

 **Norway**

Norway – Japan:

Creating value together for a sustainable future



Norway in Japan
駐日ノルウェー大使館



Copyright & Disclaimer:

The information contained herein has been obtained from sources believed to be reliable but is not guaranteed as to its accuracy or completeness. An effort has been made to go beyond simple data collection in this report: responses have been interpreted to elucidate the underlying processes, motives and relationships involved in the dynamics of the situations under investigation.

All references to factual data and properties should be recognised as respondents' perceptions of reality unless otherwise stated. This report is not intended for, and should not be used as, an investment recommendation.

All information and data gathered for this project constitutes the work product of Intralink Limited, for which Intralink retains and reserves all proprietary rights. This document has been prepared for the exclusive use of The Embassy of the Kingdom of Norway, Tokyo and will not be copied or distributed to any third party without the express consent of Intralink Limited.

Exchange rates used in the report: US\$ 1 = NOK 8.65 / JPY 100 = NOK 7.92

Table of Contents

1.0 Foreword by the Ambassador	5
2.0 Report summary	9
3.0 A long-standing partnership	12
4.0 Growing ties based on mutual synergies and common interests	14
4.1 Aspirations for a sustainable future	16
4.1.1 Equinor teams up with JERA and J-POWER with aspirations for offshore wind	20
4.1.2 Idemitsu Kosan cutting emissions in offshore operations	22
4.1.3 Sumisho Metalex and Freyr partner to provide greener batteries	24
4.2 Win-win alliances in Seafood	26
4.2.1 Processing of Norwegian mackerel revitalises Japanese rural economies	32
4.2.2 Mitsubishi Corporation acquires Cermaq with global salmon aspirations	34
4.2.3 Proximar Seafood helps Japan advance aquaculture ambitions	36
4.3 Norway and Japan continue to show leadership in the Maritime sector	38
4.3.1 Mitsui ventures into the subsea vessels through its investment in Akastor	42
4.3.2 Toyota and Corvus partner to develop maritime hydrogen fuel cell systems	44
4.3.3 Dualog providing data-driven innovation in the maritime sector	46
4.4 Innovation providing new opportunities	48
4.4.1 Tomra Japan's approach to recycling recognised by the METI Minister's award	52
4.4.2 Cognite helps Japanese industry digitalise operations	54
4.4.3 Norwegian EdTech transforming learning	56

4.4.4	Digital healthcare to the rescue	58
4.4.5	Hot Norwegian start-ups to look out for	60
4.5	A sound future based on research links	64
4.5.1	Norwegian universities lead participation in KIFEE	70
4.5.2	INTPART programme helps develop new aluminium alloys	72
5.0	A bright future	74
	Appendices	76
A.	Economic indicators Norway-Japan	76
B.	References	78
C.	Table of figures	84

1.0

Foreword by Ambassador

Trade and business ties have always been at the core of Norway and Japan's bilateral relations. First developed in the maritime domain already in the Meiji era, our economies have been complementary and mutually reinforcing, and our industrial exchanges have steadily grown into sophisticated value chains that benefit both countries.

A few examples:

-- Both Norway and Japan are important shipping nations. We cooperate closely to develop low-emission technologies for the maritime sector and to establish modern and appropriate regulations for international shipping.

-- Norway's position as the world's second largest seafood exporter has benefitted greatly from the introduction of salmon as a key ingredient in sushi and sashimi, which today is appreciated as delicious and healthy food all over the world.

-- Japanese companies are active in the Norwegian energy sector and have also invested in several Norwegian technology companies, creating innovative new products and promoting new ideas in both countries.

Norway and Japan are mountainous countries close to the sea. Our societies are sophisticated and our peoples highly educated, with a deep affection for the natural environment. In both countries, the need to protect the livelihoods of our rural communities has a high priority. We share fundamental values such as democracy, rule of law and human rights. The numerous royal visits between Norway and Japan, most recently when Crown Prince Haakon attended His Majesty the Emperor's enthronement, speak to the strength and depth of the bilateral relationship. These personal links are long-lasting, too; King Harald's participation as an athlete in the sailing competition at the Tokyo Olympics in 1964 is still fondly remembered.

Our political leaders often see the world eye to eye, despite the great geographical distance. We share many multilateral priorities such as the freedom of trade and navigation and a rules-based trading system. Both Norway and Japan have set ambitious climate targets and are committed to achieving the sustainable development goals. Our two countries have



also engaged in efforts to safeguard the continued health and productivity of the world's oceans through the High-level Panel for a Sustainable Ocean Economy, where our two prime ministers, together with 12 other countries, have resolved to sustainably manage 100 percent of our national waters by 2025.

Norway and Japan share a number of economic priority areas such as energy, maritime transport, marine resources, innovation and research. We share a common ambition to transform our economies and adapt our societies to a low-emission future in accordance with the Paris Agreement. We face similar demographic challenges, as our populations grow older and human resources become scarcer, and both countries depend on innovation, technological development, renewable energy and strong partnerships to reach our goals.

Today, our bilateral trade is growing. We see more Japanese and Norwegian companies joining forces. This report showcases some of these cases and provides an overview of our extensive bilateral cooperation.

At the same time, there is clearly a great potential for strengthening our bilateral relationship. The Norwegian government has stated its willingness to work with the Japanese government to develop our bilateral trade and investment relations further through an Economic Partnership Agreement, to the mutual benefit of both countries. We hope that this report can serve as inspiration towards that goal.

Inga M. W. Nyhamar

Ambassador of Norway to Japan



2.0

Report Summary

With diplomatic ties stretching back more than a century, the relationship between Norway and Japan is diverse and healthy. Continued dialogue between the two nations has led to new opportunities for cooperation and leadership on the world stage through initiatives like the High Level Panel for a Sustainable Ocean Economy.

Trade and investment have been at the centre of the relationship. Leveraging the respective strengths and experiences of each side to ensure maximum value creation and mutual success is at the heart of relationships. In partnership, Norway and Japan are increasingly addressing global issues related to sustainability, reducing carbon emissions and ageing populations.

This report highlights some of the successful examples of economic and research cooperation between the two nations and outlines potential areas for greater collaboration. It focuses on sectors where Norway and Japan have complementary strengths, so it not only covers long-standing business ties in the seafood and maritime sectors, but also includes recent developments in renewable energy and digital technologies.

The broad range of partnerships showcased in this report clearly demonstrates that by working together, Norway and Japan can be leaders in technology and innovation and contribute to a more sustainable future. Furthermore, greater intergovernmental collaboration between Norway and Japan

could unlock many more opportunities to the benefit of both nations and contribute towards achieving the sustainable development goals.

Energy

The need to find sustainable energy solutions drives much of the activity in this sector. Japan's Basic Hydrogen Strategy and Norway's National Hydrogen Strategy will pave the way for new developments in both countries. Equinor's deep water experience and offshore wind power credentials are helping the company to pursue potential business with JERA and J-POWER in Japan. Equinor is also working with Idemitsu Kosan in the Norwegian Sea to bring renewables to offshore remote oil and gas operations, making the project as a world first to do this. Norway's battery supply chain is increasingly attractive to Japanese companies looking to produce greener batteries and gain access to the European market. The tie-up between Sumisho Metalex and FREYR is one example of this growing interest. Future opportunities lie with the development of the hydrogen economy, more offshore wind in Japan and expansion of the battery supply chain in Norway.

Seafood

The seafood industry is of crucial importance to both countries and Japan's ambitions to become a net exporter of sustainable seafood is a key driver for growing activity in this sector. Norwegian and Japanese efforts in this space are complementary in nature and

extend far beyond the well-known growth of salmon consumption. Seafood from Norway is creating jobs in Japan such as the processing of mackerel in rural Japan. Mitsubishi Corporation's acquisition of Norwegian company Cermaq has enabled the trading house to become a global force in seafood. Additionally, Proximar Seafood's land-based aquaculture management experience matched with Japan's manufacturing prowess will help to shorten the supply chain and reduce the carbon footprint in salmon farming. Looking ahead more opportunities lie with the expansion of aquaculture, further development of the supply chain and a continued leadership in the sector to bring positive change.

Maritime

Norway's world-leading strengths in the maritime sector coupled with Japan's global shipping business are generating new solutions that make operations greener and more competitive. Norwegian innovation in electrification, the hydrogen economy, and autonomous systems is helping shipping meet reduced emission targets. The increasing use of maritime-dedicated communications that provide more data in real-time improves efficiency and further reduces emissions. The great potential for maritime collaboration is exemplified by Mitsui's acquisition of Akastor to optimise operations for deep ocean resource exploration, the partnership between Toyota and Corvus Energy to develop maritime hydrogen fuel cell systems, and Dualog's role in driving technological

innovation for the Internet of Things and Big Data with Nippon Yusen Kaisha in Japan. Further opportunities lie in areas such as growing digitalisation in the maritime industry, more cooperation with Norwegian cluster programmes, greater electrification, and the development of autonomous for shipping.

Digital technologies and Innovation

Digital technologies and innovative start-ups are increasingly becoming critical to the advancement of society. This is an area where Norway's reputable track-record as a leader in digitalisation perfectly complements Japan's renewed commitment towards a digital society. The technologies and solutions of Norwegian start-ups, which are forging the way for positive change, are helping Japan to achieve Society 5.0 while also tackling global issues related to sustainability and healthcare. Examples include TOMRA using sensor technologies to boost recycling efforts, Cognite optimising industrial operations using Big Data and artificial intelligence, and Norwegian EdTech companies opening up new and engaging ways to learn. SoftBank's recent investment in three promising Norwegian start-ups is a clear indication of the strength and relevance of the Norwegian innovation ecosystem. Further opportunities lie with EdTech, realising Society 5.0 and the digitalisation of public services.

Research and Development

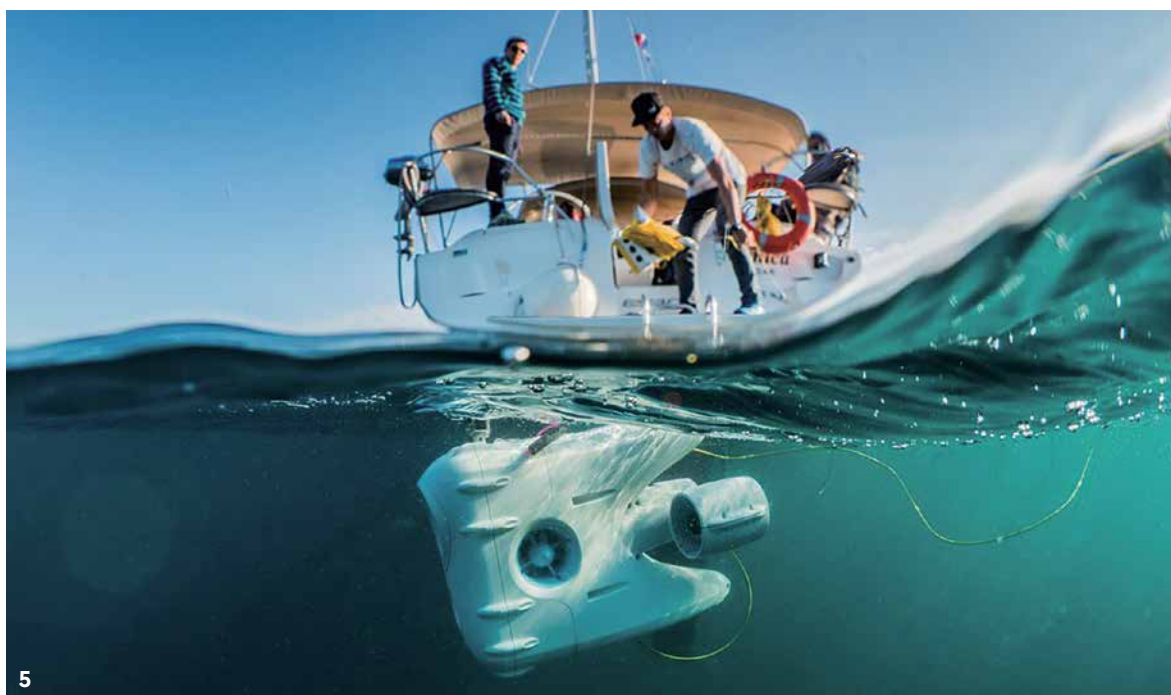
Government support and initiatives that

strengthen the ties between Norway and Japan are helping foster cluster development and closer cooperation between research institutions and industry. This is ensuring the development and commercialisation of new technologies and generating ideas that have the potential to shape the future of both countries.

Additionally, these programmes are contributing to the growth and empowerment of engineers and entrepreneurs that are pioneering world-class solutions. Initiatives, including the research cooperation platform Kyoto International Forum for Environment and Energy (KIFEE) and Norwegian government research programmes such as INTPART (International Partnerships for

Excellent Education and Research), promote robust academic exchanges, stimulate discussion on common issues and create new research partnerships. As both countries step up efforts in sustainability and digitalisation, there is room for even greater collaboration to foster progress and disruptive innovations.

Further opportunities lie with greater participation in EU and Norway-funded clusters, industry-focused research initiatives in marine and material science, renewable and clean energy, and maritime engineering and continued commitment to the 2003 Agreement between the Government of Norway and the Government of Japan on Cooperation in Science and Technology to further develop innovation.



3.0

A long-standing partnership

This section outlines the background of the relationship between Norway and Japan to set the scene for the report.

Ever since Norwegian ships brought coal to Japan in the late 19th century and Norwegian whalers started venturing into the South seas, the people of Norway and Japan have met each other across the seas that unite the two nations across the globe.

Norway and Japan share many similar characteristics. The promotion of universal human rights and freedoms such as democracy and free speech are shared values. They both possess national identities as large ocean states and have leading expertise in the maritime domain, be it in international shipping or the fisheries sector. Whaling has also been a part of both nations' history, and Norway and Japan still cooperate in the sustainable management of marine mammal resources.

Both countries have diverse and mature economies. While some countries are linked through the production of goods, and others through the supply of natural resources, access to markets, or even as mutual providers of services, investments, or technology, the economic relationship between Norway and Japan is one where all these linkages apply.

Japanese corporations have invested in the extraction of natural resources in Norway, as is the case with Idemitsu Kosan. Others have engaged in the development of new technologies, illustrated by the partnerships

to develop marine hydrogen fuel cell systems. Through the Norwegian sovereign wealth fund and the Government Pension Fund Global, Norway is a substantial investor in Japanese fixed income assets, invests heavily in real estate and has an interest in 1,499 Japanese companies. The fund's total investments in Japan, as of 31 December 2020, amount to NOK 992.4 billion.¹

With a fish and seafood self-sufficiency ratio of 55 percent, Japan relies on imports to supply almost half of its domestic demand. Norwegian seafood exporters provide eight percent of Japan's total seafood imports and three percent of the total seafood supply in Japan.² Among the high-quality seafood provided by Norway, some species are particularly prominent: Norway supplies more than half of the mackerel and 21 percent of the salmon consumed in Japan today.³ Norway exports whole fish, and the processing generally takes place in Japan. This creates many jobs in the Japanese seafood processing industry, and allows companies like Mitsubishi Corporation, Yokohama Reito and Tokai Denpun Company to add value in Japan.

The introduction of Norwegian salmon to Japan in the 1980s was a momentous culinary event. Indeed, the marriage between Norwegian seafood and Japanese culinary traditions became a worldwide phenomenon. In 1986, the initiative to promote Norwegian seafood in Japan was launched, and by 1992, Nichirei became the first Japanese company to sell Norwegian salmon for sushi,

introducing it as a staple in sushi restaurants all over Japan. The project succeeded not only in deepening mutual economic ties between Norway and Japan, but also in springboarding sushi to international markets. Salmon-topped sushi became a favourite choice for consumers all over the world.

Shipping has been, and remains, a very important sector in bilateral relations. Companies such as Kongsberg Maritime, DNV GL and Wilhelmsen all cooperate closely with Japanese partners in the maritime sector. Norway and Japan are in fact among the largest maritime nations in the world, with Japan ranking second and Norway fifth.⁴

Digitalisation and the use of innovative technologies have become important fields of cooperation. The number of examples is growing: SoftBank's Vision Fund has invested in Norwegian technology companies such as Kahoot!, Oda and AutoStore, and an increasing number of Norwegian start-ups and innovative technology companies build their businesses in Japan.

The bilateral Cooperation in Science and Technology agreement from 2003 has helped strengthen the triangle between research, innovation and business. All topics included in the agreement are well reflected in Japan and Norway's trade and business relations: energy and the environment, space and polar research, marine research, nanotechnology and new materials, as well as healthcare and welfare technology. The regular Joint Committee meetings under the agreement

ensure that further cooperation is geared towards solving the pressing matters of today.

