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GO INTERNATIONAL – SMART MANUFACTURING
IN THE NORDIC REGION

MARKET OVERVIEW
CHALLENGES AND TRENDS
RELEVANT USE CASES
STAKEHOLDERS
WAY TO MARKET FOR AUSTRIAN COMPANIES

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Preface

This report was performed by AFRY Management Consulting. It focuses on the Nordic countries Denmark, Finland, Norway, and Sweden (Iceland is excluded). The quantitative data used for export and import statistics are from Worldbank.com and CEPII.fr (aggregating trade data reported by the countries to United Nations Statistical Division).

The aim of the report is to provide an overview of the market situation, relevant players, business clusters, challenges and trends within smart manufacturing in the Nordic countries.

1. Overview of the Nordic Countries

An overview of the Nordic countries (excluding Iceland) is presented in the first chapter, including import and export statistics, trade relationships followed by an explanation of current trends and country maps of relevant players, clusters, and universities in each country. Lastly, Nordic export in manufacturing and import from Austria are presented.

1.1. Nordic Overview of Import and Export

The Nordic countries have a strong export tradition, especially within manufacturing industries. The economies of the Nordic countries are driven by similar sectors, but with a few specific sector strengths on country levels. Main sectors across the Nordics in terms of share of export (export of services excluded) are illustrated in Figure 1.

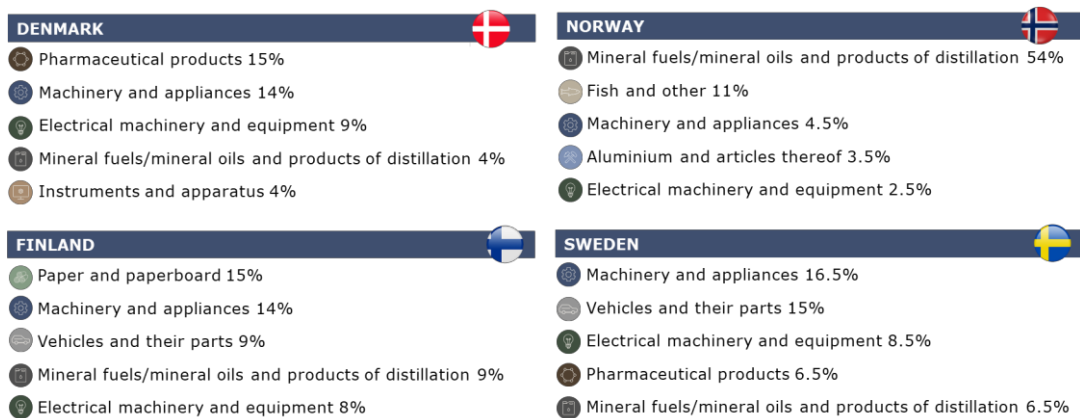


Figure 1: Export share for main sectors for all countries included in scope (2019)¹

In terms of size, Sweden has the largest export of goods and services among the Nordic countries and Denmark the second, see Figure 2. Before and after the financial crisis of 2008-2009, Sweden, Denmark and Finland have followed similar exporting patterns, while Norway has had steeper declines since 2014. The decline in exports can mainly be traced back to significantly lower export of oil and gas, and machinery.

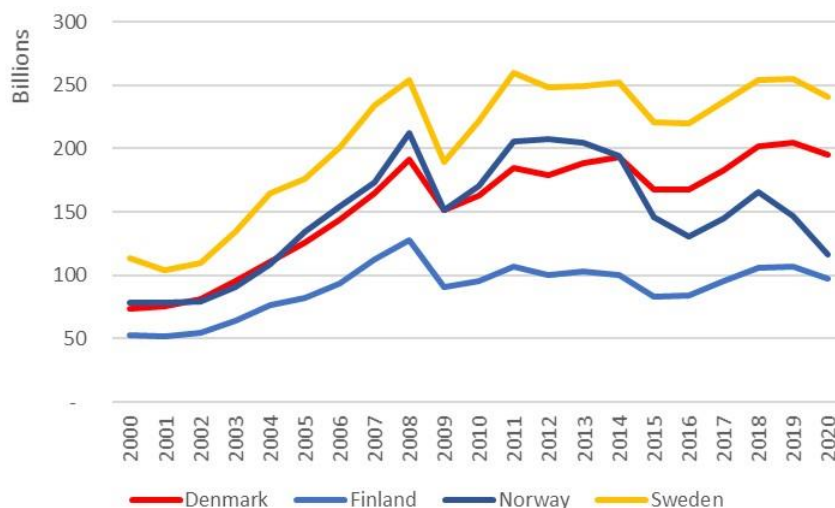


Figure 2: Export of goods and services of the Nordic countries, in bUSD (2000-2020)²

¹ CEPII Database – UN data (2019)

² Worldbank.com – Open database (2020)

In % of GDP, Denmark has the highest figure (55%, 2020) followed by Sweden in a close second (45%, 2020). This indicates that these countries are heavily dependent on their country export for driving the countries' economy. For reference, Austrian export % of GDP is 51%, and the world average is 26%.³

1. Denmark 55%
2. Sweden 45%
3. Finland 36%
4. Norway 32%

Sweden is the largest importer among the Nordic countries, with Denmark second, see Figure 3. In terms of importing patterns, all Nordic countries have followed the similar pattern before and after the financial crisis of 2008-2009. Norway has had a steeper decline in imports than its Nordic peers, matching the export pattern. The decline is difficult to trace as detailed information on production levels for 2020 has not been identified.

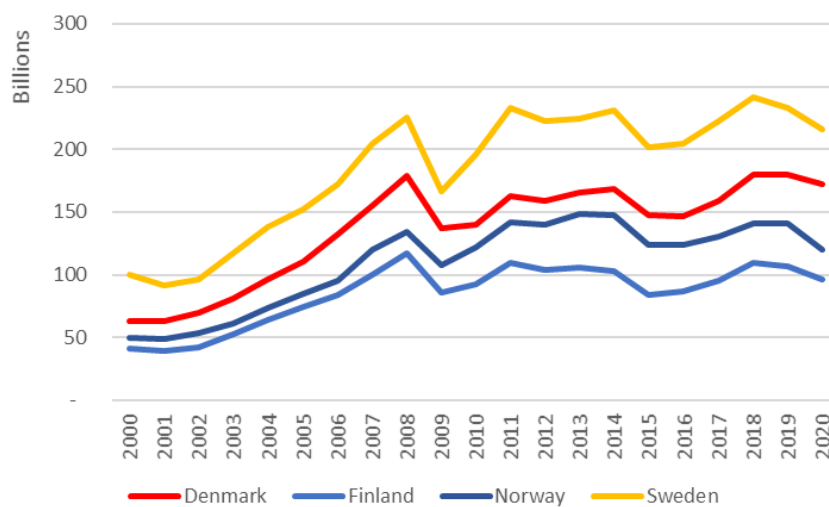


Figure 3: Import of goods and services of the Nordic countries, in bUSD (2000-2020)⁴

Although the Nordic countries have a long tradition of doing business with each other, Denmark, Finland, and Sweden only purchase ~18% of goods from the Nordic countries, while Norway purchases 25%. Also looking at the import ratio from European countries, Denmark, Finland, and Sweden purchase ~80% from Europe, while Norway purchases 70% of goods from European countries. The total import size of the Nordic countries arranges as presented in Table 1.

COUNTRY	IMPORT		
	TOTAL	% FROM EUROPE	% FROM NORDICS
Denmark	\$99B	79%	17%
Finland	\$72B	81%	19%
Norway	\$89B	71%	25%
Sweden	\$150b	82%	18%

Table 1: Detailed analysis of import statistics of the Nordic countries (2019)⁵



³ Worldbank.com – Open database (2020)

⁴ Worldbank.com – Open database (2020)

⁵ CEPII Database – UN data (2019)

1.2. Trade Relationships of the Nordic Countries

Apart from purchasing goods from other Nordic countries, the Nordic countries have close business ties with especially the Netherlands and Germany. Especially the countries' relationship with Germany stems from the manufacturing industry to a large extent. Similar countries appear on the top import countries for the Nordic countries in Europe (% of total imports), with Austria included for perspective, see Figure 4.

DENMARK 				FINLAND 			
#	COUNTRY	TOTAL IMPORT	% OF TOTAL	#	COUNTRY	TOTAL IMPORT	% OF TOTAL
1	Germany	\$ 21B	21,2%	1	Germany	\$ 12B	16,3%
2	Sweden	\$ 11B	11,2%	2	Sweden	\$ 10B	13,9%
3	Netherlands	\$ 7.5B	7,5%	3	Russia	\$ 9.5B	13,2%
4	Norway	\$ 4.5B	4,5%	4	Netherlands	\$ 4.5B	6,0%
5	Poland	\$ 4B	4,2%	5	Estonia	\$ 2.5	3,2%
16	Austria	\$ 0.9B	0,9%	15	Austria	\$ 0.7B	1,0%



NORWAY 				SWEDEN 			
#	COUNTRY	TOTAL IMPORT	% OF TOTAL	#	COUNTRY	TOTAL IMPORT	% OF TOTAL
1	Sweden	\$ 14.8B	16,6%	1	Germany	\$ 27.2B	18,1%
2	Germany	\$ 10.4B	11,6%	2	Netherlands	\$ 13B	8,7%
3	Denmark	\$ 5.8B	6,5%	3	Denmark	\$ 10.3B	6,8%
4	UK	\$ 4.6B	5,1%	4	Norway	\$ 10B	6,7%
5	Netherlands	\$ 4.4B	4,9%	5	Finland	\$ 7.2B	4,8%
15	Austria	\$ 0.8B	0,9%	15	Austria	\$ 1.9B	1,3%

Figure 4: Import relationship with European countries for each Nordic country (2019)⁶

Of the total imports, the Nordic countries are importing ~23-26% of machinery, appliances, electrical machinery, and equipment in their respective economy.

1.3. Nordic Investments into R&D

In terms of innovation and investments in research and development, Denmark, Finland and Sweden have consistently had among the highest percentage of GDP invested in R&D among all European countries (similar level as Austria). Norway has traditionally focused less on R&D but is continuously increasing its focus on R&D, see Figure 5.

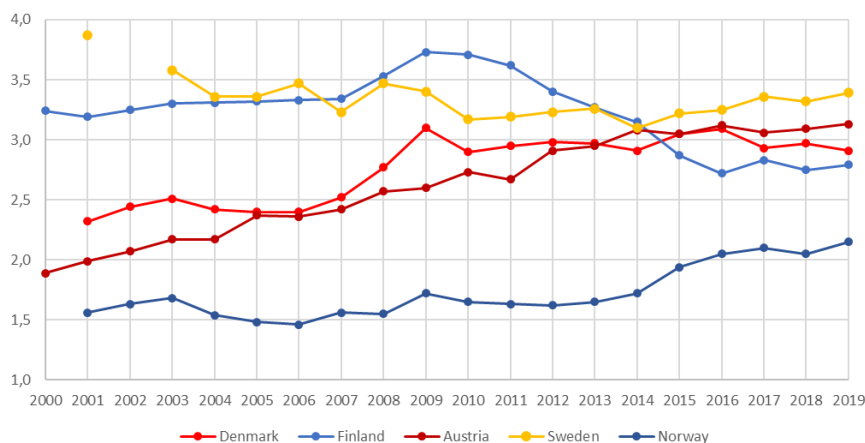


Figure 5: R&D as percentage of GDP (2019)⁷

Within manufacturing specifically, ongoing R&D initiatives and relevant R&D players are further detailed in 2.3 and 2.4.3.

⁶ CEPII Database – UN data (2019)

⁷ OECD.org – R&D as percentage of GDP 2000-2019

1.4. Nordic Trends and Competitive Situation

The global covid 19 pandemic has impacted the manufacturing industries in the Nordics by causing production stops and delays. Due to the disrupted supply chains for goods (e.g., automotive spare parts) and due to difficulties in transporting people between countries, the manufacturing sector has suffered both from lack of e.g. spare parts and material, but also people that have not been able to install solutions and equipment due to travel limitations. Also, the possibility of quickly receiving service support from suppliers has been impacted negatively. In the Nordics, the industries have recovered well since the pandemic outbreak and are showing good signs of recovery for example in GDP growth and unemployment rates⁸. Compared to other countries, the Nordics performed better than most, likely thanks to the Nordic governments being reluctant to going into full lock-down and putting great trust in the recommendations from the authorities in each country⁹.

As the entire industry sector accounts for a large share of the fossil greenhouse gas emissions (in Sweden 1/3¹⁰), sustainability is another major trend in the Nordics as the parliaments and clients require actions of e.g., reducing emissions from operations, setting science-based targets, and using fossil free production processes. National sustainability targets have been set by all Nordic countries. In the Swedish climate policy framework, the target to reach net zero emissions by 2045 is included¹¹. In Norway, the target is to be climate neutral by 2030 if other countries cut their emissions and by 2050 regardless of others' contributions¹². The target in Finland is to be carbon neutral by 2035 and carbon negative soon after that¹³. Finally, the Danish government wants to become independent from fossil fuels by 2050¹⁴. Although environmental sustainability is considered highly important, including increased attention to biodiversity, social aspects of sustainability are also being addressed by the Nordic governments.

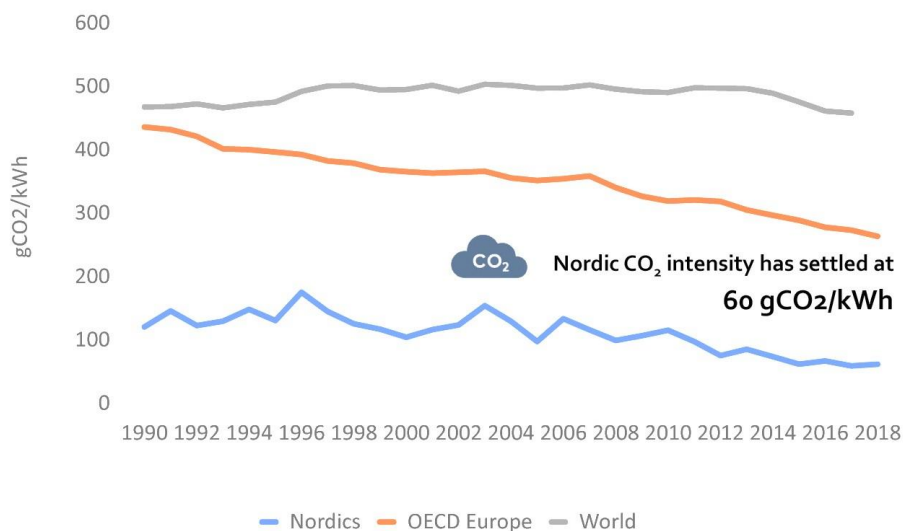


Figure 6: CO₂ intensity per kWh of the Nordics compared with OECD Europe and the world (2020)¹⁵

The players who can show they are working proactively with sustainable solutions increase their leverage and distinguish themselves from the competition.

