

VTT

Annual report 2020

New direction for the future

beyond the obvious



VTT in brief

VTT is a visionary research, development and innovation partner. We help society to develop and businesses to grow through science-based innovations. Our brand promise is to go beyond the obvious – to challenge ourselves and our partners. We have nearly 80 years of experience in cutting-edge research and science-based results. Smart industrial and energy systems, knowledge-intensive products and services, as well as solutions based on natural resources and the environment, are at the core of what we do. We are driven by global challenges that we turn into opportunities for sustainable growth. Finland’s national metrology institute and national standards laboratory MIKES is part of VTT. VTT makes an impact by matching innovations to business.

[Read more about VTT >](#)

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Highlights of the year 2020: huge leaps and great successes.

[Read more p. 7 >](#)



We updated our strategy to meet the key challenges of the coming years.

[Read more p. 10 >](#)



We can have an impact when working together with our partners and networks through research infrastructure and ecosystems.

[Read more p. 22 >](#)

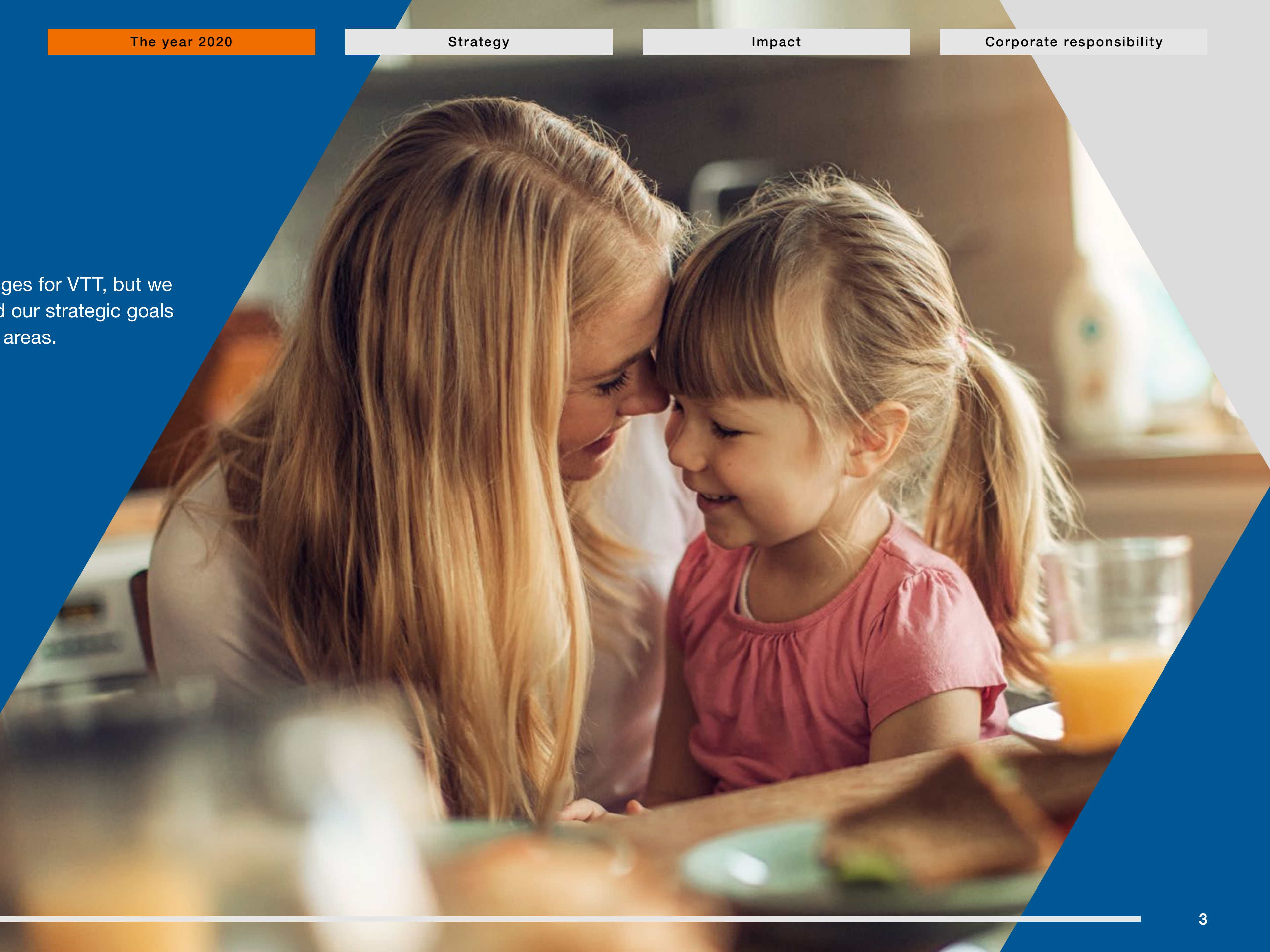


Corporate responsibility at VTT is reflected particularly well in the content of our research work. The wellbeing of our personnel is also a high priority at VTT.

[Read more p. 26 >](#)

Year 2020

The year was full of surprises and challenges for VTT, but we managed them successfully. We achieved our strategic goals and made impressive progress in several areas.



Let's make the 2020s a decade of hope

The year 2020 was a year of surprises but we prevailed nevertheless. The year 2020 boosted our self-confidence and showed us that we have the means to solve the crises facing us.

"We were able to meet many of the strategic goals we had set for 2020."

2020 demonstrated that serious challenges are not a thing of the past. The 2020s may, however, be a decade of hope. While there are huge existential challenges in the world waiting for a solution, we are now better placed than ever to tackle them. Efforts to find solutions are under way in many sectors and the tools are being developed at such a fast pace that the challenges will not remain unsolved for long. Where there is a will, there is a way, and it seems that the will is there. This gives us hope.

The challenges mean new business opportunities for companies and more work for VTT. 2020 also demonstrated the importance of a domestic research and technology base.

VTT was able to meet many of the strategic goals it had set for 2020. We achieved our target of expanding top research to new areas. We were able to advance many of our new projects: the green chemistry centre was established to achieve a cleaner world, and the year also saw the launching of the quantum computer project.