Cultural exchanges between Norway and Japan are increasing on many fronts - in literature, art and music. Norwegian culture gained traction in Japan already in the Meiji era, through the work of renowned artists such as Edvard Munch, Edvard Grieg and Henrik Ibsen. In design and architecture, the international *Japonisme* movement of the late 19th century started a tradition of mutual inspiration that developed into a shared affinity for clean lines, natural light and the sophisticated use of wood and other natural materials, characteristic both of modern Japanese and Scandinavian design.

Today, the presence in Tokyo of Fuglen coffee shops, the Norwegian Icons design store and Norwegian Rain fashion store are examples of the interest in Japan for the contemporary Norwegian art and design scene. Fuglen's iconic Norwegian design furniture from the 1960s clearly appeals to a younger Japanese generation, just as young Norwegians are drawn to the Japanese language and literature through manga and anime. These features deepen the friendship between Norwegians and Japanese and create new markets in both countries for their respective creative industries.⁵

With such a long and prosperous history of kinship and mutual inspiration, the foundations are all set for the further broadening and deepening of the Japan-Norway bilateral economic relationship.

4.0

Growing ties based on mutual synergies and common interests

This section outlines examples of initiatives, partnerships, and potential opportunities in sectors where there are matching strengths.

Successful partnerships come from dialogue to understand each side's views and to find common ground. Both Norway and Japan have put significant effort into making the conditions right to bring the two nations together, so that government, business, and academia can meet to nurture old relationships and develop new ones.

As outlined in this section, the most powerful collaborations are based on synergistic alliances where all parties use their respective strengths and experience. Whilst

economic ties in the seafood and maritime industries are long-standing, new bonds are being formed in other areas such as energy and digitalisation.

The examples of Norwegian-Japanese partnerships that outlined in this section showcase the broad nature of the relationship to give the reader a view of the situation in general. Given the limitations of this report, it is not possible to mention all the partnerships. To this end, the case studies cited were chosen by a diverse group of stakeholders as representative and relevant examples to demonstrate the rich nature of the relationship between Norway and Japan.





4.1

Aspirations for sustainable future

This subsection explores the energy sector and how renewable energy, hydrogen, and the battery supply chain are paving the way for more sustainable solutions.



Potential opportunities for consideration:

Hydrogen

Norway's hydrogen value chain is producing clean hydrogen for power generation. The Research Council of Norway is committed to supporting business and academic partnerships with Japanese organisations to develop solutions for the hydrogen economy.

Offshore wind

Norway's expertise in deep sea operations is already being applied to renewable energy and can be valuable for Japan to harness offshore wind energy and reach net zero carbon emissions by 2050. There is scope for greater development and cooperation.

Battery supply chain

Hydroelectric power is energising the development of Norway's battery supply chain to produce greener lithium-ion batteries. Japanese companies can further develop battery technologies by working with Norwegian partners to take advantage of local production and gain greater access to the European market.



Aspirations for Sustainable Future

Japan's recent declaration by Prime Minister Suga for the country to be carbon net zero by 2050 is a bold move. It will drive innovation as the private sector develops new technologies for Japan to achieve this ambitious target. As Japan seeks to decarbonise its economy, international partners have valuable experience to fast-track progress. Geographical similarities between Norway and Japan and shared expertise in maritime and energy make both nations natural partners.

The open system for industrial innovation clusters has enabled Norway to become a test bed for innovation within the energy sector and an entry point to Europe for foreign companies to participate in clusters such as NCE Maritime CleanTech and Ocean Hyway Cluster (OHC).

OHC was set up to develop the hydrogen economy and realise the maritime use of hydrogen. It allows companies from Norway and abroad to come together in partnerships to drive innovation in the energy sector. OHC members include Toshiba Energy Systems and Solutions (Toshiba ESS) and Yanmar. Toshiba ESS joined OHC to contribute towards building a next-generation hydrogen society in which renewable energy is used to produce hydrogen without producing carbon dioxide.⁶ The Toshiba Fuel Cell Ship is an example of progress to date.⁷

Norway launched its national hydrogen strategy in June 2020 paving the way for a Hydrogen Road Map to be published in

2021. The investment decision in the first full-scale carbon capture and storage (CCS) demonstration project was agreed in the Norwegian Parliament in December 2020. Project "Longship" will capture carbon dioxide from Norcem's concrete production factory, transport it and store it on the continental shelf.⁸

Norwegian companies are increasingly engaged in the hydrogen value chain. Equinor replaces natural gas with hydrogen for use in power plants and supplies liquid hydrogen to the maritime sector. ZEG Power is developing efficient and clean hydrogen production processes that integrate CCS, and generating electricity using hydrogen-based fuels. Reinertsen is simplifying the production of very pure hydrogen using palladium membranes.

As outlined in Figure 9, worldwide demand for hydrogen is expected to reach 972 million tonnes of oil equivalent by 2050. Norway's Hydrogen Road Map is designed to ensure that the country can play a key role in developing technologies and commercial solutions that help keep up with the rapid increase in demand for hydrogen.

The Norwegian government is also supporting business partnerships with the private sector in Japan. Government agencies such as The Research Council of Norway, together with the Embassy of Norway in Tokyo, have made efforts to connect with Japanese programmes focused on the development of liquified hydrogen and ammonia for alternative energy

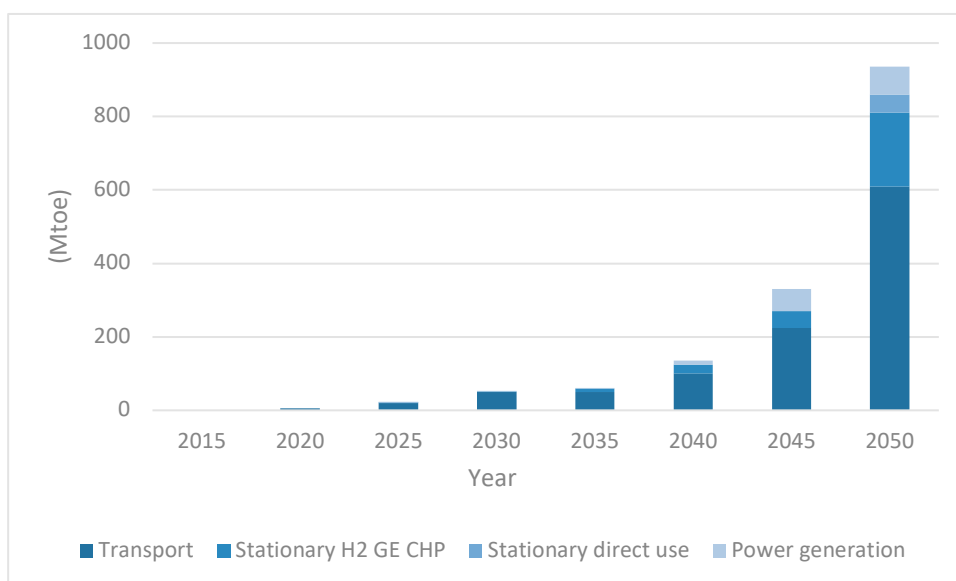
carriers. Furthermore, Norway has been actively participating in Japan’s Hydrogen Energy Ministerial Meetings (HEMM) held in Tokyo since 2018 and remains committed to working with Japan in the development of viable hydrogen technologies.

Renewable energy is another area of innovation within the energy sector where Norway has expertise. With its maritime competence and experience in deep water environments, Norwegian companies are developing technologies for offshore wind generation. This is well suited to Japan with its long coastline and limited continental shelf. A key player in this area is Equinor, which has demonstrated commitment to Japan by

opening a local office in Tokyo and partnering with Japanese companies to pursue offshore wind farm projects.

The Japan Business Federation, highlights that “Society 5.0 with Carbon Neutral cannot be realised without generating innovation. As international competition with respect to green growth becomes more intense, the generation of innovation is a vitally important issue for strengthening Japan’s competitiveness going forward.”⁹ Norway’s credentials in the energy sector make it a natural partner for Japan to work on energy-related issues associated with Society 5.0.

Figure 9: Growth in demand for Hydrogen worldwide



4.1.1

Equinor teams up with JERA and J-POWER with aspirations for offshore wind

This case study shows the potential for offshore wind in Japan and how Norwegian know-how can contribute.

The Japanese government's announcement to commit to carbon net zero by 2050 is further evidence of a strong commitment to a greener future, in which renewable energy will play an increasingly important role. With improvements in technology, offshore wind power is becoming an attractive proposition in Japan due to its long coastline and mountainous interior. Allocation of NOK 690 million to support development of offshore wind farm technologies for the 2021 fiscal year by the Ministry of Economy and Trade and Industry (METI) will help speed up change.¹⁰

Equinor has over 40 years of experience working in offshore projects including floating wind farms, which are well suited to the deep territorial waters surrounding Japan. With the opening of its office in Tokyo in 2018, Equinor committed to forming strong partnerships in Japan and helping the country develop more renewable energy.

Equinor has teamed up with JERA and J-POWER to potentially develop offshore wind farms in Akita Prefecture. The Japanese government is holding its first offshore wind auction calling for bids for two projects in the cities Yurihonjo and Noshiro, producing 700 megawatts and 400 megawatts respectively, to start operations in 2025. The auction will close in May 2021 and the winning bid will be

announced at the end of the year.

This has created a strong partnership for Equinor. JERA operates across the whole energy value chain, focusing on liquified natural gas (LNG) and wind power, with experience in an offshore wind power project in Taiwan. The electric power utility company J-POWER is the second largest wind power producer in Japan. J-POWER has been operating onshore wind power projects in Akita for several years and was awarded the Kitakyushu Hibikinada 220 megawatts offshore wind power project in 2017.¹¹

This example demonstrates how leading Norwegian and Japanese companies can come together to develop Japan's untapped offshore wind power sector. The Japan Wind Power Association is expecting offshore wind generation to be 10 gigawatts by 2030 and 30 - 45 gigawatts by 2040.¹² Whilst the partnership between Equinor, JERA and J-POWER can potentially contribute to this expansion, other partnerships between Norway and Japan will no doubt emerge too.



"Japan has a high potential to develop a market for offshore wind. The opportunities long-term, are within both bottom fixed and floating offshore wind as waters in Japan are on average deeper than in other parts of the world.

With Equinor being the leading floating offshore wind developer, we have the competence and technical skill needed and are ready to contribute long term to the country's ambitious offshore wind plans."¹³

Jens Økland
Senior Vice President of Equinor

4.1.2

Idemitsu Kosan cutting emissions in offshore operations

This case study illustrates a world first: offshore wind providing renewable energy to oil and gas operations.

The Kyoto Protocol in 1997 and the Paris Agreement in 2015 have put the spotlight on and the necessity to curb carbon emissions. Idemitsu Kosan has teamed up with Equinor to do its part by using renewable energy in its Snorre and Gullfaks field operations in the Norwegian North Sea.

Idemitsu Kosan has been active in the oil and gas sector in Norway since 1989 and has received approval by the government to extend the life of the Snorre field, 200 kilometres northwest of Bergen, to 2040 and beyond. With developments in offshore wind power technology, the company saw an opportunity to make its operations greener during the extension.

"Equinor is a global leader in terms of green initiatives such as floating offshore wind farms and CCS as well as E and P Business, and, has a good reputation for collaborating with international companies for multilateral business."¹⁴

***Hiroshi Arikawa
Idemitsu Kosan's
Resource Planning Division***

Idemitsu Kosan's subsidiary Idemitsu Petroleum Norge AS, together with the joint venture, submitted a development plan to the Norwegian government in 2019

to construct a floating offshore wind farms, called "Hywind Tampen", nearby the Snorre and Gullfaks fields. The wind farm will use Equinor's floating wind turbines applying the "Hywind" concept and become a world first to directly connect wind farms to oil and gas platforms. The Norwegian government is helping to fund the development, illustrating their confidence in the alliance.

"Hywind Tampen is a new chapter in Norway's narrative as an energy nation. With support from the Norwegian authorities, we're not only building Norway's first offshore wind project; we're refining floating offshore wind technology along with the Norwegian supplier industry."¹⁵

***Eldar Sætre
Former President and CEO of Equinor***

Operations are planned to begin in 2022 and will generate 88 megawatts from 11 floating wind turbines. The project will cut 200,000 tonnes of carbon dioxide emissions per year and 35 percent of the power needed for operations will be generated by renewable energy.¹⁶

This exciting development in pushing the boundaries for offshore wind shows how Norwegian and Japanese companies can partner to develop world-class solutions to cut emissions and make operations more sustainable. The leadership shown by Idemitsu Kosan and Equinor should provide inspiration for others to make similar moves.

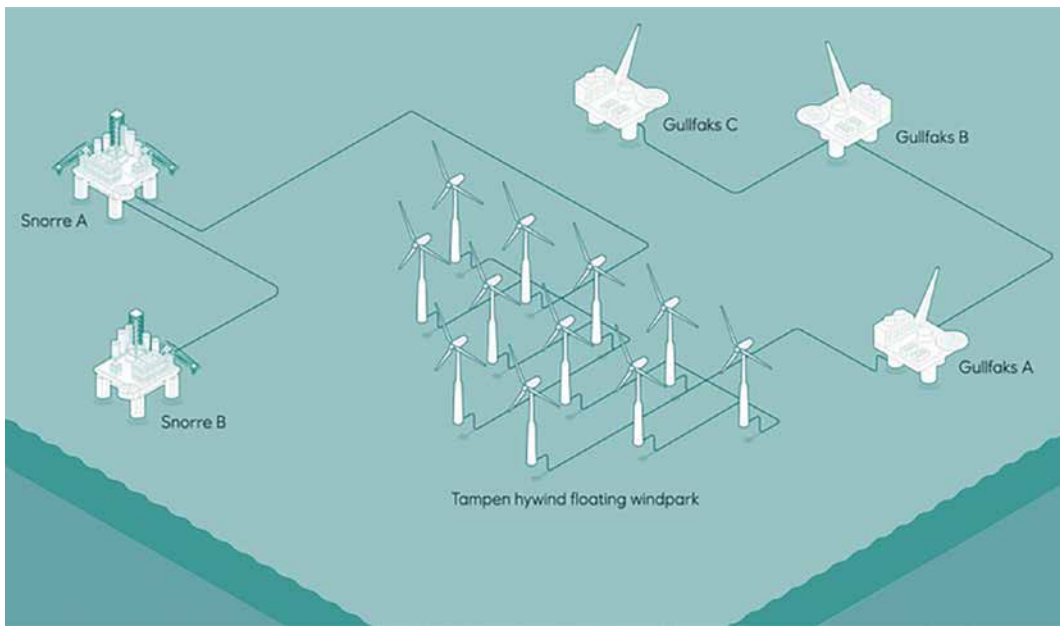


Figure 11: Power from floating offshore wind by Idemitsu

4.1.3

Sumisho Metalex and FREYR partner to provide greener batteries

This case study shows how Norway's battery supply chain is developing and becoming increasingly attractive to Japanese companies.

Increasing demand for electric vehicles (EV) in Europe is seeing robust growth every year with annual growth expected to reach 12-15 percent in 2022.¹⁹ To keep up with demand, Europe will need to develop its battery production capacity from 44 gigawatt hours in 2020 to 170 gigawatt hours by 2025 and 443 gigawatt hours by 2030.²⁰

"FREYR strongly believes a collaboration with Japanese companies for production of batteries in Norway utilising Norway's cheap, carbon dioxide-free electricity with very high skilled workers, as in Japan, is likely to result in the lowest carbon dioxide-footprint batteries with the best price and quality.

Therefore, FREYR is actively searching for partners in Japan for business in Norway as a gateway to the European market."¹⁸

***Rune Nordgaard
Director of FREYR Japan***

Norway is well placed to be a leading location for the battery industry in Europe with abundant green energy for production and the Norwegian industry producing substantial amounts of aluminium and silicon, in addition to refining nickel, cobalt, graphite and copper – all important materials in battery production.

"The European battery industry is growing rapidly, and SMX is in a position to support FREYR to contribute to a carbon neutral society."¹⁷

***Yoshimitsu Matsuda
President of Sumisho Metalex***

The Norwegian government has been actively supporting the growth of the whole battery supply chain and encouraging foreign companies to fill any gaps in the value chain, in cooperation with Norwegian companies.

In 2020, Sumisho Metalex (SMX) signed a long-term supply chain partnership with FREYR and has plans to invest in the company. FREYR was established in 2018 to solely use renewable energy to manufacture low-cost, high-energy density lithium-ion batteries. Its factory in Mo i Rana will begin production in 2022.

SMX has built a strong relationship with FREYR, offering comprehensive battery solutions including battery materials and manufacturing equipment since 2019. SMX will also help to ensure the success of FREYR by sharing market insights and qualifying Asian battery cell technology partners.