⁸ SEB - Nordic outlook (2021)

⁹ Saunes et al. - Nordic responses to Covid-19 (2021)

¹⁰ Energimyndigheten - Industriklivet (2022)

¹¹ Government Offices of Sweden - Swedens climate policy framework (2021)

¹² Nordic Energy Research - Norway: Carbon-neutral as soon as 2030

¹³ Finland, Ministry of the Environment - Finland's national climate change policy

¹⁴ Danish Energy Agency - Danish climate policies

¹⁵ Nordic Energy Research - Relatively CO₂ intensity on downward path (2020)

As the Nordic energy landscape has a rather low CO₂ intensity compared to others, see Figure 6, and has a good supply of minerals and biofuels needed for a sustainable society, the Nordic region has been selected for major investments in the industries that will support the transition. For example, investments are now being made in green steel (replacing coal in the steel making process), battery production (sustainably produced with fossil free electricity) and mining for minerals required for the energy transition (e.g., copper). More details on the energy mix in each country can be found in 1.5.

Considering recent events with the Russia-Ukraine war, the Nordic countries are strongly reacting to the events by stopping deliveries to Russia, supporting sanctions from the European Union, and reducing ongoing operations in Russia (as of 7th of April, 2022). As the Nordics are less dependent on Russian natural gas compared to central Europe, the energy market will likely be less impacted. Both Sweden and Finland are enforcing the countries' defense due to elevated threat levels. Although the war will likely impact Nordic companies negatively, most of the largest companies are strongly taking action toward Russia¹⁶

1.5. Country Introduction and Relevant Players in Manufacturing Per Country

The Nordic countries, except for Norway, are all heavily relying on their manufacturing sectors, especially for the GDP growth and the export of goods to all parts of the world. The large revenues and value added to the countries' GDP are to a large extent driven by the major manufacturing players in the Nordics. In Sweden, for example, the largest companies (+250 employees) across all sectors only made up 0.1% of the number of companies, but account for almost 35% of all employed people in the country, and 40% of the total revenues of all companies. A similar structure of the business landscape can be found in Denmark¹⁷, Norway¹⁸, and Finland¹⁹. Below follows an introduction to the manufacturing industry in each respective country, and the most recognizable companies. Additionally, interesting regional clusters are outlined. A large share of the Nordic smaller companies are suppliers for the largest manufacturers and are often located in close proximity to these clusters.

Some of the sectors within the manufacturing industry have similarities in the Nordic countries. For example, in terms of pulp and paper both Sweden and Finland are strong, as well as in steel manufacturing. In the pharmaceutical sector, Denmark and the south of Sweden have a close connection.

1.5.1. Denmark

Denmark is the second richest in terms of GDP per capita among the Nordic countries (top 15 globally) and has the highest ranking of Ease of doing business (4th globally) among the Nordic countries²⁰. The country is also seen as a pioneer in developing wind power, and in 2020 wind production accounted for 47% of the total domestic electricity supply. Overall, renewables account for 68% of the country's total electricity production with coal still accounting for 20% of the electricity production. Looking at the complete energy mix, the renewable share is approximately 40%²¹. The country's strength in wind power is also visible in the list below, which show some of the largest manufacturing companies in the country:

- Vestas A/S (wind turbine manufacturer)
- Lego A/S (play materials manufacturer)
- Siemens Gamesa A/S (wind turbine manufacturer)
- Novo Nordisk (pharma producer)
- Danish Crown A/S (food producer)
- Danfoss A/S (heat and cooling product manufacturer)
- Arla Foods A/S (food producer)

¹⁶ Dagens Industri – "Företagen redo att ta smällen" (2022)

¹⁷ European Commission – [Denmark fact sheet \(2018\)](#)

¹⁸ Statistiska centralbyrå – [Establishments \(2022\)](#)

¹⁹ OECD – [Business dynamics Finland \(2020\)](#)

²⁰ World bank – [Doing Business \(2020\)](#)

²¹ Danish Energy Agency – [Energy Statistics \(2020\)](#)

In Figure 7 the largest manufacturing companies and clusters are presented, followed by a short description of the robotics and automation cluster located around the Odense region.

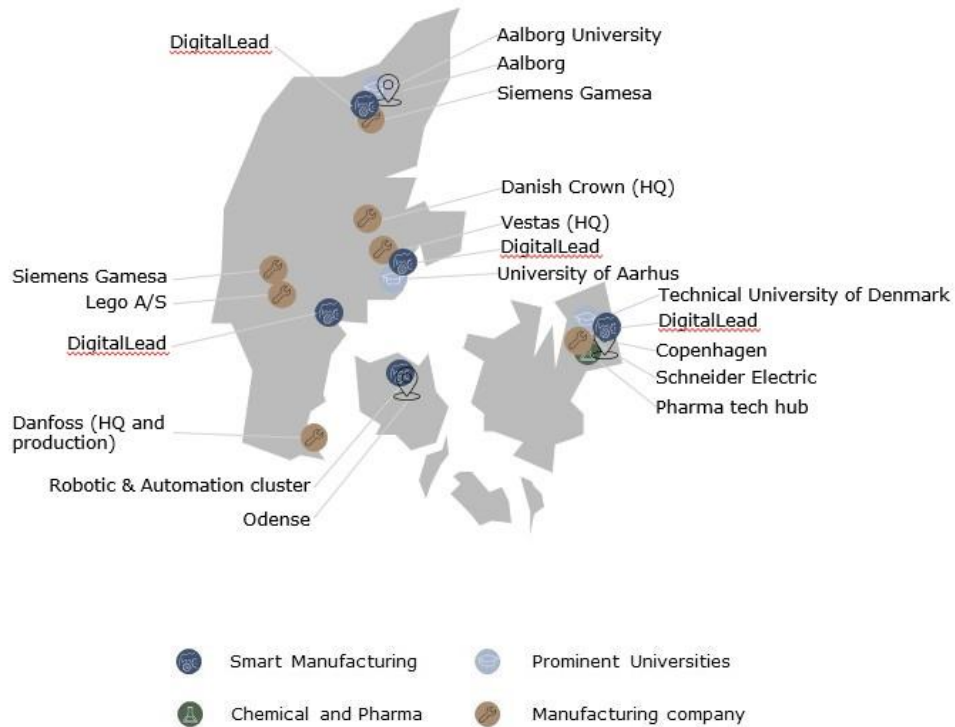


Figure 7: Main clusters and largest manufacturing companies in Denmark.

Odense Robotics & automation cluster

Leading knowledge institutions (e.g., Aalborg University, Aarhus University, Danish Technological Institute) in Denmark have founded the organization Odense Robotics which brings together the entire ecosystem of actors to drive innovation. Among the specific members, e.g., Danfoss, AFRY, and Schneider Electric can be found. The organization offers multiple network groups around the country, events, and seminars, but especially they coordinate projects for fostering innovation and automation. At present, the organization coordinates 125 projects. Both Danish and international organisations can apply for different level of memberships to be able to participate in projects and events²².

Digital Lead

DigitalLead is a platform which gather different types of actors around digital innovation²³. The aim is to create a leading platform in Denmark, by supporting innovation, growth and social impact and thus promote Denmark as an frontrunner in developing smart digital solutions.

²² OdenseRobotics – Odense Robotics [2022]

1.5.2. Finland

Although Finland has the smallest export market among the Nordic countries, the country still has a strong business tradition within certain industrial sectors. The pulp and paper industry with Stora Enso and UPM leads the Finnish economy and has also fostered manufacturing companies such as Ponsse, a manufacturer of forest machines used for logging²⁴, Valtra, which develop and manufacture tractors²⁵ and Valmet Automotive, a vehicle manufacturer which recently also started battery production²⁶. Within the steel sector, SSAB and Outokumpu are two larger companies with a presence in Finland. Additionally, there are several smaller distributors in Finland providing both their own and products from other brands e.g., Berner and ALGOL.

Like the other Nordic countries, Finland has a relatively low CO₂ intensity in the energy mix with nuclear power (19%), biofuels (28%) and other renewable supplies (wind, hydro, and peat – together account for ~10%). However, fossil fuels still account for about a third of the total energy consumption in the country (oil is the main source with 21% of the total consumption). Some of the largest manufacturing companies are listed below and illustrated in Figure 8, together with a few clusters. Followed by a short description of three clusters.

- Kone Oyj (manufacturer of elevators and escalators)
- *Note: Acquired Austrian manufacturer Sowitsch in 1970 so are now manufacturing elevators also in Austria.*
- Wärtsilä Oyj (manufacturer of power sources and equipment)
- Valtra Oyj (manufacturer of tractors)
- Metsä Group (forest industry services)
- Ponsse Oyj (manufacturer of forest machines used for logging)

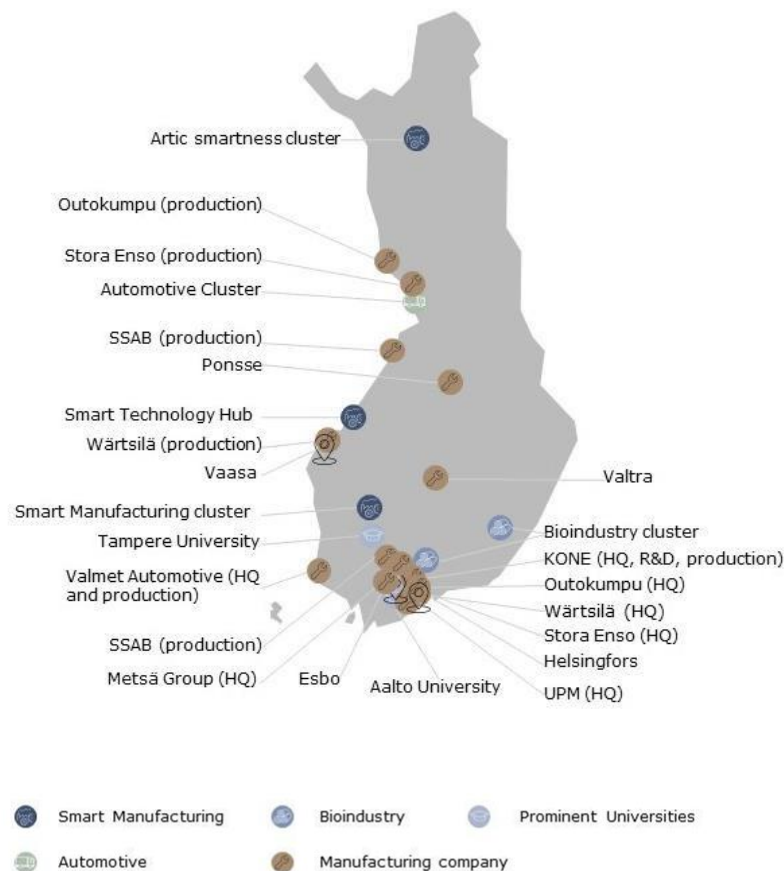


Figure 8: Main clusters and largest manufacturing companies in Finland

²³ DigitalLead - DigitalLead [2022]

²⁴ Ponsse - About Ponsse

²⁵ Valtra - Company information about Valtra

²⁶ Valmet - Valmet-Automotive [2022]

Arctic Smartness clusters in northern Finland

The Arctic Smartness cluster consists of 5 individual clusters located in Lapland, Finland, where one focus on industry and circular economy²⁷. The idea is to connect process- and mining industry companies with other relevant players to create a co-operate network for commercialise natural resources while maintaining a balance of sustainable development. One example of a company that used the service provided by the cluster is Pohjaset Oy, which is active in bioenergy, recycling and logistics services.

Oulu Automotive Cluster

Located in the city of Oulo, an automotive cluster where different kinds of actors develop solutions in the field of future mobility, i.e. electric cars, autonomous driving and new business models are present²⁸. AISpotter, Codemate and Proventia are a few

of the member companies, additionally several research institutes are also part of the cluster, such as Centria and JYVSECTEC (Jyväskylä Security Technology).

Smart Manufacturing in Tampere

The region around Tampere is known to be the center of the Finnish manufacturing industry, including actors like Kalmar, Sandvik, Metso Outotec and AGCO Power²⁹. At Tampere University of Applied Science, a project is currently being carried out with the overall target is to create and prepare the region for a frontrunner hub in Smart Manufacturing³⁰. The project is estimated to be finished by the end of year 2022 and the Hub aims to make Pirkanmaa region one of the leading centers of EU research, development and innovation support for smart and sustainable manufacturing industry.

1.5.3. Norway

Among the Nordic countries, Norway is the richest in terms of GDP per capita (10th globally). The high GDP of the country stems from rich assets for oil extraction along the Norwegian coast, and the petroleum sector alone accounts for 14% of Norway's GDP³¹. As noted in 1.1, more than half of the country's export comes from various products of oil and minerals. Additionally, the fishing and fish farming industry accounts for a large share of business activities in the country. The more typical manufacturing industry is smaller than the other Nordic countries and the largest manufacturing companies are dominated by oil and gas companies. The oil and gas tradition has made the country extremely rich, which in turn has likely caused less focus on R&D and developing other industries. However, new manufacturing industries are establishing also in Norway. For example, Morrow and Beyond are two companies working to establish battery cell production in the country. Some of the largest manufacturing companies are:

Norsk Hydro ASA (metal/aluminium producer)

Equinor ASA (oil & gas producer)

Orkla ASA (food producer)

In Figure 9 the above-mentioned manufacturing companies' locations are presented as well as some clusters associated with smart manufacturing.