In other words, as a company, VTT weathered 2020 and the coronavirus pandemic well. Our research projects made progress, our employees remained healthy, and relations with our customers remained excellent. Even though VTT is not a testing institute, our researchers applied their expertise for the common good. These successes boosted our self-confidence and reminded us of the importance of our work.

As soon as the coronavirus pandemic hit Finland, we determined our priorities. We set health as the top priority. We decided to focus on remaining healthy and to ensure that the disease would not spread. We decided that our customer projects and other work would continue with minimum interruption. We decided that we would recover from the crisis stronger than before and learn lessons from it. VTTers embraced these goals, acted in a responsible manner and applied these lessons to their own work.



In spring, we switched from office work to remote work in a single day. However, experimental work continued in-house. It is clear that VTTers will do relatively more remote work going forwards. At the same time, remote work has taught even the most hardened introverts, like myself, that it is also important to deal with other people face-to-face. In fact, teams should be able to change their work patterns in accordance with their own needs and the tasks at hand. Hopefully, we will not forget this ability to make work-related adjustments when the crisis is over.

We continued to cooperate with companies and research institutes without interruption. It suddenly became possible to bring together the world's top experts to discuss the same topic. However, the absence of corridor discussions, informal exchange of ideas and other unofficial contacts is troubling. How will we build trust and establish contacts in the future? This is also a challenge that we must solve at some point. However, I am convinced that we will find the solution to that.

President & CEO

Antti Vasara

VTT strengthened its position, visibility and reputation

VTT successfully weathered the challenges of a difficult year. VTT boosted its reputation and despite unexpected twists and turns, we achieved impressive progress in many areas.

2020 was a hugely challenging period for VTT due to the coronavirus pandemic.

Special work-related arrangements were introduced to ensure the health and safety of all VTTers, and the challenges arising from the restrictions were successfully addressed. At the same time, travel was on hold, which saved us money and forced us to use new ways to keep in touch with customers and stakeholders.

Among others, we set 'better societal visibility' and 'good reputation as an employer' as goals for the company. We achieved most of those goals, and the position and role of VTT as a technological actor and resource were highlighted during the global crisis.

