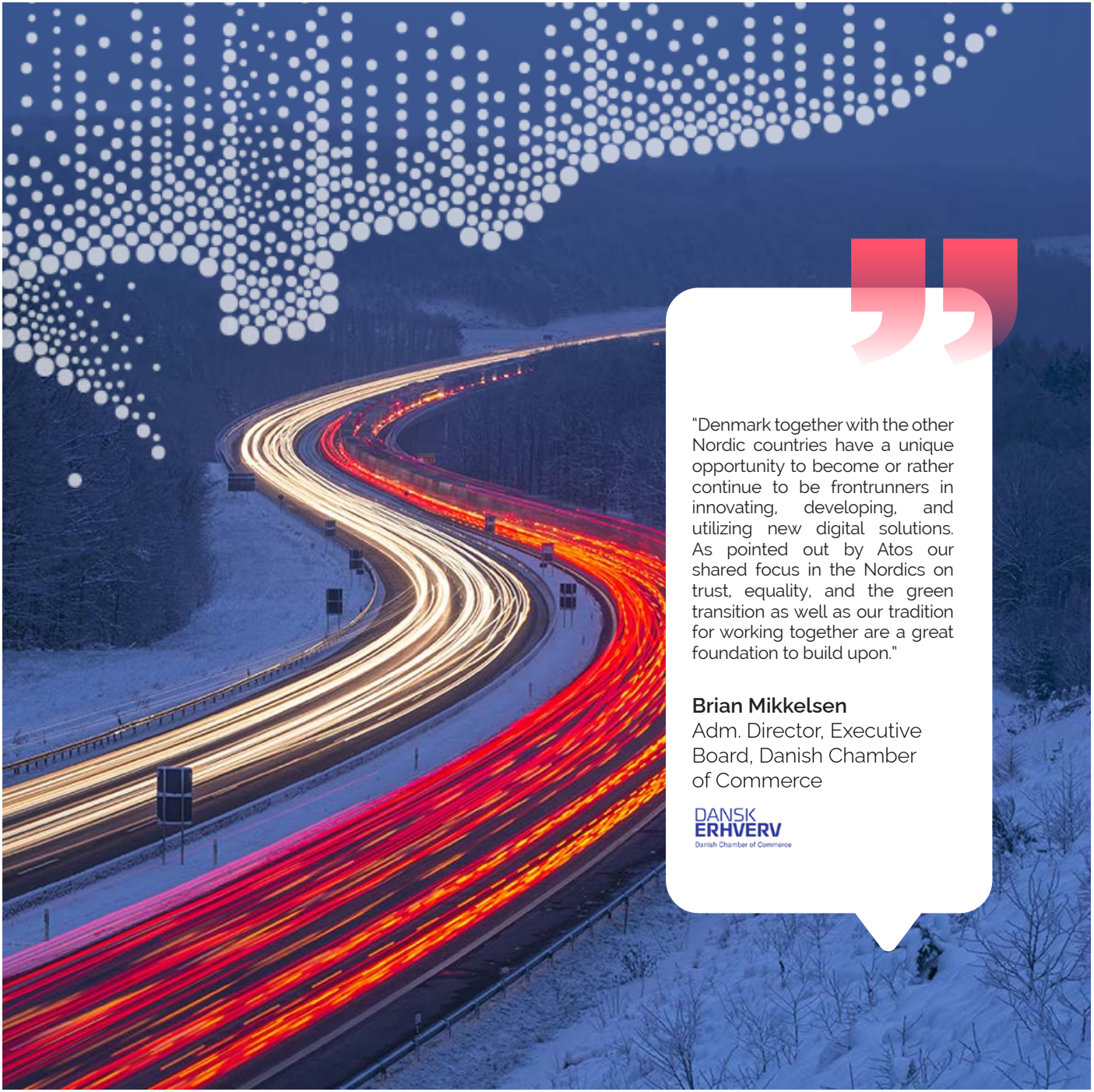
From this solid foundation there is space to innovate and grow. To accelerate this process, I believe the Nordics should continue to focus on protecting society and their way of life and focus on the following key areas:

Trust – having high citizen trust in digital is not a nice to have, it is essential for further acceleration of innovation. There must be the necessary controls in place, careful management of personal data and standardization of ethics in digital design. Citizen data is the driving force behind better and more efficient services across the public and private sector. Securing this data is vital.

Environment – digital innovation will help us to support and protect the environment and our natural resources. Governments and citizens across the Nordic countries are naturally environmentally focused. They are advanced in their approaches to tackling climate change, being front-runners in areas such as renewable energy. Innovation in this area could provide a real competitive advantage for industries. As the wider world begins to shift their view and focus on sustainability, they will look to countries who are leading the way for their expertise.

Society – digital has the potential to be a great social equalizer. It can be used to support and protect democracy, to bring education and healthcare to all and to allow widespread access to services and information.

Maintaining these pillars of Nordics values will have a positive ripple impact on innovation. The Nordics is a region that, due to its high quality of living, will encourage and retain talent. It is also becoming a hub for start-ups and venture capitalist investment with many well-known companies originating from the region.



"Denmark together with the other Nordic countries have a unique opportunity to become or rather continue to be frontrunners in innovating, developing, and utilizing new digital solutions. As pointed out by Atos our shared focus in the Nordics on trust, equality, and the green transition as well as our tradition for working together are a great foundation to build upon."

Brian Mikkelsen
Adm. Director, Executive Board, Danish Chamber of Commerce

DANSK ERHVERV
Danish Chamber of Commerce

Trust in digital

One reason for the Nordics successful digital economy is citizen trust in both digital technologies and in their Governments and public sector. This has enabled progress in both the economy and rolling out e-services to citizens.

Maintaining this high level of trust must be the priority for the future of digital across the Nordics. As we move towards automation, AI, and ML technologies it's vital that the security of citizen data and its appropriate use continues to be a cornerstone of digital strategy.

When it comes to digital leadership, there is much to be learned from the Nordic region on building a strong digital foundation through network, skills, and education. Nordic Governments have worked hard to support their economies through well-executed digital strategies and by maintaining a high level of citizen trust. One thing is for sure, their clout in this area exceeds their size!

Claus Larsen
Country Manager - Denmark, Atos

Strong digital leadership across the Nordics

The Digital Economy and Society Index compiled by the European Union shows us that the Nordic region is a leading force in digital within Europe. Although there are, of course, differences across the region, many of the same strengths can be seen across the board. Active cooperation between public and private sector and far-sighted digital policies tends to be the cornerstone of success across the region underpinned by good connectivity and network, enabling widespread citizen access, and a population with high digital use and trust.

Public and private sector digital partnership

The public sector across the Nordic countries has long been aware of the vital role it plays in supporting the digital economy. There are long-term strategies and investments in place across all countries, driving the digital economy.

In Denmark, huge investments were made in 2018 to support initiatives relating to digital growth. Three objectives were set out: support the digitisation of trade and industry, provide the best conditions for the digital transformation of businesses, and ensure that Danes are digitally prepared. They have been widely successful across the board.

Sweden has invested heavily in ensuring its population are digitally savvy and educated. This has been vital to their success in leading digital initiatives, as has their great connectivity cross-country. When it comes to enterprise, Sweden has a digitally mature economy but there is a difference between large organizations, which tend to be very mature and the SME sector. More is being done by the public sector to encourage digital transformation in SMEs, including vouchers for consultancy. There is clearly agreement across Government that improving and maintaining their lead in digital is important to Sweden's economic prowess.

Digital transformation of the public sector

Across the Nordics, public sector is taking a citizen-centric approach to services and putting more of the control and onus into the hands of their citizens. This has had a carrot and stick impact when it comes to citizen use and uptake of digital. Moving services online for all those who don't opt out means that citizens must learn to use digital services. Education programmes are available across most Nordic countries to ensure inclusion.

Norway has transformed its approach to public sector through digital technologies, making it more efficient, and data-driven, enabling it to respond to the changing needs of citizens. Denmark has established e-Boks, a secure digital mail system used by the public sector to communicate with citizens more effectively and at reduced cost.

In Sweden, a digital mailbox is also widely used by citizens to receive information from public authorities, and they are one of the highest users of e-Government services in the EU, largely due to a trusted and highly secure identity process.

Timo Tiainen
Head of Operations – Nordics, Atos

The potential of digital for enterprise decarbonization

It is fair to say that the Nordics are a leader in decarbonization through government policy and budget announcements and driven by citizen activism. Whilst writing this article, Finland released their budget proposal, which included tough measures on meeting decarbonization objectives.

In 2019, Finland, Iceland, Sweden, Norway, and Denmark committed to working towards carbon neutrality with the Declaration on Nordic Carbon Neutrality as well as a new vision to become the world's most sustainable and integrated region by 2030.

The Declaration is on the right path, covering current and future economic recovery plans, redirection of financial flows and investments, and the collaboration between private and public sectors.

Private and public sector collaboration

Structural changes to the way our economies and societies work are needed to reach our global carbon reduction goals, which is why public and private sector must work together. Both carrot and stick need to be used to incentivize decarbonization by enterprise but also regulate and legislate towards this goal.

Creating tax systems that favor carbon neutral companies would be a strong driver for innovation in this area. Establishing semi-private R&D funds with governments investing a share in return for green investments would provide great momentum for change. Carbon reduction targets should also form part of new contracts from government to drive decarbonization across industry solutions.

This push and pull within both private and public sector are necessary to drive the right behaviors across society.

Enterprise actions towards decarbonization

Industries are increasingly understanding the risks presented by climate change and are actively focusing on decarbonization across the organization, impacting purchasing, supply chain and pricing decisions. Advancing change will require investment of money, resource and, longer-term, cultural shifts within the workplace, enabled through a greater understanding of environmental impact through data and analysis. Change will be laborious, but a vital requirement driven by new legislation and market forces.

For those beginning the journey, we recommend three vital first steps.