²⁷ Arctic Smartness – Arctic Smartness Cluster

²⁸ Oulu Automotive Cluster - automotive oulu.com/

²⁹ Business Tampere – Intelligent machines

³⁰ Tampere University – Smart manufacturing hub

³¹ BBC.com – "Norway's oil and gas sector will not be dismantled, new government says" [2021]

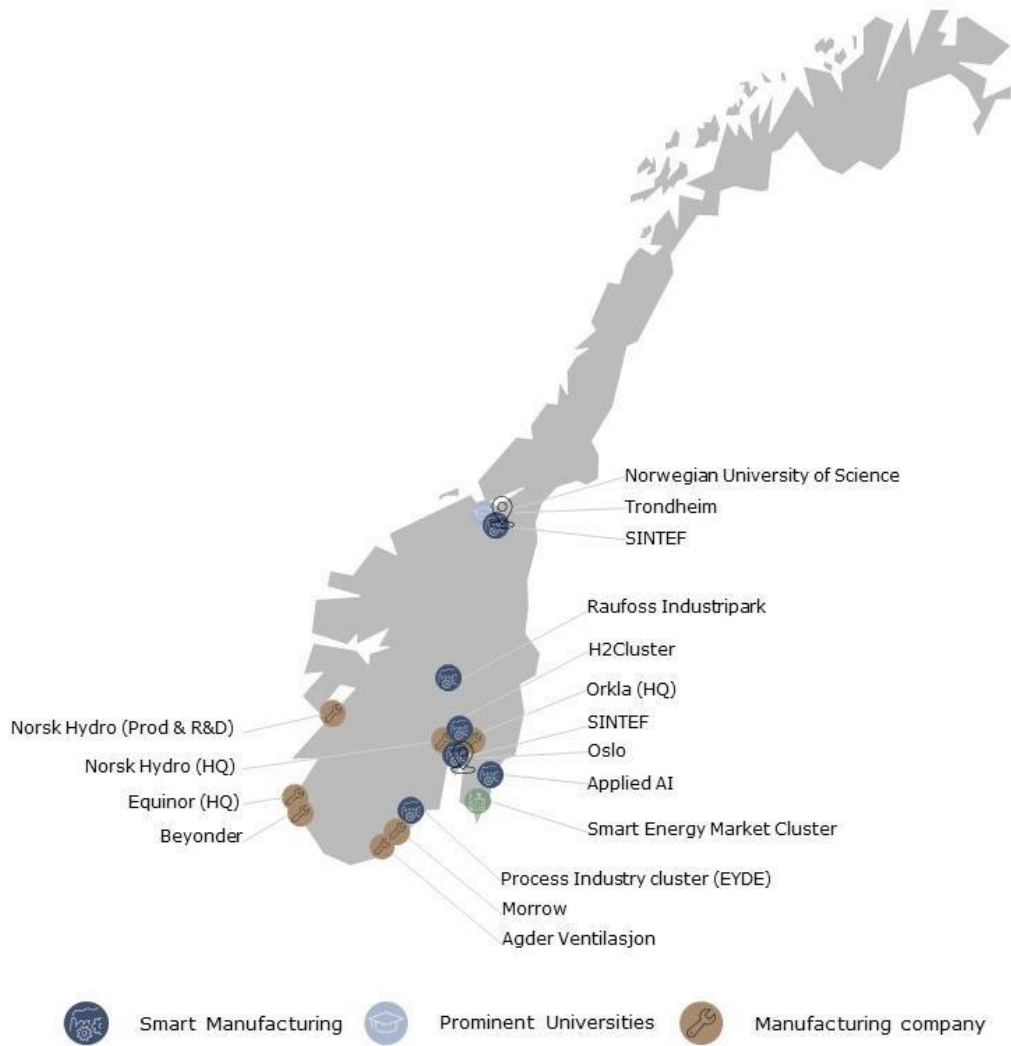


Figure 9: Main clusters and largest manufacturing companies in Norway

Although Norway is heavily dependent on its oil and gas industry, electricity production and consumption are fully from renewable sources. The main source is hydro power, which accounts for 90% of the overall electricity supply³². In the total energy mix, fossil fuels account for 36% of total energy consumption (oil 30%)³³.

Applied AI cluster

A cluster for applied AI in the south of Norway was established in 2019 by Smart Innovation Norway, Institute for Energy Technology, eSmart Systems and Ostfold University college³⁴. The cluster represents the entire value chain of AI and has around ~50 cluster members, e.g. Microsoft, Netron and Neurin.

EYDE cluster (process industry)

The EYDE cluster focuses on process industries with production in Norway³⁵. The cluster is ranked as a mature cluster by the Norwegian Center and Expertise and as a "Gold Cluster Management Excellence" by the EU Commission. Agder in the south is

³² Energifakta Norge – Electricity production [2020]

³³ Ssb.se – Production and consumption of Energy [2019]

³⁴ Smart Innovation Norway - Cluster for Applied AI [2022]

³⁵ EYDE – Norwegian Center of Expertise - Sustainable Process Industry

the region where most of the activity is present, however, the cluster is connected to other regions as well. The main focus for EYDE is intelligent and sustainable industry and among the almost 100 members, Norsk Hydro, Agder Ventilasjon and Avitell elektro can be found.

Raufoss Industripark

Raufoss Industripark accounts for one of Norway's major clusters in lightweight materials and has a strong position due to its robotised and automated technologies for industrial manufacturing³⁶. With 125 years of history, the park has been a site for innovation and today consists of ~50 companies, e.g., Hexagon Ragasco, Caverion and Benteler Automotive Raufoss.

1.5.4. Sweden

As mentioned, the largest companies in Sweden constitute 0.1% of all companies in Sweden. On the other end, the smallest companies (0-9 employees) make up 96.5% of all companies, and 23% of all employed people in Sweden. In relevance for Austrian companies, the segments in between should not be neglected. Companies with 10-249 employees make up ~40% of all revenues created by Swedish companies split evenly between the two groups of 10-49 employees and 50-249 employees. In 2016, the Swedish government published a strategy for new industrialisation for Sweden, Smart Industry³⁷ with a focus on Industry 4.0, sustainable production, industrial skills boost, and testbed Sweden. Another initiative, with a focus on sustainability, is The Green Industry Leap (Swedish: Industriklivet)³⁸. The Green Industry Leap support technologies that can reduce greenhouse gases, create negative carbon dioxide emissions and other strategic initiatives that support the net zero- emission transition.

The energy and electricity mix of Sweden is a key competitive advantage for driving the sustainability agenda. In 2021, nuclear (31%) and hydro power (42%) accounted for around 75% of total electricity production and are complemented by wind power (16.5%). For the energy mix in Sweden, however, fossil fuels still account for ~27% of the total consumption of energy with also biofuels being the main source (25%)³⁹.

Sweden has a long tradition of innovation and is regarded as one of the most innovative countries. Several factors may explain this, but especially the focus on education and focus on R&D to transition from a poor agricultural nation have played its part. The broad adoption of internet pushed out by the government in the 1990s and getting a head start in the digital era is also believed to be a main factor.⁴⁰ The largest industries in Sweden are the automotive industry, the machinery industry, and the steel industry. The manufacturing industry employs over 0.5m people and is by far the largest contributor to the GDP result. Some of the largest players in Sweden's manufacturing industry are:

- Volvo Group AB (truck manufacturer)
- Volvo Car Sverige AB (car manufacturer)
- Scania AB (truck manufacturer)
- Electrolux AB (home appliances manufacturer)
- Essity AB (hygiene product manufacturer)
- Atlas Copco AB (industry equipment manufacturer)
- Assa Abloy AB (lock solution manufacturer)
- Sandvik AB (industry equipment manufacturer)
- SKF AB (industry equipment manufacturer)
- SSAB (steel producer)

³⁶ Raufoss Industripark – Raufoss Industripark

³⁷ Regeringskansliet, *Nyindustrialiseringsstrategi för Sverige* (2016)

³⁸ Energimyndigheten, *The Green Industry Leap* (2022)

³⁹ Energimyndigheten.se – *Statistik 2020*

⁴⁰ Sweden.se – *A country of innovation*

In Figure 10 some of the manufacturing companies together with relevant clusters are presented, followed by short information regarding the most significant clusters.

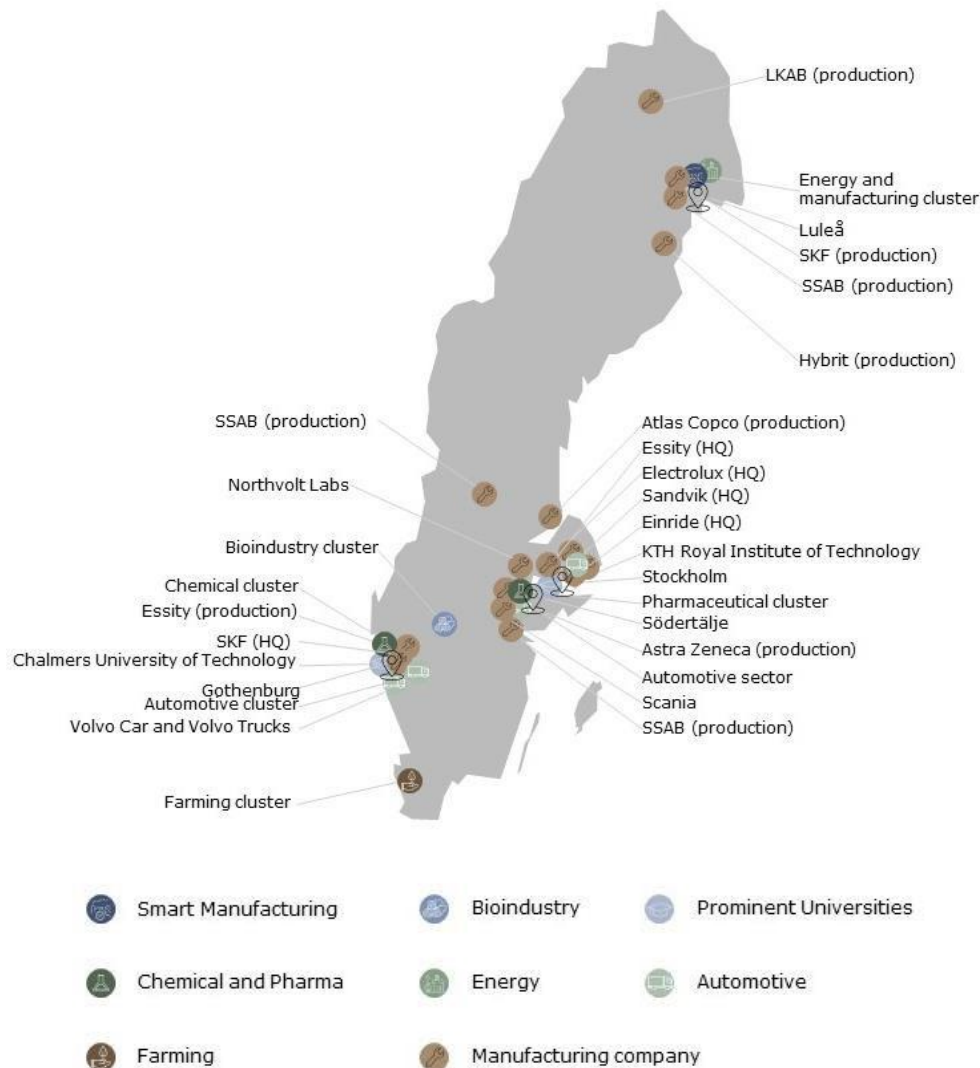


Figure 10: Main clusters and largest manufacturing companies in Sweden

Energy transition cluster in northern Sweden

Thanks to a combination of a good supply of natural resources, high availability of land to build large scale industries, high availability of cheap and green electricity and several relevant industry players already established – the Northern part of Sweden has become a business region with huge growth potential. The region has the potential to become a central part of the energy transition with large investments in renewable energy, battery production, electrification, and fossil-free steel. The players involved are Northvolt (producer of battery and storage systems), LKAB (state-owned mining company), SSAB (steel producer), Vattenfall (state-owned energy company) and Hybrit (a joint-owned company with LKAB, SSAB and Vattenfall – aimed at producing fossil-free steel by using hydrogen).

Automotive cluster in western Sweden

Gothenburg and its nearby cities have established themselves as a well-known cluster for the automotive industry. The cluster has developed itself over almost a century and today holds OEMs such as Volvo AB, Volvo Cars, Geely, Nevs. As ~98% of car production and ~50% of truck production in Sweden take place in Gothenburg, the region holds a large group of tier 1 and tier 2 automotive suppliers. In

Figure 11, the pyramid of the automotive cluster is presented by the organisation for the business region Gothenburg⁴¹.

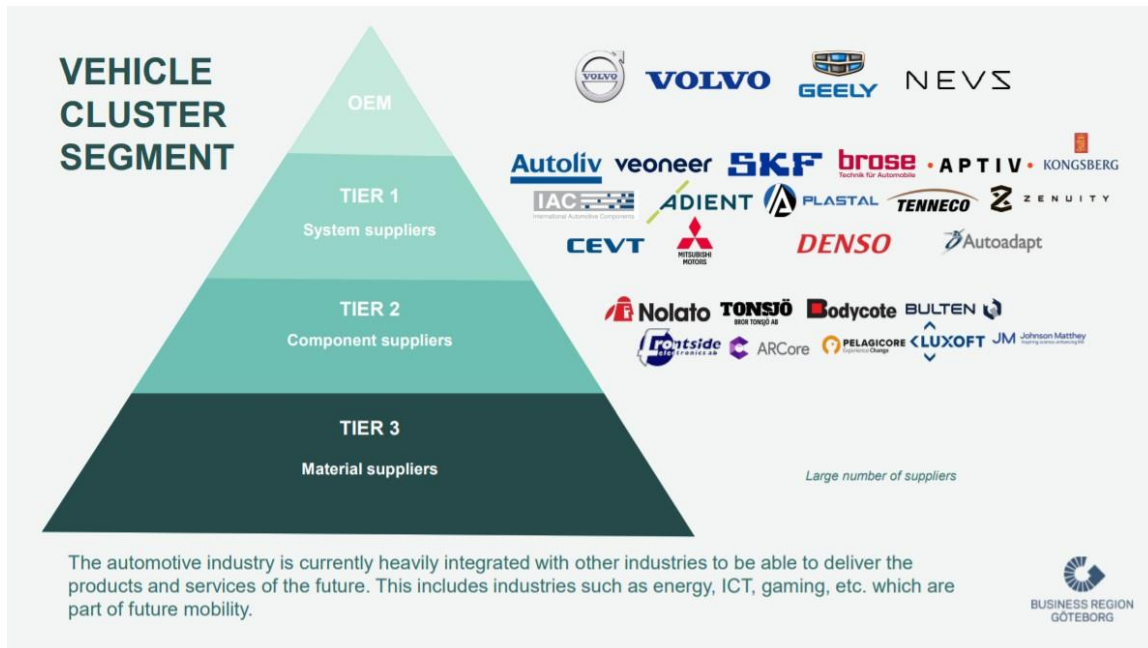


Figure 11: Vehicle cluster segment in western Sweden and involved players (2018)

In addition to the automotive cluster in western Sweden, large production of trucks can be found in the region around Stockholm, more specifically in Södertälje.

Södertälje is also home to larger pharma manufacturers such as Astra Zeneca.

Smart farming in the south of Sweden

A large share of the domestic food production in Sweden has its origin in the southern part of the country. Thus, a higher concentration of businesses involved in this sector is present. However, no clear network exists today.

On a higher level, SmartAgriHubs exist which is part of the Horizon 2020 instrument, i.e. a EU funded project. The hub consists of different types of players all around Europe with a regional hub in Scandinavia⁴². The project was initiated to promote digitalisation within the agriculture industry. In Scandinavia, the hub assists stakeholders with defining roles and developing services, to endorse digitalisation of farms.

Bioindustry cluster in Sweden

Starting from Karlstad in the south and up the northern coastline, different types of bioindustry facilities are present and lately, quite large investments have been prioritised in this segment. One concrete example is Paper Province, which is a cluster consisting of 120 companies, e.g., Sveaskog and Ahlström Munksjö, active in the forest-based bio economy, around the Karlstad region⁴³.

Chemical cluster in western Sweden

In Stenungsund, Sweden, there is a cluster of companies manufacturing products used in the chemical industry, e.g., Borealis, Adesso Bioproducts and Nouryon. Several of the companies are either direct, or indirect, dependent on each other business. Five of the companies in the cluster have a common vision defined as *Sustainable Chemistry 2030*, which points out the direction for the future.

⁴¹ Investingothenburg.com – Cluster analysis Automotive (2018)

⁴² Smartagrihubs.eu – Regional clusters Scandinavia (2022)

⁴³ Paper Province – About Paper Province

1.6. Domestic vs Foreign Supplier in the Nordics

The business culture between the Nordic countries and Austria differs. Additionally, also between the Nordic countries differences in cultural characteristics in businesses can be identified. However, what is common for the Nordic companies is the preferred choice of doing business with local suppliers (see 3.2).