The ability of VTT to find the best experts hinges on its reputation as an employer. Our reputation as a development and research partner is important, as this will impact future cooperation projects. It was therefore pleasing that VTT substantially improved its ranking in the Reputation&Trust survey of T-Media and in the Universum employer ranking. In the latter study, VTT was one of the three most attractive employers for engineering professionals.

The work carried out by VTT to enhance its visibility and reputation is producing results, and our achievements so far provide a good basis for the future. In financial terms, VTT can also be pleased with 2020.

The decision to develop and construct a quantum computer in Finland and to use it as a basis for new expertise in our country was one of the most significant strategic milestones of the year. The project constitutes a huge leap towards new opportunities. Significant progress was also achieved in the field of biotechnology and transport.

As members of the VTT Board, we have also worked on a virtual basis without having a single face-to-face meeting. During the year, we worked extensively to update VTT's strategy. The challenges that the company must meet and the choices that it must make to achieve its goals are more clearly set in the new strategy.



"Recovery from the pandemic will be the number one issue in the coming years."

When Finns look back at the coronavirus year, they will probably remember the face mask tests quickly launched by VTT. However, those tests are only a fraction of what we do and what we are capable of.

Recovery from the pandemic will be the number one issue in the coming years. We must invest in growth and in the future. It is increasingly important for VTT to act as a joint technological resource and to be a good partner for companies and research actors. We must integrate our activities with the recovery programmes launched by the European Union.

Only by doing this, can VTT perform one of its key tasks: generating new expertise for Finland. Even though there will be challenges along the way, we should persist and continue. Let's be creative – beyond the obvious!

The work of VTT is of such a nature that we must be innovative and at the same time be prepared to discard things that are no longer needed. Making progress is in our DNA. Let's keep it that way.

Chair of the Board
Pekka Tiitinen

VTT 2020 in figures

The aim of VTT is to help its customers and society to grow. We are building a better future with applied research and science-based innovations.

2020 highlighted the role of research and new solutions. The year was successful, and there was an increasing awareness of the purpose of our work. Our customers remained extremely satisfied with the results and impact of our work.

VTT impacts the activities of its customers beyond projects by speeding up their research and product development and by strengthening their knowledge and expertise base. In fact, we exceeded our expectations in many of these areas. Cooperation with VTT also helped our customers to become more extensively networked on a global scale.

The adjacent key figures describe 2020 for VTT and our ability to use scientific and technological excellence to have an impact during an exceptional period.

Operating income, EUR million

244

Doctors and licentiates

692

Patent families on 31 December 2020

> 440

Number of employees on 31 December 2020

2,129

International scientific articles

493

Invention disclosures

201

The role of science and technology was highlighted during the exceptional period.

The figures are for the entire VTT Group.

Highlights of the year 2020



Keeping microplastics out of waterways!

Small particles such as microplastics are usually only noticed after they have accumulated in the organs of fishes. VTT has developed a method in which nanocellulose is used to capture the particles before they end up in waterways.



PEF vs PET

VTT has developed a technology in which bio-based PEF plastic bottles can be produced to replace fossil-based PET bottles. In this technology, peels of citrus fruits are used in the production of plant-based recyclable plastic bottles.