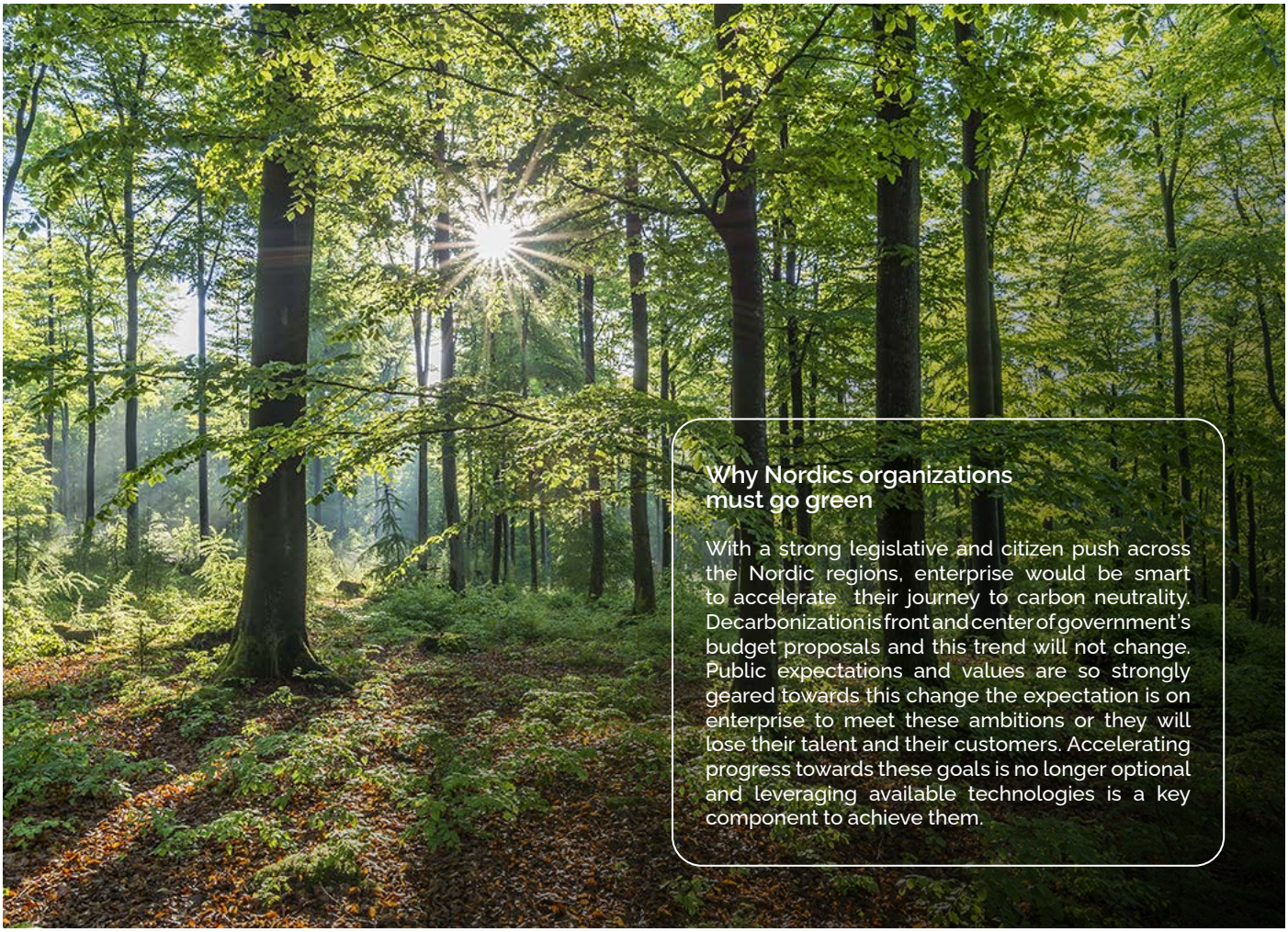
The first is measuring and understanding your footprint. You must know exactly what your emissions are and where they come from, first starting with a baseline and a maturity assessment to build accuracy as data validity increases. This really needs to consider both direct emissions and those of your value chain, crucial to determining the total footprint of your operations. Data is at the heart of this challenge to obtain, validate and analyze your impact, and utilize available models to implement the most effective actions.

The second is to set ambitious science-aligned targets for emissions reduction and work to reduce emissions of your business processes, products, services, and wider value chains. Your digital environment and business services can support your climate actions and help accelerate decarbonization, but their impact must also be understood. Shifting to the cloud, choosing energy efficient data centers, and utilizing cutting edge technologies, such as high-performance computing, AI and ML can all enable efficiencies in resource consumption but need to be measured utilizing carbon tools and assessments. Digital technology can also enable you to redefine business processes,

enable travel reduction through better workplace collaboration tools and optimize the use of real-estate to support organizational transformation.

The third step is to capture any emissions you are still working to reduce. Although reducing emissions is first and foremost, neutralizing emissions (via carbon offsetting projects that are verified by recognized international standards) has an important role to play in our global goal to tackle climate change; by providing a source of vital finance for sustainable development and by strengthening natural or technological carbon sinks. In addition, supporting projects that align to company values and deliver social and environmental value, can be a good means of engaging internal and external stakeholders with your sustainability targets and initiatives.

Decarbonization needs to be on the agenda across the organization,starting from the top to give it strategic importance, direction and empower action. Using concrete measures such as applying Internal Carbon Pricing to put a price on generated transmissions can force change, make environmental consideration part of company culture and educating employees to embed sustainable practices. In today's competitive landscape, becoming an attractive business through a thoughtful environmental strategy is also crucial to attract and retain talent, particularly within the younger generation who are your key stakeholders for the future.



Why Nordics organizations must go green

With a strong legislative and citizen push across the Nordic regions, enterprise would be smart to accelerate their journey to carbon neutrality. Decarbonization is front and center of government's budget proposals and this trend will not change. Public expectations and values are so strongly geared towards this change the expectation is on enterprise to meet these ambitions or they will lose their talent and their customers. Accelerating progress towards these goals is no longer optional and leveraging available technologies is a key component to achieve them.

Michael Luther
Head of Cloud Enterprise Services – Nordics, Atos

Improving the adoption and strategic use of cloud across the Nordics

The Nordic region is, overall, mature when it comes to cloud adoption with recent research from a variety of sources suggesting a footprint of around 50%. However, barriers remain for some businesses with the journey to cloud not always easy and the benefits of moving to cloud could still be articulated more clearly. Because the conversation has not yet evolved sufficiently, strategic use of cloud still lags in the rest of Europe.

Industry-wise there are strong differences in Nordic cloud adoption. The financial sector remains less mature in the Nordics than within neighboring regions, but manufacturing is a strong cloud adopter showing strong maturity.

Barriers to adoption

Security within cloud remains a concern for industry within the Nordics. Managing data controls, access and regulations requires expert knowledge and skills and with a large SME sector, some organizations lack the in-house skills to take on this challenge.

Feedback I often receive from organizations around cloud is that conversations are still focused on infrastructure rather than business value and benefit. Making a shift to better explain the benefits of moving to cloud would move the dial and encourage more organizations to research and take the leap. Understanding automation, Dev Ops, and allaying security concerns would go a long way to improving uptake.

Data Sovereignty and privacy concern

In the last 15-18 years, the Nordics and the rest of the EU have become dependent on companies outside the EU to handle their data infrastructure on the cloud. To place the most valuable assets, such as data, outside of European jurisdiction impedes the potential growth of cloud consumptions. This explains the crave for GAIA-X, and cloud Data Sovereignty in the Nordics, and the rest of Europe.

Acknowledging that the GAIA-X project (co-founded by Atos) has a key role to play in the creation of the next generation of the global data economy, several industries are collaborating to make available GAIA-X user cases and requirements.

Moves in the right direction

From pay-as-you-use commercial models, to scalable on-demand and highly available infrastructures and configurable platforms it is easy and getting easier to move to cloud. These days, powerful compute capability can be bought online in minutes, rather than months, that alone is making any cumbersome provisioning governance a thing of the past, and obsolete. In principle, a one-person business can gain fast access to the same level of compute power and functionality that might previously have been restricted to the largest enterprises. Given that most of the Nordics SME private businesses have less than 50 employees, this access model provides a fast and simple way for the Nordics entrepreneurs to start benefitting from cloud technologies and levelling the digital playing-field.

Nordics as a growing center for cloud services

Despite being slightly behind the rest of Europe in cloud maturity, the Nordic region is a great and growing hub for cloud services in Europe. The low costs of clean energy as well as its stable infrastructure and politics makes it a perfect region for hyperscalers and other providers to set up a base. For compliance and regulatory reasons, it is also a safe bet for meeting security and privacy requirements with rights guaranteed.

This trend in growth is likely to continue with the added advantage of the Nordics being a front-runner in carbon reduction and sustainability. These elements make it an extremely attractive proposition for providers who are keen to give their customers an energy efficient service.

What does the future hold?

Cloud adoption and maturity will increase across the region if providers and businesses continue to have the strategic, business value conversations and demonstrate that security and data protection can be guaranteed. As growth in cloud continues, so too will the Nordics economic growth and potential – reason for us all to make a shift and get cloud right.

The future is brighter in the cloud!

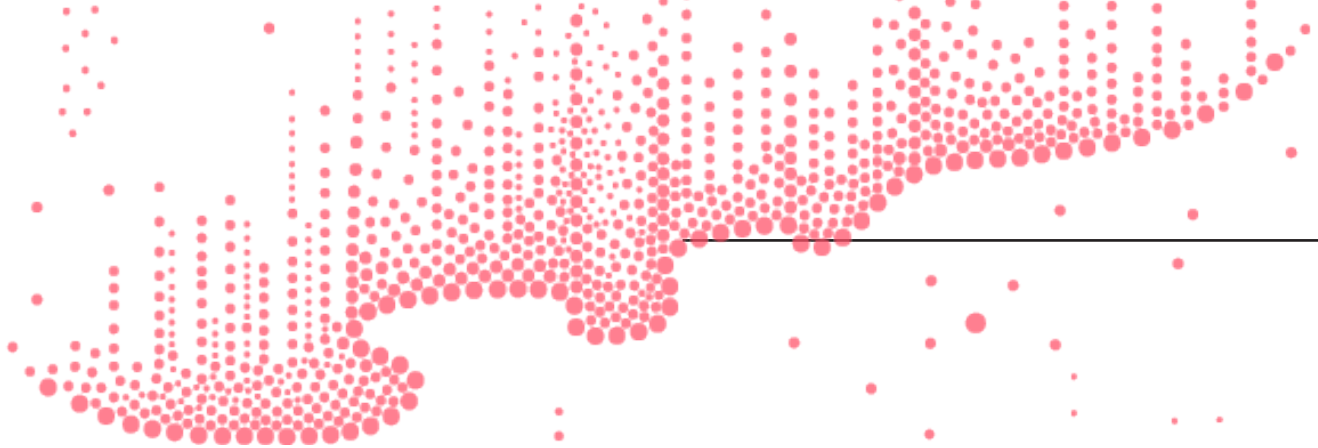
Nilesh Sakarikar
Manufacturing Industry Head, Nordics and Baltics, Atos

The focus for smart manufacturing in the Nordics

The Nordic region has a proud history in manufacturing. Both historically and today, they have had an aggressive sector with manufacturers who have punched above their weight globally. In recent decades, they have had to increasingly up their game through smart factories and digitalization to compete against its competitors and the other large global powerhouses. SME manufacturers within the Nordics have often led the way in terms of innovation, particularly within their production lines, but the larger global manufacturers have further work to do, since the maturity on digitalization differs from region to region.

The Nordics have had a technological advantage in developing industry 4.0 with a strong foundation to build upon. Innovation and digital growth are extremely high within the Nordic region. An important aspect to this is that the Nordics boasts one of the strongest 5G network infrastructures in Europe, meaning that IoT and smart devices can develop and be widely used. For this reason, and due to their stable political and economic landscape they have a great opportunity for growth.

However, it remains key to get the steps right and target their focus and investments in the best places. This means shifting the way business operates to view IT as an enabler of business value, rather than a cost center. When manufacturers successfully move the function to the center of their organization, the gains are palpable. The enabler for this is to have well-defined business "Digital Business KPIs".



Christer Alm
CIO, Handicare

handicare

As a CIO, it is my role to educate the business in the benefits of technology and bring the function further into the center. Within my organization, we have focused on the following key benefits of digitalization:

1. **Harmonization** – a key focus must be global harmonization. Putting the global systems and infrastructure in place to be able to capture data from across the entire business. Factories in separate countries lack efficiency and insight if they are not supported by standardized tooling that can ensure a smooth supply chain, quality processes and efficiencies that come with these.

2. **Enabling a holistic view of the business** – digitalization can connect the process from upstream to downstream. Rather than having an IT strategy working within siloes, manufacturers need to use IT to enhance their business strategy and connect the dots. This process needs to run from the product and customer all the way back through the production line and supply chain and even into R&D. This is not an easy transition for manufacturers that are often dealing with legacy infrastructures. But moving IT from being a backbone to the business to an enabler of business value is vital

3. **Smart data capture** – data has the potential to change your product and your relationship with your customer in ways that will future-proof your business and ensure long-term success. Having access to clean data at each point in the production chain and even within the product can guarantee that your business is evolving with customer need. Cutting-edge technologies such as digital twin can be a gamechanger in this space.