Developments in the battery value chain in general continue with activity seen from other players. Panasonic signed a Memorandum of Understanding with Equinor and Hydro in November 2020 to assess opportunities in the European battery industry.²¹ The strategic partnership aims to give the partners a

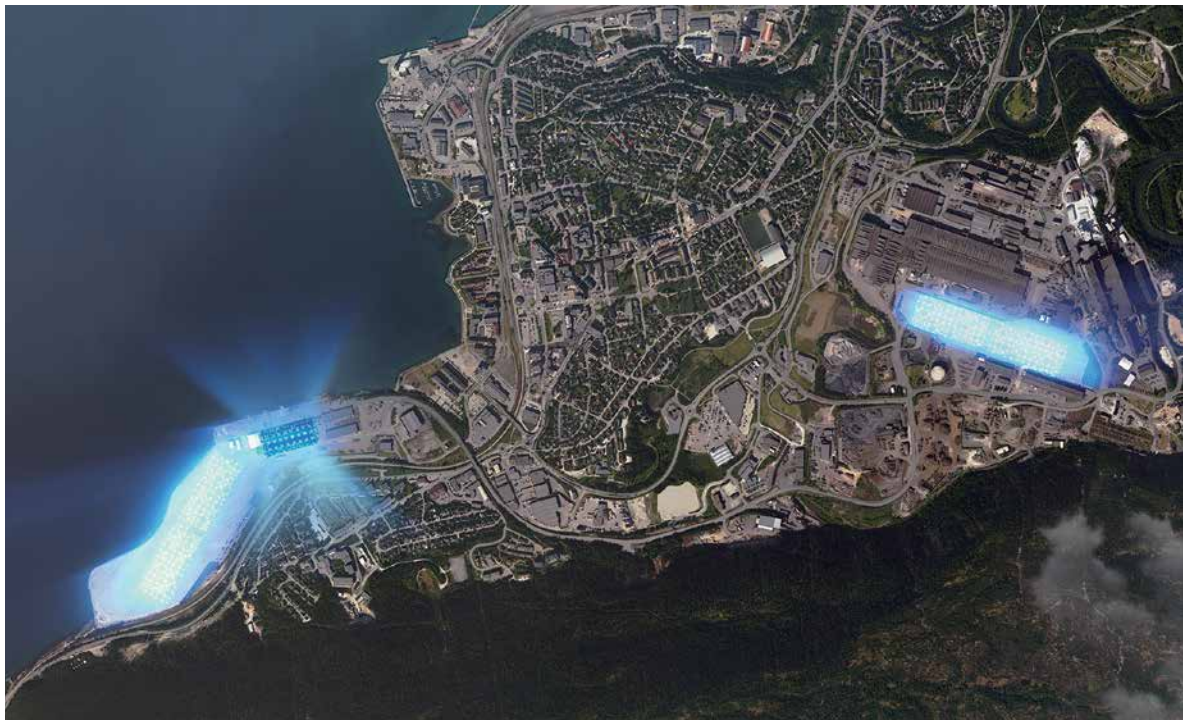


Figure 12: Top-view of FREYR battery factory in Kamstålbygget

sustainable and competitive position in the European battery industry.

Other innovative lithium-ion battery producers include Beyonder and Morrow Batteries. Beyonder focuses on reducing the environmental footprint by producing batteries with clean energy and carbon neutral materials.²² Their batteries are manufactured using bio-fuels like sawdust instead of fossil fuels. Morrow Batteries has grand plans to set up a giga-scale factory by 2024.²³ The company aims to build a cost-competitive manufacturing system based on low energy prices, vertical integration, scale, operational excellence,

and an efficient supply chain.

These examples show how Japanese companies with innovative battery technologies can partner with Norway to gain access to low-cost green production and greater access to the European market. The door is now open for more Japanese battery players to come to Norway.

4.2

Win-win alliances in seafood

This section outlines trends in the seafood sector, including new practices in aquaculture, and demonstrates how partnerships are helping Japan to become a net exporter.



Potential opportunities for consideration:

Aquaculture

Norwegian expertise in sustainable fisheries management and financial resources can benefit Japan when fast-tracking greater uptake of land-based systems for increased seafood production and the development of highly skilled jobs.

Further supply chain development

Norwegian companies can be of interest to Japan to further develop its seafood supply chain. Other opportunities lie with shortening the supply chain with Norwegian companies producing in Japan, reducing transportation distances, and enabling the multiplier effect.

Greater leadership in the seafood sector

Norway and Japan are already defining the direction for the seafood industry by leading multinational government initiatives such as the High Level Panel for a Sustainable Ocean Economy (Ocean Panel). There is scope for further cooperation.



Win-win alliances in seafood

Seafood demand around the world has significantly increased over the past 50 years. It is expected to increase by 20 percent in the next ten years because of population growth, expansion of the middle class, and greater urbanisation. Both Norway and Japan are well placed to capitalise on the opportunity given their deep-rooted history with the production of seafood and innovation in relevant adjacent sectors, such as maritime and digital.

Figure 14 illustrates the growing importance of aquaculture, greater adoption of which is reflected in Japan. The country is now set on becoming a net exporter of seafood and has already made moves to achieve this by investing in aquaculture projects and improved fisheries management.

The Norway-Japan partnership in seafood has resulted in many successful initiatives in the past. The relationship has deep roots in the introduction of Norwegian salmon to Japan due to the success of this partnership and salmon's existing worldwide popularity as a topping for sushi.

In recent years, Japanese consumers have grown to love Norwegian mackerel given its high quality, high fat content and rich flavour. Exports to Japan increased by 21 percent from 2019 to 2020 with 60,000 tonnes of the fish, worth over NOK 1 billion, being exported to Japan in 2020.²⁴ Norwegian mackerel now represents 88 percent of the Japanese Atlantic mackerel market, as outlined in Figure 15.²⁵

The mackerel from Norway is also playing an important role in revitalising rural economies where it is now being processed in communities in the prefectures of Chiba, Fukui and Tottori. This value-added activity has helped to create many jobs in rural areas as pointed out by Kin Kamakura, a member of the town council of the coastal city Choshi in Chiba Prefecture.²⁶ The creation of jobs is not limited to mackerel. For example, the Norwegian salmon farming company Mowi has three factories in Japan, employing over 200 people, processing the salmon airfreighted from Norway.

Sustainability in sourcing and production is gaining momentum and providing new opportunities to work together. An important area of focus for the Norwegian Institute of Marine Research is how resources such as feed and energy can be recycled to create a circular economy.²⁷ Urchinomics, a sustainable sea urchin harvesting company, is a recent example of a Norway-Japan partnership that is helping to address global environmental issues while creating circular economic value in multiple territories: Japan, Norway, and the United States. The rehoming of sea urchins improves the health of seaweed in the oceans, creates additional jobs for coastal workers and brings about new economic value by selling fattened urchins to restaurants.²⁸

With a vibrant start-up ecosystem and government initiatives driving innovation in the seafood sector, Norway is a pioneer

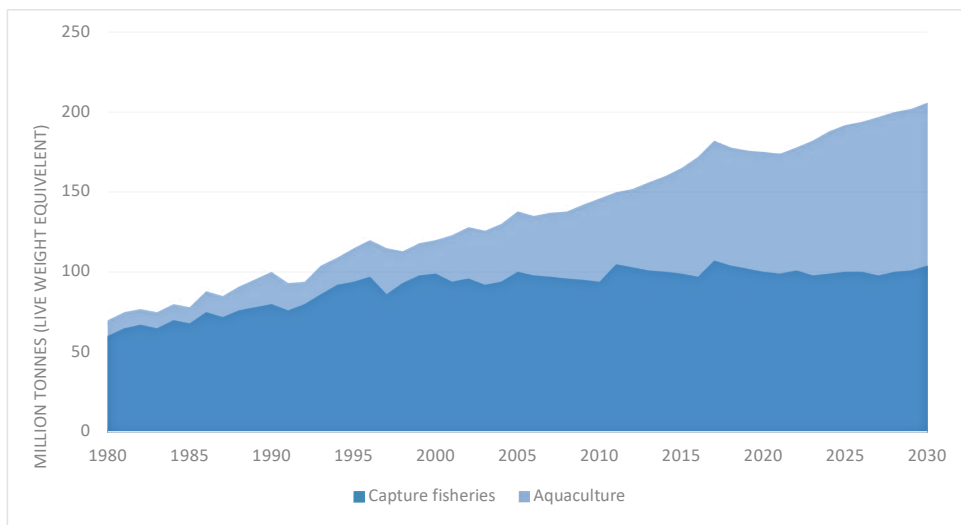


Figure 14: World capture fisheries and aquaculture production, 1980-2030

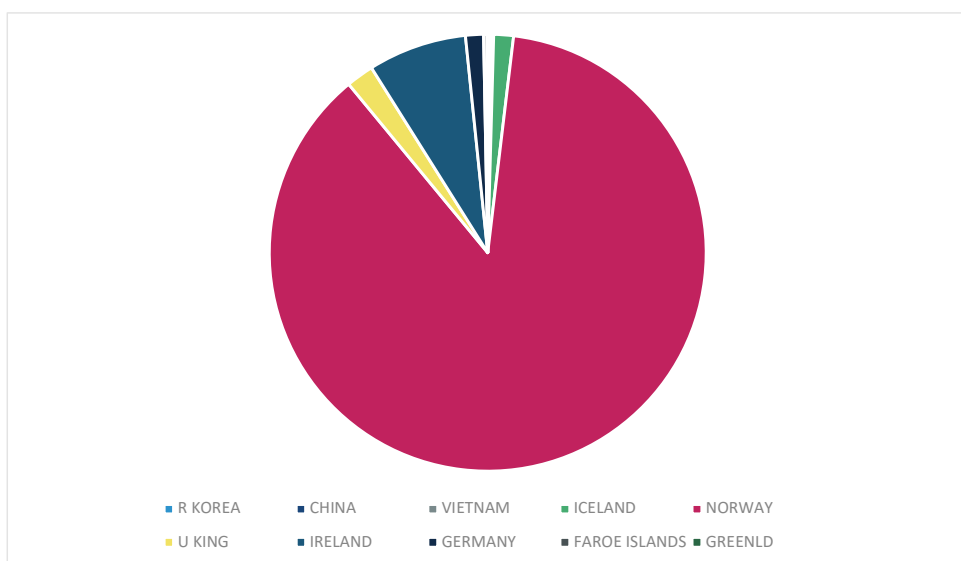


Figure 15: Sources of frozen whole mackerel imported to Japan in 2020

in modernising the industry using advanced technologies such as artificial intelligence and Internet of Things systems to transform practices and improve efficiency, profitability and environmental sustainability. Companies like Aker BioMarine, Bioceonor and Dynaspace have been contributing to this with their business models that support a circular economy and innovation. Dynaspace is contributing to aquaculture by providing satellite imagery of operations to empower farmers to gain access to the resources they need to ensure sustainable production.²⁹

Norway and Japan are harnessing their broad experience in the seafood market while also embracing change to develop new and sustainable opportunities to work together, maintain a competitive edge and continue to be leaders in the sector.



17



4.2.1

Processing of Norwegian mackerel revitalises Japanese rural economies

This case study shows how matching high-quality Norwegian mackerel with skilled jobs in Japanese fishing communities can benefit both countries.

In October 2020, the Suga Cabinet outlined that “creating vibrant communities” is one of the eight policies of highest importance.^{30,31} Japan’s agricultural exports and job creation in the sector is key to boosting the Japanese economy through the revitalisation of local economies.³² Export targets of 400 billion NOK by 2030 were set to promote a national effort to reform Japan’s agriculture, forestry and fisheries, and deliver the industry’s products to the world.

Seafood factories that process Norwegian mackerel in the Japanese town Choshi are helping to play their part in revitalising the rural economy. Norwegian mackerel imports go back to the 1980s and, due to its long-standing relationship with Norway, Choshi was well placed to move up the value chain to process the mackerel.

The collaboration begins when Norwegian mackerel, which is usually imported frozen, enters the Japanese value chain in Choshi. Noteworthy companies involved in the supply chain are Brødrene Sperre, one of Norway’s largest producers of wild-caught fish, and Vikomar, a Norwegian leader in producing pelagic fish that has been freezing mackerel for the Japanese market since 1990.³³

Once the mackerel arrives in Choshi, it is meticulously processed by companies like

Edono Seafood, which produces at least five varieties of the product for the Japanese market and has become a household brand.³⁴ Choboshi is a company in Choshi that is paving the way in processing boneless fish products.³⁵ Since the deboning process must be done by hand, a large number of workers are required to meet the rising demands of Norwegian mackerel, creating buoyant demand for local workers.³⁶

Today, there are approximately 2,000 employees across 73 companies that work in seafood processing factories in Choshi.³⁷ About half of those employees work daily to process Norwegian mackerel.

The relationship has had other positive benefits according to Choshi town council member Kin Kamakura, as it has also improved the image of the town. As a result, Choshi has begun to establish itself as a key export town in recent years, even naming itself as a “window to Asia”, according to Mr. Kamakura.³⁸

This demonstrates how the two nations, which are well known for their strong seafood sectors, can draw on respective strengths to create win-win partnerships that have benefits for both nations and strengthen the whole supply chain. The use of high-quality Norwegian mackerel matched with Japan’s manufacturing prowess produces world-class products.



"The synergy between Norway's high-quality fish and industry know-how with Japanese world-class processing factories will continue to benefit both countries."

***Kin Kamakura
Choshi Town Council***

Mitsubishi Corporation acquires Cermaq with global salmon aspirations

This case study shows how matching the experience and resources of a Japanese trading company with a successful Norwegian salmon fish farming company has led to a global leader in the seafood industry.

As part of Japan's measures to strengthen the seafood industry, the government revised the Fisheries Act in 2018 to encourage more private companies to enter the sector.⁴¹ Prior to this, companies had already been seeking new opportunities as demonstrated by the acquisition of Cermaq by Mitsubishi Corporation in 2014.

"Mitsubishi Corporation is an internationally leading and highly respected diversified business group with a strong financial basis, offering considerable synergies within the seafood sector, and sharing many of the important values of Cermaq, including corporate social responsibility, commitment to sustainability and a long-term perspective."⁴⁰

***Rebekka Glasser Herlofsen
Former Vice Chairman of the
Board of Directors Cermaq***

A key part of Mitsubishi Corporation's "New Strategic Direction" in 2013 was to provide a stable supply of food products to consumers and to expand the company's earnings base by strengthening the supply chain. To help achieve this, Mitsubishi Corporation paid NOK 8.9 billion for 100 percent of the shares of Cermaq to gain access to the world's

third largest salmon farming company with operations in Norway, Canada and Chile.⁴²

This bold move has allowed Cermaq to become a global leader in the seafood business, developing a safe and sustainable food supply for both Norway and Japan.⁴³ It was able to combine synergies from Mitsubishi Corporation's experience as a trading company in the food sector with Cermaq's expertise in aquaculture to expand sales globally, reaching its highest sales volume of 184,000 metric tonnes in 2019.⁴⁴

"Salmon farming has significant growth potential as it presents a sustainable alternative for fulfilling growing demand for safe, healthy and tasty seafood around the world, particularly in Asia where markets are rapidly expanding."³⁹

***Ken Kobayashi
Chairman and former President
and CEO Mitsubishi Corporation***

This acquisition illustrates how synergies can be achieved when two successful companies come together with a joint vision. In tackling issues of food security and sustainability, more partnerships between Norway and Japan will emerge as the two nations continue to show leadership in the industry.



4.2.3

Proximar Seafood helps Japan advance aquaculture ambitions

This case study shows how bringing Norway's long experience in aquaculture and adoption of new sustainable methods can help revolutionise the industry in Japan.

The United Nations Food and Agriculture Organisation (FAO) highlighted aquaculture as the fastest growing food production sector, with an average 5.8 percent annual growth rate.⁴⁵ In 2018, aquaculture accounted for 46 percent of total production of global fish, valuing it at 2.1 trillion NOK.⁴⁶ This sector can not only help meet global demand for seafood, but also provide sustainable solutions as climate change becomes a pressing global issue.⁴⁷

As Japan looks to maintain its competitive edge and fulfil aspirations to become a net exporter of seafood, it is increasingly looking to pursue domestic development of aquaculture to play its role.

Recognising this growing opportunity, Joachim Nielsen and his company Proximar Seafood are bringing the concept of the recirculating aquaculture system (RAS) to Japan. RAS significantly improves fish health and safety and has the smallest environmental footprint in the food production industry.⁴⁸ Plans are well advanced, and the goal is to combine Norway's long experience in aquaculture management and expertise with modern technology to provide the Japanese market with fresh Atlantic salmon within a day.⁴⁹

The project, which will be located at the foot

of Mt. Fuji, will produce 5,300 metric tonnes of salmon in phase 1, and has ambitious plans to increase production four-fold by 2024.⁵⁰ The plant will initially hire around 30 Japanese staff overseen by a few key personnel from Proximar, with the intent to fully localise the operation. The Norwegian staff will be key in ensuring that knowledge and management knowhow are passed on to the local labour force to ensure a complete transfer of technology and assure the future success of the operation. The project will also develop the local supply chain as Proximar will buy feed sourced from Fukuoka and put in place the logistics to deliver fresh Atlantic salmon harvested the same day to restaurants and supermarkets.