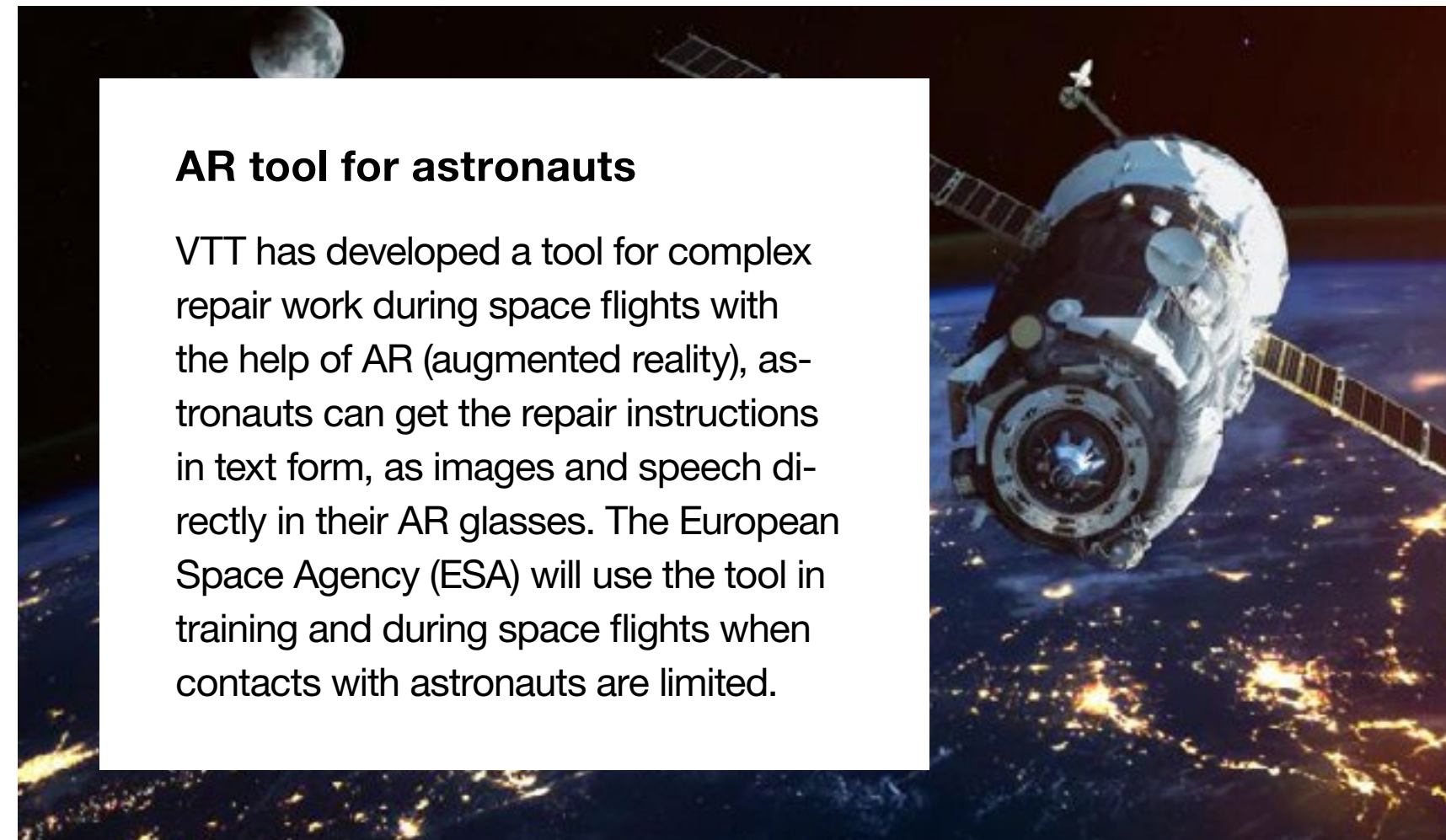


The construction of next-generation wireless systems is about to start. The world's first experimental 6G research environment will be built in Finland. Funding for the project was secured at the end of 2020 and it will serve as the start for a far-sighted development of research and testing environments in cooperation with universities.



An ecosystem for carbon-neutral construction

Build4Clima brings together actors from the construction sector to map carbon dioxide emissions of buildings and to develop ways to reduce them. The project was launched in cooperation with Tampere University.



AR tool for astronauts

VTT has developed a tool for complex repair work during space flights with the help of AR (augmented reality), astronauts can get the repair instructions in text form, as images and speech directly in their AR glasses. The European Space Agency (ESA) will use the tool in training and during space flights when contacts with astronauts are limited.



A cup of hot coffee

VTT Sip of Science virtual coffee breaks offered 20 discussion rounds on topical science and research themes.



World-class piloting

With the launching of the new process chemistry piloting platform, VTT's Bioruukki is now one of the most important piloting centres of the world. Bioruukki takes ideas and methods developed in laboratories towards industrial-scale applications. At the moment, researchers in Bioruukki are developing plastics recycling and alternative plastics materials.



VTT FutureHub, housing VTT's office work and research facilities, was inaugurated in Otaniemi in September.