Failure in IT strategy is often down to a lack of defined business vision driving it. Understanding the business outcome and objective you're striving for enables you to take the right steps to get to that point. Manufacturers with larger margins are often at the forefront of innovation because they allow their teams the space to focus on long-term future innovation, rather than short-term cost-saving goals. Driving a vision-led organization is vital to maintain a competitive advantage.

Digitalization can also bring a new edge and flavor to a manufacturer by building in sustainability and security. Both these factors will support an improved position in an increasingly consumer-led market.

There are huge opportunities for success in this area and the Nordics are strongly positioned to be global players in manufacturing. To get there it is vital to change the view of IT. Its role is now fundamental to the success of an organization, and it cannot be decoupled from business strategy. Moving forwards with aligned teams across the business working to a common vision of the future is essential.


Smart Industrial Control System
Dashboard
Overview
Product report
Performance
Product Quality
Machine State
32.04%
99%
25%
67%
Fine

Jaakko Hartikainen,
CEO, IDEAL GRP, an Atos company

Closed-Loop Manufacturing – critical success factor for future personalized production

Over the past few years product complexity has increased as a result of systemic nature of connected products. At the same time customers across all industries are increasingly looking for more personalized products, at price levels comparable to mass-produced products.

Manufacturers have responded to changes in buying behavior by increasing product variability, and by adopting various levels of mass-customization strategies. This has led to proliferation of product variants and decrease in manufacturing lot sizes. In an extreme case every manufactured product can be different, meaning that the lot size is one.

To retain production efficiency while lot sizes are being reduced Nordic manufacturers need to establish highly automated production systems that adapt flexibly to manufacturing different product variants. This isn't the case with traditional manufacturing systems and is the driving force behind Industry 4.0 initiatives.

Making use of digital product information throughout manufacturing value chain enables cost efficient manufacturing of personalized products.

High fidelity product and production digital twins understood by production systems are the corner stones of smart manufacturing and enable production automation to adjust itself to manufacturing each different product variant.

In contrast to ERP-based manufacturing operations management systems, modern closed-loop manufacturing-systems that integrate PLM, ERP and manufacturing operations management solutions are capable of managing rapid product and schedule changes, controlling material flow between manufacturing steps, distributing work instructions, controlling production automation, and collecting information on installed components and the process itself.

Closed-loop manufacturing can give Nordic manufacturing companies the much needed competitive edge over their rivals in the global competition for buyers on search for low-cost personalized products.

Timo Pyykönen
SAP Practice Lead, Nordics, Atos

Nordics SAP S/4 transformation wave is taking off

SAP holds a strong position cross-sector in the Nordics, particularly dominant within the manufacturing industry and the managing of supply chains. Historically, when ERP started to evolve SAP was well-positioned and took market-share at the right time and has maintained this position by developing systems and landscapes through new functional areas.

Data and real-time data will always be vital for organizations to remain competitive so SAP will continue to be strong in the Nordics market. As support for old SAP ECC will end 2027, organizations can harness the benefits of SAP S/4 as real time data enables more effective finance, supply chain and logistics operations.

How to get started with S/4 transformation

SAP S/4 offers much better capabilities and possibilities to design digital more agile future processes and smart finance with real-time reporting and analytics.

You will need to spend some time developing and clarifying your own improvement potential and business case. A pre-study or feasibility study is usually needed to plan the business change, necessary technical steps, and business case.

To improve the process, I recommend:

- That you fully understand your current system.
- Assess fundamental challenges and look at competitors – particular focus on digital natives and how they operate should help you focus in the right direction, for example, retailers should look at Amazon.
- Ask yourself the question: if I could start from scratch what would I do? Here is the direction you should move towards.

Why the time is right for S/4 transformation?

The necessity to shift from SAP to S/4 has been on the table for a while and whilst many organizations postponed their transformation for a while, they are now in a hurry. The technology is mature enough, and the move is less risky than previously with many organizations having already gone through the process. There are good examples of successful transformations out there for business to learn from.

The pandemic caused organizations to pause decision-making on projects such as this, but only momentarily. In fact, COVID-19 made clear the need for robust digital supply chains and that ecommerce services are necessary. It has accelerated S/4 transformation overall across the Nordics, but the investment cycle would have remained largely the same, with or without the COVID impact.

Companies should not think of this only as a technical change, it's an opportunity to streamline processes and even change the business model as well. The overall goal should be delivering a new system of doing business, so you get more with less effort.

Per Edoff
Head of Global Energy & Utilities Presales for Data and Analytics, Value Based Maintenance, Atos

Maintaining the Nordics edge in energy through digital twin technology

Although there are differences between the different countries, it is safe to say that the Nordics are world-leading in the energy market. Across the region, money has been invested in renewable energy sources, smart grid solutions and cutting-edge innovations from the market.

As global leaders, I believe the next big development for Nordics energy companies will be an investment in digital twin technologies. This combined with the power of machine learning (ML) and artificial intelligence (AI) will bring greater predictability of resources, improved operation, financial savings as well as improved optimization and availability of assets.

These technologies can accelerate the resilience of energy businesses in two key areas.

The first and biggest potential – for cost optimization and operational benefits – is around how plant assets are operated and maintained. Given the millions of euros required to keep plants going every year, the challenge has existed for decades: how to maximize the value and life of assets while maintaining quality and availability.

The second, which applies specifically to the Nordics with their focus on renewables, is on prediction and planning capabilities enabling better and more confident trading in the renewable energy market.

How digital twin works

A digital twin is a virtual, evolving digital representation of a physical asset (or process, system, or service) that is complete at any scale. This can be used to model almost anything – from a wind turbine, to an engine part or a generator – leveraging all the information needed during its design, manufacture and operation, as well as real-time operational data from IoT sensors and operational systems like SCADA.

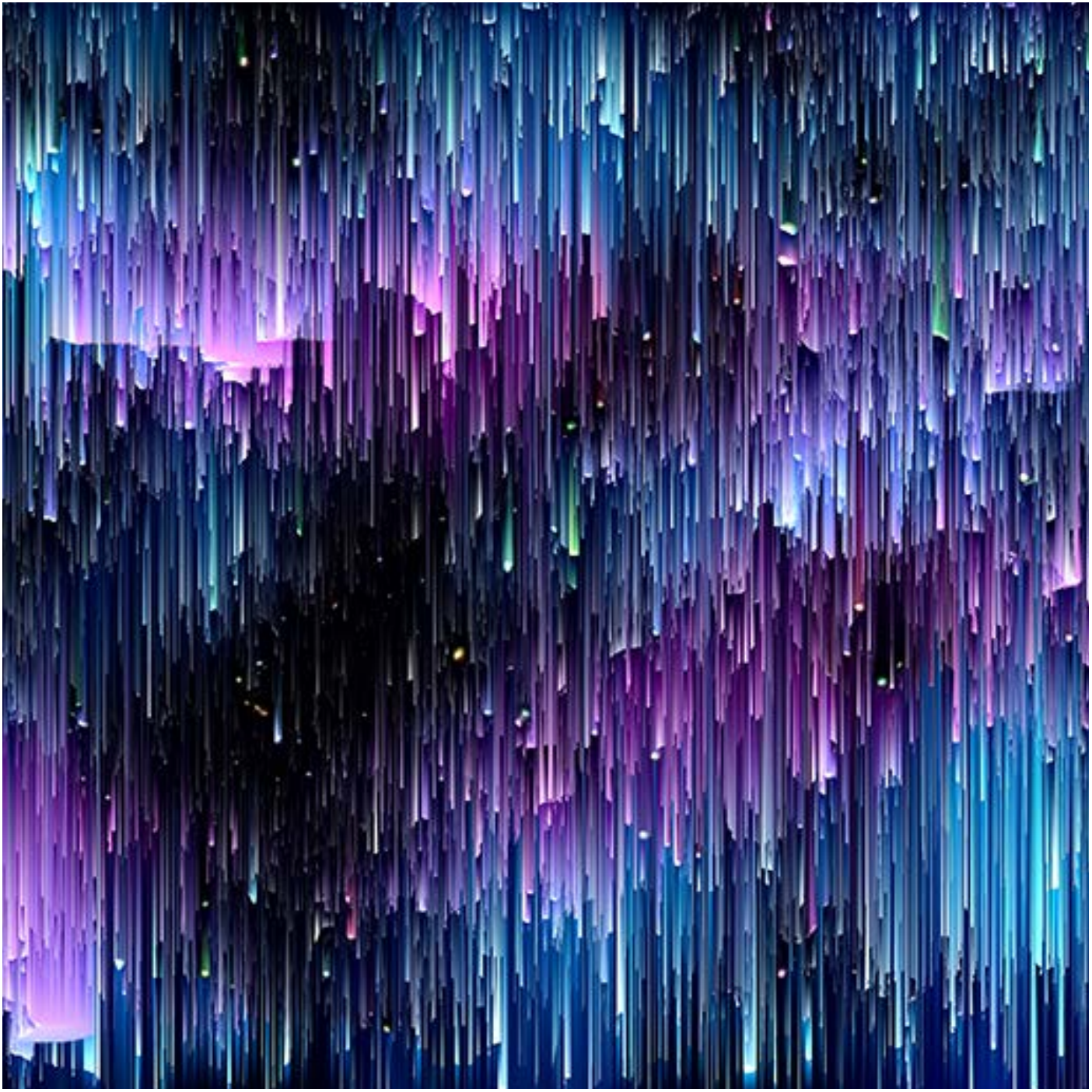
Using digital twins, energy companies can simulate detailed 'what if..?' scenarios for strategic investment planning. They can change different parameters to see the impact of different investment decisions and plans at an enterprise level. This capability can significantly simplify the planning process while increasing the value from investment portfolios through more precise risk-based CAPEX allocations. It can also help to optimize operations, using simulations to plan for differing weather conditions and downtime based on the outcome of different scenarios.

Proven results for energy & utilities

With some of the most ambitious energy and climate policies in Europe, the Nordics must be at the forefront of both innovation and efficiencies in this market. Digital twin technology can help.

We have seen great results already - improved CAPEX allocation, prolonged component lifetimes, minimized downtime, maximized efficiency and reduced operating costs.

Using these technologies for forecasting capacity in the renewable sector is yet to be explored but should yield results. Connecting weather data, consumption patterns together with asset production data, could lead to better forecasting of consumption and better predictability of capacity needed providing a way to manage the ongoing capacity challenge renewables bring. It's a competitive advantage that shouldn't be missed.



Sami Kuorilehto
Client Executive Partner, Public Sector & Defense Finland, Sweden & Baltics, Atos

Connecting communities and smart cities

The Nordic countries have long been leaders in progressive societies and policies that focus on citizen services and wellbeing. Digitalization has created an incredible framework from which to improve and update services. It has challenged us to question existing norms and practices and re-create them, to make them work more flexibly for individuals and communities. In practice, digitalization brings citizens, companies, and public services together and this is well demonstrated by the smart city agenda.

Electronic services increase the opportunities for citizens, businesses, and communities to use public services regardless of time and place. Electronic transactions are also the easiest and fastest way to handle government matters, also in real-time. As the use of electronic services increases, public service production will become more efficient and common tax resources will be saved. The premise is that smart city, e-government services are functional, easy to use and secure.