Although most people in the Nordic region understand English, it could be an obstacle for an international player not to know the local language when targeting the Nordic market, especially when targeting smaller companies. But as several large Nordic companies have a decentralised business model, it could also be the case that some units prefer doing business in their local languages. Thus, if there's a strong will to enter the Nordic markets, translating information to the local language is advised, not the least to show engagement in the potential business agreement. In some cases, it can also be wise to use a local representative, to bridge the language and cultural gaps and conduct the business dialogue in the local language (see 3.2.2)

1.7. Business Culture in the Nordics

Describing business culture including decision-making and relationship building can easily become too heavily based on stereotypes and prejudice, and not based on data and facts. However, some common traits of the business cultures in the Nordic countries can be noted and serve as relevant insights when approaching the Nordic markets. The "non-visible" linkages between the Nordic countries and their neighbouring countries can be mentioned, along with some key cultural traits of each country.

Norway and **Sweden** have to a large degree a lot in common and share a sizeable border. As Swedes and Norwegians, in general, understand each other's local language and have a tradition of positive relationships, Norway and Sweden are probably the most similar countries in the Nordic region. In terms of decision-making, Sweden and partly Norway are commonly known for non-hierarchical structures which require several decision-makers and several alignment meetings to ensure that all stakeholders are involved. Additionally, since Swedes and Norwegians are not known for being straightforward, decision-making can often be implied in meetings without formal decisions. All participants would still be aligned on what decisions were taken as it was discussed thoroughly, and participants was agreeing on the way forward.

Finland shares several traits with Sweden, and in Finland, pupils are still learning Swedish in school. However, Finnish people are known for being a bit more introverted and more direct in decisions and negotiations compared to e.g., Swedes. This implies that Austrian manufacturers should consider how local partnerships and agents are utilized in the best way to approach Finnish companies and try to build long term trust.

Denmark stands out compared to the other Nordic countries as Danish people tend to be more straightforward and direct than its Nordic neighbours. Hence, it could be perceived as easier and less time-consuming to negotiate and discuss sales opportunities with Danish companies/decision-makers. Likely the link between Denmark and other European countries has inflicted a more European-like culture in terms of directness and negotiation.

Naturally, business culture varies between companies, groups of people, and regions. For foreign suppliers, it could be difficult to navigate the cultural differences, but foreign suppliers and companies can of course identify these differences and overcome them. Being on the lookout for the cultural traits mentioned above and considering how to best overcome these is likely required by Austrian manufacturers. For example, it could be required to give Swedes and Norwegians some space to align on decisions and build long-term trust with the Finnish people before going into negotiations and pushing for decisions. By gaining a position in the manufacturing ecosystem, Austrian manufacturers could create a better understanding of cultural differences and thereby enhance their position and legitimate their offerings further.

1.8. Nordic Education and Technical Universities

Apart from a tradition of manufacturing industries and export, the Nordic countries have also had a strong tradition of education. For example, Finland has been a sensation in the PISA (Programme for International Students Assessment) results since the turn of the century. The country has stood out from all western countries in results for children of 15 years old, although slowly dropping in the results in the last decade. Moreover, between 77-93% of the population in the Nordic countries enrol in tertiary education (above secondary school, e.g., universities)⁴⁴ and all Nordic countries finished in the top 20 among the world's best educational systems⁴⁵.

Looking at the technical universities, relevant to the manufacturing industry, both Sweden and Denmark have 2 universities respectively on the Global top 100 list for technical universities. KTH Royal Institute of Technology in Stockholm stands out in the Nordic region (place 31 globally), followed by Technical University of Denmark (Kongens Lyngby) in 63rd place, Chalmers University of Technology (Gothenburg, Sweden) at 79th place, and Aalborg University in 88th place globally. Finland's best university in Espoo, Aalto University, shares the ranking position with Technische Universität Wien at 116th place in the global ranking of technical universities. Norway's highest ranked technical university sits at place 150 (Norwegian University of Science, Trondheim)⁴⁶.

1.9. Nordic Export within Manufacturing

The Nordic countries are exporting various goods from the manufacturing industries. To better compare potential market sizes for Austrian manufacturers, a closer look into the manufacturing of machines & tools, automotive, metal and pulp & paper industries is relevant. The large differences in terms of the size of the exporting sectors in the Nordics become evident and indicate why Sweden is more in focus in the report than the other Nordic countries, see Table 2.

	MACHINES	AUTOMOTIVE	METALS	PULP&PAPER	TOTAL
Denmark	\$23,8B	\$4,3B	\$6,5B	\$1,3B	\$35,9B
Finland	\$16,3B	\$8,9B	\$9,9B	\$11,2B	\$46,3B
Norway	\$7,6B	\$4,6B	\$9,4B	\$1B	\$22,6B
Sweden	\$39,6B	\$25,6B	\$15,2B	\$12,2B	\$92,6B

Table 2: Exporting sectors deep dive (2019)⁴⁷

As seen in Table 2: Exporting sectors deep dive (2019), Sweden is by far the largest exporting economy within the four sectors and exports the most value of goods in all four categories. Given that Sweden also has the highest import among the four Nordic countries, it highlights the Swedish market as currently the most attractive for manufacturers of machinery and equipment. Finland is the second largest exporter within the selected manufacturing sectors, especially thanks to the large pulp & paper export. In terms of manufacturing of machines & tools, Denmark is the second largest after Sweden and is likely an interesting target for Austrian manufacturers. As can be seen in the table above, the Norwegian market looks significantly smaller than in the other Nordic countries (if the oil and gas industry is excluded as in this case).

The historic and current view presented above will of course not be fixed going forward, and for example, the oil and gas industry in Norway will need to decline in the future due to the energy transition for a more sustainable society. This might open up opportunities in other sectors in Norway that will need to grow to take a larger share of the economic activities. However, these changes will occur slowly and for a majority of the dominating sectors in the Nordics, it is believed that these sectors will hold a firm growth. For example, the wind industry in Denmark will likely remain strong due to the strong demand for fossil free energy, the pulp & paper products of Sweden and Finland will be necessary for sustainable buildings and packaging, and the automotive and mining industries of Sweden will likely be an important enabler of the energy transition in many years to come.

⁴⁴ Worldbank – Open database (2020)

⁴⁵ CEOWorldMagazine – Ranked: World's Best Countries for Education Systems (2020)

⁴⁶ QS Top Universities Globally – Engineering & Technology (2021)

⁴⁷ CEPII Database – UN data (2019)

1.10. Nordic Import from Austria within Manufacturing

Looking closer at the current business relationships with Austria within manufacturing, Nordic companies imports in total \$1.3B worth of manufacturing equipment from Austria. The total import distributed among the Nordic companies arranges as follows (% of the country's total imports from Austria)⁴⁸:

1. Sweden \$556m (29%)
2. Finland \$307m (41%)
3. Denmark \$251m (29%)
4. Norway \$200m (24%)



The Swedish import from Austria is significantly larger than that of the other Nordic countries. While Finland has the least import in total among the Nordic countries, the import of manufacturing equipment from Austrian companies is second highest and a larger share of the country's total imports is from the Austrian manufacturing sector. The higher percentage in Finland compared to the other Nordic countries indicates a higher penetration rate for Austrian manufacturers in Finland.

The 5 largest categories of manufacturing equipment being imported to Nordic countries are:

1. Electrical transformers \$82m
2. Cranes \$80m
3. Electrical lighting and signaling equipment \$49m
4. Washing and bottling machines \$47m
5. Transmissions (for vehicles) \$45m

The top five categories make up ~23% of the total import from Austria for manufacturing equipment. As presented above, Electrical transformers and Cranes are the dominating product categories.

The top five import categories in each of the Nordics are listed as follows in Figure 12.

DENMARK 			FINLAND 		
#	CATEGORY	TOTAL	#	CATEGORY	TOTAL
1	Electrical Transformers	\$ 44.6m	1	Spark-Ignition Engines	\$ 43m
2	Cranes	\$ 17.9m	2	Electrical Lighting & signalling equipment	\$ 32m
3	Transmissions	\$ 14.3m	3	Lifting Machinery	\$ 18.4m
4	Machinery Having Individual Functions	\$ 11m	4	Cranes	\$ 18m
5	Rubberworking Machinery	\$ 8.4m	5	Excavation Machinery	\$ 13m



NORWAY 			SWEDEN 		
#	CATEGORY	TOTAL	#	CATEGORY	TOTAL
1	Cranes	\$ 15.8m	1	Washing and Bottling Machines	\$ 47.5m
2	Lifting Machinery	\$ 10m	2	Ball Bearings	\$ 37.8m
3	Machinery Having Individual Functions	\$ 9m	3	Electrical Control Boards	\$ 28.8m
4	Telephones	\$ 8.4m	4	Cranes	\$ 28.4m
5	Transmissions	\$ 8.3m	5	Electrical Transformers	\$ 26.6m

Figure 12: Import figures for each country in scope (2019)⁴⁹

⁴⁸1 CEPII Database – UN data (2019)

⁴⁹1 CEPII Database – UN data (2019)

2. Smart Manufacturing

In the second chapter, an introduction to smart manufacturing is described as well as the identified challenges and trends in the sector. Relevant use cases are described followed by description of specific stakeholders active in the smart manufacturing industry, including distributors, system integrators, innovation hubs/research institutes, and business networks.

2.1. Short Introduction to Smart Manufacturing

The trend of Smart Manufacturing is closely related to various trends in manufacturing and industries. Additional concepts linked to Smart Manufacturing are Industry 4.0, Automation, and Industrial Digitalisation. In this chapter, the current progress in smart manufacturing of the industries in the Nordics is presented, while also introducing some key stakeholders in enabling the transition to sustainable and smart production.

Although the manufacturing industries of the Nordic countries are dominated by a few recognized sectors (machinery & automotive in Sweden, food and wind turbines in Denmark, forestry & machinery in Finland, and oil & gas in Norway), a wide range of manufacturing ecosystem players and enablers of smart manufacturing can also be recognized. To a large extent, most of the smaller Nordic manufacturers are placed in proximity of the large multinationals and/or the specific sector cluster. More details on clusters are available in section 1.5.

Large companies such as ABB, Atlas Copco, Sandvik, and Valmet are producing important products and solutions for the manufacturing industries. For example, ABB is a pioneer in robotics and machine automation and plays a key role in automating and digitizing factory plants across the globe. Sweden has the 5th highest industrial robot density globally per 10 000 employees in the manufacturing industry⁵⁰. Another enabler of smart manufacturing in the Nordics is the Swedish telecommunications provider Ericsson which aims to drive the development of smart factories and industry 4.0 by enhancing the connectivity capabilities of Nordic and global manufacturers.

2.2. Challenges and Trends in the Nordic Manufacturing Sector

Several key challenges for manufacturing companies, both in general and specifically for the Nordic, are outlined below. In the following section, major trends for manufacturing companies in the Nordics are described, which are also partly linked to the identified challenges.

2.2.1. Challenges

The Nordic manufacturing sector faces several challenges which are commonly mentioned also in the wider manufacturing community. The more classical manufacturing challenges evolve around e.g., **reducing down-time of production, ensuring safe production environments, and increasing efficiency in production**. Specifically in the Nordics, **logistics** are also a challenge to consider.

Compared to Denmark and partly Norway, the logistics supply chain of Sweden and Finland is a typical challenge for manufacturing companies as several large cities and factories are not easy to get to by standard delivery methods. For that reason, Nordic suppliers sometimes prefer local suppliers over international suppliers. New types of challenges in the Nordic manufacturing sector evolve around **flexible production** and **managing data and integration of systems**. Having a **flexible factory** to be able to shift manufacturing procedures and processes is a challenge in several manufacturing sectors. As an example, several automotive factories now must adapt to producing electric vehicles instead of traditional combustion engine vehicles which creates challenges for inflexible and standardized production lines. Overall, as the pace of change is moving faster than ever, manufacturers struggle with creating flexible factories that can adapt to changing consumer and business behavior.

In several manufacturing sectors one of the main challenges is the **management of data and the integration of production systems**. Most components and solutions can be connected today and provide data, but in most cases, that value of data cannot be extracted due to either lack of competencies or software support. In most manufacturing sectors, the companies have historically purchased a new system and solution for each specific production challenge, locking themselves into data silos. The old systems are also difficult and costly to maintain. In contrast, manufacturers

today want to connect the whole production to a holistic platform. This has in turn created a significant system legacy which makes the integration of systems in production a real challenge and requires large investments and time-consuming projects to integrate into holistic production platforms. According to manufacturing experts, some existing production systems are so isolated that the data cannot even be integrated with the holistic production platform.

The recent large investments in Northern Sweden have highlighted the continuous **skills shortage** within manufacturing. Within some sectors, companies are now becoming reliant on foreign engineers to find employees with the right skills (e.g., Northvolt suddenly requires a large number of engineers in Northern Sweden). Several companies and municipalities must now make targeted efforts in convincing people to move to their geographical regions. As seen in the country maps in section 1.5, the major technical universities are located around the largest Nordic cities, and attracting engineers to other cities is a challenge, especially in geographically stretched countries such as Norway, Sweden, and Finland.

Looking at potential legal challenges, no specific general legal framework that could heavily impact the business relationships between Austrian companies and Nordic companies has been identified. There are regulations that might play a role for example regarding installation of electrical equipment, when operating in the pharmaceutical sector and when dealing with public procurement. This needs to be further investigated where applicable but is not affecting business opportunities for Austrian manufacturers in general. The electricity security for the installations in Sweden (EvA) is regulated by the Swedish Work Environment Authority and covers the electricity-related work environment risks and safety measures⁵¹. In Finland, its Tukes, the Finnish Safety and Chemicals Agency, that regulates, and issues permit, for electrical work⁵². In the pharmaceutical sector, there is in general a requirement of a completed GMP (Good Manufacturing Practise) training. When performing business with public organisations in the Nordics, the suppliers need to comply with the policies for public procurement. The background is to secure maximum value for the citizens' money and ensure compliance in regard to equal treatment, non-discrimination, and transparency. All Nordic countries receive a high-performance score while investigating whether purchasers get good value for money or not in public procurement⁵³.

2.2.2. Trends

Based on AFRYs collective knowledge from the manufacturing sector through the deep experience from both the largest manufacturing companies and smaller manufacturing players in the Nordics, 5 specific trends have been identified: reconfigurable solutions, merging physical and virtual environments, integration of systems, Proof-of-concept testing (PoC) and sustainability.

In more detail, a higher degree of configurable production, **reconfiguration**, is one of the upcoming trends in several manufacturing sectors. The trend indicates the need for both hardware and software to be adapted to changes when shown in the market. The possibility of reconfiguration ensures some flexibility within the manufacturing sector, thus, when the market is changing the manufacturing sector existing equipment can easily be adapted. A limitation to reconfiguration capabilities is the larger investment needed. Investing in more flexible solutions and machines is likely more expensive today

⁵⁰ IFR.com – [Robot density \(2021\)](#)

⁵¹ Installatörsföretagen – [Elsäkerhet vid arbete - EvA](#)

⁵² Tukes – [Electrical works and contracting](#)

⁵³ European Commission – [Public Procurement](#)

but could be a profitable investment in the long run. Reconfiguration of production lines requires the manufacturing sector to adopt a more agile production approach. The agile way is suitable for larger projects where the requirements are not clear (or changing), and the solutions are not defined⁵⁴.