Financial statements

VTT Technical Research Center of Finland Ltd is a Finnish non-profit limited liability company owned by the state. The company falls within the mandate of the Ministry of Economic Affairs and Employment. According to the law VTT is an independent and impartial research organisation. VTT operates as a research, development and innovation partner to help the society and companies to grow through technological innovations.

Despite the challenging operating environment due to the pandemic, VTT coped well with the situation both financially and taking care of the health and safety of its employees. The omission of travel generated significant savings but we were still able to maintain a good connection with our customers, which was reflected in commercial sales. The parent company's net turnover increased slightly due to Business Finland funding. VTT received a 3 M€ increase in the government grant annually for 2021 and 2020 to promote the circular economy, and an additional 10 M€ government grant to restore manufacturing jobs in Finland and to develop the reliability and flexibility of the intelligent energy system during 2020 and 2021. As a separate corona measure, VTT received funding to support the start-up of protective equipment production in the healthcare sector in Finland. VTT started building Finland's first quantum computer, for which VTT was granted a 20.7 M€ special government grant (investment grant) for years 2020–2024.

Key financial figures

	VTT Group			Parent company		
	2020	2019	2018	2020	2019	2018
Net turnover (1,000 euros)	149,403	147,471	171,163	148,863	147,179	159,785
Other operating income (1,000 euros)	94,586	97,549	96,738	95,506	97,728	81,286
Government grant	84,425	78,509	71,135	84,425	78,509	71,135
Government special grant	2,133	10,400	-	2,133	10,400	-
Other	8,028	8,640	25,603	8,947	8,819	10,151
Operating result before special items* (1,000 euros) (operative, unaudited)	8,585*	-5,630*	-1,968*	10,492*	-4,819*	-1,821*
Operating result (1,000 euros)	11,351	3,129	9,876	13,259	3,940	-7,794
Operating result (%)	7.6	2.1	5.8	8.9	2.7	-4.9
Result of the financial year (1,000 euros)	9,578	3,644	13,503	11,475	2,997	15,480
Return on equity (%)	6.1	2.4	10.0	7.3	1.5	7.5
Equity ratio (%)	69.5	66.0	66.3	69.3	64.6	64.6

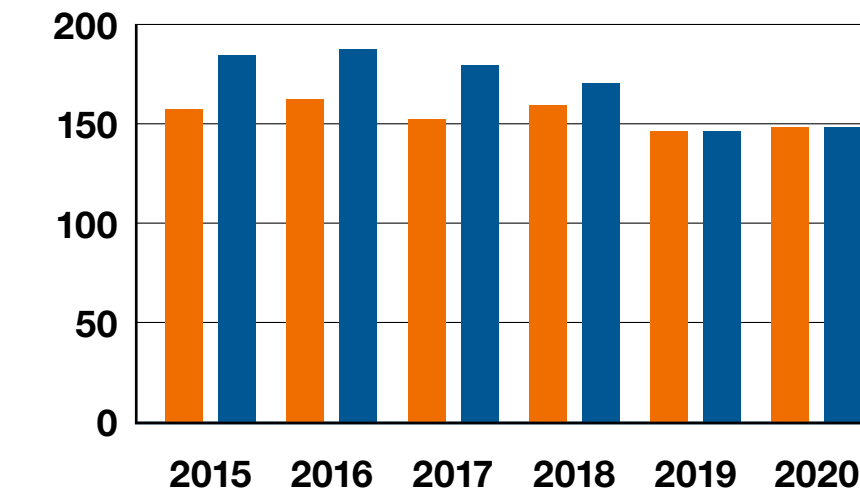
VTT Technical Research Centre of Finland Ltd's net turnover consisted of 59% public sector revenue (Group 59%) and of 41% private sector revenue (Group 41%). The domestic revenue accounted for 56% (Group 55%) and foreign revenue for 44% (Group 45%) of the net turnover.

*Comparable operating result before special items does not include the government special grant for the decommissioning of FIR1 research reactor and restoration old hotcell facilities (2020: 2.1 M€, 2019: 10.4 M€) or the additional provisions made in previous years for the future decommissioning and restoration costs (2018: 5.4 M€).

The Group's operating result before special items (*) does not include the proceeds from the divestment of the subsidiaries. In the parent company the proceeds from the divestment are presented in the financial income, not in the operating result.