In 2021, Proximar commissioned Daiwa House as its contractor to build the plant and the "ground-breaking ceremony" took place in April 2021.⁵¹ Mr. Nielsen recognises the long-standing collaboration between the two countries paired with the strong support he has received from Japanese people, multipliers like JETRO and the Embassy of the Kingdom of Norway. Given this, he is convinced about the potential of building a big player, not just for the Japanese market, but also for niche markets in Asia.⁵²

This example demonstrates how expertise in Norwegian fisheries management and the use of recent advances in aquaculture technology matched with Japan's deep-rooted skillset in seafood is helping to fast-track progress in this sector.



"Japan's world-class quality control and high hygienic standards in food processing as well as Japan's strong manufacturing culture are crucial elements for success in the food industry. A shorter supply chain will also help to reduce the carbon footprint." ⁵³

***Joachim Nielsen
Founder and Managing
Director Proximar Seafood***

4.3

Norway and Japan continue to show leadership in the maritime sector

This subsection focuses on trends within the maritime sector for both Norway and Japan, including decarbonisation through new fuels and how digitalisation is helping to provide better-optimised operations.

21



Potential opportunities for consideration:

Greater digitalisation

Norwegian tech companies in maritime are developing new solutions using artificial intelligence, Internet of Things and Big Data. These can be tested and developed further by Japanese shipowners who lead the world in shipping innovation.

Cooperation with clusters

The Norwegian cluster programme was set up for domestic and foreign companies to collaborate and drive innovation. Several clusters focus on maritime hydrogen. Some Japanese companies are already taking advantage of this to develop energy solutions.

Greater Electrification

As Norway forges forward in electrifying shipping, there are opportunities for cooperation with Japanese companies to develop battery technology systems.

Development of autonomous

Help with the transition to autonomous of maritime coastal vessels.



Norway and Japan continue show leadership in maritime sector

Norway and Japan are both seafaring nations and share a rich maritime history. Moreover, the maritime sector is one of Norway's most global, innovative and forward-looking industries. The Norwegian maritime sector is embracing new challenges related to sustainability and is viewed as a leader in the field.⁵⁴

Long-standing governmental support since the 1960s has been a key element of success in the maritime partnerships between Norway and Japan. One of the major events in the Norway-Japan maritime relationship was the formation of Knutsen NYK Offshore Tankers (KNOT) in 2010, a joint venture between TS Shipping Invest (TSSI) and Nippon Yusen Kaisha (NYK).

A Memorandum of Understanding signed in 2011 reaffirmed the partnership between the two nations. The Norwegian Ministry of Trade, Industry and Fisheries and the Japanese Ministry of Land, Infrastructure, Transport and Tourism agreed to cooperate in the field of maritime technology and industry. Areas of focus include offshore wind power, the Arctic, LNG-fuelled ships, ship recycling and the promotion of environmentally friendly and energy efficient maritime technologies.

Furthermore, in 2017 The Nippon Foundation and the Norwegian University of Science and Technology (NTNU) signed a Memorandum of Understanding that focuses on natural resources and maritime energy. The agreement involves the sharing of information and knowledge related

to maritime engineering, to enhance the capabilities of young engineers in this field and promote development on a global scale.⁵⁵

Government support in Norway has been key in helping the sector develop and maintain its edge. Investment has been substantial over the years through initiatives such as the MAROFF programme.

External factors are further driving change and innovation. In April 2018, the International Maritime Organisation (IMO) laid out a strategy to reduce total annual greenhouse gas (GHG) emissions from international shipping by at least 50 percent by 2050.⁵⁶ Figure 22 shows the positive trajectory in reducing emissions based on this strategy.

Both Norway and Japan are committed to helping to achieve this ambitious goal. As part of its Strategic Energy Plan published in July 2018, Japan set a goal to lead the world in energy transitions and decarbonisation in the maritime sector by sharing its superior low-carbon and decarbonisation technologies.⁵⁷ In 2019, the Norwegian government presented its action plan for green shipping.⁵⁸ The ambition is to reduce emissions from domestic shipping and fisheries by half by 2030 and promote the development of low- and zero-emission solutions for all vessel categories.

The development of zero-emission technologies, electrification as well as the use of hydrogen and ammonia for fuels are areas of key focus in Norway. Activities to

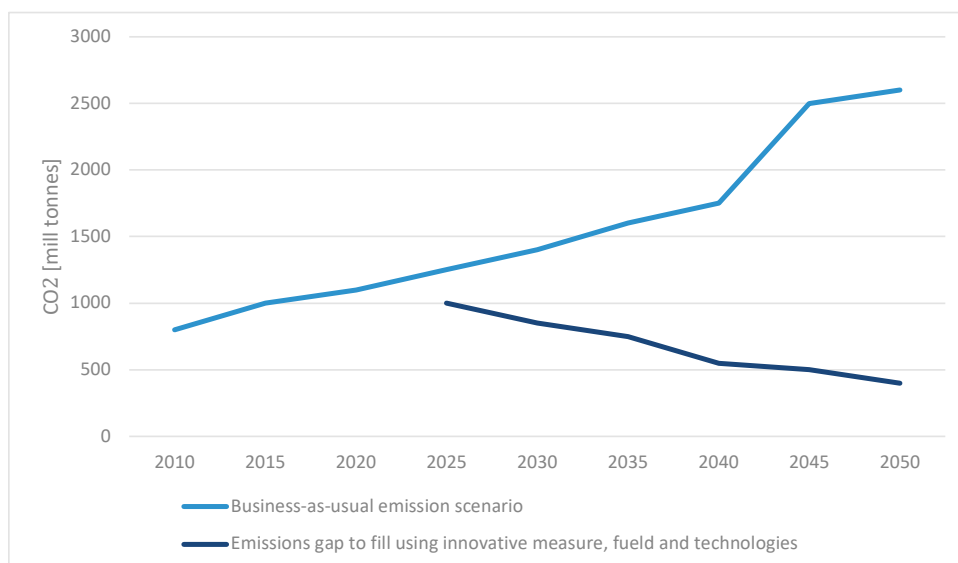
promote greater electrification have included the development of shore power in ports and new battery-related technologies such as electric ferries.

Digitalisation and autonomous solutions will help rationalise operations and cut emissions from shipping. Norway's most innovative maritime businesses are already partnering with Japanese companies to develop maritime-specific digital solutions. One example is the collaboration between NYK and Dualog. NYK has been working with Dualog to improve connectivity of vessels and greater use of Internet of Things for better management of its fleet.

Furthermore, Norway is developing the world's first autonomous and zero-emission container vessel due for commercialisation by 2022. The fertiliser producer Yara, Kongsberg Maritime and Massterly have worked together to develop the vessel called Yara Birkeland, which will replace 40,000 truck journeys a year.⁵⁹ The ship is currently being tested and prepared for fully autonomous operations in domestic waters.⁶⁰

With the global focus on zero carbon emissions, Norway and Japan's close relationship and track record for collaboration will support existing and new partnerships to innovate the industry.

Figure 22: Greenhouse gas emissions driving innovation



4.3.1

Mitsui ventures into the subsea vessels through its investment in Akastor

This case study demonstrates how Mitsui has teamed up with Akastor to gain access to deep-sea exploration resources.

Although Japan has large potential reserves of deep-sea minerals, technological limitations and marine regulations currently keep them out of reach. Gaining access to exploration operations in the search for ocean bed minerals overseas was the prime motivation for Mitsui's recent alliance with Akastor. Mitsui & Co. and Mitsui O.S.K. Lines (MOL) bought a 50 percent stake in Akastor's AKOFS Offshore subsea vessel assets to gain access to its expertise in the oil and gas industry.

"We are pleased to announce this partnership with Mitsui and are excited about additional joint business opportunities currently being explored.

This transaction will increase Akastor's financial flexibility, while laying the groundwork for longer term value creation together with Mitsui."⁶¹

***Kristian Røkke
Chairman of the Board of Akastor***

AKOFS Offshore has a fleet of three subsea support vessels for the construction and maintenance of petroleum and gas fields in Norway and Brazil.

The partnership is founded on sharing expertise. Mitsui has brought 50 years of ocean cable laying experience to the alliance.

As one of the world's leading ship owners, MOL brings 130 years of experience in operation and management of ships. A priority area of activity is optimising shipping routes to reduce fuel consumption.

Given MOL's track record in developing environmentally friendly technologies, the company also plans to take an active role in research and development. Technologies that reduce carbon dioxide emissions such as offshore wind power generation and battery-powered ships is of particular interest. Notably, the development of their Propeller Boss Cap Fins (PBCF) saves energy and reduces underwater noise pollution.

This partnership shows how Norway and Japan can work together to share expertise and create new opportunities in the maritime sector, helping operations become more sustainable and competitive.



Figure 23: AkerSolutions



Figure 24: Mitsui-Akastor

4.3.2

Toyota and Corvus partner to develop maritime hydrogen fuel cell systems

This case study shows how Toyota's manufacturing expertise, matched with Corvus' maritime credentials, will generate fuel cell systems for maritime applications.

To help realise zero emissions in shipping, Toyota and Corvus signed a Memorandum of Understanding in December 2020 to develop large-scale maritime-certified hydrogen fuel cell systems.⁶⁴ Production of these systems will be located in Bergen, and Corvus will work closely with Toyota's recently established Fuel Cell Business Group in Brussels. The Norwegian government is financially supporting the project with a NOK 54 million grant to ensure its success.⁶⁵

"Decarbonisation is an inevitable future, and at Toyota we are convinced that hydrogen will play a central role in creating a better future both environmentally and economically."⁶³

***Thiebault Paquet
Director of Toyota Motor
Europe's Fuel Cell Business***

Corvus Energy is a Norwegian leading supplier of energy storage solutions in the maritime industry. It is also a member of Norway's maritime cluster NCE Maritime CleanTech and is well positioned to become a key industry player and contribute to the long-term success of the project.⁶⁶

Toyota will work closely with Corvus to address issues of scaling production and making this technology affordable globally. This is

crucial for accelerating the transition to a zero-emissions future.⁶⁷ Plans are to develop a prototype maritime fuel cell system onboard a vessel by 2023 and a commercial maritime-certified product available from 2024.⁶⁸

"Toyota is the best partner for us to make this a success."⁶²

***Geir Bjøkeli
CEO of Corvus Energy***

This partnership shows how Norway and Japan can work together by sharing expertise and knowledge to develop maritime fuel cells and systems for zero-emissions ships. Advances in fuel cell technologies in this area will open the door for new alliances to promote a more sustainable maritime industry.



Figure 25: Fuel-cell systems for ships by Corvus

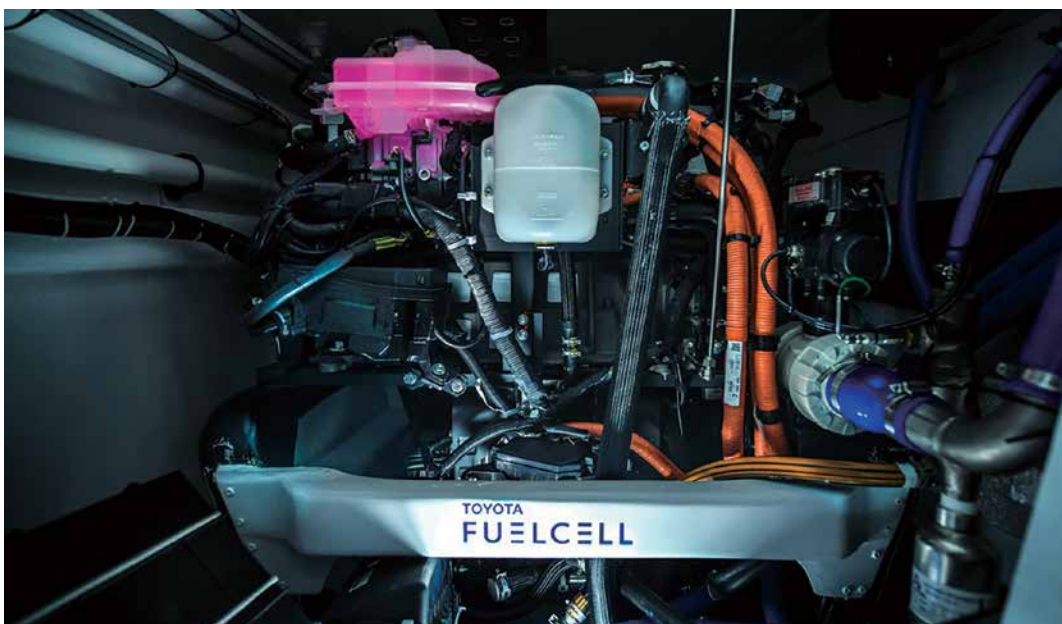


Figure 26: Fuel-cell systems by Toyota

4.3.3

Dualog providing data-driven innovation in the maritime sector

This case study shows how NYK is working with Dualog to adopt maritime-dedicated digital technologies to continue to be a leader in innovation.

The maritime sectors in Norway and Japan are digitising operations to maintain a competitive edge in the global market and meet new sustainability requirements. Advanced technologies including Big Data, artificial intelligence and the Internet of Things are being deployed to help achieve this.

"It is very exciting for Dualog to work with NYK as they are pushing innovation in the maritime sector forward and have valuable partnerships with companies such as NTT.

Collaboration among Dualog and NYK with its partners have been ongoing since 2017 by Dualog actively trying to address the challenges NYK is facing as shipowners."⁶⁹

**Morten Lind-Olsen
CEO of Dualog**

NYK has been developing a partnership with Norwegian company Dualog to explore ways in which they can bring about significant technological advancement within the maritime sector.

NYK saw Dualog's bespoke digital platform as attractive to help it develop Internet of Things solutions to monitor its fleet of ships. Developing readily accessible real-time automated flows of data was a key challenge.

"In Japan, shipping companies are leading new technology implementation and seeking cutting-edge technology providers globally."⁷⁰

**Hideyuki Ando
MTI (NYK Group)**

R&D teams at both companies are now collaborating on the 'Cepa Shield' project, with Internet of Things and Big Data analysis being used to allow 50 vessels to receive real-time communication and alerts. The project aims to streamline operations and improve safety by removing human errors.

Dualog sees the real value in data collection and analysis coming from the ability to bring data to shore and the ability to share it further. NYK is a valuable partner for Dualog due to its effort to take the leading position in data-sharing and innovation within the sector.

The extensive field trials will achieve a number of objectives. Firstly, it will help NYK to stay a step ahead of rivals. Secondly, the services and technologies developed, such as the Dualog drive, are expected to be used by other players in the global maritime industry as they strive to become safer and more efficient. This highlights the synergistic relationship between agile innovators and incumbent firms, which ensures that robust and workable solutions are successfully implemented.



4.4

Innovation providing new opportunities

This subsection focuses on trends in digital innovation and how start-up partnerships are helping both Norway and Japan to modernise their economies and transition to Society 5.0.

28



Potential opportunities for consideration:

EdTech

Norway as a global leader in digital learning platforms can work with Japan to innovate its education system through new learning habits and methods for studying.

Society 5.0

Norway's excellence in digital welfare and smart city technologies can be of interest to Japan while working to achieve its future Society 5.0 and moonshot goals.

Digital transformation of public services

Norway's experience in the development and deployment of e-government initiatives can be shared with Japan through dialogue and exchange of options and best practices.



Innovation providing new opportunities

The development of new technologies and business models is disrupting the traditional way of doing things across the globe. Notably, the pace of change and success in digital transformation varies greatly between industries and sectors. To speed up innovation, sharing experiences and best practices to help ensure progress is important.

Norway's cluster programme has helped support Norwegian industries for over 15 years, contributing to making the country a test bed for innovation and the development of new technologies. Programmes focus on specific topics while engaging companies from a variety of relevant industries and territories. Two leading examples include the Cluster for Applied AI (artificial intelligence) and the Ocean Hyway Cluster.

The Cluster for Applied AI aims to create an optimal platform to help participating companies achieve sustainable development through artificial intelligence. Members of the cluster benefit from shared data, infrastructure and other technologies to facilitate artificial intelligence applications within their respective businesses.

Recognising the need to attract the best talent and ideas from across the world, these programmes are open to international organisations and institutions. Moreover, foreign companies can benefit from extensive European and Norwegian financial support schemes. Japan has had a keen eye on Norwegian companies, as demonstrated

by successful partnerships in recent years such as Sanden's investment in Exabel in 2018, venture capital firm DRONE FUND's investment in GRIFF Aviation in 2019, and SoftBank's investments in Kahoot!, AutoStore and Oda through the Vision Fund in 2020-21.