Another trend that has been shown during recent years is the ability to **merge physical and virtual environments**. The Real Digital Twin (RDT) framework is another example of this trend. At AFRY, this technology has been used to create an exact digital twin of clients' production operations which makes commission and ramp-up in the factory more efficient. According to AFRY experts, RDT can save up to 75% of the cost compared to traditional commissioning and ramp-up ad hoc⁵⁵. Recently, the RDT has for example been used in decommissioning of nuclear power.⁵⁶ Additionally, within the automotive sector, the Virtual Factory Acceptance Test (VFAT) has become a standard in the last two years, partly accelerated by the pandemic. Earlier, tests of new equipment and solutions have been performed by the supplier in a physical test environment but with VFAT it can be done virtually which reduces downtime and improve the efficiency of the factories when implemented in the actual factory.

A third trend is the **integration of several systems** into one smart platform. By integrating systems, data can be aggregated and used to create insight and find opportunities for improvement. E.g., with the use of AI and machine learning, larger manufacturing companies are on their way to extracting value from the large amount of data available. According to AFRY experts, especially smaller manufacturing companies (SMEs) really need support in finding ways how to digitalize and make use of production data. These smaller companies often neither have the human nor the financial capital to drive these projects.

Given the increased focus on integrating several production systems into holistic platforms, e.g., equipment, tools, robots, AGVs must all take part in the same manufacturing ecosystem. This has accelerated the need for harmonization in manufacturing environments in general, and harmonization of communication protocols for machines and products. Harmonization and common standards within the industry enable players in the manufacturing ecosystem to collaborate further and utilize each expertise area.

PoC testing is a major trend within the Nordic manufacturing industries, also linked to several other trends mentioned above. In the Nordics as of today, manufacturing industries have not been able to achieve smart manufacturing processes and industry 4.0 at a large scale. In most cases around smart manufacturing and industry 4.0, it still occurs on a PoC and R&D level. The pace of change for turning old traditional factories into highly digitalized and automated factories is not going as fast as could be expected. Limiting factors such as access to capital, highly skilled workers, and legacy systems are limiting the development. According to AFRY experts, procurement requests from manufacturing companies today are still often conventional and focused on similar machines and tools as currently installed. On the other hand, many R&D projects and PoCs are being made both by the companies themselves and by research institutes. In the ongoing R&D projects, several ecosystem players within manufacturing are involved. A selection of relevant use cases from the Nordics and relevant stakeholders/ecosystem players are detailed in 2.3 and 2.4.

Sustainability is a major factor in Nordic manufacturing from several perspectives. There is both an interest from clients and stakeholders for more sustainable products, e.g., "green batteries" produced with renewable energy, but also from the manufacturing clients that are looking to reduce their carbon footprint, use less water, reduce energy consumption to cut costs and achieve sustainability targets. Specifically, topics being discussed within sustainability in the Nordics are:

- **Traceability** has received increased attention from businesses and consumers, not least since supply chains tend to increase in complexity at the same time as the demand for sustainable solutions increases. Certification of a sustainable supply chain creates trust towards clients which is something the Nordic player values.
-

⁵⁴ Rösiö C, et.al (2021). Agil och rekonfigurerbar produktion – Projektmetod och utformning av produktionssystem

⁵⁵ AFRY.com Real Digital Twin Framework

⁵⁶ AFRY.com "Decommissioning of nuclear power"

- **The ninth SDG (Industry, Innovation, and Infrastructure)** aims to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. Large organisations focus their business to align with some of the goals to assist in achieving a sustainable future. As an example, the Nordic region has the vision to become the most sustainable and integrated region globally. Hence, the Nordic Council of Ministers works to increase digitalisation (among other things) by focusing activities associated with goal 9 (industry, innovation, and infrastructure), goal 12 (responsible consumption and production), and goal 16 (peace, justice, and strong institutes)⁵⁷.
- **Both ethical and business perspectives are increasingly being integrated** into businesses, e.g., through integrated business and sustainability strategies. Further, science-based targets are an initiative to create a path for companies to reduce their emissions in line with the Paris Agreement⁵⁸. More than 2000 businesses are working with the initiative in total, and in the Nordics e.g., ABB, Ericsson, Valmet, Vestas, and Orkla have set targets. All of them are now committed to science-based targets and have had their target validated by Science Based targets organisation. Additionally, all the mentioned companies, except for Valmet, are also members of the Business Ambition for 1.5°C campaign, initiated by UN agencies, businesses, and Race to Zero.

2.3. Selection of relevant use cases in Smart Manufacturing

Around the manufacturing sector in the Nordics, there is an extensive number of innovation and R&D projects ongoing across the Smart Manufacturing ecosystem. Several actors are building up partnership networks to ensure that both a technical, operational, and business-related perspective is being covered. For example, Ericsson has built an extensive partner network within Industry 4.0 with partners ranging from device & hardware providers to integrators and consultancies.⁵⁹ High-profile use cases and projects within Smart Manufacturing from the Nordics are:

2.3.1. Use case assessment for 5G in an automotive factory

A more holistic example of the limited progress in smart manufacturing can be made from a case with one of the largest automotive manufacturers in the Nordics in 2020, before the pandemic. The project aimed at assessing potential use cases for 5G connectivity on their factory floors. The most interesting use cases, where the factory leads saw the highest potential value, were around 1) connected assembly tools, 2) remote assist for maintenance, and 3) localization and positioning of finished goods. For the connected assembly tools, the manufacturer sought wireless tools (most tools were currently connected by cables) that could transfer precise data on how screws had been tightened. The remote assist for maintenance was to analyse the potential for utilizing Augmented Reality and Virtual Reality equipment in cases machines or product lines broke down or stopped. By using AR/VR equipment, maintenance staff could potentially sit at different locations than the actual facility and support a factory worker in how to perform the maintenance. The third investigated use case came from issues in finding produced goods out at the parking lot. Currently, factory workers could have trouble finding the right cars which would be about to be delivered to end customers.

These use cases were not particularly advanced but were dependent on other equipment (5G connected tools and AR/VR headsets) and several tests had already been initiated for solving this but had not yet been solved. For example, the factory workers were not satisfied with the performance of AR/VR headsets and the tests had been terminated. The assessment for the manufacturing 5G use-cases and potential implementation of these was later paused due to the pandemic.

⁵⁷ Nordiska ministerrådet - Hållbarhetsredogörelse 2020 (2020)

⁵⁸ Science Based Target - Science Based Target

⁵⁹ Ericsson - [Industry 4.0 Ecosystem](#)

2.3.2. ABB 5G connectivity in Ludvika

Ericsson, AFRY, and Telia supported ABB Power Grids factory in Ludvika, Sweden, (now sold to Hitachi Power Grids) in setting up the first private dedicated 5G network for industrial purposes. One of the first use cases was to connect screwdrivers wirelessly over 5G to transmit information and give accurate insights into the tightening of screws, see Figure 13. The use cases were completed during a trial period but have not been scaled up due to a lack of available tools (screwdrivers specifically developed for 5G connectivity are not supplied by e.g., Atlas Copco yet). ABB Power Grids referred to the project as crucial in their digitalization journey and wanted to explore other potential digital solutions through the 5G network.⁶⁰ The development can be seen as a typical manufacturing ecosystem project where multiple players were involved to make the trials a success.



Figure 13: 5G connected screwdrivers in Ludvika, Sweden – ABB/Hitachi (2020)

Although the implementation of private 5G networks in the Nordics, in general, has picked up speed, the market for setting up private 5G networks has been opened and manufacturers are starting to identify how 5G can be used in their factories. Some uncertainties still remain regarding access to 5G-ready tools and equipment, and how the roles of system integrators, operators, and hardware suppliers should be defined. As private 5G networks could be operated by the manufacturer itself, or with the support of a system integrator, the roles of operators are not as clearly defined as with e.g., 4G where operators have always run the maintenance and set up.

2.3.3. Autonomous and electrical transport of goods

In the intersection between manufacturing and logistics, Einride is a highly endorsed start-up that could play a major role for several manufacturers wanting to reduce their dependency on fossil fuels and make logistics more efficient with autonomous transportation of goods. Einride is supplying what they call a 'pod' truck that is electric, autonomous, and digital and can be controlled remotely. Einride has already entered partnerships with SKF (the Swedish bearings manufacturer), Electrolux (home appliances manufacturer), Oatly (food producer), and Lidl (grocery distributor).⁶¹ In Finland, Stora Enso has also explored autonomous vehicles at one of their sawmills in Finland together with several relevant manufacturing ecosystem players⁶²

2.3.4. Highly automated plants powered by ABB

Derived from the ongoing trend of electrifying vehicles, Scania has been looking at a major investment in a new battery assembly plant in Södertälje/Stockholm, Sweden. The plant is expected to include a comprehensive range of robotic solutions from ABB, which will automate the processes from delivery of the Northvolt battery cells to the assembly to delivery of complete battery packs. ABB has also been involved in setting up the Northvolt facility in Skellefteå.⁶³

⁶⁰ ABB – 5G in Ludvika [Swedish] (2020)

⁶¹ SKF / Einride – Partnership (2021)

⁶² Stora Enso – Automated trucks (2021)

⁶³ ABB – Scania automated plant

2.3.5. Digital capabilities across the company

Danish wind turbine manufacturer Vestas has worked with Apple and SAP to develop a range of applications for their business, especially leveraging the powerful capabilities of Augmented Reality (AR), cloud platforms, and custom-made applications for iPhones and iPads. Through AR, the sales agents can build digital wind turbines ahead of construction to visualize how it might look. Service technicians can access use a custom-made application to find details on work schedules, equipment lists, and send updates on completed work. Previously, the information for this application was only accessible through a computer and across 14 different applications. In the Vestas factories, employees can use a dedicated app to confirm component quantities by scanning barcodes, and report risks the moment they happen with iMessage. Similar production applications have also been built for Swedish bearing manufacturer SKF to trace production flows and information⁶⁴.

2.3.6. Northvolt smart factory blueprint

Northvolt is a manufacturer of battery cells and is rapidly scaling up production for batteries for electric vehicles, grid-connected batteries to enable grid flexibility, and battery storage solutions for industries. Their first Gigafactory producing battery cells have been built in Skellefteå in Northern Sweden and produced their first lithium-ion battery cell in the end of December 2021⁶⁵.

Within smart manufacturing, the company is building the factory with a “cloud-first” mindset and is in detail documenting the key infrastructure of the factory. With the detailed information of the first factory, the company is together with Amazon Web Services, creating a digital blueprint factory. With their digital blueprints, the reusable pieces can be used for future Northvolt factories. The digital blueprints include information about how to measure manufacturing line effectiveness, machine learning applications, and artificial intelligence to predict the quality of battery cells⁶⁶.

2.3.7. Automated logistics in factory floors

Ponsse, in Finland, has developed its production facility into a highly digitalized factory now occupying more than 4 hectares of factory floor. The company has developed a fully automated warehouse which ensures that goods needed in the production lines are delivered fast, with accuracy, and automatically to each working station in the factory. The factory is utilizing the latest technology to ensure flexibility and high quality in their production⁶⁷.

Overall, AFRY sees the just-in-time delivery in internal factory logistics enabled by AGVs and AMRs as an area with great potential. Enhanced connectivity, combined with machine learning and AI capabilities is expected to fuel the need for industrial solutions from e.g., players like Omron. In other industries, remote-controlled vehicles are related to this trend and are currently developed by e.g. Sandvik within the mining sector⁶⁸.

2.3.8. Significant investments into Additive Manufacturing

Although 3D printing and additive manufacturing (AM) has been on the agenda for some time, AM is quickly growing within the Nordic manufacturing industries. Sandvik, a global manufacturer of equipment for manufacturing, mining, and infrastructure, is investing significantly into additive manufacturing. The metal powders developed by Sandvik are used in the Sandvik facilities both in Sweden and Italy to develop components requested by their clients.⁶⁹ Additionally, AMEXCI is a network for additive manufacturers active in both Sweden and Finland. This organization is described in more detail in 2.4.4.

⁶⁴ Apple.com – [Vestas digital capabilities](#)

⁶⁵ Northvolt.se – [First cell](#) (2021)

⁶⁶ Amazon.com – [Northvolt's next-gen factory](#) (2022)

⁶⁷ Ponsse – [Opening of factory expansion](#) (2018)

⁶⁸ Sandvik – [Automine solution](#)

⁶⁹ Sandvik – [Additive manufacturing \(2021\)](#), and [AM services](#)

2.3.9. Sandvik’s “Factory of the Future”

In 2019, World Economic Forum announced the production facility in Gimo, north of Stockholm as one of the global lighthouses in manufacturing. The highly automated factory has fully embraced the digital benefits and has successfully digitalized its production processes and improved the productivity of its site significantly. For example, sensors have been fitted to a wide range of equipment in the plant to predict when maintenance will be required for machines. Using the data from the sensors for pressure, temperature, vibration etc., reveal patterns of when maintenance is needed and reduces down-time in the production⁷⁰.

2.3.10. Cobots flexible feeder system

Through the MADE network (Manufacturing Academy of Denmark), several companies have collaborated around developing a cobot system that can feed parts to the production in a flexible and accurate way. The cobot is able to sort out specific components from a pile of mixed objects and can also be re-programmed within 30 minutes to handle another type of component. This solution solves a main challenge with cobots, as these are usually programmed for specific tasks and does often not have the ability to sort out similar components from each other. The new cobot system was developed by KUKA, PJM, and Danfoss, together with Danish Technological Institute.⁷¹

2.3.11. ASKO’s autonomous and electric vessels

Grocery wholesaler ASKO has set up a maritime unit that is developing autonomous and electric vessels to be used for transporting containers of goods between two locations in Norway. The vessels are expected to be put into regular traffic in 2022, and other players involved in the project are Kongsberg (autonomous technology), ABB (electric chargers), and Hagel (backup power). The project was also partly financed by ENOVA (a publicly owned organization financing energy transition projects).

2.3.12. Smart logistic centers (Lidl & S-Group)

Two Finnish companies have transformed their logistics center to become intelligent and energy efficient. Both Lidl’s distribution center in Järvenpää and S-Group’s logistics center in Sipoo have been upgraded with smart solutions that will intelligently optimize the energy consumption and take e.g., weather, energy prices, and center activity into consideration. Additionally, Lidl’s distribution center can even use excess heat from the large cooling solutions to distribute heat to nearby households, and in S- Group’s, almost 85% of the warehouse volume goes through automated processes.⁷²⁷³

2.4. Stakeholders in smart manufacturing

In the manufacturing industries in the Nordics, a wide range of stakeholders, beside the actual customers, are involved which can be of relevance for international companies wanting to extend their business network in the Nordic. The categories of relevant stakeholders are **distribution partners, system integrators, innovation hubs/research institutes** and **business networks**.

2.4.1. Distribution options

The three different types of distribution options identified are:

- 1) **Large distributors** are regarded as mainly B2B companies with a wider assortment of components and solutions for manufacturing clients. These companies can sell the same or similar products from several brands.
- 2) **Large distributors** are regarded as mainly B2B companies with a wider assortment of components and solutions for manufacturing clients. These companies can sell the same or similar products from several brands.
- 3) **Local subsidiaries** can be set up to manage the local distribution. Likely, a subsidiary would only be set up if the business in the actual region is picking up speed or is seen as a high potential market.