**VTT sold VTT Expert Services Oy and Labtium Oy, which offer testing, inspection and certification services, to Eurofins Scientific Group on May 31, 2018. VTT Expert Services Oy and Labtium Oy are included in the Group's figures until the date of sale.

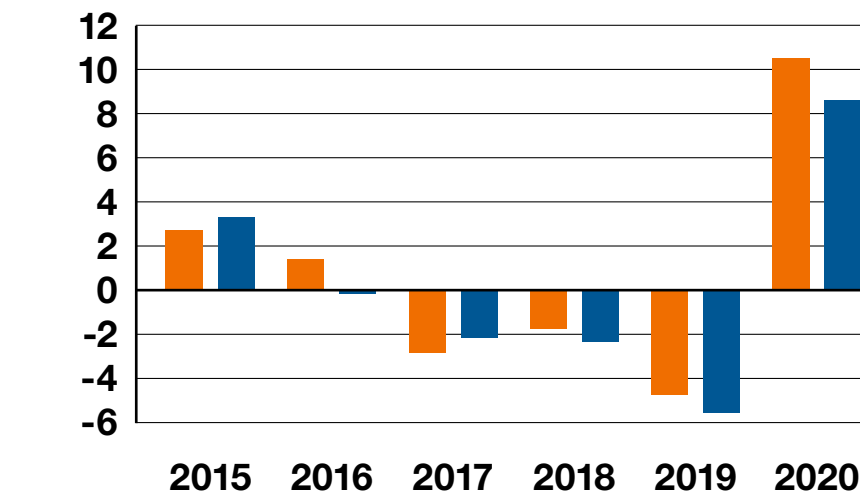
Net turnover M€



The parent company's **net turnover increased slightly** during the financial year due to Business Finland funding.

Parent company VTT Group

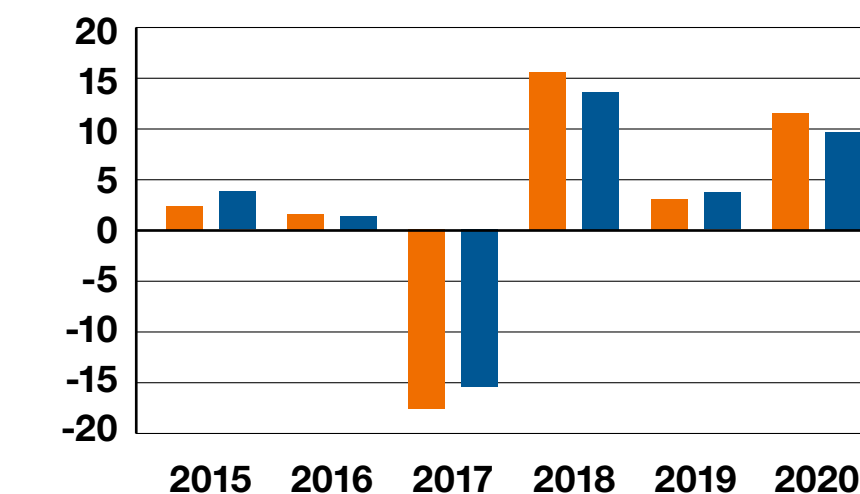
Comparable operating result M€



The **comparable (adjusted) operating result** of the parent company and the Group* **were positive** due to higher net turnover and savings made especially in travelling.

Parent company VTT Group

Result of the financial year M€



The parent company's and the Group's **result of the financial year were positive**.

Parent company VTT Group

Strategy

VTT completed its strategy period with good results, and updated its strategy to be able to meet future challenges. Finding sustainable solutions to global challenges will remain at the core of our work, and will continue in a more focused manner.



Stronger impact with a new strategy

2020 marked the end of VTT's strategy period, which was launched in 2016. Updating the strategy for the period 2021–2025 was one of the key tasks of the year. A more clearly focused strategy will significantly enhance the impact of our research and innovation work.

We want to bring exponential hope to the world, which must solve such problems as the climate crisis and guarantee the adequacy of resources.

2020 marked the end of VTT's five-year strategy period. At the start of the strategy period in 2016, we set ourselves a core objective of responding to global challenges and transforming them into opportunities for sustainable growth for companies, organisations and society at large. The results have shown that that was the right choice.