Digitalisation is high on the agenda for the Norwegian government. The direction is set by Norway's Agency for Public Management and eGovernment (Difi) and the Digitisation Council.⁷¹ The increasing use of technological solutions when providing public services to citizens and other persons in Norway is at the forefront of innovation both at the national and local level of government institutions.⁷² The aim is to improve the efficiency and quality of public services and to modernise government in general.⁷³ As outlined in Figure 29, Norway is well above average compared to other European countries and ranks third in the digital economy.⁷⁴

Norway and Japan recognise the importance of supporting innovation and entrepreneurship in both large corporations and smaller start-ups. Further cluster development and dialogue will help generate new ideas and technologies so that Norway and Japan can seize new opportunities and retain competitiveness in global markets.

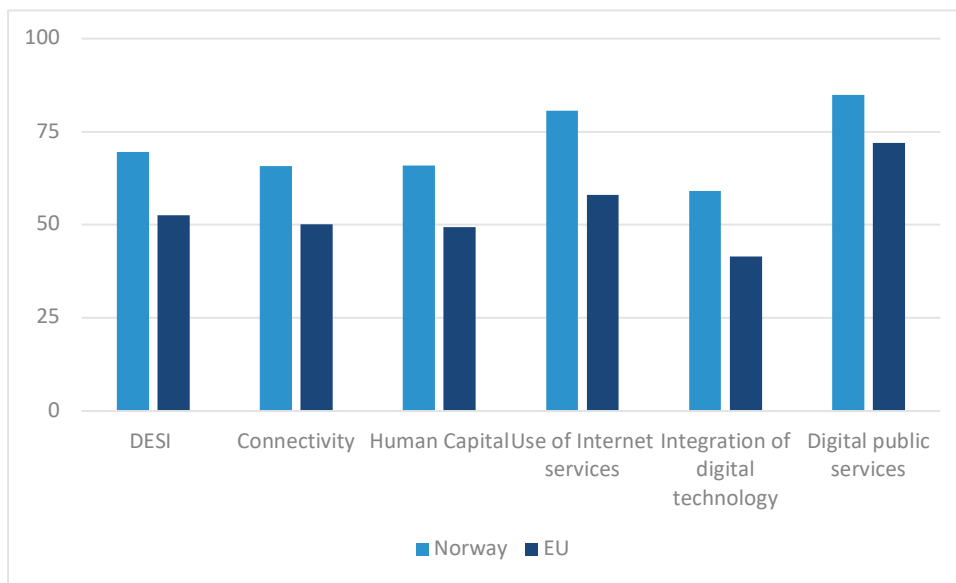


Figure 29: Norway's relative performance in the digital economy in Europe in 2020

4.4.1

Tomra Japan's approach to recycling recognised by the METI Minister's award

This case study shows how Norwegian technology is helping Japanese consumers to recycle more PET bottles.

Media coverage on plastic waste, especially in terms of damage done to marine ecosystems, has raised the profile of circular economy business models and recycling amongst consumers. Japan has an admirable track record in the recovery of plastic waste. The Polyethylene terephthalate (PET) bottle recovery rate of 91.5 percent in 2018 led to an 84.6 percent recycling rate of all bottles.⁷⁷ Tomra Japan's efforts have helped Japan maintain its high recycling rate by introducing the Reverse Vending Machine (RVM).

"We take this as evidence that reverse vending has become a real benefit in Japan and that more and more consumers are starting to view used drink containers as a resource, rather than waste."⁷⁵

***Sonny Söderberg
President of Tomra Japan***

Tomra Japan was jointly established in 2008 by Sumitomo Shoji from Japan and Tomra Systems from Norway to provide automated reverse vending solutions for PET bottles and aluminium and steel cans for retailers and municipalities.

The RVMs are placed at supermarket chains and convenience stores for easy access. Seven-Eleven Japan has installed around 300 units so far and has decided to collaborate

with Higashi-Yamato city to increase the number of RVMs installed. Moreover, The Nippon Foundation has agreed to cover half of the installation fee.⁷⁸ Notably, by 2020, approximately 1,300 RVM units have been installed, mostly in the Kanto area.⁷⁹

"RVMs improve the recycling quality, because machines use sensor technology to crush PET bottles at source making collection easier and greener. The reduced size saves collection costs and lowers the CO2 emissions as fewer truckloads are needed."⁷⁶

***Daisuke Fujii
Sumitomo Shoji***

In 2016, Tomra Japan collected 9,300 tonnes of used bottles (300 million bottles) or 1.5 percent of the total consumption of bottles.⁸⁰ The following year, their efforts were recognised when the Reduce, Reuse, Promotion Association (3R Promotion Association) awarded them the METI Minister's Award.

Norway also has an admirable recycling track record with a 97 percent plastic bottle recycling rate, which puts Norway ten years ahead of its European counterparts.⁸¹ As the world looks for more sustainable solutions and technologies it can look to both Norway and Japan as leaders in this field.



Figure 30: Tomra Japan wins METI award



Figure 31: RVMs by Tomra

4.4.2

Cognite helps Japanese industry digitalise operations

This case study looks at Cognite's digital industrial platform to optimise asset management in the energy and infrastructure sectors.

The COVID-19 pandemic has accelerated digital transformation in Japan. Both government and businesses have been seeking new solutions to get to grips with new work practices and offering more flexible ways of dealing with partners and customers. Cognite has been playing its part in enabling the digitalisation of asset management in the energy and infrastructure sectors by working in Japan with companies like Sumitomo Corporation.

"Sumitomo Corporation is happy to welcome Cognite to Japan.

We have a long-standing partnership with Cognite's parent company, Aker, and we are happy to start working together in Japan. Industries such as oil and gas and manufacturing have an unrealised potential when it comes to using data to optimise their operations.

We believe that Cognite's technology contains the solution to this issue." ⁸²

**Masahiko Yokohama
General Manager of
Sumitomo Corporation**

Whilst Cognite has its origins serving the oil company Aker BP, it has now expanded globally with customers like Lundin

Petroleum, OMV, BP and Saudi Aramco.⁸³ The company's core software, Cognite Data Fusion, helps industrial users reduce costs and achieve sustainable goals through production optimisation, smart maintenance, and equipping workers with digital tools. Customers benefit from reduced downtime, efficient use of resources and smarter demand projections. Use of the platform can bring about a 15 to 18 percent decrease in annual operational costs.

Digital transformation of industry has recently caught on in Japan, making the 2019 opening of Cognite's Asia-Pacific headquarters in Tokyo very timely. Since beginning operations, the company has seen interest across the industry and secured customers like Yokogawa Electric Corporation.

As businesses increase their interest in digitising operations and seek more sustainable solutions, companies like Cognite will help to revolutionise the use of Big Data and artificial intelligence for analytics to save costs and resources.

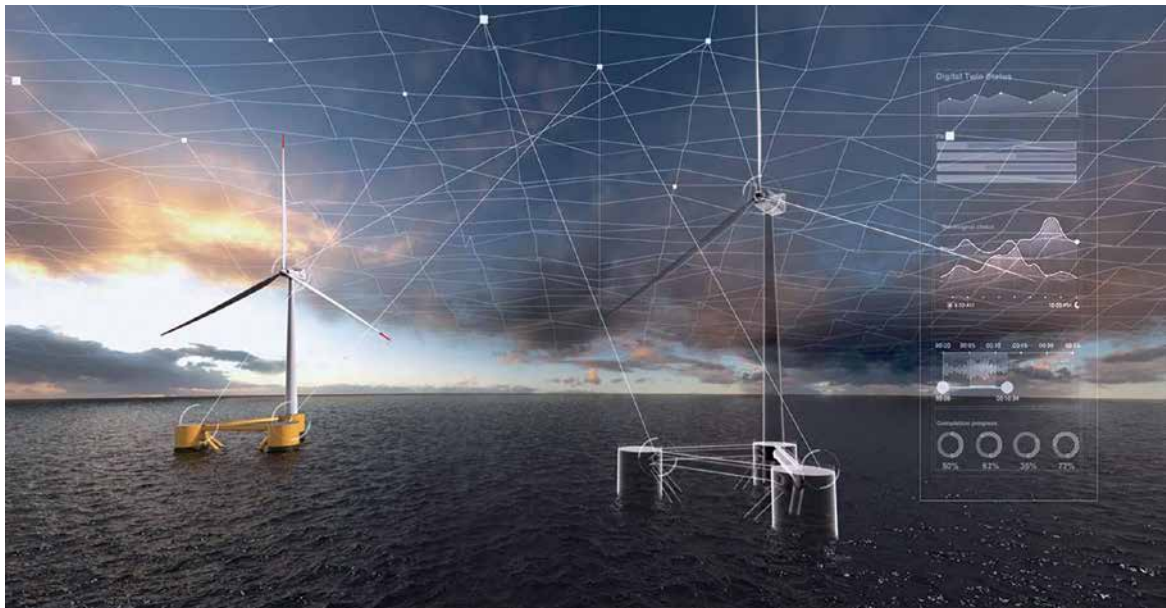


Figure 32: Digitalisation by Cognite



Figure 33: Digital transformation for heavy industries

Norwegian EdTech transforming learning

This case study looks at how Norwegian EdTech companies are helping Japanese students to find new ways to study.

Reform is coming to the education system in Japan through the GIGA School Programme, in which the Japanese government has invested over NOK 16 billion both in 2019 and 2020.⁸⁵ To promote the wider use of ICT in schools, the government's ambitions are founded on the principle of "one device for one student with a high-speed network in every school". The Ministry of Economy, Trade and Industry (METI) is also funding initiatives to help EdTech companies get a stronger foothold in the education sector.⁸⁶

"It's all about the general switch in mindset from digital tools being a nice-to-have additional set of features in schools and classrooms, to being maybe the most important toolkit they can use to create engagement."⁸⁴

**Eilert Hanoa
CEO of Kahoot**

Norway is a natural partner for Japan given its vibrant EdTech sector with names like Kahoot!, Conexus and Inspira developing new learning methods using concepts of gamification to better motivate students. Norway is a leader in the field of EdTech, which began in the early 2000s, and attracts 17 percent of all EdTech investments in Europe.⁸⁷ The sector is growing fast with more than 80 companies and over 140 million users internationally.⁸⁸

SoftBank's investment of NOK 1.8 billion in Kahoot! in 2020 may help push forward change in Japan. Due to the ongoing COVID-19 pandemic, SoftBank predicts there is robust demand for the digital learning platform designed to empower everyone including children, students, and employees.

EdTech offerings are diverse. A notable example is Inspira, which has developed a secure and reliable platform for digital exams and assessments of students in primary, secondary, and higher education. Working closely with Norway's education sector, Inspira has helped to digitise paper-based national tests.⁸⁹ Another example is Conexus, a leading provider of digital learning platforms used by thousands of schools and more than one million students worldwide.⁹⁰

By 2023, the EdTech market in Japan is projected to be worth NOK 24 billion.⁹¹ As the market rapidly grows, there will be opportunities for more partnerships with leading and emerging Norwegian companies to help develop the Japanese market.



Figure 34: Norwegian EdTech



Figure 35: Children with No Isolation robot

Digital healthcare to the rescue

This overview shows the rapidly growing role of Norwegian start-ups that can contribute to the transformation of the healthcare sector in Japan.

With aging populations in both Norway and Japan developing sustainable healthcare and welfare services is becoming more of a pressing challenge for both nations. This was recognised at the 6th Japan-Norway Joint Committee Meeting in 2018, where agreements were made to include “healthcare and welfare technology” as a new prioritised area for cooperation to encourage greater sharing of knowledge.⁹²

Both countries have been spearheading programmes to drive innovation in healthcare. Whilst Japan is focusing on its “life innovation” initiative, Norway is exploring technologies to develop sustainable healthcare and welfare through cluster programmes such as the Norwegian Smart Care Cluster (NSCC) and the Norway Health Tech cluster. The NSCC consists of 220 businesses and government institutions. As an international hub for companies, healthcare providers, research and development institutions and financial players, the cluster’s aim is to enhance its global competitiveness by working on several sub-projects at the national testing centre called the Norwegian Smart Care Lab.⁹³ Norwegian as well as foreign member companies can gain expertise from networking opportunities the cluster offers and further expand their businesses.

Norway is one of the most digitised countries

in the world and is very committed to improving the lives of its elderly citizens. This is demonstrated, for example, by a growing number of healthcare-tech companies that are focusing on improving the lives of patients and helping the elderly to stay in their homes longer.⁹⁴ New technologies include sensor monitoring, video systems for remote patient-physician communication and fall detection Internet of Things systems. Especially in the field of smart homes and welfare, Norway is a global pioneer with several highly successful start-ups. Sensio is Norway’s largest player in welfare technology and has implemented over 10,000 smart home installations to date. Jodapro delivers software and hardware technologies for “digital collaboration in patient care” during emergency situations.⁹⁵ Dignio has developed a platform that allows patients to remotely monitor their health with the use of sensing devices and data analytics.

Norwegian companies are engaged in the digitalisation of healthcare to secure comfortable lives for the growing elderly populations, including in Japan. Companies like MediStim are focusing on ultrasonic surgical guidance and are active in the Japanese market.

In the rapidly developing sector of AgeTech, furthering collaboration between Norway and Japan within digital healthcare and welfare will be necessary to urgently address changing demographics resulting from ageing societies.



4.4.5

Norwegian start-ups to look out for

This overview showcases Norwegian start-ups in a diverse range of sectors that could be of interest to Japan when tackling global challenges related to climate change, healthcare and Society 5.0.

Norway's start-up scene is vibrant and rapidly developing, with both Norwegian and foreign entrepreneurs and investors discovering new opportunities to make the country a leader in technology and innovation. The Norwegian government is supporting innovation through various funding schemes, including direct investment in start-ups, incentives for entrepreneurs and investors, and programmes such as incubators and accelerators.⁹⁶

The entrepreneurial spirit of the Nordic region has drawn attention from all over the world and Japanese investors have invested in or acquired at least 36 Nordic-founded start-ups since 2013.⁹⁷ Organisations like the Nordic Innovation House are promoting start-ups to foster partnerships and are active in Japan, reflecting both countries' appetite for world-class technologies.

The range of start-ups mirrors Norway's unrivalled strengths not only in seafood and the maritime sector, but also other areas like energy, digital transformation, EdTech and healthcare. Below is a small sample of Norwegian start-ups to watch out for.

AutoStore delivers automated robot-based warehouse systems which reduce the storage footprint by 75 percent compared

to conventional solutions. Ideal for space-restricted locations, AutoStore's system can increase storage capacity by up to four times without moving location and improves performance by ten times without hiring extra staff. Partners in Japan include Nittori and Shiseido, and in 2021 SoftBank Group acquired 40 percent of AutoStore's shares for NOK 23.2 billion. *More details:* <https://autostoresystem.com/>

Bergen Carbon Solutions (BCS) produces carbon nanofibers using an innovative and carbon dioxide-negative production process. The product is lighter than plastic and stronger than steel, with exceptional thermal and electrical conductivity that has a wide range of industrial and technological applications. Instead of using natural gas to produce carbon nanofibers, which results in carbon dioxide emissions, BCS uses captured carbon dioxide and Norwegian hydropower to produce the nanofibers, leaving only oxygen emissions. *More details:* <https://bergencarbon.com>

Compact Carbon Capture (3C) aims to make carbon capture cheaper and more accessible. By cutting investment costs and introducing a high-speed rotation technology, 3C can not only decrease plant sizes by 75 percent, but also provide a scalable solution to capacities of various sizes. *More details:* <http://compactcarbon.no>

Decon-X has developed a user-friendly automated disinfection robot, Decon-X DX1, that extracts dry mist consisting of

hydrogen peroxide and removes 99 percent of all microbes, viruses and spores from the room and all its surfaces and equipment. The robot's sensor measures all the parameters of the disinfection process and provides the user with the results. *More details:* <https://www.deconx.com/en>

EpiGuard has developed the EpiShuttle which is a self-contained stretcher designed for the transportation of contagious patients. Its advantages include less personal protection equipment for medical staff, on-site medical and intensive care, and a dual protection system that can be set to either protect the environment from the infected patient or protect the patient from contaminants in the air. *More details:* <https://epiguard.com>

Evoy designs, develops, and delivers electric motor systems for new and existing power boats aiming to eliminate boating emissions. Their 100 percent electric motor system has no emissions, no fumes and little noise, bringing a ground-breaking technology to the electric boating market. The powerful plug-and-play inboard and outboard turn-key system can be placed into any boat between 20 and 50 feet. *More details:* <https://www.evoy.no/about>

Motitech has developed a system that provides physical and mental stimulation for the aged and those living with dementia. By using an exercise bike and an audio-visual stimulation system, users can take cycling trips through familiar surroundings and childhood memories. Benefits are

widespread and lead to improved physical, mental and social well-being. *More details:* <https://motitech.no>