Smart cities in practice across the Nordics

There are some advanced examples of smart city developments today, especially from the Swedish and Finnish capitals Stockholm and Helsinki.

The City of Stockholm has implemented a smart traffic steering system based on cameras instead of sensors in the ground, saving unnecessary groundwork and money. Additionally, as they receive real time information, they can minimize traffic congestion by building AI into traffic light control systems. This system has the added benefit of being more environmentally friendly, which fits the Swedish agenda to be ecological, economical, democratic, and socially sustainable in the future.

The City of Helsinki is building some really cool digital services for their citizens too. Some projects that are currently ongoing include a hobby passport for youngsters to find something easy to do, daycare placement arranged via one SMS, local services in your hand through an interactive Helsinki map, Helsinki digi advice services (free advice in libraries, resident houses, elderly service centers etc), workspace reservation for citizens in public areas, chatbot for welfare advisory services, and free of charge digi support week.

Where next for the Nordics and smart cities?

Different cities are at different stages with their projects. Some have started to build their main strategies and have also built supporting data strategies, some are already building the necessary infrastructure, some are procuring services for clerks and schools to support the 24/7 open city goal, some have even hired their own software groups. There are also cities that have implemented solutions using IoT technology already, though often without any data strategies behind them.

In my view, before starting to build public services, the main task must be to have a data strategy in place with focus on security privacy. Most large cities across the Nordics seem to have one. There are many aspects to this. For example:

What do we want to achieve with the captured data?

- Does the data need to be stored? If so, where should it be stored? On-premise, off-premise, sovereign cloud, multi cloud.
- How accessible does it need to be?
- What should the city expect in return for sharing data with

private sector? Value of the data can not only be expressed in terms of hard currency.

- Who can access the data and how secure does it need to be?
- How do we protect the data from viruses and ransomware?
- How fast does the data need to be restored if lost?

These questions, plus many more form the basis of a strategy and needs to be answered. This strategy must ensure public trust is maintained but can also form the basis of a business strategy, which can help public sector pay for services using money other than from the taxpayer – something that would be popular with Nordic citizens.

When the data strategy is in place, the basic infrastructure needs to be established. Network, storage, compute power, IOT, end user devices etc. depending on what solutions will be provided. This, too, is not a small task but the Nordics countries tend to be advanced in terms of digital infrastructure.

One thing is certain, the smart cities agenda is firmly in place across the Nordic region and likely to gather pace over the next few years, bringing benefits to communities and supporting efficiencies as well as the green agenda.

Anssi Pakkanen
Industry Lead, Transportation and Logistics – Nordics, Atos

Finland Digirail Program: Building a more safe, sustainable, and efficient rail network with cutting edge innovation

Finland Digirail is at the beginning of an ambitious, world-leading project to modernize the technical systems of railways and secure the future of rail. It will also set the scene for efficient multimodal transportation in Finland. The project is driven primarily by a desire to put the passenger at the heart of a new transportation system, which increases capacity and cost efficiency, improves reliability and safety, and is more environmentally friendly.

Getting this right will make Finland a leader in digital rail and, undoubtedly, others will be looking to follow their lead. For this reason, understanding the global market and direction of travel will play a role in the development of Digirail and its ongoing success.

Enabling digital transformation

One of the primary challenges in digital rail will be connectivity, which will have to reach a high performance level to transfer massive flows of data and manage operations in real-time. There is therefore a requirement in a project such as Digirail for both OT and IT expertise; and knowledge of how the two systems must work together.

In other areas of the transportation and logistics industry, such as car manufacturers they have worked with this convergence for decades. For rail it is still relatively early days with operators only now changing the conversation to include both disciplines with equal importance.

Cost efficient public 5G / 6G - an advantage for Finland

Finland will be utilizing a public 5G network for their Digirail project. This brings some natural advantages ahead of other projects across Europe where private operators will have to build their own 5G networks and, in the near future transition to 6G.

5G, and later 6G, brings improved connectivity, low latency, and machine-to-machine communication.

This is all possible because 5G is software defined, rather than hardware, which means a great benefit to rail is that the network can essentially be sliced into segments for different uses. There can be an ultra-secure segment for emergency communications, which can be managed in a different way to less vital services. This means you can prioritize power and capacity when necessary and push resources to a specific place.

On the flip side, as Finland will be the first digital rail project on a public 5G network, they won't be able to look to other European projects for guidance. 5G's increased personalization potential also brings larger complexity, particularly around security. A technology partner who understands the complexities of 5G networks, and is already looking forward towards 6G, will be needed to navigate these issues.

Strong ecosystem of public and private partnerships

Managing an ecosystem of partners and providers will be fundamental to this project's success. There are seven public stakeholder organizations involved, which adds complexity of its own, but the project itself will draw together technical and operational skills from a number of different players within the private sector also. Strong systems integration is needed, and this must be a core skill within the project team.

Beyond this, the most important stakeholder is the public. This project will require public support lasting decades. The key focus for an operational Digirail is customer experience but in public sector projects this focus must start at the planning stage and last all the way through to delivery of the project.

Building a more safe, sustainable, and efficient rail network with cutting edge innovation will reap benefits to the whole European transport of the future.

Mansing Bhor
Industry Lead Telecom, Media and Technology - Nordics, Atos

Leading the way of intelligent society by unlocking the power of 5G connectivity and Edge Computing

Across all digital indicators in the Nordics, connectivity and network remains one of the leading advantages for the region. In the EU, Finland, Sweden and Denmark take the top three positions in Digital Economy and Society index, largely due to connectivity. This is a great advantage for the region and certainly helps it punch above its weight, particularly when it comes to driving 5G and Edge Computing.

All sectors are going through a rapid digital transformation by unlocking the data potential of the connected devices enabled by 5G connectivity and Edge computing.

5G Innovation and Edge computing are truly changing the way the industries are functioning and building consumer interaction to meet the end needs. This is supported by devices communicating with each other, collecting, and exploiting the data for the new industrial solutions.

Across all digital indicators in Europe, 5G connectivity has become an innovation platform, using data to unlock innovation for business-critical solutions which remains one of the focus areas.

The Nordic countries are aimed to lead the high-speed connectivity of 5G technology, innovate solutions and services around the connected devices. All the Nordic countries are working together to identify and abolish regional and legal obstacles to rolling out 5G across borders supported by sustainable solutions. As a result, Denmark's TDC NET has become the first Nordic digital infrastructure provider to reach nationwide 5G coverage.

With 5G in place now, companies are able to bring speed, lower latency, and more reliability in machine-to-machine communication. With connectivity, adding edge computing transforms the way connected devices process the huge number of data generated by the devices in the infrastructure. To make the system real-time smarter and experience heavy, bringing cloud applications optimizes overall service performance.

5G promises a lot more benefits but without the right stakeholder, the end-to-end value will not be possible. Hence it is important that Network providers must work alongside digital services organizations to provide end-to-end service and solutions for the public and private sectors. These consortiums can together define what's needed for innovation for a particular industry: managing connection, speed, security, hardware, data storage, and so on. Industry must develop the hardware and software supporting advanced networks. This is how the next generation digital transformation will happen.

Beyond the Nordics ambition, the EU has taken the decision to have a trustworthy federation of data infrastructure bodies that will drive the future infrastructure of Europe, defining the roadmap, policies, rules, and regulations: GAIA-X. Atos is a founding member of GAIA-X, partnered with other service providers to design and build core industrial solutions such as smart cities and industrial infra services.

Network alone cannot bring innovation, but it is the foundation on which it can be built. Nordics has been the home of Telecom for the last hundred years. They are ahead of the rest of Europe in terms of innovation because networks are driving it fast, and their societies are fast adopters of technology. Some of the world's most experienced network providers are situated in the Nordics, for example Nokia and Ericsson . They have experience and global clout that they bring to the Nordic industry. The region has a strong foundation on which to build, and this remains a huge competitive advantage.

Janne Ahonen
Financial Services and Insurance Industry Lead - Nordics, Atos

How Nordic banks can lead the way on the race toward net-zero and make decarbonization banking sense

Nordic societies are driving towards a decarbonized future in order to safeguard our planet. In doing this, banking can set the industry example and plot the path for others to follow by committing to a digital approach and transitioning to net-zero.

Nordic banks are in a unique position to make significant strides towards decarbonization within their own operations, while also supporting decarbonization through their investments. The establishment earlier this year of the industry-led, UN-convened, Net-Zero Banking Alliance bringing together 53 banks from 27 countries representing almost a quarter of global banking assets (over €32 trillion), is the most vivid demonstration of this. For many in the sector, the starting point has been to analyze and change what the enterprise can most closely control. This can involve setting targets for reducing paper, energy, and water consumption, along with efficiency goals for our buildings and data centers.

Enabling decarbonization across the economy

Harnessing digital finance, big data, artificial intelligence (AI), mobile platforms, blockchain and the Internet of Things (IoT) to deliver products and services offers ongoing opportunities for decarbonization. More can be done to pioneer decarbonization along the value chain, such as through Decarbonization Level Agreements to set measurable targets with suppliers and partners. In addition, Nordic banks can learn the lessons of the pandemic to move their operations further towards a lower-carbon way of operating, embedding some of those changes adopted rapidly in response to Covid-19 to deliver ongoing sustainability and productivity benefits. One example is the reduction of air travel between Nordic countries.

Yet still, at face value, it may seem that banking has less to do around decarbonization when compared with companies operating in the energy and manufacturing sectors for example. However, given the nature of the role that banks play in most people's lives, they have huge potential to drive progress towards delivering net-zero. This is an exciting opportunity to lead change in decarbonization, responding to changing public expectations, regulatory requirements, and the needs of investors. Banks can become part of a wider decarbonization ecosystem, with mutual value around integrating environmental, social and governance (ESG) criteria into business or investment decisions. Many Nordic banks have already taken sustainability into their strategy, but more can be achieved. Digital technologies and data have a role to play, for example with the application of artificial intelligence algorithms to identify more sustainable investment strategies. At Atos, for example, we have worked with DreamQuark, a French start-up specializing in AI applied to the finance and insurance sectors. Together, we've launched the Sustainable Investment Brain, the first digital platform for banks and insurers that is both dedicated to socially responsible finance and compliant with the principles of transparent artificial intelligence as set out in new proposed European regulations.

Leading the transition to net-zero

Supported by a growing interest in ESG issues, global sustainable fund inflows were up 88 % in the fourth quarter of 2020 to more than €132bn. Their success has since continued to build, supported by the growing demand for meaningful investments during the health crisis. The Sustainable Investment Brain helps to accelerate this trend by combining AI and deep learning, leveraging financial and extra-financial data, including accurate and standardized

ESG data. This can be used to identify potential investors most interested in responsible investment and to recommend the most suitable assets and investment products, taking into account their individual profile and objectives.

The Nordic banking sector can build on the progress made in recent years by embracing new digital tools to become a key enabler and catalyzer of a greener society. The combination of digitally enabled banking and innovative sustainable finance can help to power economies while supporting the transition to a net zero future.

NatWest

Developing a data-driven approach to energy management for NatWest

Challenge

NatWest Group (formerly RBS) needed a comprehensive way of managing its energy performance and environmental reporting. Key objectives were to reduce energy consumption and costs while enhancing environmental engagement with internal and external stakeholders. Involving multiple suppliers, data sources and a reliance on spreadsheets, the company knew that its reporting was slow, with problems around the integrity of data. It wanted a more robust approach, using digital tools and a complete repository of reliable data.