⁷⁰ Sandvik – Factory of the future [2019]

⁷¹ MADE – New cobot system [2020]

⁷² Lidl.com – Järvenpää distribution center

⁷³ Is.fi – Visit Finland largest building [2019], and Adven.com – Sustainable hybrid energy concept

There are several **large distributors** within manufacturing active across the Nordic countries. The most well-known distributors in the manufacturing community in the Nordics, are:

Ahlsell. One of the leading distributors in the Nordic region, supplying their customers with goods used for installation, tools, and machineries⁷⁴. Moreover, Ahlsell has initiated its own innovation lab to adjust its digital offering according to what the market requires.

Solar. Distributor aimed at e.g., services and products for electrical, heating and plumbing, and climate and energy solutions. Their business is centered around a broad product range, and the company operates in Denmark, Norway, Sweden, the Netherlands and Poland. The company is originally from Denmark ⁷⁵.

Local agents and subsidiaries of Austrian companies are not listed here as these are company-specific entities and in most cases substantially smaller than more typical distributors. How to approach these are discussed in 3.2.2.

2.4.2. System integrators

System integrators are stakeholders working to integrate solutions for manufacturing companies across the Nordics. Key characteristics of system integrators are that 1) these players have the deep industry knowledge and can adapt systems and solutions to fit with the company's overall system landscape and business operations, 2) the integrators provide a wide range of services from consultancy to actual hands-on installation of new systems and solutions at companies' sites, 3) integrators can provide both their own-developed systems and solutions, as well as integrating and adapting the solutions of a third-party supplier. Below integrators are all active in the Nordic countries and have strong capabilities in system integration and consultancy services (e.g., within design), and are seen as relevant stakeholders in the smart manufacturing ecosystem in the Nordics. Other notable system integrators with smaller presence in the Nordics are Semcon, Alten, Knapp and SSI Schäfer.

AFRY. The company is a provider of engineering, design, and advisory services for industry clients within several sectors. Operating across all Nordic countries, AFRY is often involved in integrating solutions and systems for manufacturing clients, while also advising on what solutions to purchase. Additionally, AFRY partners with relevant smart manufacturing ecosystem players such as Siemens, Dassault systems, Ericsson, and ABB. ⁷⁶

Ramböll. The company was founded in Denmark and now operates across all Nordic sectors. Like AFRY, the company provides engineering, design, and advisory services for major industry players in manufacturing.⁷⁷

PTC. A system integrator originally from the US, but active across the Nordic countries in supporting the digital transformation of industrial companies. For example, the company has supported Vestas (Denmark) and Metso (Finland) in improving their supply chains through digital solutions.⁷⁸

Rejlers. The company was founded in Sweden in 1942, and today provides technical services within design and advisory for several sectors, including the industry sector. The company is active across Sweden, Finland, and Norway.⁷⁹

⁷⁹ Rejlers – [Rejlers.com](https://www.rejlers.com)

⁷⁴ Ahlsell – [Innovation lab \[2019\]](https://www.ahlsell.com)

⁷⁵ Solar – [Solar.eu](https://www.solar.eu)

⁷⁶ AFRY – [AFRY.com](https://www.afry.com)

⁷⁷ Ramböll – [Ramböll.com](https://www.ramboll.com)

⁷⁸ PTC – [Industrial machinery and components](https://www.ptc.com)

Cowi. The company has its headquarters in Denmark, where it was also founded in the 1940s. In the Nordics, the company provides engineering and advisory services to a wide range of sectors, including energy, infrastructure, and industry. The company is mainly active in Denmark, Norway, and Sweden.⁸⁰

WSP. Originally from Canada, WSP has taken a strong position in the Nordic countries mainly through large acquisitions. The company provides a wide range of engineering, design, and advisory services for large industrial clients within all four Nordic countries.⁸¹

Sweco. Founded in Sweden over 100 years ago, the engineering and design company still has its stronghold in the Swedish market (especially in infrastructure services). The company has also taken a strong position in Europe and manages projects in over 70 different countries.⁸²

L&T Technology Services. Although being an Indian conglomerate, the company has been identified as an engineering and R&D focused company that has established itself in the Nordic markets and is working with several of the largest industry companies in Sweden.⁸³

Additionally, there are several integrators with a more IT-leaning profile such as Tata Consultancy Services (TCS), DXC, Capgemini, and CGI active across the Nordics.

2.4.3. Innovation hubs and research institutes

Within smart manufacturing, innovation hubs are seen in several regions and sector areas, including both companies' individual innovation hubs and general research institutes. Although many R&D projects in the Nordics are in joint collaborations across country borders, the larger manufacturing industry of Sweden implicates a wider range of innovation hubs and research institutes related to the manufacturing sector. Below, some of the most prominent innovation hubs and research institutes are outlined.

Vinnova. The Swedish Innovation agency Vinnova provides funding and opportunities to help Sweden develop and sustain innovative growth.

RISE. The Swedish research institute RISE offer ~100 testbeds and demonstration environments for industrialisation and verification all over Sweden to businesses, researchers, and the public sector⁸⁴.

VTT. VTT is the Finnish research institute, owned by the state⁸⁵. The research institute is divided into three business areas, including carbon-neutral solutions, sustainable products and materials and digital technologies.

SINTEF. Located mainly in Trondheim and Oslo, Norway, SINTEF employ approximately 2100 employees, where 75% of them are researchers⁸⁶. SINTEF consists of 7 different research institutes, and several service areas, including industry and digitalisation.

⁸⁰ Cowi – [Cowi.com](https://www.cowi.com)

⁸¹ WSP – [WSP.com](https://www.wsp.com)

⁸² Sweco – [Sweco.com](https://www.sweco.com)

⁸³ L&T Technology Services – [ltts.com](https://www.ltts.com)

⁸⁴ RISE – [Test beds](https://www.rise.se)

⁸⁵ VTT – [About](https://www.vtt.fi)

⁸⁶ SINTEF – <https://www.sintef.no/en/sintef-group/this-is-sintef/>

Vehicle strategic research and Innovation (FFI). FFI is a Swedish joint collaboration between Vinnova, the Swedish Transport Administration, the Swedish Energy Agency, and vehicle businesses. FFI finance research, innovation, and development with a focus on climate, environment, and security⁸⁷.

ASSAR Industrial Innovation Arena. Founded by Volvo, Science Park Skövde, University of Skövde, and IDC (industrial development center). ASSAR is a forum for education, innovation, and research in the manufacturing industry.

Northvolt Labs. Northvolt has established its research and development facility in Västerås, Sweden, called Northvolt Labs. The idea of Northvolt Labs is to develop battery cells and support the industrialisation of the cells, rather than mass-produce⁸⁸. Moreover, the activities in the lab include refining manufacturing processes and producing demonstration cells for the automotive manufactures and providers. In Skellefteå, the gigafactory, Northvolt Ett, will manufacture lithium-battery cells (the first battery assembled December 2021).

Kone R&D center. Based in Hyvinkää, Finland, the elevator and escalator manufacturer Kone has its largest R&D facility with 1000 people employed in the Finnish countryside. In the lab, the future of elevators is being worked on with ongoing tests within software, hardware, automation, and data insights. The HQ of Kone is in Espoo (close to Helsinki), but production facilities are spread out in seven different countries globally.⁸⁹

Ericsson ONE. As an innovation accelerator, Ericsson One, strives to create new business ideas⁹⁰. The Entrepreneurs get support in various forms, including resources, training, funding, and early adopter customers. *Preventing disasters with AI, A plug- and-play 5G Edge network* and *Accelerating the arrival of autonomous vehicles* are a few of the current ventures being carried out.

Siemens Gamesa R&D center. In Brande, Denmark, Siemens Gamesa has set up an R&D facility which is focusing on developing innovative solutions for optimizing components of wind turbines, software related to turbine maintenance, and computer applications for optimizing processes.⁹¹ Recently, the company also developed a pilot project with producing hydrogen directly from wind.⁹²

MobilityXlab. In 2017, CEVT, Ericsson, Polestar, Volvo Cars, Volvo Group, Veoneer, and Zenuity founded MobilityXlab to develop innovations within future mobility⁹³. The idea of the hub is to support companies that have an idea in mobility and connectivity with the opportunity to access the market. MobilityXlab is hosted by **Lindholmen Science Park**, see below.

Lindholmen Science Park. Owned by Chalmers University of Technology, the city of Gothenburg, and businesses, the science park has for more than 20 years developed ideas for the market of future mobility. Main partners include Ericson, Volvo Group, SAAB, Telenor, Toyota, and others. **Accelerating applied AI in Sweden** is one of the programs, which is the national centre for applied AI with the mission to accelerate the use of AI to increase the benefit of our society.

Synerleap. Powered by ABB, Synerleap offer support, including access to their network and clients, to start-ups to accelerate and expand on the global market⁹⁴. The main office is located in Västerås, Sweden, but Synerleap is active in the entire Nordic region and is open to global opportunities as well. Other start-ups initiatives by ABB include **ABB Technology Ventures**, **Drivers CCC** (connect, collaborate, commercialise), and the **ABB Industrial AI Accelerator**.

⁸⁷ Vinnova - FFI

⁸⁸ Northvolt - <https://northvolt.com/articles/the-opportunity-of-northvolt-labs/> (2020)

⁸⁹ Kone - *At a glance*, and R&D center in Hyvinkää

⁹⁰ Ericsson - *One*

⁹¹ Siemens Gamesa - *Innovation strategy* (2020)

⁹² Siemens Gamesa - *Green hydrogen* (2021)

⁹³ MobilityXlab - mobilityxlab.com

⁹⁴ ABB - *Synerleap*

Smart Otaniemi. With a focus on energy, mobility, circular economy, data & connectivity and city design Smart Otaniemi connects different types of players to collaborate on ideas and innovations⁹⁵. The innovation hub consists, for example, of ~5000 researchers and 200 SMEs.

Wärtsilä Smart Technology Hub. Located in Vaasa, research to decarbonize the maritime and energy sector is being performed at Wärtsilä's hub⁹⁶. At the hub, different types of testing are being carried out and work as a link between several centers of excellence. The total investment sums up to ~200 million euro. Recently, Wärtsilä has joined a collaboration with Fastems, Leinolot, Prohoc, Roima Intelligence, Synocus, Tasowheel and VTT to establish a new hub called **Open Smart Manufacturing Ecosystem** (OSME)⁹⁷. The idea is to create a forum where data, solutions, and ideas can be shared to create manufacturing excellence on a global scale. The ecosystem is also supported by a number of associated partners, such as ABB and Valmet Automotive, and Business Finland.

Industrial Biotechnology Cluster Finland (IBC Finland). With the aim to identify industrial needs and fulfil them by providing innovative cooperation, Industrial Biotechnology Cluster Finland work as an innovation hub in the biotechnology industry⁹⁸. *Fermatra –Tackling mass transfer challenges in fermentations* is one of the projects carried out between 2016-2019 with IBC Finland as support. In the project, both hardware and software were researched to enable an efficient process.

6G Flagship. Funded by the Academy of Finland, 6G Flagship is part of the programme *Finnish Flagships offer solutions for the future*, which support research⁹⁹. The 6G flagship has three main goals: support businesses with 5G, develop the technology required for 6G, and speed up the digitalisation.

Urban areas in the Nordic region. The capitals and some other larger cities in the Nordic region attract the high-tech sector, especially given the good access to highly competent students. Recently, Volvo Cars announced their new investment in a technology hub in central Stockholm which will employ 700 people¹⁰⁰. The focus will be on software technology, computer science and analysis, user experience, product management, and e-commerce.

2.4.4. Business networks

The business networks gather different types of companies to share ideas and knowledge. One way to enter the Nordic market is to establish relationships with business networks. If successful, there is a chance to attend internal events and initiate dialogues with the member companies. Since the networks consist of several companies it could be an efficient market strategy to reach several companies at the same time. Additionally, it's a good way to learn a lot about the market, both in terms of technology status but also business characteristics. Below, some of the most prominent business networks are listed.

Seiia - Swedish Industrial Interoperability Association. Many industries today face the problem of sharing data automatically with current IT systems, due to the fact that the definitions are not uniform. Seiia is an organisation that support the creation of an industrial, international reference system to automate data sharing. Seiia work to gather the industry to develop, provide and share knowledge within the industry¹⁰¹.

⁹⁵ Smart Otaniemi - smartotaniemi.fi

⁹⁶ Wärtsilä Smart Technology Hub - smarttechnologyhub.com

⁹⁷ Open Smart Manufacturing Ecosystem - www.smarttechnologyhub.com

⁹⁸ Industrial Biotechnology Cluster Finland - www.ibcfinland.fi

⁹⁹ 6G Flagship - www oulu.fi/6gflagship

¹⁰⁰ Volvo – Hub in Stockholm [2022]

¹⁰¹ Seiia - seiija.se

FindIT - Forum for Industrial IT-solutions. FindIT is a forum that support small and medium sized companies in Gothenburg and Dalarna (Sweden) to increase their competitiveness. Together with Sandbacka Science Park they have created a center of competence within IT.

Automation Småland. The purpose of Automation Småland is to strengthen the manufacturing industry with automation and digitalisation in the area of Småland, Sweden¹⁰². The networks bring ~25 regional companies together with the overall target to increase their market position by introducing new technology, competence, research, and innovation as well as creating additional work opportunities.

DIMECC - Digital, Internet, Materials & Engineering Co-Creation. Owned by companies and a research institute, DIMECC is a Finnish platform, active in the manufacturing and technology business¹⁰³. The overall idea is to speed up the time to market. The platform offers ecosystems, see FAMN below, programs and projects, co-creation services, and international networks. Other ecosystems are Intelligent Industry, FAME – Finnish Additive Manufacturing Ecosystem, and One Sea – Autonomous maritime ecosystem. All in all, more than 400 organisations are involved.

FAMN – Finnish Advanced Manufacturing Network. FAMN is a network, part of DIMECC ecosystem, that brings Finnish industrial companies together and focuses on 5 areas, including facilitation, innovation funding, competence development, acceleration, and RDI infrastructure¹⁰⁴.

FIMA – Forum for Intelligent Machines. A Finnish network consisting of ~35 OEMs, system integrators, and researchers aiming to develop intelligent automation for heavy mobile work machines¹⁰⁵. Sandvik, John Deere, GIM Robotics, and VTT are a few of the members.

NCE Manufacturing. Norwegian Center of Expertise (NCE) is a initiative to develop clusters in Norway. NCE Manufacturing focus on advanced lightweight materials and automated production and consists of ~60 industrial companies¹⁰⁶. Additionally, the Norwegian Catapult Center (MTNC), Læringsfabrikken, and Total Innovation are also part of the ecosystem and aim to increase the business development and support companies in the start-up phase.

AMEXCI – Additive Manufacturing Excellence for Industry. AMEXCI was founded to accelerate the additive manufacturing development by assisting companies in Sweden and Finland¹⁰⁷. Among the members are global players such as Ericsson, ABB, SAAB, Scania, Stora Enso.