NOVELDA provides the world's most accurate, intelligent, and reliable sensor solution for human presence detection. Their ultra-wideband (UWB) impulse radar can detect humans up to ten metres away, enabling secure remote log-in to a PC. The ground-breaking technology offers new levels of user experience and is integrated on a single chip, making delivery between devices seamless. In 2020, NOVELDA announced their cooperation with Lenovo's Yokohama-based team to integrate their product into Lenovo laptops. *More details:* <https://novelda.com>

No Isolation wants to end involuntary loneliness and social isolation by developing communication tools that help those affected. The two most exposed groups are children and young adults, and people over the age of 80. No Isolation has developed two products to fight loneliness on a large scale. The AV1 is a telepresence robot that acts as a child's eyes, ears and voice in the classroom and helps sick school children keep in contact with their classmates and learn from home. Their second product, KOMP, helps elderly stay in touch with their loved ones through an easy-to-use tablet that allows children to share photos, messages, and make video calls. *More details:* <https://www.noisolation.com/global>

Pexip is a high-quality video communication platform that connects all video conference

technology with a single solution. The Pexip Infinity technology offers both 'self-hosted' and 'as-a-service' deployment options to provide a world-class meeting and calling service. The company has a presence in Japan through their distributor VTV Japan. *More details:* <https://www.pexip.com>

ScanReach is a maritime Internet of Things company with the mission of developing affordable and user-friendly lifesaving technologies for vessels and offshore installations, in particular for Personnel On Board control. They have developed the world's first maritime wireless Internet of Things platform that enables locating of personnel and asset control in complex and confined steel environments by removing the need for expensive cabling through the establishment of wireless mesh networks that function in demanding maritime environments. *More details:* <https://www.scanreach.com>

Scantrol Deep Vision is a company that supplies innovative solutions for fish sampling. Their Deep Vision technology is a subsea vision system that identifies and measures fish underwater without having to bring the catch onboard the vessel. This technology is invaluable for marine researchers and is a technology that contributes to more sustainable fisheries. *More details:* <https://deepvision.no>

Spacemaker is the world's first commercial platform that uses artificial intelligence to help architects, urban planners, and

developers make better decisions faster, through a revolutionary software that does difficult and time-consuming computations and design generation. *More details:* <https://www.spacemakerai.com>

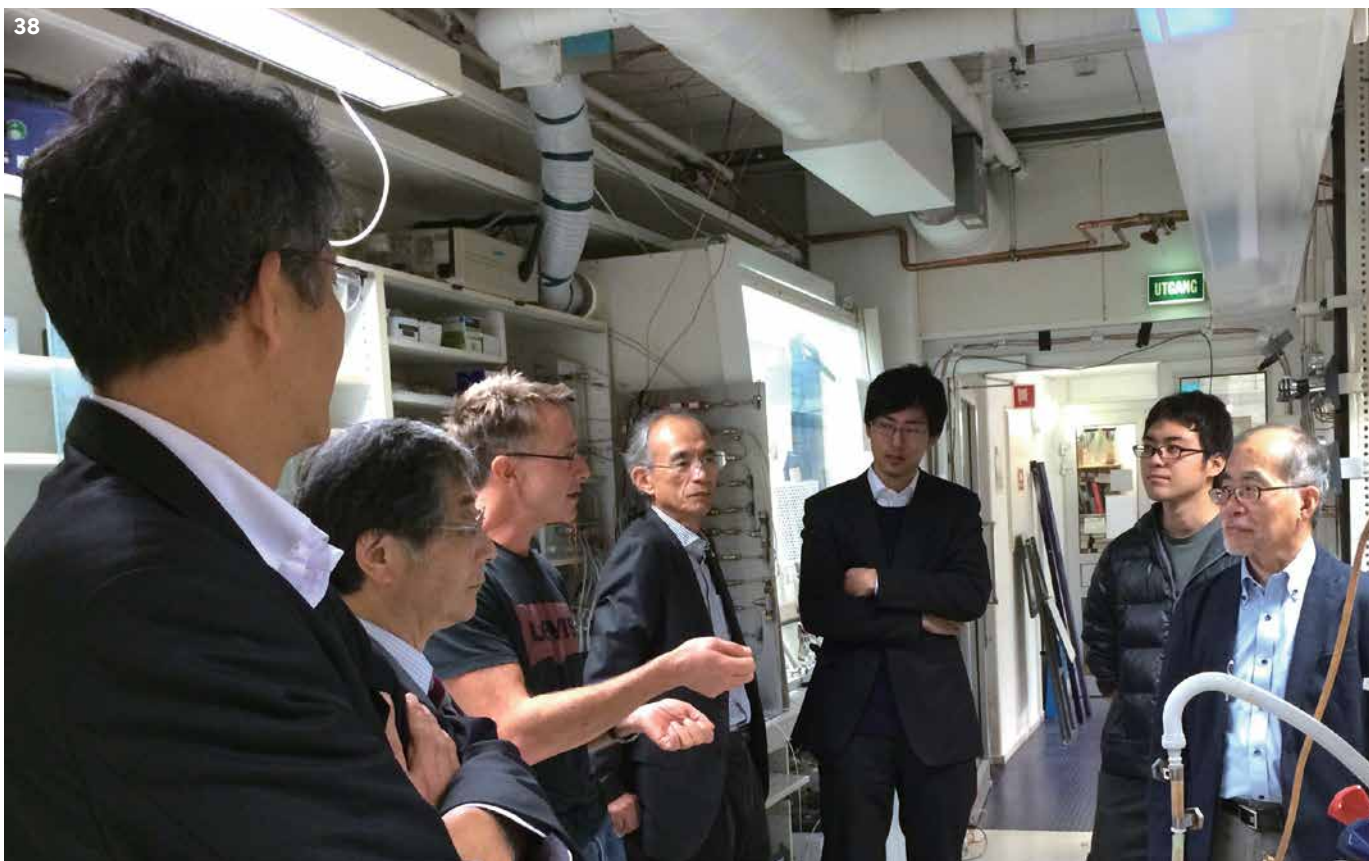


37

4.5

A sound future based on research links

This subsection shows how aligned goals and strong relationships in government, academia and industry are driving initiatives to commercialise new sustainable technologies.



Potential opportunities for consideration:

Greater participation in common research programmes

The promotion and support of clusters in Norway can help Japanese companies gain access to partners, customers and expertise when participating in EU- and Norway-funded research programmes. Clusters may include a range of companies and institutions in applied artificial intelligence, sustainable maritime transport and hydrogen technologies.

Industry-focused research initiatives

Norwegian universities and research institutions have expertise in areas such as marine and material science, renewable and clean energy, and maritime engineering. The Japanese private sector can gain access to world-class research groups to help develop next generation technologies by collaborating with these Norwegian organisations.

Commitment to the bilateral agreement on Cooperation in Science and Technology

Norway will continue to work within the agreement to further research, innovation and education. This will create further opportunities for Norway-Japan collaboration and knowledge-based business development.



A sound future based on research links

Science and technology relations between Norway and Japan have continued to grow and prosper since the bilateral Agreement between the Government of Norway and the Government of Japan on Cooperation in Science and Technology was signed in 2003.⁹⁸ Six subsequent joint committee meetings have been held to discuss and agree actions on the agreement. This has contributed to a substantive deepening of science, technology and innovation exchanges and has firmly established cooperation as one of the most important foundations for the bilateral relationship. Common challenges like ageing populations, the environment and climate change, coupled with shared ambitions to be pioneers in the development of sustainable technologies to meet these challenges make Norway and Japan ideal partners. Both nations have complementary competences and research environments that form a firm foundation for cooperation.

Indeed, “Team Norway Japan”, that is the Research Council of Norway, Innovation Norway, the Directorate for Higher Education and Skills, the Norwegian Seafood Council, the Norwegian Chamber of Commerce Japan, along with the Embassy of Norway in Tokyo, work on the premise of a “knowledge triangle” or tripod. This refers to the three pillars of research, innovation and business development, through which Japan and Norway can showcase bilateral dialogue, knowledge-based innovation and business development. This is a model that allows for innovative technology development to

meet global needs in transitioning to a more sustainable future, as formulated in Japan’s Society 5.0.

Indeed, the role of innovation in science, technology and business development has been further emphasised in Japan by the inclusion of “Innovation” in Japan’s 6th Basic Plan on Science, Technology and Innovation that was published in March 2021. This Plan addresses the needs of Society 5.0 directly and underlines international cooperation as a means to realise this vision. In this emphasis on innovation and international cooperation, Norway and Japan can find common ground for a deepening of bilateral dialogue on research cooperation and sustainable growth.

Norway-Japan research cooperation to date has been broad, with research themes including the development of renewable energy such as offshore wind and floating solar power, ocean space research for sustainability, cooperation on polar and space research in both the Arctic and the Antarctic, material science, and climate change and sustainability. Figure 39 reflects the growing cooperation outlined by the increasing number of papers co-published by Norway and Japan. Proactive participation in the commercial sector initiatives has generated positive results in producing many diverse technologies.

Norway and Japan have enjoyed many benefits resulting from their well-established and long-term partnerships. The year 2015 marked great progress for the bilateral

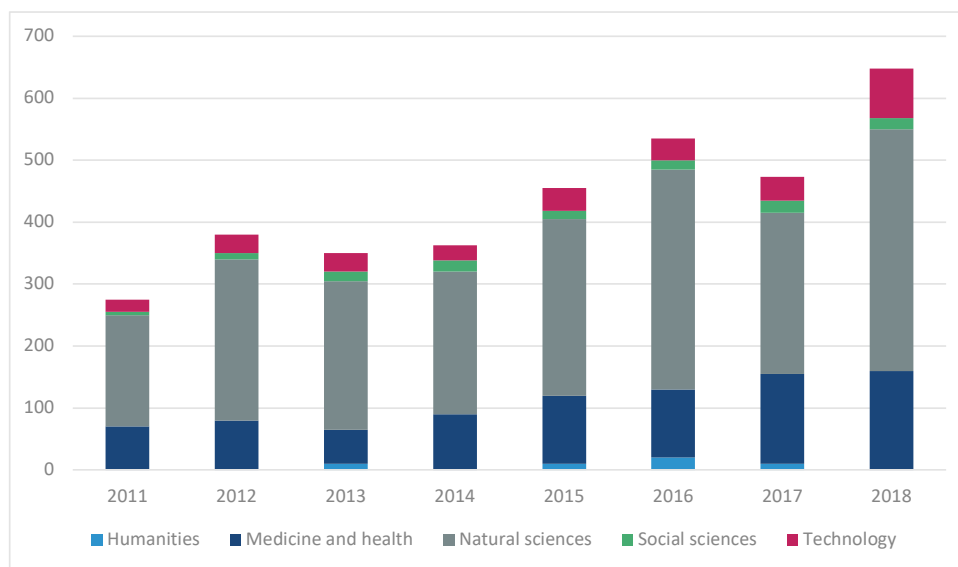


Figure 39: Number of collaborative academic papers between Norway and Japan

relationship, illustrated by the Norway-Japan Energy Science Week and Norway prioritising Japan for cooperation in Norway’s Panorama strategy programme.

The 2015 Norway-Japan Energy Science Week focused on “Sustainable Energy Solutions”, with key areas for cooperation including energy and the environment, marine research, advanced materials, nanotechnology, polar research and space research. These areas reflect the priority areas under the aforementioned bilateral agreement on Cooperation in Science and Technology.

This Science Week has seen several long-term outcomes. Cooperation on the hydrogen economy has continued through events

and seminars and continued Norwegian participation at the International Hydrogen and Fuel Cell Expo in Tokyo, supported by the Embassy of Norway. Topics covered by these exchanges have included the establishment of value chains for environmentally friendly production and distribution of hydrogen, and the development of new technologies for the use of hydrogen in the transport sector. Exchanges and cooperation on developing hydrogen value chains remain one of the most important areas for bilateral cooperation within the energy field.

The continued cooperation on marine science is fully reflected in the project ExcelAQUA 2.0, focusing on marine aquaculture. The collaboration is an exchange programme between

the University of Bergen and other Norwegian institutions in Bergen with several Japanese universities including the University of Tokyo, University of Hokkaido and Nagoya University, and Japan Fisheries Research and Education Agency.⁹⁹ The research group in Bergen is part of a well-functioning research and innovation ecosystem collaborating with Norwegian aquaculture industry.

"I developed connections with researchers I met through the Science Week and there were a number of cases that led to joint research." ¹⁰⁴

***Professor Koji Amezawa
Tohoku University***

Polar research exchange has continued with additional research both in the Arctic and Antarctic. These topics were further discussed at the 2016 Norway-Japan Arctic Science and Innovation Week, which proved to be a successful arena for establishing cooperation between new partners to share research infrastructure. The Arctic remains an important point of Norwegian-Japanese knowledge development, and new collaborations and projects are at present being mapped out on Arctic research that aim to bring new knowledge on climate and environmental change.

In 2015, Japan was designated by Norway as a priority country for cooperation in higher education and research as part of the Norwegian government's Panorama strategy.¹⁰⁰ The Panorama strategy has been successful in establishing long-term partnerships for ex-

cellence in research through two key funding programmes, INTPART and UTFORSK.

The INTPART programme has been particularly important in supporting the development of aluminium alloys between Norwegian and Japanese research institutions and companies. Notable results from the project include students from both Norway and Japan participating in engaging exchange programmes and internships, with a few students receiving full-time offers from leading companies in the aluminium industry. The programmes have strengthened interaction in research, education and innovation in industry and further increased researcher and student mobility. As a result, the Norwegian government is prioritising further cooperation with Japan by extending the Panorama strategy for a second term running from 2021-2027.

"There are some fantastic examples of Japanese investment in our country and vice versa. There is a growing need to increase our research-based cooperation and work more on high-tech development, which are areas of key competence for Norway that can benefit Japan." ¹⁰³

***Haakon Haugli
CEO of Innovation Norway***

In 2019, the Research Council of Norway signed the "Money Follows Cooperation" agreement with the Japan Agency for Science and Technology (JST), which facilitates a mutual establishment of national research pro-



Figure 40: Japan-Norway joint committee meeting

grammes.¹⁰¹ The Research Council has been engaged to ensure exchange of researchers and the establishment of collaborative projects and research networks, within the priority areas under the agreement and their own roadmap for cooperation with Japan.

Both Norway and Japan are active in cooperation with the European Union through the Seventh Framework Programme for Research and Technological Development (FP7), whose activities have continued under the new name of European Interest Group (EIG) CONCERT-Japan. Japan actively participates in the CONCERT-Japan initiative and aims to further develop science and technology cooperation between Europe and Japan.¹⁰² This provides a framework for dialogue with research councils in Japan, such as Japan

Science and Technology Agency (JST), Japan Society for the Promotion of Science (JSPS), New Energy and Industrial Technology Development Organisation (NEDO) and Japan Agency for Medical Research and Development (AMED).

The continued ties between Norway and Japan in academia and the research sector are key to expanding research collaboration initiatives at all levels, from student exchange programmes, to industry internship opportunities, to partnerships between institutions and the private sector. This will not only help to address today's challenges, but also motivate young scientists and ensure future research themes maintain their relevance.

4.5.1

Norwegian universities lead participation in KIFEE

This case study looks at how Norwegian and Japanese research institutions are collaborating in fields to address climate issues and energy alternatives.

Japan is a world leader in research and recently policy has driven activity to target solving economic and social challenges such as ageing populations and environmental issues. Inspired by the Kyoto Protocol, the Kyoto International Forum for Environment and Energy (KIFEE) was created in 2004 to develop and promote international cooperation between universities working to develop a sustainable society.¹⁰⁷

"We see many areas where we can cooperate. I look forward to deepening and strengthening our collaborative relationships in Japan."¹⁰⁵

***Gunnar Bovim
Rector of The Norwegian
University of Science and Technology***

This project is led by top universities in the Kyoto area and the main programmes are the KIFEE symposia which began in 2004 and the Mobility Grants which were established in 2016 to encourage greater movement of students and researchers between collaborating institutions in Norway and Japan.¹⁰⁸

Two Norwegian institutions have been active in this initiative. First, the University of Bergen (UiB), which cooperates on climate, marine, energy and polar research.

The second is the Norwegian University of Science and Technology (NTNU), which has a long-standing partnership with Japanese universities in physics, mathematics, neuroscience, energy, environment, materials science and international politics.¹⁰⁹

"Norwegian universities have world-leading researchers and engineers in the four fields covered, and we are aware that our activities at KIFEE have produced significant results in terms of research and education exchange."¹⁰⁶

***Professor Koji Amezawa
Tohoku University***

Held regularly since 2004 with themes such as inorganic materials, biomaterials and chemical processes, the KIFEE symposia has brought together leading researchers and engineers from universities and national laboratories from both Norway and Japan.¹¹⁰ Since 2014, over 60 joint articles have been published between Norway and Japan, demonstrating success in promoting joint research and the substantial commitment from both countries.¹¹¹

With a firm foundation and ongoing exchanges, the future looks positive for more collaboration between Norway and Japan, especially as global issues become more pressing and world-class collaborations are needed to solve them.