An innovative partnership

Embedded within the NatWest Group's own team, EcoAct was uniquely placed to understand the day-to-day challenges and work closely with the company to engage with stakeholders and achieve its goals. The team implemented a data and analytics platform that captures, integrates and analyses data from over 5,000 locations in 57 countries, facilitating and driving expense management, reporting and energy management activities.

The results

The NatWest Group's foresight in deploying an innovative embedded service and digital platform has balanced climate action with improvements in efficiency and significant commercial returns:

- £2.4 million in savings and cost avoidance delivered during the first 11 months
- A more efficient billing validation has generated over £1.8 million in cost avoidance
- Energy consumption is lower, keeping the bank on track with its energy reduction targets
- Insightful exception reporting has realized at least £128,000 of energy savings beyond business-as-usual energy savings so far.
- The platform is in place to improve performance, efficiency and productivity even more by using automation and machine learning to continually model, analyze and exploit rich customer intelligence.

SelfBack
Søren Kleberg
CEO, SelfBack

The future of digital health apps

When it comes to healthcare, digital health is the next frontier. The trend has been accelerated through the COVID-19 crisis and governments and citizens are waking up to the advancements and possibilities it brings. Within the next ten years, it will be so prevalent and mainstream across public health services, we won't remember how we lived without it!

Across Europe, many countries have followed Germany's example in passing legislation such as the Digital Health Application Act (DiGA), enabling digital apps to form part of recognized treatment programs and therefore be accredited and funded by state insurance. Any digital apps put forward will need to go through the same rigorous regulatory procedures as new vaccines - albeit with digital regulators rather than pharma – with clinical trials sanctioned country by country.

Digital solutions support the macro trend of value-based healthcare, which is defined by being able to effectively measure the success of treatment options for patients versus cost – does a treatment plan produce the best results for the investment made. The still to be tested hope is that with large amounts of data able to be extracted from digital health apps, this assessment can be easily achieved. Digital apps that produce personalized healthcare plans for individuals automatically, that can be managed by patients, should be an extremely cost-effective solution for healthcare systems that are stretched. This hypothesis can only be established through data and careful work with clinicians, which is the vital next step in our journey.

Surprisingly, given their status as digital frontrunners, the Nordics have yet to push digital healthcare legislation through, although they are close. The Council of Nordic Ministers is already tasked to manage this uniformly across the region.

SelfBACK

SelfBACK is leading the charge in digital health apps. It is a self-management program for non-specific lower back pain and the current results from high-quality clinical trials we have undertaken are very positive, with SelfBACK currently being implemented in new digital pathways in Denmark, Norway and NHS England.

Lower back pain is the most significant contributor to disability in Europe. Every year, about 1 in 15 people in the European population will consult their general practitioner suffering from it, and it is one of the most common reasons for activity limitation, sick leave, and work disability. Finding treatment programs for those affected is a top priority given the massive personal, social and economic implications it brings.

The reason SelfBACK is such an important tool for back pain management is that it has essentially digitized a vast amount of clinical data, building on decades of research. The app is powered by AI, which means it can match individual profiles with vast knowledge of successful treatment plans for each profile producing evidence-based advice that no human could have the knowledge to deliver.

Implementation models

The next stage in large-scale roll out for digital health apps is understanding how to successfully implement at scale and to monitor if the good effects are maintained. Here, public and private sector organizations must work together and map out processes.

SelfBACK is acting as a pilot for this process and tackling some vital questions that surround delivery such as:

- **Liability** – as a licensed product, the app must form part of a treatment plan that is overseen by a medical practitioner. Although there is scope to open the app to the public, the pathways and advice may have to be tweaked to adjust liability from clinical to personal.

- **Data sharing** – who owns the data produced and how is this managed securely and in-line with regulations. At SelfBACK, we believe the patient owns their data and this is clear within

the application, however, we ask our patients to opt into sharing anonymized data with us because the more data we can use, the better the treatment plans can be personalized for individuals.

- **Network, stability and scale** – producing an innovative app with cutting-edge technology is something small digital organizations, like ours, are fantastic at. Bringing it to scale requires the expertise you can find in large global digital organization. Partnerships can be extremely helpful here in managing both innovation and scale.

Where next?

We are on the cusp of a digital health revolution – there is no doubt. Delivering digital treatments with proven results at low cost must be a focus for worldwide healthcare systems and has powerful implications for reducing healthcare inequality and bringing better outcomes to all. What's needed now is a huge research effort to begin to prove the hypothesis around digital treatments' effectiveness and cost benefits.

Focus is required from governments to manage the integration, implementation and outcomes carefully. This starts with legislation, for which a working framework already exists in many countries. After this we must start to pilot apps such as ours, identifying any hurdles there may be and resolving them. Gaining understanding – through research – of effectiveness, cost and any other issues we may encounter such as disenfranchised groups and any digital divide that may impact outcomes, is vital for safe and successful roll-out.

The pandemic has shown us that digital healthcare can bring huge benefits to citizens, let's keep the momentum going to push the benefits forward.

> "SelfBack is a great example of what we can expect to see more of in the future, when we combine big data and AI with user-centered experience design to build the next generation digital health solutions."
>
> **Professor Paul Jarle Mork, Norwegian University of Science and Technology**

> "We have only seen the beginning of the digital revolution in healthcare. The potential to improve public health and patient care is enormous. It is important to prioritize research that can help us understand where digital health solutions can be an advantage, for whom, what they should look like, and to study outcomes and cost. Just as in the physical world, one size is not likely to fit all."
>
> **Professor Jan Hartvigsen, University of Southern Denmark and co-developer of the selfBACK app**

Michael Folkmann-Schjerbeck,
Head of IT & Digital Projects, Satair

Reindert de Leeuw,
Head of Digital – Nordics, Atos

Delivering successful AI

AI can be a game-changer for organizations, but its success relies on careful implementation and, often, trial and error. Because it's been talked about for decades, it's easy to forget that the technology is still new. Getting it right can bring great rewards, getting it wrong can be costly and time-consuming.

At Satair, we have worked to develop Lilly, an automated quote handling platform for our e-commerce site. This has been successful in several ways: improving the customer journey through fast turnaround of quotes, releasing our own talent from low-value work and reducing costs.

As margins for the aviation industry continue to be squeezed, successful innovation such as this will be more and more of a necessity for survival. But where do you start?

Solving problems

At Satair, our call volume from customers was greatly increased by the pandemic. This was largely because stock inventory changed as travel decreased; moving to ordering more frequent, lower volume stock supplies. This meant we had a huge increase in the number of calls coming through to customer service.

We started with this problem and went directly to the source – our customer service representatives – to gather information and understand the impact on the ground. We made these employees active members of our development team. They supported the project through their knowledge and insights initially and later through trial-and-error phases.

This contributed hugely to the success of the project. The better the understanding of the problem and quality of the data you put into an AI project, the better it will work.

Technology-agnostic approach

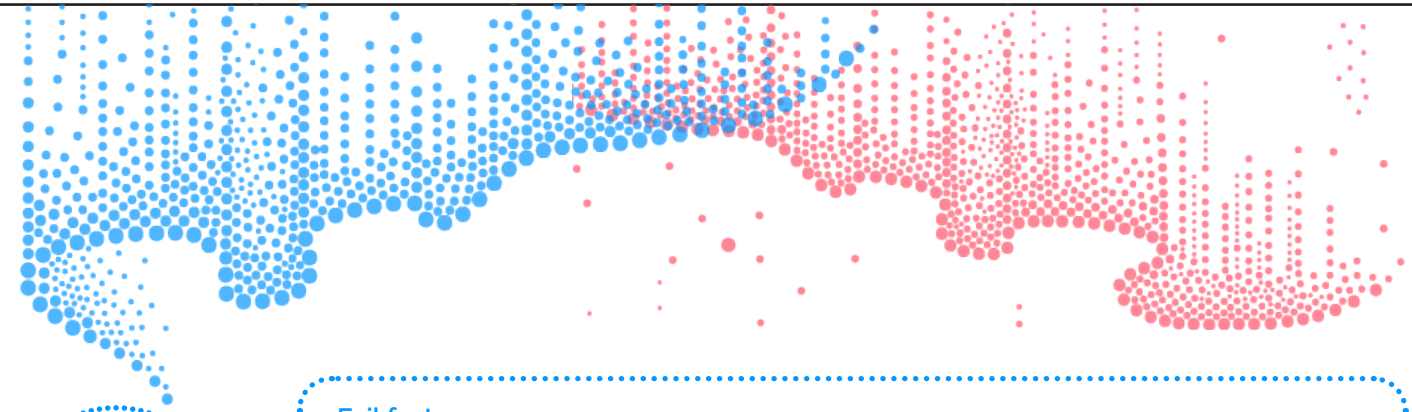
Starting with the problem also means removing any pre-conceived ideas you have about the technology you will use.

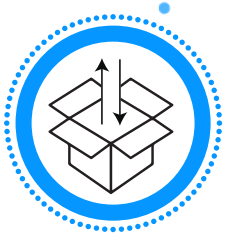
If you build the technology stack from the basis of the problem using an agile methodology, then you're able to identify issues as they appear, iterate, resolve them and move forwards. This also means you don't get locked into a costly bespoke technology solution that cannot be managed and maintained in-house.

Mario Cappitelli,
Product Owner Lilly, Satair

Nick Moesker,
Solution Lead – Nordics, Atos

SATAIR





Fail fast

Short development cycles and daring to go live with Minimum Viable Products means there's no wasted time and you find out what's most useful quickly. If your team on the ground – in our case, our customer services representatives - are on board, they can test products for you and start giving you further feedback quickly.

This means there are no late discoveries of issues, onboarding new solutions is less fraught with potential failure and delivery is swift.

Keep proving your worth

Starting small and proving you can solve a problem means that asking for further investment to expand has more chance for success. We built our initial solution in six weeks and had results we could demonstrate before we thought about expanding.

At Satair we are developing an AI operations platform and moving away from a project-based development. Once innovation is established as the foundation to evolve the business, there will be further capacity and funding through freeing up time for revolutionary projects to take place.

Why innovation is vital

The aviation industry was dramatically impacted by the recent pandemic, but this is only a precursor to a far greater change that the industry must navigate around the impact of climate change and the changing face of air travel.

In the future, aviation must lead the way in early adoption of tech to pave the way to a better future – for the industry, our customers and the planet – learning from innovative projects such as this one will help us deliver large-scale success for re-building the foundation of our business.

CSC
ICT Solutions for Brilliant Minds
Irina Kupiainen
Public Affairs Director, CSC

Nordics as a hub for sustainable innovation across Europe

CSC's views on the contribution of HPC/AI to the dramatic effect of digital technologies in the Nordics and the potential for Nordic countries to create competitive advantage and sustainability in today's global economy.

Modern research both in academia and industry is dependent on digital technologies, such as HPC and AI. Therefore, the adoption of such technologies is key for countries to remain competitive and achieve scientific breakthroughs of high societal impact, such as understanding climate change, designing new medical treatments, or finding new materials.

The Nordic countries have been very successful in promoting the uptake of digital technologies and are among the most digitalized countries in Europe[1]. This digital leadership is a significant competitive advantage, not only for the Nordics but for the whole of Europe. It must be continued and leveraged in the years to come, which is why we must focus on innovations such as high-performance computing that can power AL, ML, and data analytics.