MADE – Manufacturing Academy of Denmark. MADE was established in 2014 by industries, foundations, associations and research companies to develop Danish production companies¹⁰⁸. The focus is advanced production for SMEs. The branch **MADE FAST**, is yet another platform with the target to develop and test solutions that increase flexibility, agility and sustainability.

MITC – Mälardalen Industrial Technology Center. Since 2011 MITC has supported SMEs through various initiatives¹⁰⁹. In Eskilstuna, MITC operates a tech center that works as a hub for innovation in the region. Alfa Laval, Hexagon, and Autotec are some of the financing partners. Alfred Nobel Science Park, Automation Region, and Robotdalen are a few of the collaboration partners.

¹⁰² Automation Småland – automationsmaland.se

¹⁰³ DIMECC – dimecc.com

¹⁰⁴ FAMN – famn.fi

¹⁰⁵ FIMA – fima.fi

¹⁰⁶ NCE Manufacturing – ncemanufacturing.no

¹⁰⁷ AMEXCI – amexci.com

¹⁰⁸ MADE – made.dk

¹⁰⁹ MITC – mitc.se

3. Way to market for AA companies

For the Austrian companies to enter the Nordic market several perspectives need to be considered. In this chapter AFRY presents recommendations on how to access the Nordic market, a suggestion of which stakeholders and networks that are of most interest as well as identified knowledge gaps in the Nordic region.

3.1. Countries to target

For all the Nordic countries, the progress within Smart Manufacturing is quite similar. The largest manufacturing companies have been able to invest heavily in digitalisation of their factories and processes and can also attract high-tech employees that can make use of new technology. However, large businesses are continuously researching new opportunities within AI, automation, and robotics but struggle with scaling the use cases across their operations. Many Nordic companies have test and R&D facilities where innovation projects and experiments are ongoing, but limited progress has been made in implementing these solutions to the existing production facilities at scale.

Where interesting progress has been identified is with the factories that are more or less “born digital”, as in the case of Northvolt’s battery factories, Scania’s highly automated assembly plant in Södertälje, or the expansion of Ponsse’s factory in Finland. These factories create an opportunity for factory floors without legacy production systems and production lines, with optimal flexibility.

Looking at the Nordic manufacturing sectors, there are certain aspects to consider for Austrian manufacturers wanting to approach the Nordic companies. To start with, for typical manufacturing industries such as automotive and machinery, **Sweden** is the largest market in terms of import and export size and the number of manufacturing companies in general. Moreover, Sweden is already today the largest importer of Austrian manufacturers among the Nordic companies, so Austrian brands may already have some recognition among the Swedish manufacturers. The Swedish manufacturing industries are also to a larger degree than the neighbouring countries organised around distinguished clusters for e.g., automotive, metals, and pulp & paper. The regionalisation of these Swedish industries stems from the widely stretched size of the country, access to natural resources in the north (e.g., mines and forests) and logistics advantages in the west (e.g., shipping cars from Gothenburg). Finally, the Swedish companies are often also active in the other Nordic countries, especially in Norway and Finland. Hence, Sweden could be a relevant starting point for Austrian manufacturers wanting to target not only Swedish but also Norwegian and Finnish companies. In terms of barriers (e.g., language and culture), these are expected to be lowest between Sweden and Norway, while Finland could be a bit more difficult due to cultural aspects and business traditions. More details on business culture in the Nordic countries are mentioned in 1.7.

Second in import, from other countries is **Denmark**. Although the country has a prominent position in pharma, the country also holds several large wind turbine manufacturers and other manufacturing companies such as Danfoss, Schneider, and Lego. Given the low percentage of imports from other Nordic countries, and easy access to the European markets, Denmark is a highly feasible target for Austrian manufacturers. The business culture is also expected to fit better with Austrian and European business cultures compared to the Nordic countries. As the country is geographically smaller than the other Nordic countries it does not possess the same logistic challenges as in especially Sweden and Finland, and the regional clusters are more interlinked and closer to each other. The Smart Manufacturing industries are mainly organized around the large cities of Aalborg, Aarhus, Copenhagen, Odense, and Sonderborg.

Norway is the third-largest importer among the Nordic countries but has a significantly higher percentage of imports from the other Nordic countries (~25% of imports, compared to ~17-19% in the other countries) and currently low imports from Austria. Given the high dependence on oil and gas and the fish industry, Austrian manufacturers with products and components suited for these sectors could likely be interested in targeting the Norwegian market with a more dedicated sales approach with local partners or agents. As the other manufacturing industries are small, and Norway tends to purchase from especially Sweden, the opportunities for Austrian companies wanting to sell smart manufacturing products could be limited.

Although **Finland** is the smallest importer among the Nordic countries, 41% of the total import from Austria stems from the manufacturing industry (~24-28% of Austrian import can be traced to the Austrian manufacturing sector in the other Nordic countries). This implies that Austrian manufacturers have found a way into the manufacturing community in the country to build from and utilize existing business relationships to widen the scope of products delivered.

3.2. Approaching the market

There is no straight answer to which types of players should be targeted in the Nordic markets, to approach the Nordic manufacturing clients. The product portfolio, business sector, and company size are all factors that affect how the Nordic manufacturers are best approached. For Austrian manufacturers wanting to approach Nordic companies, several players to target have been identified dependent on the product to be sold.

The approaches for the category of manufacturing players are outlined below.

3.2.1. Targeting system integrators

The system integrators' role is varying depending on the type of product that is being purchased. For IT and production systems, and larger turnkey solutions system integrators are usually first involved together with the client in assessing options and advice on what decisions to make, and then supporting the actual hands-on integration and adaptation of the solution. In most cases, the final decisions of what products and solutions to buy still lie with the manufacturers themselves but for non-core solutions and products, the manufacturers usually look towards the recommendations of the system integrators. For products and solutions that belong to the core operations of the manufacturers, the manufacturers are often highly knowledgeable themselves and can navigate between the available options in a more self-sufficient way. For smaller manufacturers in the SME segment, system integrators can often play a more important role as the manufacturers tend to lean more often towards the recommendations of the system integrator.

The challenge with larger system integrators such as e.g., AFRY and Sweco, is that these organisations are largely decentralised into sections (~20-50 people each), where each section has its own network and business relationships. Combined with the manufacturing companies also being quite decentralised, it is a challenge to identify contact persons at the system integrator which in turn has the appropriate contacts in the manufacturing company. Finding the right contacts at manufacturing companies to present new offerings is even considered a great challenge for system integrators themselves. As an example of how system integrators and manufacturing companies work together, AFRY has several employees that are working as more or less as inhouse integrators at smaller manufacturers, or within smaller units at multinational companies such as Scania or Volvo. Initiating contact with these system integrators at a higher organisational level, and then trying to work its way outward towards relevant people with access to manufacturing companies is seen as a viable approach, although it could be time-consuming to find the relevant contacts.

Relevant system integrators with a strong presence in the Nordics to build relationships with, for Austrian manufacturers, are identified in section 2.4.2.

3.2.2. Selecting distribution options

To overcome some costs of having to establish a local presence through company- owned offices, approaching distributors and local agents could be of high interest for Austrian manufacturers that are looking for sales channels for more specific components or products. However, as noted by AFRY experts, the distributors will not automatically go on and sell the products from new manufacturers.

Large distributors

The relationship with the largest distributors will demand marketing efforts in the local markets, and potentially adding other partnerships with smaller local system integrators or local agents which can sell the products in closer relationships with the manufacturer. Relevant distributors to build a relationship with for Austrian manufacturers are identified in section 2.4.1 and particularly the distributor Ahlsell is a distributor with good reach across the Nordic countries that could be a viable counterpart

for Austrian manufacturers. The large distributors can usually be found through desktop research or identified through discussions around supplier networks with larger manufacturers.

Local agents/small distributors

In the Nordics, there are also several local agents distributing and selling products from one or a few selected brands. These smaller firms and sales partners are usually established close to the large manufacturers and their respective suppliers. The suggested way to identify these smaller agents is through smaller business networks where these agents are participating. For example, participating in business networks (e.g., Lindholmen Science Park) around the automotive cluster in western Sweden could be a feasible way forward to approach smaller agents or distributors with good relationships within the automotive sector and larger manufacturers.

Local subsidiary

Opening a new office in any of the Nordic countries to sell and distribute products could also be a viable approach to target specific segments or countries. To set up a subsidiary in the Nordic region, one must consider, for example, the market size of its products, the country's characteristics, and the geographical location. As seen in section 3.1, the different sectors vary largely between the countries, and as the sector data is publicly available a deep analysis of potential market size is needed. Given the large geographies to cover, an Austrian manufacturer must consider what geographic region gives the best access to the relevant segments. A suggested approach to reduce the financial risk of establishing a local office is to first work with a local agent to ensure that there is a demand in the market to later aim at acquiring the local agent to capture a larger share of the financial margins.

3.2.3. Targeting multinationals

The work for qualifying to the preferred supplier lists of the major manufacturers in the Nordics is extensive. Going directly to the companies to sell products is often of limited use unless it is a crucial component for the manufacturer which is significantly better in e.g., quality or cost. Introductory sessions could be initiated to increase awareness of the specific Austrian smart manufacturer or a network of Austrian smart manufacturers but can be hard to schedule with relevant stakeholders if no prior relationships exist. To succeed in approaching these companies, collaboration in R&D and innovation projects is seen as a good entrance for building relationships. In most of the identified forums and networks presented in 2.4, the largest multinationals are represented. Given the large amount of funding that is going into PoCs and smart manufacturing projects from both the public and private sector, opportunities for collaboration for Austrian manufacturers would be available. Additionally, the manufacturers often have their own R&D facilities (e.g., Northvolt, ABB, Kone) where experiments are continuously ongoing. Additionally, most multinationals are working with preferred supplier lists, and qualifying for these takes time and effort. Looking at working as subcontracting partners to their suppliers instead, is seen as a feasible approach for targeting the multinationals, and is more described in section 3.3

In terms of digitalisation and automation, multinationals are significantly investing both time and financing into turning their business 'smarter'. However, major progress is yet to be seen and the companies have in many cases not implemented smart manufacturing solutions at scale. More about the current challenges and trends for manufacturing companies in the Nordics can be read in 2.2.

3.2.4. Targeting networks and other R&D organisations

For approaching the Nordic manufacturing companies, several innovation hubs, research institutes, and networks have been identified apart from going directly to the companies. These are all seen as potential door openers and a platform for developing relationships with both companies and R&D-focused organisations active in the smart manufacturing ecosystem. The specific stakeholders and networks that are suggested to target are in the initial phase (description of hubs/networks available in section 2.4):

- Ericsson One (focus on 5G in factory applications), Sweden
- Odense Robotics, Denmark
- FindIT, Sweden
- FIMA, Finland
- MobilityXlab, Sweden

Companies with their own innovation hubs such as ABB and Northvolt are also seen as prominent players in the Nordic manufacturing landscape and could be relevant for Austrian manufacturers to target.

3.2.5. Targeting SMEs

In general, SMEs have shown less progress in smart manufacturing and are in many cases lagging behind the larger companies. The SMEs are often family-owned, traditional manufacturers with limited access to capital and to highly skilled personnel that could make use of the available technology. On the other hand, these companies do not seem to have as developed partner networks as larger peers, which could possess an opportunity for Austrian manufacturers that wants to approach the SMEs directly.

Below are several SMEs involved in the manufacturing sector that are well-known to AFRY, where all are a member of previously presented business networks, see 2.4.4.

- **Axelent Engineering**, located in Gislaved, Sweden, with smart solutions offers in the machinery and automation sector¹¹⁰.
- **Blowtech**, working with plastic blow-blowing in both Gnosjö, Sweden, and Kongsvinger, Norway¹¹¹.
- **Pema Metall** manufactures specialised machines in the entire industry sector, present in Åsenhöga, Sweden¹¹².
- **Delfoi** support smart manufacturing solutions, including production planning & scheduling, robot offline programming, and simulation services for industry clients¹¹³. Delfoi are located in Espoo, Tampere and Seinäjoki (Finland).
- **Hydal Aluminium profiler** provides different kinds of processing equipment, e.g., CNC and assembly, and have two production locations, Vetlanda, Sweden, and Raufoss, Norway¹¹⁴.
- **Bror Tonsjö** is a family-owned manufacturing business located in Kode, Sweden, which recently won the IVA (Royal Swedish Academy of Engineering Sciences) price Smart Industry 2021 for their efforts in innovation in digitalisation and smart manufacturing¹¹⁵.

3.3. Aspects to consider

Although the Nordic countries are very much integrated and purchase goods and services from each other to a large extent, Nordic manufacturing companies are in general open to purchasing machines and components from European and international suppliers. However, there are several aspects to consider for Austrian manufacturers when approaching the manufacturing industries in the Nordic countries. A few identified aspects are more general in their nature, and would likely apply in most European countries, but several are also more specifically highlighted by the manufacturing community in the Nordics. As the manufacturing industries in the Nordics are highly specialised and often market leaders within their industries, the expectations on new suppliers from especially the largest companies are high. Aspects which Austrian companies would want to consider when approaching the Nordic manufacturers include:

- **Preferred supplier lists.** Especially the largest companies in the Nordics are consistently using lists of preferred suppliers, and in many cases, purchase requests and tenders are not publicly announced.

¹¹⁰Axelent Engineering - [About Axelent Engineering](#)

¹¹¹Blowtech - [About Blowtech Group](#)

¹¹²Pema Metall - [About Pema Metall](#)

¹¹³Delfoi - [About Delfoi](#)

¹¹⁴Hydal Aluminium profiler - [About Hydal Aluminium Profiler](#)

¹¹⁵IVA - [Bror Tonsjo AB recieve award](#)

Instead, the specific requests are sent to companies on the “preferred supplier list”. These companies have in general worked for a long time with the manufacturer and have extensive relationships established. In some cases, the companies even select one specific supplier for equipment. For example, one of the largest food and life science companies in Denmark has decided to only use Danfoss cooling and heating solutions, and not products from Schneider due to quality and integration benefits with Danfoss. SME manufacturers, seem to not have as developed supplier networks as larger manufacturers and could be easier to approach and get into the door. Linked to the preferred supplier lists, there are in general frame agreements set up between the manufacturer and the suppliers, especially for multinationals. These frame agreements are not publicly announced and finding the relevant procurement manager at the manufacturer can be difficult and depend on the products. To overcome the tedious process of identifying the right contacts, an alternative way for Austrian manufacturers would be to find a top-tier supplier of the multinationals and work as a subcontractor for the supplier. However, it should be noted in these setups, that the price pressure throughout the relationships could get exceedingly high for subcontractors of the top tier suppliers.