Figure 41: KIFFEE symposium



Figure 42: INPART programme students

4.5.2

INTPART programme helps develop new aluminium alloys

This case study shows how collaboration between academia and business can lead to concrete results and the development of new products.

The INTPART programme established and funded by the Research Council of Norway has the objective of developing world-class research groups in Norway through long-term international cooperation.¹¹⁴ The programme emphasises integrating higher education and research with business partners, and Japan has been an active member since it joined in 2015.

"Exchange of students on Master and PhD level between the university partners with research close to the aluminum industry, will ensure strong and long-lasting international collaboration."¹¹³

***Associate Professor Equo Kobayashi
Tokyo Institute of Technology***

The "Norwegian-Japanese Aluminium Alloy Research and Education Collaboration" project is a great example of the commercialisation of aluminium alloys brought about from research. Research partners have been able to engage key private sector players in both Norway and Japan during the research phase and in transferring knowledge to business during product development.

Over three years there were workshops, student exchanges, and internship programmes, attracting many students and enhancing the

research, education, and business triangle. The kick-off workshop held in 2016 between NTNU, University of Toyama and Tokyo Institute of Technology (Tokyo Tech) included 64 NTNU students, 12 Toyama Students, and 33 Tokyo Tech students and professors.

"The goal now is to further develop relations and collaborative activities both within academia and business, as a basis for strong and more formalised bonds."¹¹²

***Professor Randi Holmestad
The Norwegian University of Science and
Technology***

Following this, there were ongoing exchanges of students between universities and internships at Hydro Aluminium in Norway and Kobelco, UACJ Corporation and Nippon Light Metal in Japan. The Japan Aluminium Association also strongly supported the programme.

This project shows how the cooperation of academia and business supported by government is crucial for developing new commercial opportunities. Drawing on the strengths of Norwegian and Japanese partners and with well-established relationships, further collaboration will no doubt follow.



Figure 43: INPART programme

5.0

A bright future

Common interests and sector strengths between Norway and Japan, coupled with the deepening relationships at the government, academic and industry level, paint a positive picture for many new opportunities for creating value together for a sustainable future.

The world was a very different place when Norway-Japan formal diplomatic relations kicked-off in 1905. Today, global issues are affecting all nations and the need for sustainability is at the top of the agenda. Despite the challenges that society faces, the numerous examples of strong partnerships between Norway and Japan are a testament to what can be accomplished.

This report has outlined examples of cooperation in the energy, seafood, maritime, digital and research sectors, which reflect some of the joint achievements so far. There is scope for a lot more collaboration and Table 1 summarises immediate opportunities on which Norway and Japan can focus. Many of these are steps towards the goals both countries, as likeminded partners, share on a sustainable future. These items can be used as the basis for further discussions between Norway and Japan to seek new opportunities at the government or industry level.



Table 1: Potential opportunities between Norway & Japan

Sector	Area of interest	Opportunity
Energy	Hydrogen	Expand the hydrogen economies by developing new technologies and solutions in Norway and Japan
Energy	Offshore wind	Develop Japan's vast offshore resources
Energy	Battery supply chain in Norway	Develop greener battery production and gain access to the European lithium-ion battery value chain
Seafood	Aquaculture	Fast-track uptake of land-based aquaculture systems in Japan
Seafood	Further supply chain development	Enhance and/or fill gaps within and shorten Japan's seafood supply chain
Seafood	Greater leadership in seafood sector	Use strong position of both nations to set the agenda through new initiatives
Maritime	Digital transition in the maritime sector	Increase implementation of advanced technologies in maritime solutions
Maritime	Cooperation with the cluster programmes	Further innovation and collaboration with Norway's leading maritime companies
Maritime	Greater electrification	Further development of battery technologies for maritime use
Maritime	Development of autonomous	Aid transition to the use of autonomous for maritime coastal vessels
Digital/Innovation	EdTech	Increase opportunities for more cost-effective and efficient education tools and systems
Digital/Innovation	Society 5.0	Collaborate with Norwegian start-ups to develop all facets of Society 5.0 more quickly, especially smart city and digital health
Digital/Innovation	Digital transformation of public services	Improve the access to, efficiency and resilience of government services
Research/Academia	Greater participation in common research programmes	Access to sector expertise, business partnerships and funds from the EU and Norway for research programmes
Research/Academia	Industry-focused research initiatives	Develop next-generation technologies in marine and material science, renewable and clean energy, and maritime engineering
Research/Academia	Commitment to the agreement on Cooperation in Science and Technology	Develop a common Norway- Japan knowledge base for innovation and business development

Appendices

A.

Economic indicators Norway-Japan

Table A1: General facts related to both countries in 2020

Item	Norway	Japan
Population (millions)	5.3	126
Land Area (km ²)	323,808	377,975
Fresh water control (km ²)	18,754	13,430
Real GDP (billion USD)	\$ 366	\$ 5,346
Real GDP growth (annual % change)	- 2.5 %	- 4.8 %
GDP per capita (USD)	\$ 68,117	\$ 42,368
Trade (% of GDP)	36.3 %	17.5 %
Agriculture (% of GDP)	1.93 %	1.24 %
Industry (% of GDP)	29.1 %	29.07 %
Services (% of GDP)	57.72 %	69.31 %
Unemployment rate	5.0 %	2.9 %
Gini coefficient	28.6	33.8

Source: <OECD, WorldBank, Statistics Norway, Statistics Bureau of Japan>

Table A2: Health indicators in 2020

Item	Norway	Japan
Life expectancy (years)	82.18	84.4
Elderly population (% of total population)	15.8 %	28.24 %
Health spending (% of GDP)	10.5 %	11.1 %

Source: <OECD, WorldBank, Statistics Norway, Statistics Bureau of Japan>

Table A3: Trade data of Norway in relation to Japan in 2020

Share (%)	Import	Export
Food and live animals	0.7	56.5
Raw materials (non-edible)	0.2	1.2
Fuels, oils, electric current	0.0	4.6
Chemical products	3.9	13.8
Processed goods grouped by material	32.5	8.8
Machinery and means of transport	55.6	12.5
Various finished products	7.0	2.6

Source: <Norwegian Embassy Japan>

Table A4: Foreign Direct Investment between Norway and Japan in 2019

Item	Data
Norwegian direct investment to Japan	\$ 501.4 million
Japanese direct investment to Norway	\$ 23.8 million
Norwegian-controlled companies in Japan	28
Japanese-controlled companies in Norway	45

Source: <Japan Ministry of Finance, Norges Bank, Norwegian Embassy Japan>

B.

References

- 1 Investments” – Norges Bank Investment Management, 2021, www.nbim.no/en/the-fund/investments/#.
- 2 “Fish and Shellfish Self-Sufficiency Ratio in Japan FY 2010-2019” – Statista, 2021, www.statista.com/statistics/1039848/japan-food-self-sufficiency-ratio-fish-seafood
- 3 Trade Statistics of Japan Ministry of Finance” – Ministry of Finance, The Japanese Government, 2021, <https://www.customs.go.jp/toukei/srhc/indexe.htm?M=01&P=1,2,,,,,,3,0,2020,0,1,12,2,030354000,,,,,,1,,,,,,20,,,,,20>.
- 4 Top 10 Ship Owning Nations” – ISES Association, 12 May 2020, <https://www.isesassociation.com/top-10-ship-owning-nations/>.
- 5 Japan-Norway Relations (Basic Data” – Ministry of Foreign Affairs of Japan, 2018, <https://www.mofa.go.jp/region/europe/norway/data.html>
- 6 “Members — Arena Ocean Hyway Cluster”. Ocean Hyway Cluster, 2021, <https://www.oceanhyway-cluster.no/members>.
- 7 “Toshiba Delivers Mobile Hydrogen Fuel Cell System to Fuel Cell Ship | TOSHIBA ENERGY SYSTEMS & SOLUTIONS CORPORATION”. Toshiba Energy Systems & Solutions Corporation, 2021, https://www.toshiba-energy.com/en/info/info2019_1227.htm.
- 8 “Pioneering Sustainable Solutions”. Innovation Norway, 2021, https://www.innovasjon Norge.no/globalassets/norway_program_engelsk_190322_web_enkeltsider_ok-003.pdf.
- 9 “Toward Realizing Carbon Neutrality By 2050 (“Society 5.0 With Carbon Neutral”) (2020-12-15)”. Japan Business Federation, 2020, https://www.keidanren.or.jp/en/policy/2020/123_proposal.html.
- 10 “洋上風力発電に関する 経済産業省の取組状況”. Japan Agency For Natural Resources and Energy, 2020, <https://www.gyoukaku.go.jp/review/aki/R02/img/s9-1.pdf>.
- 11 “MHI Vestas Set for Japan’s First Large-Scale Offshore Wind Farm | Recharge”. Recharge, 2019, <https://www.rechargenews.com/wind/mhi-vestas-set-for-japans-first-large-scale-offshore-wind-farm/2-1-702021>.
- 12 Staff, Reuters. “Japan Wind Power Group Aims for 10 GW Offshore Wind Capacity By 2030”. Reuters, 2020, <https://www.reuters.com/article/us-japan-wind-power-idUSKCN24V2JT>.
- 13 “Equinor Teams Up for Offshore Wind Growth in Japan”. Equinor, 2020, <https://www.equinor.com/en/news/2020-09-equinor-teams-up-for-wind-growth-in-japan.html>.
- 14 Arikawa, Hiroshi. Interview. By Intralink. March 16th, 2021.
- 15 “Construction Starts on The World’s Largest Floating Offshore Wind Farm”. Equinor, 2020, <https://www.equinor.com/en/news/20201001-construction-start-hywind-tampen.html>.
- 16 “Submit A Development Plan of An Offshore Wind Farm to The Norwegian Government - World’s First Attempt to Power Oil and Gas Platform with Offshore Wind Farm - | News Releases | Idemitsu Kosan Global”. Idemitsu Kosan Global, 2019, <https://www.idemitsu.com/news/2019/191016.html>.
- 17 “FREYR And Sumisho Metalex Strengthen Supply Chain Partnership to Accelerate Clean Battery Cell Production in Norway”. FREYR, 2020, <https://news.cision.com/freyr/r/freyr-and-sumisho-metalex-strengthen-supply-chain-partnership-to-accelerate-clean-battery-cell-produ,c3249046>.
- 18 Nordgaard, Rune. Written interview. By Intralink. 16 March 2021.
- 19 Birch, Scott. “Mckinsey: Chinese and EU Markets Drive Demand for EV Sector | Smart Energy | Energy Digital”. Energy Digital, 2021, <https://www.energydigital.com/smart-energy/mckinsey-chinese-and-eu-markets-drive-demand-ev-sector>.

- 20 Nordgaard, Rune. Written interview. By Intralink. 16 March 2021.
- 21 “Panasonic And Norwegian Companies Equinor Hydro Signed a Memorandum of Understanding for The Potential Assessment of The Battery Business in Europe”. Panasonic, 2020, <https://news.panasonic.com/jp/press/data/2020/11/jn201118-5/jn201118-5-1.pdf>.
- 22 “Next Generation Battery Solutions”. Beyonder, 2021, <https://www.beyonder.no>.
- 23 “Morrow Will Build Up World-Class Battery Cell Manufacturing Capabilities”. Morrow Batteries, 2021, <https://www.morrowbatteries.com/manufacturing>.
- 24 Holmvik, Peter. “Canned Mackerel Is a Bestseller in Japan”. Norway Today, 2021, <https://norwaytoday.info/finance/canned-mackerel-is-a-bestseller-in-japan/>.
- 25 “Seafood Media Group - Worldnews - Mackerel Imports Customs Official Data, Prices and Origin”. Fish Information & Services, 2020, <https://www.fis.com/fis/worldnews/worldnews.asp?monthyear=&day=12&id=104044&l=e&special=0&ndb=0>.
- 26 Kamakura, Kin. Interview. By Intralink. 18 February 2021.
- 27 “Havforskningsinstituttet”. Havforskningsinstituttet, 2021, <http://www.hi.no/en/news/2021/february/what-will-farmed-fish-eat-in-the-future>.
- 28 “Impact”. Urchinomics, 2021, <https://www.urchinomics.com/impact>.
- 29 “Space Technology Meets Aquaculture”. Dynaspace, 2021, <https://dynaspace.no/>.
- 30 Ibid
- 31 “Summary Of The Major Policy Outlook from The First Policy Speech”. The Government of Japan, 2020, https://www.japan.go.jp/kizuna/2020/summary_of_the_major_policy.html.
- 32 “Creating Vibrant Communities by Expanding Agricultural Exports”. The Government of Japan, 2020, https://www.japan.go.jp/kizuna/2020/expanding_agricultural_exports.html.
- 33 “History”. Vikomar, 2021, <https://www.vikomar.no/history>. “About”. Brødrene Sperre, 2021, <https://sperrefish.com/about>.
- 34 “Edono”. Edono Foods, 2021, <http://www.edonofoods.com/syohin.html>.
- 35 “新しい取り組み”. Choboshi, 2021, <http://www.choboshi.jp/torikumi/index.html>.
- 36 Ibid.
- 37 Kamakura, Kin. Interview. By Intralink. 18 February 2021.
- 38 Kamakura, Kin. Interview. By Intralink. 18 February 2021.
- 39 “Mitsubishi Corporation CEO Meets with Erna Solberg”. Cermaq Global, 2015, <https://www.cermaq.com/news/mitsubishi-corporation-ceo-meets-with-erna-solberg>.
- 40 “Cermaq ASA : NOK 96 Cash Offer from Mitsubishi Corporation to Acquire Cermaq”. Manufacturing Journal, 2021, <http://manufacturing-journal.net/press-release/3259-cermaq-asa-nok-96-cash-offer-from-mitsubishi-corporation-to-acquire-cermaq>.
- 41 Sasatani, Daisuke. “Japan Revises Fisheries Act Seeking Global Competitiveness”. USDA Foreign Agriculture Service, 2019, https://www.usdajapan.org/wpusda/wp-content/uploads/2019/04/Japan-Revises-Fisheries-Act-Seeking-Global-Competitiveness_Tokyo_Japan_4-9-2019.pdf.
- 42 “Mitsubishi Corporation - Press Room - 2014 - Mitsubishi Corporation Commences Recommended Voluntary Cash Tender Offer to Acquire 100% Shares of Cermaq ASA”. Mitsubishi Corporation, 2014, <https://www.mitsubishicorp.com/jp/en/pr/archive/2014/html/0000025661.html>.
- 43 “Integrated Report”. Cermaq, 2014, <https://www.cermaq.com/assets/Global/PDFs-sustainability/cermaq-integrated-report-2014.pdf>.

- 44 “Sustainability Report 2019”. Cermaq, 2019, https://www.cermaq.com/assets/Global/PDFs-sustainability/CermaqGroupAnnualSustainabilityReport2019-1_2020-10-19-142033.pdf.
- 45 “The State of World Fisheries and Aquaculture”. Food and Agriculture Organization of The United Nations, 2018, <http://www.fao.org/3/i9540en/I9540EN.pdf>.
- 46 “The State of Fisheries and Aquaculture”. Food and Agriculture Organization of The United Nations, 2020, <http://www.fao.org/3/ca9229en/ca9229en.pdf>.
- 47 “Fish To 2030”. The World Bank, 2013, <http://www.fao.org/3/i3640e/i3640e.pdf>.
- 48 “Certain That RAS Technology Is the Future of The Aquaculture Industry”. Nofima, 2021, <https://nofima.no/en/nyhet/2020/12/certain-that-ras-technology-is-the-future-of-the-aquaculture-industry/>.
- 49 “Proximar Seafood”. Proximar Seafood, 2021, <https://proximarseafood.com>.
- 50 Evans, Owen. “Grieg Family-owned Japanese Land-Based Salmon Farm Plans Listing”. Salmon Business, 2020, <https://salmonbusiness.com/grieg-family-owned-japanese-land-based-salmon-farm-plans-listing/>.
- 51 “About”. Proximar Seafood, 2021, <https://proximarseafood.com/about-2>.
- 52 Nielsen, Joachim. Interview. By Intralink. 13 February 2021.
- 53 Ibid.
- 54 “Maritime Opportunities – Blue Growth for A Green Future”. Norwegian Ministry of Trade, Industry and Fisheries, 2021, https://www.regjeringen.no/contentassets/05c0e04689cf4fc895398bf8814ab04c/maritim_strategi_engelsk_trykk.pdf.
- 55 “Maritime Development MoU Signed with NTNU”. The Nippon Foundation, 2017, <https://www.nippon-foundation.or.jp/en/news/articles/2017/20170125-21194.html>.
- 56 “Reducing Greenhouse Gas Emissions from Ships”. International Maritime Organization, 2021, <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx>.
- 57 “Strategic Energy Plan”. Ministry of Economy, Trade and Industry, 2018, https://www.enecho.meti.go.jp/en/category/others/basic_plan/5th/pdf/strategic_energy_plan.pdf.
- 58 “The Government’s action plan for green shipping”. Government of Norway, 2019 <https://www.regjeringen.no/en/dokumenter/the-governments-action-plan-for-green-shipping/id2660877/>
- 59 “The world’s first zero emission, autonomous container feeder.” Sams Norway, 2020, <https://sams-norway.no/partners/yara-birkeland/>
- 60 “Vard Delivers World’s First Electric & Autonomous Container Ship to Yara”. Marine Link, 2020, <https://www.marinelink.com/news/ward-delivers-worlds-first-electric-483546>.
- 61 “Akastor And Mitsui Create Joint Venture”. Akastor, 2021, <https://akastor.com/news/akastor-asa-akastor-and-mitsui-create-joint-venture>.
- 62 Ibid.
- 63 <https://fuelcellsworks.com/news/corvus-energy-to-start-development-of-maritime-fuel-cell-systems-with-hydrogen-fuel-cell-technology-supplied-by-toyota/>
- 64 “Corvus Energy, Toyota to Develop Hydrogen Fuel Cell Systems”. Ship Technology, 2021, <https://www.ship-technology.com/news/corvus-toyota-fuel-cell-systems/>.
- 65 “We Are Launching a Ground-breaking New Initiative”. Corvus Energy, 2021, <https://www.youtube.com/watch?v=s9F2AZ3Sobk>.
- 66 “Powering A Clean Future”. Corvus Energy, 2021, <https://corvusenergy.com>.
- 67 “Powering A Clean Future”. Corvus Energy, 2021, <https://corvusenergy.com>.