A unique offering of supercomputing environments and expertise on a global scale

Renforsin Ranta business park in the City of Kajaani, Finland is the location of CSC – IT Center for Science Ltd.'s national supercomputing environments Puhti, Mahti and Allas and forthcoming LUMI EuroHPC supercomputer. Modern infrastructure includes supercomputers supporting artificial intelligence, secure data management, and reliable data communication networks to the world.

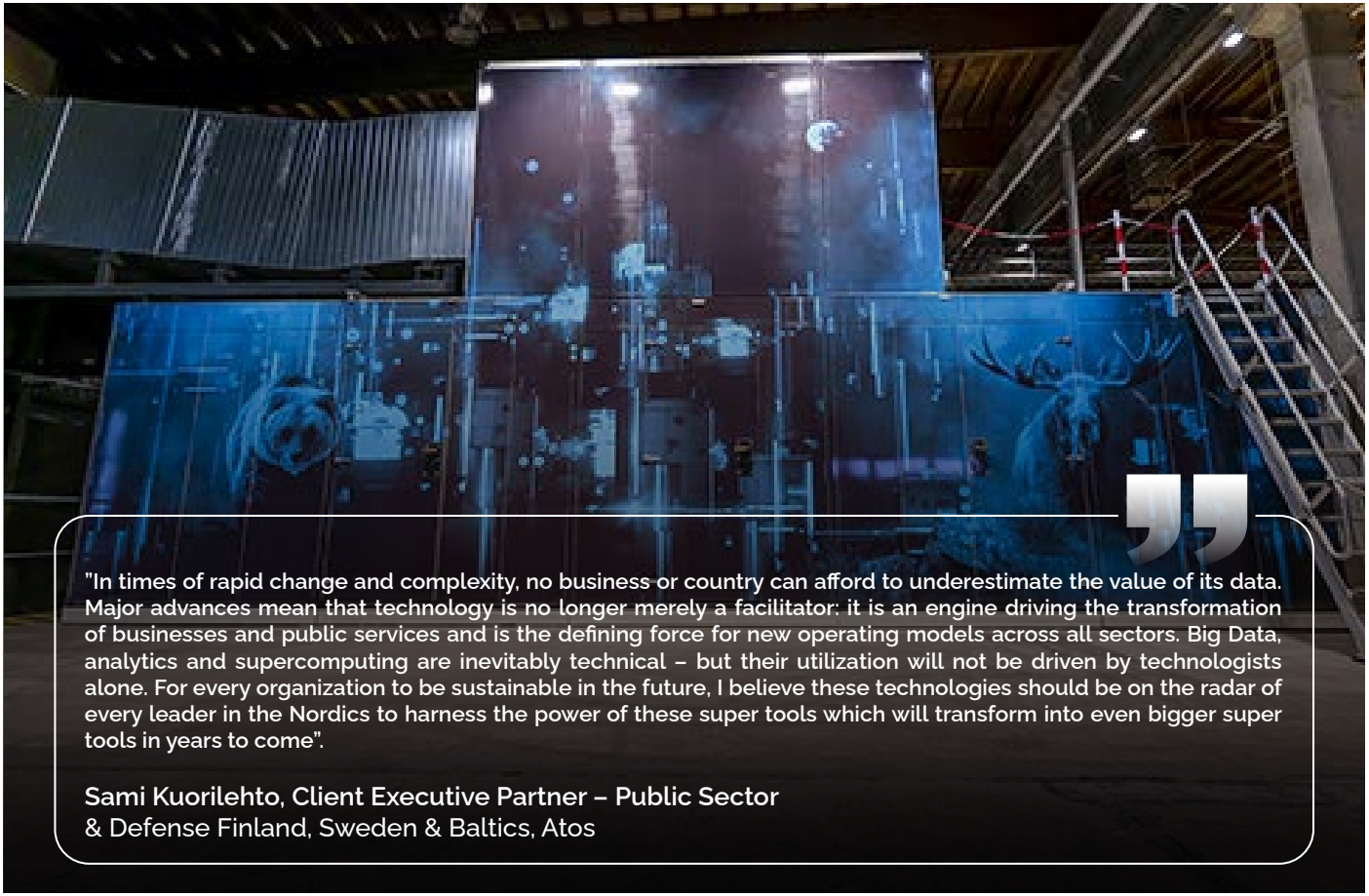
Kajaani data center is located in an old paper mill area and offers advantages such as energy and cost efficiency, societal and geographical stability, and high security standards, making it ideal for building a sustainable data center ecosystem. This data center, with its zero carbon footprint, is one of the most eco-efficient in the world and will thus be able to play its part in support reaching the ambitious climate targets. In addition, the area has unique expertise and education on data analytics and data center functionalities thanks to the Kajaani University of Applied Sciences and numerous ICT companies.

LUMI

Currently, the installation of LUMI, which is one of the most powerful supercomputers in the world, is being finalized. In addition to the remarkable computing power, LUMI is one of the world's most advanced platforms for artificial intelligence and it will be one of the world's best-known scientific instruments throughout its lifetime. With LUMI, European researchers can access world-class computing resources, which have a direct positive impact on European research in nearly all scientific disciplines. With 20% of its computing capacity reserved for industrial use, LUMI is also a unique opportunity for companies to develop R&D activities and boost innovation.

All the Nordic countries are members of the LUMI consortium, which consists of 10 countries, and have a solid tradition of collaboration in HPC training and education, user support and data management services. Building on this experience, the Nordic countries are well-placed to advance cross-border and cross-sector collaboration to develop state-of-the-art research ecosystems that connect HPC, AI, cloud, quantum computing, networks, and data repositories.

1. Digital Economy and Society Index (DESI) 2020



"In times of rapid change and complexity, no business or country can afford to underestimate the value of its data. Major advances mean that technology is no longer merely a facilitator: it is an engine driving the transformation of businesses and public services and is the defining force for new operating models across all sectors. Big Data, analytics and supercomputing are inevitably technical – but their utilization will not be driven by technologists alone. For every organization to be sustainable in the future, I believe these technologies should be on the radar of every leader in the Nordics to harness the power of these super tools which will transform into even bigger super tools in years to come".

Sami Kuorilehto, Client Executive Partner – Public Sector
& Defense Finland, Sweden & Baltics, Atos

Nordic countries can provide ideal locations for digital infrastructures for a number of reasons including:

- abundant and stable supply of affordable renewable energy to power the infrastructures
- climate conditions that allow for free cooling of the infrastructures all year round
- highly capable telecommunication connections linking the infrastructures to users all over the word
- highly educated population with an innovative mindset
- stable societies capable of providing high security and safety standards as well as high levels of trust
- existing sites, for example CSC's Kajaani ecosystem, with scaling opportunities and the surrounding infrastructure and know how already in place.

The joint values and culture of the Nordic countries stems from a shared history, and they aim to continue the long tradition of collaboration. Between 2020-2024, the Nordic Council of Ministers is implementing an action plan towards the vision that the Nordic Region will become the most sustainable and integrated region in the world by 2030. This includes for instance actions within education and research, digitalization and innovation[2].

2. Action plan for Vision 2030 | Nordic cooperation (norden.org)

Janne Ahonen
Country Manager – Finland and Baltics, Atos

Finding the Nordic quantum advantage

Once a domain of the most hardened physicists and mathematicians, Quantum Computing is starting to enter the mainstream with many companies experimenting with real-life applications. A study[1] published by IQM and Atos found that 76% of HPC data centers worldwide plan to use quantum computing by 2023 already. Due to their strong tradition in researching and adopting modern technologies, the Nordic countries are already looking to maximize this opportunity, with programs already in full swing across the countries. However, with the global superpowers and Big Tech having much deeper pockets for the necessary investments, the Nordics must find a new relative advantage in the Quantum era.

Although the Nordics remain active members in the EU Quantum Technologies Flagship program, it is vital that they also form a separate coalition to develop their own Quantum technology within a unique area. One area of quantum research, where the Nordics could have a natural advantage, is in sustainability, and many of the Quantum Computing experts I have spoken with on this subject have agreed that this makes strong commercial and political sense for the Nordics.

The Nordic countries are traditionally environmentally focused, understanding that their pure and unspoiled natural environments provide a global competitive advantage and are a positive differentiator. In many respects, these countries are already quite advanced in their approaches to tackling climate change, pollution and other environmental issues being front-runners in areas such as renewable energy. They also enjoy widespread public support for sustainability initiatives, which should improve the chances of gaining access to public funding. For industry, this would make sense as an area of competitive advantage as they are already producers of sustainability-improving products such as wind turbines, batteries and novel materials, all of which can benefit from new research findings that only Quantum Computing may provide.

Talk of building a strong Nordic Quantum ecosystem is already firmly underway. This coalition must be formed of public sector organizations, academics and researchers, as well as industry representatives. The different parties should come together to define the leading theme for their research and product development. Beginning with sustainability sounds like a natural and even an obvious choice, but of course fast advances in some of the technologies can bring new ideas into the mix. Industry involvement is essential to focus efforts to commercially relevant solutions, so that Quantum Computing starts producing business value. A good example of this is the 12-year WACQT (Wallenberg Centre for Quantum Technology) project funded by the Knut and Alice Wallenberg Foundation in Sweden, a long-term commitment.

Consensus between Nordic countries on direction may prove tricky. Both hardware and software initiatives are in swing across the region. Sweden and Finland are developing their own machines, such as Finland's first Quantum Computer delivered by IQM in collaboration with CSC and Atos, aiming for 54 qubits. Sweden (Wallenberg Centre for Quantum Technology) is currently testing a five-qubit QPU and will expand to twenty qubits by the end of 2021. Danish researchers have produced advanced Photonics and Quantum Sensing devices. In quantum algorithmic side, Norway and Sweden seem to be investing the most. Chemistry, material science, financial services, marine sector, transportation, and energy production optimization were most often mentioned as promising areas for real-life applications.

Focusing efforts on Quantum into a subject that sits very naturally within the Nordics culture and ideals, may be the way to generate a self-sustaining idea with public support and consensus behind it. This will bring together the ecosystem that will possess the Nordic Quantum advantage.

"To realize the potential of near-term quantum computers for innovation in industry it's time to fill the gap between theory and practice. Looking into real-world use cases combined with in depth-knowledge of hardware-adapted algorithm design will be key to achieving this. Collaboration within the Nordics, particularly by building HPC-Q systems will be vital for gaining an advantage in the field."

Franz Fuchs
Research Scientist, SINTEF

"Superconducting technology has a long tradition of cooperation between Finland and Sweden, and it has been strengthened within the field of quantum information science and technology. The efforts toward boosting High Performance Computers with quantum accelerators has broadened the opportunities for a wider Nordic collaboration by including computer science and software development. In addition to collaborations within the EU Quantum Flagship, it is essential to form a strong Nordic HPC-Q ecosystem.

Professor Göran Wendin
Chalmers University of Technology, Gothenburg

1 "The State of Quantum Computing in High Performance Computing (HPC)", IQM and Atos 18.11.2021

Anders Greve
Head of Digital Security, Nordics - Atos

Managing cybersecurity risks in critical industry across the Nordics

Due to their location, the Nordics have very particular security threats they must manage – both physically and digitally. This puts real pressure on the need for advanced cybersecurity defenses across public sector and critical industry.

In fact, within Sweden and Finland, the security of critical infrastructure is a matter for the state, and they are actively involved in vetting and approving security personnel and protocols. There is a requirement to be a national citizen and cleared by security services to manage critical infrastructure security needs.

Despite its importance, when it comes to the IT / OT security of critical infrastructure, the Nordics are, like the rest of the world, 10 – 15 years behind being mature.