- **Sustainability.** Several of the Nordic industries are widely known for their focus on sustainability and sustainable production processes. Additionally, there is governmental pressure and willingness to be a leader in the energy and climate transition. In some cases, Austrian manufacturers may discover that sustainability and a low carbon footprint is a hygiene factor to sell products in the Nordic markets. The electricity production is largely fossil-free and producing goods with “green electricity” labels is common in the Nordics. Discovered in this analysis is also that sustainability is very much a marketing initiative from Nordic manufacturers and countries. Large businesses do not seem willing to purchase sustainably produced goods that are significantly more expensive than other products. As an example, to the above reasoning, data center developers are to a large extent not willing to purchase expensive cooling recovery solutions for their centers, as they could already market themselves as green (electricity used in their centers was 100% fossil-free). For Austrian manufacturers, sustainability aspects of products should be continuously addressed with Nordic companies but do not seem to be the main consideration in the purchasing decisions.
- **Quality.** Nordic industries (e.g., steel, automotive, and pulp/paper) are much associated with high quality end-products compared to other regions in the World. Hence, the expectations from the industry companies are high when it comes to the quality of machines and components. The manufacturing companies are relatively open to switching suppliers if there are machines and components available with better quality, but low brand awareness and price are of course factors that could limit the willingness to transition to a new supplier. Given that most manufacturing industries in the Nordic countries are relatively mature in terms of developed supplier relationships, the low brand awareness of Austrian manufacturers compared to e.g., Nordic, or German manufacturers is seen as a key improvement area for increasing the willingness to switch suppliers.
- **Price.** Nordic manufacturing companies are as in most industries fairly price-sensitive and are continuously balancing costs vs. non-financial aspects such as reconfigurability and digitally advanced products. Although e.g., reconfigurable products and high-tech applications are in demand, manufacturers are relying on high-quality products at the best possible prices. More specifically, requests from larger manufacturing companies for their older factories are still mainly focused on conventional machines and products with limited digital capabilities, thus at a lower price than digitally advanced machines. For Austrian companies, the financial and non-financial value of machines and products in terms of e.g., enhanced quality, increased flexibility, more powerful digital insights, and integration opportunities, need to be clearly outlined and presented to the manufacturers.
- **Connected products.** According to Nordic Smart Manufacturing Experts, there is an overall agreement that a great majority of the machines and tools used in the Nordic manufacturing community have some level of connectivity. This means that machines and tools can provide data into the manufacturers’ production systems and enable the extraction of relevant insights from them. However, the main challenge for Nordic manufacturers is that they are not using the available data and extracting insights from the factory floor to the extent possible. The

three identified reasons for this are lack of investment in digitalisation platforms and integrations, lack of competent personnel, and issues in easily connecting various data sources to holistic production platforms. An opportunity for Austrian manufacturers would be to approach Nordic manufacturers with tech agnostic machines and equipment that are easy to integrate with production systems

- **Reconfiguration.** One of the key trends in certain Nordic manufacturing industries is to increase the flexibility of both old and new factories. Manufacturers are increasingly looking for machines that are reconfigurable to be able to accommodate new developments in customer demands. In some sectors such as pulp and paper, the requirement of reconfiguration is less important due to limited development in the overall manufacturing processes compared to automotive where a major shift in manufacturing processes is underway (i.e., combustion engines to electric motors).
- **Installation and maintenance.** Widely accelerated during the pandemic, several industries have experienced difficulties in receiving deliveries according to schedule and receiving adequate service from international suppliers. During the pandemic, foreign suppliers have not been able to fly in service personnel due to travel restrictions and around manufacturing experts, this is believed to be a crucial factor when selecting suppliers and products in the nearby future. For Austrian manufacturers, it is recommended to present Nordic companies with a clear plan of how delivery, installations, and continuous service would be provided.
- **Local presence and language.** As in most industries, local presence and doing business in the local languages is in some cases important for Nordic manufacturers. Especially around SMEs, it is believed that there are certain companies that prefer doing business only with domestic suppliers due to the language and local presence of the supplier. In those cases, it could be beneficial to translate manuals and instructions to the local languages and use local agents to develop tighter relationships. Further, some country variations have been identified, where the aspect of translated instructions seems to be more important in Finland and Sweden, especially in the SME segment.

In many of the Nordic multinational companies and larger manufacturers, English is quickly becoming the standard business knowledge. As an example, battery manufacturer Northvolt has 70+ nationalities among their employees and suppliers do not need to speak local languages to build a strong relationship.

Although the Nordic countries are interlinked in many aspects, the manufacturing industries are in general not hesitant towards building relationships with European and international suppliers. For example, the automotive industry is heavily reliant on German suppliers for manufacturing equipment and automotive components, and the oil and gas business in Norway has well developed supplier relationships with UK and Italian suppliers (e.g., valves, pumps, gas turbines).

However, it should be noted that the pandemic (and possibly also the Russia-Ukraine war) has accelerated the willingness to select suppliers that are closer to the home operations or at least suppliers that can guarantee smooth delivery, installations, and maintenance. If local agents or partners could be used by Austrian manufacturers for ensuring delivery and maintenance, that is recognized as the main advantage when approaching the Nordic manufacturers.

3.4. Roadmap for Austrian manufacturers

For Austrian manufacturers, there are several categories of players of interest within the Nordic smart manufacturing landscape. The benefits of meeting with these players are expected to be somewhat different but will serve the overall aim of Austrian manufacturers to increase brand awareness, increase sales and develop better business relationships in the Nordic manufacturing markets. Two main purposes for approaching Nordic manufacturing companies have been identified:

1) Positioning in the Smart Manufacturing ecosystem

In the Nordics, several stakeholders, companies, and networks are involved in the Smart Manufacturing ecosystem. Gaining a position in the Nordic manufacturing ecosystem is believed to be a viable approach for improving brand awareness and finding initial contact persons to build relationships with.

2) Direct sales opportunities

As the Nordic manufacturers are in general used to working with foreign suppliers, specific sales opportunities towards Nordic manufacturers are seen as important to identify. If successful, direct sales opportunities can be transformed into success stories where Austrian manufacturers enter new relationships which can inspire both other Austrian manufacturers and more Nordic companies to purchase products from Austria.

Given the two overarching purposes for Austrian manufacturers, different categories of players linked to these purposes have been identified. The first two identified categories of players of interest, linked to the first purpose, are R&D/networks (e.g., innovation hubs and networks listed in chapter 2) and high-profile companies (e.g., Northvolt, ABB, Ericsson with a strong position in the smart manufacturing ecosystem). The actors in these categories are believed to provide Austrian manufacturers with some initial contacts to build relationships from and serve as a door opener into the manufacturing ecosystem.

For the two next categories, multinationals and SME's/distributors, the success is more dependent on the specific offerings from the Austrian manufacturers, i.e., which manufacturing companies likely have the greatest potential in opening new sales channels with the multinationals, SMEs in manufacturing, and distributors of manufacturing equipment.

Our recommendations to Austrian manufacturers are to initially focus on the two first categories, participating in Nordic business and industry networks, combined with taking part in R&D projects with innovation hubs and trying to build a relationship with high-profile companies in the ecosystem. This first step will be useful to raise the awareness of the Austrian manufacturers and build initial relationships with relevant manufacturing stakeholders and companies.

Appendices

Appendix A: Top 20 import categories in per country within manufacturing (from Austria)

DENMARK	
IMPORT CATEGORY	AMOUNT
Electrical Transformers	\$44 632 844
Cranes	\$17 876 962
Transmissions	\$14 274 601
Machinery Having Individual Functions	\$10 993 381
Rubberworking Machinery	\$8 351 071
Large Construction Vehicles	\$7 898 555
Electrical Control Boards	\$6 826 270
Refrigerators	\$6 518 363
Office Machine Parts	\$6 264 357
Centrifuges	\$5 683 006
Industrial Food Preparation Machinery	\$5 666 245
Other Construction Vehicles	\$5 661 146
Excavation Machinery	\$5 549 940
Harvesting Machinery	\$5 510 816
Valves	\$5 220 976
Lifting Machinery	\$5 213 636
Electric Motors	\$5 001 683
Electrical Power Accessories	\$4 956 465
Insulated Wire	\$4 019 053
Broadcasting Equipment	\$3 901 690

FINLAND	
IMPORT CATEGORY	AMOUNT
Spark-Ignition Engines	\$ 42 974 067
Electrical Lighting and Signalling Equipment	\$ 32 171 874
Lifting Machinery	\$ 18 427 104
Cranes	\$ 17 976 299
Excavation Machinery	\$ 13 077 265
Electrical Transformers	\$ 10 662 023
Air Conditioners	\$ 9 678 949
Papermaking Machines	\$ 9 253 797
Insulated Wire	\$ 7 998 885
Valves	\$ 7 829 902
Large Construction Vehicles	\$ 6 955 156
Rubberworking Machinery	\$ 6 764 162
Machinery Having Individual Functions	\$ 6 589 900
Air Pumps	\$ 6 550 889
Vacuum Cleaners	\$ 6 194 442
Refrigerators	\$ 5 748 304
Video Displays	\$ 5 456 923
Transmissions	\$ 4 334 880
Liquid Pumps	\$ 4 179 568
Forging Machines	\$ 3 863 337

NORWAY	
IMPORT CATEGORY	AMOUNT
Cranes	\$ 15 838 509
Lifting Machinery	\$ 9 929 190
Machinery Having Individual Functions	\$ 9 006 083
Telephones	\$ 8 375 023
Transmissions	\$ 8 339 524
Valves	\$ 7 870 063
Electrical Control Boards	\$ 6 352 513
Air Pumps	\$ 6 333 266
Stone Processing Machines	\$ 6 196 723
Harvesting Machinery	\$ 6 105 093
Excavation Machinery	\$ 5 909 119
Broadcasting Equipment	\$ 5 867 977
Refrigerators	\$ 5 761 484
Large Construction Vehicles	\$ 5 721 716
Electrical Transformers	\$ 5 683 806
Carbon-based Electronics	\$ 5 171 697
Blank Audio Media	\$ 5 130 798
Other Electrical Machinery	\$ 4 973 502
High-voltage Protection Equipment	\$ 3 925 960
Liquid Pumps	\$ 3 281 243

SWEDEN	
IMPORT CATEGORY	AMOUNT
Washing and Bottling Machines	\$ 47 486 587
Ball Bearings	\$ 37 757 624
Electrical Control Boards	\$ 28 740 389
Cranes	\$ 28 405 525
Electrical Transformers	\$ 26 595 579
Transmissions	\$ 22 106 944
Vacuum Cleaners	\$ 18 772 204
Electrical Lighting and Signalling Equipment	\$ 17 137 966
Engine Parts	\$ 16 076 607
Insulated Wire	\$ 15 735 989
Rubberworking Machinery	\$ 15 158 148
Machinery Having Individual Functions	\$ 13 622 829
Traffic Signals	\$ 13 510 097
Large Construction Vehicles	\$ 12 956 466
Lifting Machinery	\$ 11 944 446
Excavation Machinery	\$ 11 447 041
Refrigerators	\$ 9 683 150
Electrical Power Accessories	\$ 9 241 677
Broadcasting Equipment	\$ 8 854 739
Gas Turbines	\$ 8 779 870

Appendix B: Top 20 country relationships for Denmark in Europe (in terms of import)

DENMARK		
Country	Amount	% of total
Germany	\$ 21 015 415 986	21,2%
Sweden	\$ 11 059 441 300	11,2%
Netherlands	\$ 7 428 831 802	7,5%
Norway	\$ 4 430 793 603	4,5%
Poland	\$ 4 158 549 860	4,2%
United Kingdom	\$ 3 600 208 610	3,6%
France	\$ 3 424 559 729	3,5%
Italy	\$ 3 284 481 807	3,3%
Belgium	\$ 3 188 675 747	3,2%
Russia	\$ 2 818 212 956	2,8%
Spain	\$ 1 975 957 198	2,0%
Czechia	\$ 1 957 954 631	2,0%
Finland	\$ 1 158 547 191	1,2%
Switzerland	\$ 1 126 852 719	1,1%
Ireland	\$ 971 087 987	1,0%
Austria	\$ 874 797 678	0,9%
Hungary	\$ 863 115 427	0,9%
Lithuania	\$ 800 419 134	0,8%
Slovakia	\$ 661 575 827	0,7%
Latvia	\$ 650 102 021	0,7%
TOTAL	\$ 75 449 581 213	76%

FINLAND		
Country	Amount	% of total
Germany	\$ 11 743 611 032	16,3%
Sweden	\$ 10 016 297 295	13,9%
Russia	\$ 9 502 424 813	13,2%
Netherlands	\$ 4 316 964 563	6,0%
Estonia	\$ 2 286 694 115	3,2%
France	\$ 2 210 836 897	3,1%
Poland	\$ 2 146 517 988	3,0%
Belgium	\$ 2 105 385 855	2,9%
Italy	\$ 1 945 468 593	2,7%
Denmark	\$ 1 891 727 593	2,6%
United Kingdom	\$ 1 766 952 572	2,5%
Norway	\$ 1 552 607 313	2,2%
Spain	\$ 1 095 885 828	1,5%
Czechia	\$ 1 066 015 811	1,5%
Austria	\$ 749 305 987	1,0%
Switzerland	\$ 663 481 419	0,9%
Lithuania	\$ 567 425 542	0,8%
Ireland	\$ 547 928 384	0,8%
Hungary	\$ 459 167 981	0,6%
Portugal	\$ 387 793 974	0,5%
TOTAL	\$ 57 022 493 555	79,3%

NORWAY		
Country	Amount	% of total
Sweden	\$ 14 791 361 128	16,6%
Germany	\$ 10 337 719 248	11,6%
Denmark	\$ 5 802 325 921	6,5%
United Kingdom	\$ 4 560 711 134	5,1%
Netherlands	\$ 4 364 186 540	4,9%
Poland	\$ 3 125 263 929	3,5%
Russia	\$ 3 084 863 318	3,5%
France	\$ 2 288 537 564	2,6%
Italy	\$ 2 270 537 794	2,6%
Finland	\$ 1 877 427 108	2,1%
Belgium	\$ 1 734 512 005	2,0%
Spain	\$ 1 462 219 636	1,6%
Lithuania	\$ 1 010 363 111	1,1%
Czechia	\$ 893 597 889	1,0%
Austria	\$ 819 505 155	0,9%
Switzerland	\$ 745 286 416	0,8%
Estonia	\$ 656 014 157	0,7%
Romania	\$ 555 117 623	0,6%
Ireland	\$ 508 674 711	0,6%
Latvia	\$ 345 803 778	0,4%
TOTAL	\$ 61 234 028 165	68,9%

SWEDEN		
Country	Amount	% of total
Germany	\$ 27 248 068 732	18,1%
Netherlands	\$ 13 132 783 123	8,7%
Denmark	\$ 10 303 472 117	6,8%
Norway	\$ 10 067 176 531	6,7%
Finland	\$ 7 242 754 628	4,8%
Belgium	\$ 7 004 305 252	4,6%
Poland	\$ 6 875 116 938	4,6%
United Kingdom	\$ 6 580 943 197	4,4%
France	\$ 6 063 967 693	4,0%
Italy	\$ 5 410 850 813	3,6%
Czechia	\$ 3 144 634 699	2,1%
Russia	\$ 2 826 411 800	1,9%
Spain	\$ 2 549 745 009	1,7%
Austria	\$ 1 925 215 832	1,3%
Hungary	\$ 1 727 182 214	1,1%
Estonia	\$ 1 563 547 272	1,0%
Switzerland	\$ 1 541 693 295	1,0%
Ireland	\$ 1 501 714 487	1,0%
Lithuania	\$ 1 398 729 455	0,9%
Slovakia	\$ 1 202 433 243	0,8%
TOTAL	\$ 119 310 746 330	79%

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