- 68 “Corvus Energy to Start Development of Maritime Fuel Cell Systems with Hydrogen Fuel Cell Technology Supplied by Toyota”. Corvus Energy, 2021, <https://corvusenergy.com/corvus-energy-to-start-development-of-maritime-fuel-cell-systems-with-hydrogen-fuel-cell-technology-supplied-by-toyota/>.
- 69 Lind-Olsen, Morten. Interview. By Intralink. 9 March 2021.
- 70 Ando, Hideyuki. Interview. By Intralink. 26 February 2021.
- 71 “Digital Government Review of Norway: Boosting the Digital Transformation of The Public Sector”. OECD Government Studies, 2020, <https://www.oecd.org/gov/digital-government/digital-government-review-norway-recommendations.pdf>.
- 72 “OECD E-Government Studies: Norway”. Organisation for Economic Co-Operation and Development, 2021, <https://www.oecd.org/innovation/digital-government/oecd-governmentstudiesnorway.htm>.
- 73 “OECD E-Government Studies: Norway”. Organisation for Economic Co-Operation and Development, 2021, <https://www.oecd.org/innovation/digital-government/oecd-governmentstudiesnorway.htm>.
- 74 “Digital Government Review of Norway: Boosting the Digital Transformation of The Public Sector”. OECD Government Studies, 2020, <https://www.oecd.org/gov/digital-government/digital-government-review-norway-recommendations.pdf>.
- 75 “TOMRA Japan Receives the Minister of Economy, Trade and Industry 3R Prize”. Tomra, 2017, <https://www.tomra.com/sv-se/collection/reverse-vending/reverse-vending-news/2017/tomra-japan-r-prize>.
- 76 “Fun Recycling by Crushing Bottles”. Immuno8.com, 2013, <http://www.immuno8.com/common/pdf/aboutus2014.pdf>.
- 77 “プラスチック資源循環に関する 経団連の基本的考え方”. Japan Business Federation, 2020, <https://www.env.go.jp/council/03recycle/200512ref03.pdf>.
- 78 “東京都東大和市とセブン、ペットボトル回収で連携”. 日本経済新聞, 2019, <https://www.nikkei.com/article/DGX-MZO45186430T20C19A5L83000/>.
- 79 “地域に向けた飲料容器のリサイクルシステムを構築”. 住友商事, 2021, <https://www.sumitomocorp.com/ja/jp/business/case/group/261>.
- 80 “Tomra Japan Wins A METI Minister Award”. Sumitomo Corporation, 2017, <https://www.sumitomo-corp.com/en/jp/news/topics/2017/group/20171101>.
- 81 “In Norway, Bottles Made of Plastic Are Still Fantastic”. Phys Org, 2020, <https://phys.org/news/2020-02-norway-bottles-plastic-fantastic.html>.
- 82 “Cognite Launches Japan Operations”. Businesswire, 2019, <https://www.businesswire.com/news/home/20191125005762/en/Cognite-Launches-Japan-Operations>.
- 83 “コグナイト、日本法人「コグナイト株式会社」を設立”. 日本経済新聞 電子版, 2019, https://www.nikkei.com/article/DGXLRS524122_W9A121C1000000/.
- 84 Browne, Ryan. “Softbank Invests \$215 Million In Education Start-Up Kahoot As Coronavirus Boosts E-Learning”. CNBC, 2020, <https://www.cnbc.com/2020/10/13/softbank-invests-215-million-in-education-start-up-kahoot.html>.
- 85 “The Image of The Transformation of Learning Brought by “1 Device For 1 Student with A High-Speed Network””. Ministry of Education, Culture, Sports, Science and Technology, 2020, https://www.mext.go.jp/en/content/20200716-mxt_kokusai-000005414_04.pdf.
- 86 “Trade Data”. International Trade Administration, 2021, <https://www.trade.gov/market-intelligence/japan-educational-technology-opportunities> The Nordic EdTech Scene: <https://medium.com/the-edtech-world/edtech-norway-dff10491e68f>. Accessed 31 Mar 2021.
- 87 The Nordic EdTech Scene: <https://medium.com/the-edtech-world/edtech-norway-dff10491e68f>
- 88 “About Oslo EdTech Cluster”. Oslo EdTech Cluster, 2021, <http://osloedtech.no/en/om-oss/>.

- 89 Rustberggaard, Bjørn. ““Look to Norway”:
Reaching Full-Scale Digitisation of Inspera Assessment”.
Inspera.Com, 2021, <https://www.inspera.com/blog/look-to-norway-the-success-story-of-e-assessment-in-norway>.
- 90 Evensen, Steinar. “Conexus Partners with
Verdane to Accelerate International Growth | Verdane”.
Verdane, 2021, <https://verdane.com/543/>.
- 91 Taichi, Kumabe. “EdTech市場の現状と課題 —
教育産業の変化と働き方改革に向けた活用—”. Nri.Com, 2021,
https://www.nri.com/-/media/Corporate/jp/Files/PDF/knowledge/publication/it_solution/2018/06/ITSF180605.pdf?la=ja-JP&hash=D06155068CA89444E1336B-1784D38EA1FE8D9B0E.
- 92 96 Bakken, Anbjørg. “Norway And Japan
Expand Scientific and Technological Cooperation”.
Regjeringen.No, 2018, <https://www.regjeringen.no/no/aktuelt/norway-and-japan-expand-scientific-and-technological-cooperation/id2603813/>.
- 93 “About Us - NSCC”. Norwegian Smart Care
Cluster, 2021, <https://www.smartcarecluster.no/english/about-us>.
- 94 “Health Tech Sector Sees International
Interest - NSCC”. The Norwegian Smart Care Cluster,
2021, <https://www.smartcarecluster.no/aktuelt/2020/10/health-tech-sector-sees-international-interest>.
- 95 “Home - Jodapro Norge”. Jodapro Norge,
2021, <https://www.jodapro.no/en/home>.
- 96 “Startup Scene in Norway - Nordichq”. Nordichq,
2021, <https://www.nordichq.com/startup-scene-in-norway/>.
- 97 Innovation Lab Asia, 2021, https://innovation-labasia.dk/wp-content/uploads/ILA-Investor-report_JAPAN_Dec_2020.pdf.
- 98 “Panorama.” Government, 2015, <https://www.regjeringen.no/en/dokumenter/panorama/id2457714/>.
- 99 Norway and Japan Expand Scientific and
Technological Cooperation.” Ministry of Education and
Research, 2018, <https://www.regjeringen.no/en/aktuelt/norway-and-japan-expand-scientific-and-technological-cooperation/id2603813/>.
- 100 “Panorama.” Government, 2015, <https://www.regjeringen.no/en/dokumenter/panorama/id2457714/>.
- 101 “Money Follows Cooperation.” NWO,2019,
<https://www.nwo.nl/en/money-follows-cooperation>.
- 102 CONCERT-Japan Project | Strategic International
Research Cooperative Program (SICP).” Japan
Science and Technology Agency, 2016, <https://www.jst.go.jp/inter/english/sicp/country/concert-japan.html>.
- 103 Ibid.
- 104 Amezawa, Koji. Written Interview. By Intralink.
March 2021.
- 105 Publications.” NTNU, 2019, <https://www.ntnu.edu/kiffee/publications>.
- 106 Amezawa, Koji. Written Interview. By Intralink.
March 2021.
- 107 KIFEE-Kyoto International Forum for Environ-
ment and Energy.” NTNU, 2018, <https://www.ntnu.edu/kiffee>.
- 108 “Mobility Grants 2016-2018.” NTNU, 2018,
<https://www.ntnu.edu/kiffee/mobility-grants-2016-2018>.
- 109 UiB and Establish Presence in Japan through
the Norwegian Embassy in Tokyo.” NTNU, 2015, <https://www.ntnu.edu/news/uib-and-ntnu-establish-presence-in-japan-through-the-norwegian-embassy-in-tokyo>.
- 110 “KIFEE-11 | About KIFEE.” Tohoku University,
2019, <http://www2.tagen.tohoku.ac.jp/lab/amezawa/html/KIFEE/pages/AboutKIFEE.html>
- 111 Publications.” NTNU, 2019, <https://www.ntnu.edu/kiffee/publications>.
- 112 “Aluminium Activity Strengthens Connection
with Japan.” SFI CASA, 2019, <https://sfi-casa.no/sfi-casa-and-ntnu-in-closer-connection-with-japan/>.
- 113 Kobayashi, Equo. Internship Workshop. <http://injapan.no/wp-content/uploads/2018/12/JPN-NOR-Internship-Workshop-Equo-Kobayashi.pdf>

114 INTPART International Partnerships for Excellent Education, Research and Innovation.” The Research Council of Norway, 2020, <https://www.forskningsradet.no/en/call-for-proposals/2020/intpart-internasjonale-partnerskap-for-fremragende-utdanning-forskning-og-innovasjon/>

sjon/

C.

Table of figures

Figure 1: Martinez, Louie. Juxtaposition of Norway with Tokyo – Tokyo. Unsplash. 2017. <https://unsplash.com/photos/locJwyqRv3M>

Figure 2: Ankes, Michael. Juxtaposition of Norway with Tokyo – Norway. Unsplash. 2018. https://unsplash.com/photos/kmhZI_wVsPY

Figure 3 : Forward by Ambassador. Norwegian Embassy in Japan. <https://www.norway.no/ja/japan/norway-japan/1/#大使·外交官Ambassador/Diplomats>

Figure 4: Tryfanava, Darya. People near Snohetta building. Unsplash. 2019. <https://unsplash.com/photos/QO3TDIsuDec>

Figure 5: Underwater drones for ocean inspection and exploration from Blueye Robotics. Norway Brand Center.

Figure 6: North Pole Exhibition. National Institute of Polar Research. 2019. <https://nipr-blog.nipr.ac.jp/jare/201901132019113-422d.html>

Figure 7: Bidstrup, Karsten. Hybrid cruise ship sailing towards the horizon in calm seas and sunset. Norway Brand Center.

Figure 8: Basberg, Bard. Hiking from Loen Skylift. Brand Center Norway. 2021.

Figure 9: Iida, Shigeki, and Ko Sakata. "Hydrogen Technologies And Developments In Japan". Researchgate, 2019, https://www.researchgate.net/publication/332953252_Hydrogen_technologies_and_developments_in_Japan.

Figure 10: Hansen, Helge. Floating offshore wind turbine on the horizon with large wave in the foreground. Equinor. 2019.

Figure 11: Image of power from floating offshore wind. Idemitsu. 2018. https://www.idemitsu.com/en/news/2018/ide_180829.html

Figure 12 : Topview of Kamstålbygget. Freyr. 2021.

Figure 13 : Aslaksen, Einar. Fish farming. Puddler Agency. Brand Center Norway. 2020.

Figure 14 : "The State of World Fisheries and Aquaculture 2020". Food and Agriculture Organization of The United Nations, 2020, <http://www.fao.org/3/ca9229en/ca9229en.pdf>.

Figure 15 : "Trade Statistics of Japan". Ministry of Finance, 2021, https://www.customs.go.jp/toukei/info/index_e.htm.

Figure 16 : Aslaksen, Einar. Inside a fish facility. Puddler Agency. Brand Center Norway. 2020.

Figure 17 : Fishing in Norway. Brand Center Norway.

Figure 18: Norwegian minister of fisheries's visit to Edono Foods, K.K. in Choshi. 2019.

Figure 19 : Saetre Bernhardsen, Mia. Sushi chefs. 2021

Figure 20 : Groundbreaking ceremony of Proximar. Innovation Norway. 2021.

Figure 21 : Dybvik, Peder Otto. Antarctic Endurance. Aker BioMarine. 2021.

Figure 22 : "Reducing Greenhouse Gas Emissions from Ships". International Maritime Organization, 2021, <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx>.

Figure 23: Exploring deep sea minerals. AkerSolutions.

2014. <https://www.akersolutions.com/news/news-archive/2014/aker-wayfarer-wins-five-year-contract-from-petrobras/>

Figure 24: Mitsui-Akastor. Mitsui OSK Lines. 2016. <https://www.mol.co.jp/en/pr/2016/16069.html>

Figure 25. Hampel, Carrie. All electric vessels. Electrive. 2021. <https://www.electrive.com/2021/02/02/corvus-to-develop-fuel-cell-system-for-ships/>

Figure 26: Eason, Craig. Subsea Support Vessel "Skandi Santos". Fathom. World. <https://fathom.world/toyota-set-to-sell-fuel-cell-systems-into-shipping/>

Figure 27. Maritime cyber risk management. SeaWanderer. 2019. <https://seawanderer.org/norwegian-government-supports-cyber-risk-management-system>

Figure 28: From the Deichman Library to Oslofjorden. Aslaksen, Einar. Pudder Agency. Norway Brand Center.

Figure 29 : "Digital Government Review of Norway: Boosting the Digital Transformation of The Public Sector". OECD Government Studies, 2020, <https://www.oecd.org/gov/digital-government/digital-government-review-norway-recommendations.pdf>.

Figure 30: Tomra Japan wins METI award. Sumitomo Corporation. 2017. <https://www.sumitomocorp.com/en/jp/news/topics/2017/group/20171101>

Figure 31: Tomras's RVMs. Sumitomo Corporation. 2017. <https://www.sumitomocorp.com/en/jp/news/topics/2017/group/20171101>

Figure 32 : Cognite hels Japan digitalise. Cognite. 2021. <https://www.cognite.com/customers/dataops-manufacturing-maintenance>

Figure 33: Digital transformation for heavy industries. 2021. <https://www.cognite.com/customers/dataops-manufacturing-maintenance>

Figure 34: The Norwegian Classroom. Oslo EdTech. 2018. <https://osloedtech.no/en/2018/01/the-norwegian-classroom-bett-2018-b390/>

Figure 35: Children with No Isolation Robot. No Isolation. 2021. <https://www.noisolation.com/global/av1/>

Figure 36: Measuring devices. Dignio. 2021. <https://dignio.com/en/care-homes/>

Figure 37: Oalh, Leon. Unsplash.

Figure 38: KIFEE-8 symposium. NTNU Faculty of Natural Sciences. 2015. <https://www.flickr.com/photos/92416586@N05/albums/72157659596997793>

Figure 39: <https://www.innovasjon Norge.no/globalassets/kontorer-i-utlandet/japan/2-grandum-et-al-rcn-diku-in.pdf>.

Figure 40: Japan-Norway joint committee meeting. Government.no. 2015. <https://www.regjeringen.no/en/aktuelt/mote-om-forskningssamarbeid-med-japan/id2396269/>

Figure 41: KIFEE-8 symposium 2. NTNU Faculty of Natural Sciences. 2015. <https://www.flickr.com/photos/92416586@N05/22838157544/in/album-72157659596997793/>

Figure 42: INTPART Program. University of Toyama. <https://www.u-toyama.ac.jp/en/news/2019/0513.html>

Figure 43: INTPART Program Aluminum 2. Injapan. <http://injapan.no/wp-content/uploads/2018/12/JPN-NOR->

Internship-Workshop-Equo-Kobayashi.pdf

Figure 44: Goerend, Johnny. Northern lights. Norway
Brand Center. 2019.

Table 1: Potential opportunities between Norway and
Japan. Intralink. 2021.

[except for the cover]



Utilizing 70% post-consumer
recycled paper pulp

 **Norway**