Securing the convergence of IT / OT

The fourth industrial revolution has seen two different domains forced together causing a convergence that benefits industry and consumers but can also leave operations, sometimes critical operations, open to risk.

The OT environment was not designed to be connected. It is generally extremely expensive to build, complex to change and doesn't run on the same operating systems that we use in a modern technology environment. Upgrading and adapting these systems is incredibly complex.

When the two environments converge, a potential major cyber risk is introduced, and this must be managed. The Nordic region have seen these vulnerabilities exploited, for both common criminality and ransomware as well as within the context of cyber warfare which threatens international stability and diplomacy.

Convergence is a great opportunity, but it comes with the cost of an increased risk that must be identified, managed, and controlled.

Cyber-insurance

One area where we're likely to see an evolution is in cyber-insurance for critical industry. How can financial and civil risk be shared through insurance? Cyber-threats are now within the top five risks identified by insurers on their risk register.

Tailor-made insurance offers are made for manufacturers using diligence reports and assessment lists to cover what they know but it is likely that it will become harder and more costly to insure critical infrastructure.

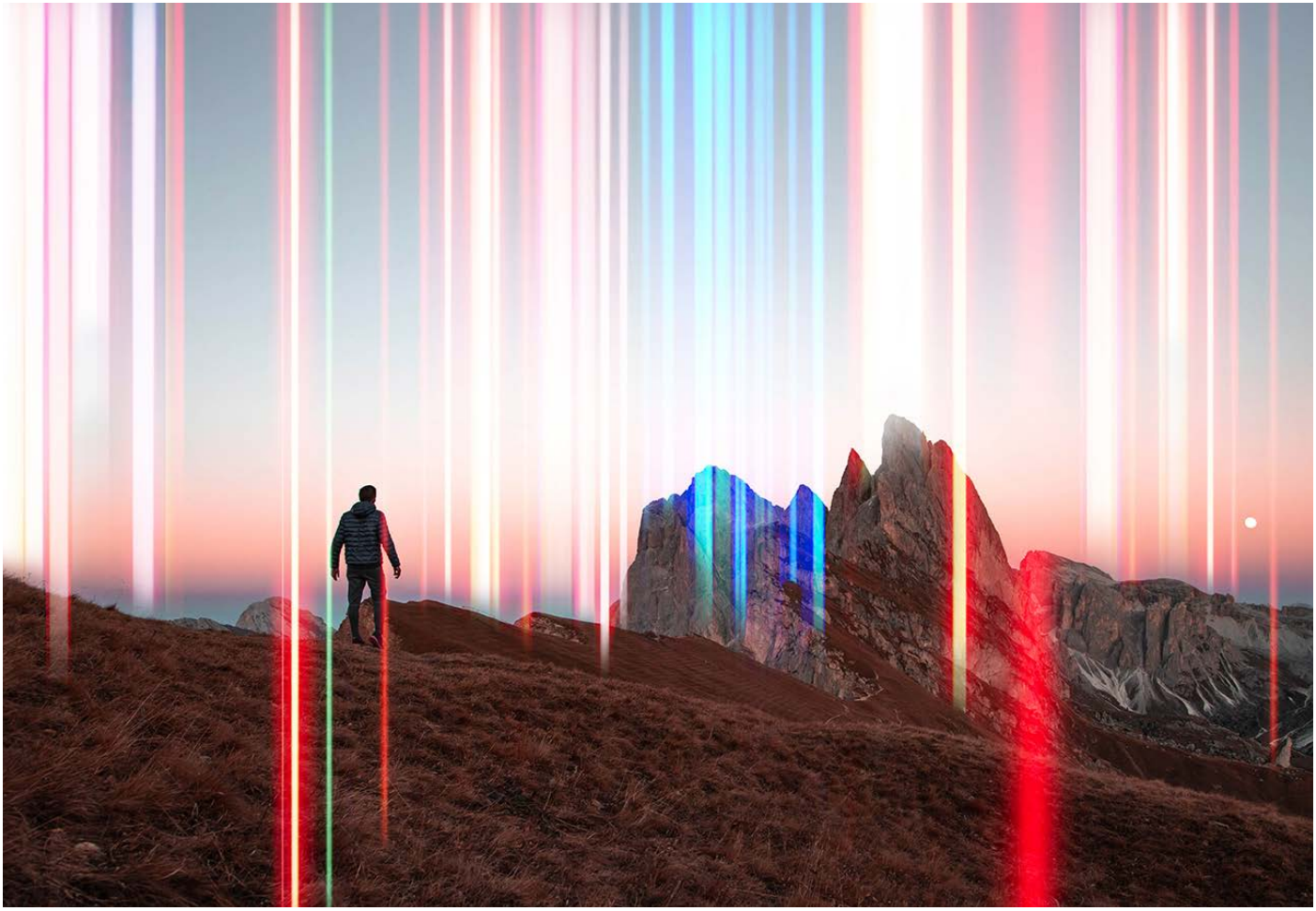
As cyber threats continue to rise, bringing risk to life, will insurers continue to support this industry?

A longer-term solution is around public and private enterprise working together to accelerate the maturity of IT / OT security. They must work to protect each other's interests on the understanding that hostile nations can and do use industry as tools in their political campaigns. Given the very real threat seen in the Nordics, they could become a test bed for this teamwork and lead the way.

What does this mean for the Nordics?

There is real pressure on Finland and Sweden to have the right skills within their country. Consultants and security operations centers that are not physically located in these territories are not allowed to be used. There are exemptions, where required, but the workaround is that a non-national would have to work side-by-side with a national to perform their role making them an extremely costly resource. This means constant effort across the public and private sector to upskill and re-skill their experts. Public funds must be invested in this area.

In Norway, Iceland and Denmark they are free to use consultants with global knowledge, which means a wider group of experts to choose from. But with a highly digitalized manufacturing and utilities sector, they are always at risk of disruption.



Harri Saikkonen
Managing Director – Nordics, Atos

Rebounding from COVID-19 in the Nordics

The World Economic Forum believed that the Nordics societal model would stand it in good stead to recover quickly from COVID-19. They highlighted their generous social safety nets, relatively low dependence on tourism and mature and widespread digitalization. They have been proved correct. Several indicators have shown that the Nordics have recovered from the social and economic impacts of COVID-19 faster than the rest of Europe, this despite regional differences in managing the health crisis.

So why have the Nordics fared so well in the crisis and what lessons could we learn from them moving forwards?

Preparing for the rebound after the COVID-19 crisis

In our thought leadership report: preparing for the rebound after the COVID-19 crisis, which is written by members of our Atos Scientific Community we discussed four imperatives for society and business to keep in mind as they rebuild. These were:

- **Technology mastery:** ensuring that the technology choices you make for your organization offer you flexibility and speed to achieve your goals, even if these goals change. To ensure that you don't get trapped or limited by the technology choices you make.
- **Embrace frictionless working:** when the pandemic first hit and we had to move to remote working swiftly, short-term solutions were often put in place to support this shift. Now, we can really think about what frictionless working means and can bring to your organization. Taking a pragmatic approach to making work frictionless from anywhere.
- **Move toward data equity:** getting smarter with the way we use and share data will be transformative for the economy and for society. We have seen how data-sharing has supported the global goal of managing the pandemic – there are many opportunities for good with proper data equity in place.
- **Be sustainable by purpose:** the pandemic created a new reckoning for societies, governments, enterprises and for individuals. Nothing is guaranteed, which has made purpose-led organizations so much more secure than those who drive only profit. A wider purpose is vital for future success.

The Nordics were well-placed in at least three of the imperatives above, making a rebound far easier than within regions who lagged in these areas.

Firstly, the Nordics are extremely strong in technology mastery. The region benefits from world-leading network connectivity, enabling digital transformation of industries. They also benefit from high levels of digital engagement and skills. Due to this, shifting services and solutions to the cloud was far simpler than within regions who are less technically developed. This also enabled remote, frictionless working to flourish with network reaching most citizens homes and services able to move seamlessly online.

Alongside this is their world-renowned focus on society and purpose-driven approach to social policies. Focusing on sustainability and equality have long been part of the Nordics way of life. Both Governments and citizens actively push a sustainable agenda through society, giving their economies a stable platform from which to weather unforeseen events.

Where next?

We believe that data equity is an area of growth the Nordic region should consider as a next step in their socio-economic journey. Creating an economy with shared data and more equitable distribution of the wealth this brings could propel the region ahead of global competitors, creating new business models that could thrive and survive in less stable times ahead. Nor would this shift be too hard for the Nordics, they're a region blessed with stable politics and society who embrace change.

Now is the moment to take actions towards building back better. Carefully considering a new model for business would be a good place to start.

Marianne Hewlett
Chief Marketing Officer, Northern Europe, Atos

The future of work across the Nordics

Although there are significant differences across the separate countries, the Nordics share an ambitious social policy agenda with a strong focus on happiness and wellbeing. This ambition stretches to workplace and labour policy and practices with the Nordics being front runners in flexible working both pre and post pandemic. Now that we are preparing to return to the office in a managed and safe manner, can we look to the Nordics to see whether we will embrace a more balanced and blended work life?

Natural advantages in flexible working

Hygge is regarded as a highly defining characteristic of Danish The Nordics have natural advantages in progressing with a more balanced work life. Their progressive politics means that politically and culturally they are open to changes in the labour market that suit workers. The Nordic region also boasts a high standard of living, offering good home working space to much of their population as well as advanced digital access, education and connectivity. This means that "frictionless working" ie. smooth, effortless, without any difficulty is attainable, enabling people to work seamlessly from anywhere, anytime on any device. In fact, it is very common in the Nordic region, where populations can be relatively dispersed compared to European neighbours, to see remote work taking place across rail networks whilst people travel and commute. This is also testament to good cross-country network connectivity.

Hygge in the workplace

Hygge is regarded as a highly defining characteristic of Danish culture. Over the last few years, it has gained traction in other countries with many adopting both the word and the practice. The word conveys a quality of cosiness and comfort, leading to greater happiness and wellbeing.

During the pandemic, we have seen continual blurring of the boundaries between work and home with employees adding the commute time onto their working day, taking less breaks and failing to adequately switch off from the workplace. Some Nordic organizations have tried to support their workers mental health with the introduction of "Hygge calls" – daily or weekly calls to bring people together for a moment in the day. In some instances, these began with a song to boost morale and help employees stay connected to colleagues.

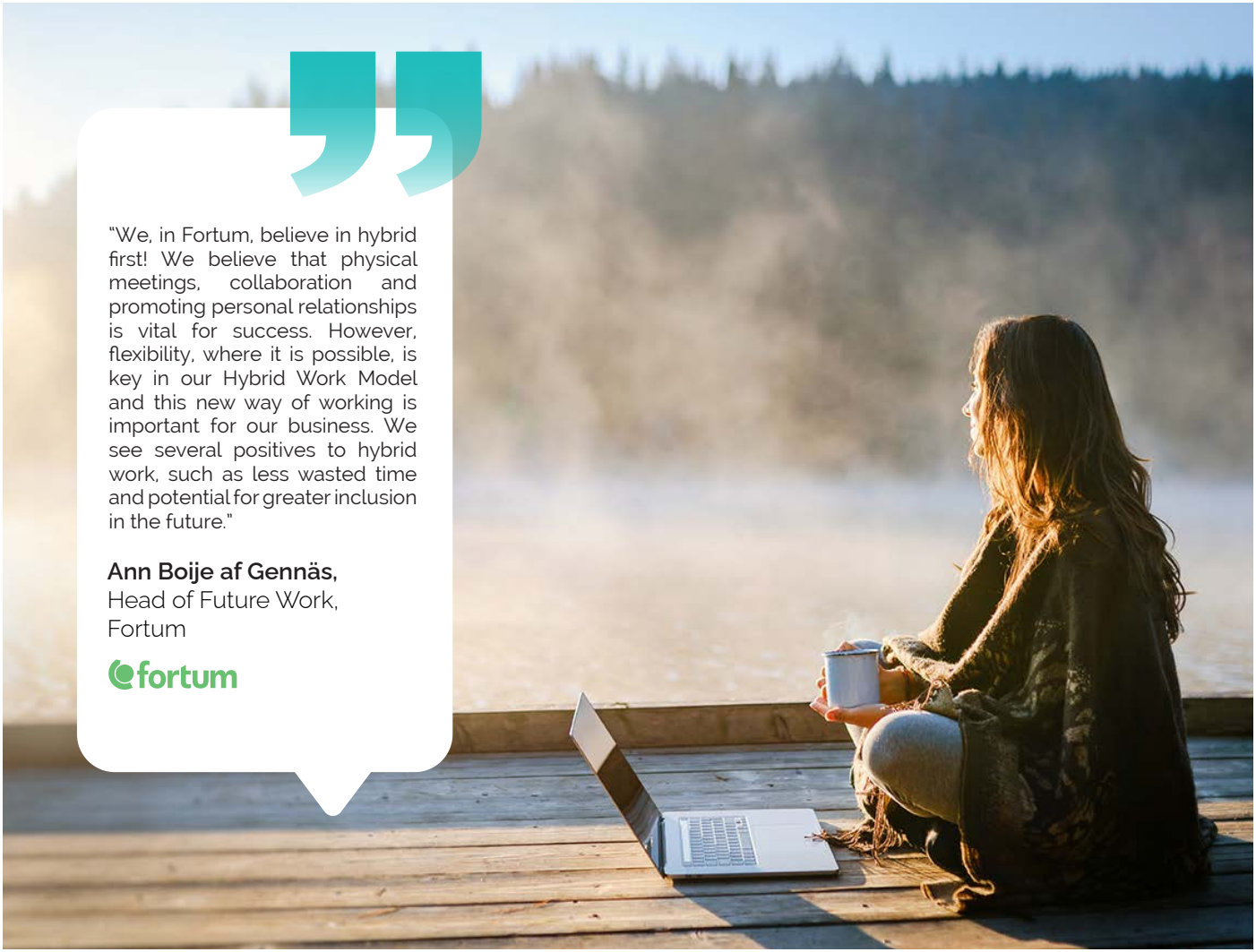
In a sign of their dedication to citizen wellbeing, the Nordics have also been at the forefront of pilots into the impact of reduced working hours on productivity, with further research on-going in this area. As we all dream of the four-day working week, we are looking to the Nordics to lead the way. An early experiment in Iceland for example suggested greater productivity comes with better balance and was an overwhelming success. Now nearly 90% of the working population have reduced hours or other accommodations and workers stress and burnout considerably reduced.

Enter the era of hyper-personalization

As we strive to find a new balance in our work lives, the workplace itself must also change to keep employees active and engaged in spending at least some of their time in a physical office. This race for workplace excellence is one of the trends being used to attract and retain new talent now that working from home is so widespread.

One of the biggest new trends to emerge is personalization. Understanding that individual workers want and need different things, including when it comes to their physical workspace.

Smart workplaces are likely to emerge over the coming years.



These will mean that individuals have greater control over their work environment. In the future they may be able to set their preferences to automatically "switch on" when they enter the workplace. This could be automatic adjustment of the chair and desk space to suit personal preferences around height and lumbar support, to controlling the temperature, lighting and perhaps music that surrounds their workstation.

Change is guaranteed

One thing is for sure, the future of work will require changes in physical and digital infrastructure as well as in our behaviour and interactions. I believe the Nordic region is well placed to lead the race to excellence in the workplace.

A revolution in the way we work is truly underway that will not only optimize teamwork but will also drive creativity and innovation — essential ingredients for a sustainable, successful business!

Michelle Wedfald
Data Scientist – Nordics, Atos

Building digital skills for the Nordic's future

Although there are, of course, huge differences across the region, the Nordics remain a growing market with high trust in technology and a proud history of innovation. They should be a hub for digital skills, given the high demand and incredible opportunities in the region. So why do the Nordics not lead here?

As a millennial woman in technology living in Denmark, I am interested in understanding and supporting the Nordics in improving their digital education and encouraging further women into STEM subjects.

Preventing the brain drain

More needs to be done to encourage uptake in STEM subjects and here both Government and industry can play key roles.

From my own experience, when being taught science in school I had no awareness of the more practical uses for the discipline across all areas of society and business. My view was that the study of science subjects led only to education, research or academia. I had a natural leaning towards both science and humanities, and it was only in higher education, when I studied Health Tech, that I saw the convergence of the two disciplines.

STEM has an image problem, particularly with women, which educators and industry would do well to try to tackle as a quick and easy win. Re-naming subjects with a focus on the practical application of STEM in diverse areas from health to retail and everything in between would be a start and would demonstrate the more inclusive angle to these subjects that can be found. A stronger focus in specialized education, such as my subject – Health Tech – might make STEM more compelling to young children and girls, compared to more traditional courses, such as Computer Science and Software Engineering.

Encouraging diversity within the sector makes real business sense. You cannot build applications and solutions that meet the needs of all citizens without having a broad range of perspectives from the developers producing them.

What's changing?

Much has been made of the impact of Millennials and Gen Z entering the workforce and the practical changes they bring. It is true that as digital natives we have a different mindset toward technology: we trust it implicitly and see it as an integral and immoveable part of our lives.

But the skill we really bring, that is shared with the generation above us, is adaptability. Technology is not static. My generation is learning to live with huge leaps in digital – from social networks becoming a new way to communicate to digital health and remote working – just as the generation before learnt to live with the internet.

However, there are interesting differences in our skill sets and in our expectations for employers. Context switch comes very naturally to us, and we tend to be able to pick up new subjects quickly. This is partly due to the need to constantly adapt and partly down to our willingness to learn and try new things. If there is one thing my generation knows, it's that everything changes. Fast!

Industry would be smart to look at our demands for the workplace if they want to acquire and keep the best talent and skills. They

should also broaden the profiles they search for to encourage further diversity in their workforce and upskill them in digital enabling more multidisciplinary talents.

How employers must adapt

Although highly motivated, millennials expect flexibility and a positive work / life balance. Encouraging people into roles by offering these things makes perfect sense for an employer looking for the best talent. The tech industry can lead the way here with advanced communication and collaboration tools that make flexibility easier.

The Nordics are well-placed to provide and lead the way with more flexibility in the workplace. Across the region, there is a strong digital infrastructure providing great connectivity, high standards of living and progressive social policies that put the needs of employees front and center.

There is no reason that the Nordics should continue to lack digital skills. Some small adjustments – as highlighted above – would bring great benefits to the region and make it a hub for innovation with global clout that is beyond its scale.

Patrick Adiba
CEO Olympics & Major Events, Atos

Ten digital trends that will shape the future of sport

The recent health crisis has accelerated digital transformation in sports. Finding new ways to keep users engaged yet safe and reinventing stadium services to comply with social distancing. Agility and flexibility remain essential.

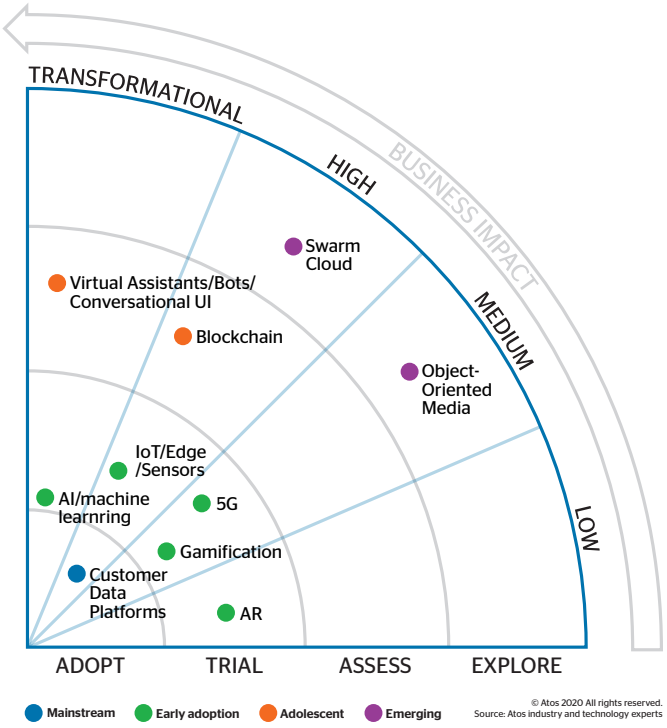
Events will become more digital and contactless than ever. Medical certificates could become a routine part of the accreditation process in liaison with local and national public health authorities.

The goal posts have changed

Sports teams and governing bodies are seeking direct engagement with fans. Rights holders are facing more competition from other entertainment sources for fans' very thinly spread attention, while globalization is growing their market.

Increasing global engagement comes at a cost: strict observation of local and global data protection legislation, such as General Data Protection Regulation (GDPR) and Children's Online Privacy Protection Act (COPPA) data protection laws, to protect fan intimacy.

Cybersecurity is also topping agendas: fake news, brandjacking, impersonation, trolls, or even organized violence could destroy a brands or player's reputation. Smart security technologies can help police and sports ecosystems eradicate these activities.



Technology Radar for Sports

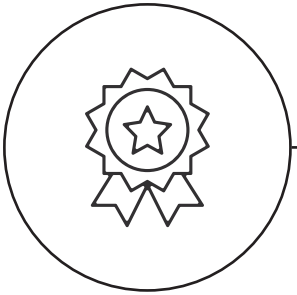
Reinventing for the future

Digital is transforming the fan experience while changing the way content is produced, distributed, and consumed. Mobile and social media allow fans to dip in and out at any time, from anywhere and on any device.

Supported by High-Performance Computing, Big Data and artificial intelligence (AI) will change the world of sport, delivering the compelling phigital fan experience based on the information obtained from fan interactions. The challenge is not how intelligent we can make machines, but how well the machines can ingest and use the deluge.

We believe that sport is an extremely powerful way to bring people together across the world and, as worldwide partner to the Olympic and Paralympic Games, we have much research and knowledge of the emerging technology trends that will shape the future of sports.

Here (see the diagram on page 48) we look at the ten digital trends that will shape the future of sport across the world.



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Opinion paper

About Atos

About Atos
Atos is a global leader in digital transformation with 109,000 employees and annual revenue of c. € 11 billion. European number one in cybersecurity, cloud and high performance computing, the Group provides tailored end-to-end solutions for all industries in 71 countries. A pioneer in decarbonization services and products, Atos is committed to a secure and decarbonized digital for its clients. Atos is a SE (Societas Europaea), listed on Euronext Paris and included in the CAC 40 ESG and Next 20 Paris Stock indexes.

The purpose of Atos is to help design the future of the information space. Its expertise and services support the development of knowledge, education and research in a multicultural approach and contribute to the development of scientific and technological excellence. Across the world, the Group enables its customers and employees, and members of societies at large to live, work and develop sustainably, in a safe and secure information space.

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Let's start a discussion together

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