VTT has pioneered the promotion of a challenge-driven strategy and placed itself firmly on the world map as a source of creative innovation. Our reputation, job satisfaction among our employees and our attractiveness as a workplace have improved, and customer satisfaction has remained at a high level. Over the past five years, VTT has strengthened its position as an internationally recognised research, development and innovation partner for both private and public actors. All of this shows that there is now a better understanding of our role and the value we create.

Our second strategic decision in 2016 was to focus on impact and excellence in research and other areas, and we have also achieved this over the past five years. We have built top-class research facilities and environments in which we can perform more high-quality work to create new innovations. At the same time, we are determined to focus our activities more sharply so that we can deliver expertise that meets the needs of our customers and society at large.

Focus on hope and impact

VTT's key project over the course of 2020 was to update its strategy for the next five years. Responding to global challenges and creating sustainable growth will remain our guiding principles. VTT's purpose is to bring together people, business, science



Our attention will be on areas in which we can speed up the transformation towards sustainable development.



and technology to solve the world's biggest challenges so that we can create sustainable growth, jobs and wellbeing. Our ambition is to bring more exponential hope to a world that needs to deal with the climate crisis, achieve resource sufficiency, drive industrial renewal, provide safety and security and enable good life for all.

This updated strategy will guide us on our path towards having a greater impact. Over the next five years, our attention will be on areas in which we can speed up the transformation towards sustainable development. We will thus focus on tackling systemic and technological challenges in areas where we can generate maximum impact and where we already possess or can acquire top-class excellence.

Generating sustainable growth by focusing on seven key challenges

With its new strategy, VTT takes a more focused approach to its research agenda. Working together with our customers, we will concentrate on the following systemic and technological challenges:

Systemic challenges

- 1. Carbon neutrality:** To reach a carbon neutral economy in the coming decades.
- 2. Productivity leap:** To achieve a 10-fold productivity leap from resources.
- 3. Societal resilience:** To secure society's functions, fiscal sustainability and wellbeing while demographics shift.

Technological challenges

- 4. Quantum technology:** To bring about the quantum leap in computing.
- 5. Super-performing materials:** To create superior-performing materials and shorten design cycle by 50%.
- 6. Superior digital systems:** To unleash superior performance and sustainability in digital systems.
- 7. Synthetic biology:** To match nature's engineering skills through synthetic biology and bioinspired production.

In addition to these seven challenges, we are also exploring emerging technologies and continuing to support the public sector.



VTT World combines our technology platforms and infrastructure into a single application. You can now access the world of innovations in an entirely new manner.

[Read more](#) ▶

Hope is at the core of our new strategy

The five choices we make every day to make our strategy a reality

The 2,000 top professionals, the VTTers, will make our strategy a reality. The impact we create arises from the daily work they carry out in cooperation with our customers. For this reason, we have also specified the daily choices that we make to create optimum impact and value for our customers and that guide us on our path of exponential hope:

1. Always aim for **impact**.
2. Always create impact together with a **customer**.
3. Always lead for **excellence**.
4. Always drive **sustainable** business.
5. Always build the world's most **meaningful** place to work.

So, over the next five years, we will cooperate with our customers in a more meaningful and impactful way to achieve sustainable growth. Research, development and innovation work performed in cooperation with VTT must always have a clear purpose so that it can provide the basis for new sustainable business and wellbeing for building a bright future.

Our strategy 2021–2025: The path of exponential hope

OUR PEOPLE

Top professionals capable of systemic and technological breakthroughs that can bring about fundamental transformation.

OUR PURPOSE

We bring together people, business, science and technology, to solve the world's biggest challenges, creating sustainable growth, jobs and wellbeing.

5. Always build the world's most **meaningful** place to work

4. Always drive **sustainable** business

OUR AMBITION

We bring exponential hope to a world that needs to deal with the climate crisis, achieve resource sufficiency, drive industrial renewal, provide safety and security, and enable good life for all.

The **choices** we make every day

1. Always aim for **impact**

2. Always create impact together with a **customer**

3. Always lead for **excellence**



Impact

To summarise our work, we produced a list of exponential hope setting out the five areas that will provide the solutions to the most urgent global challenges. By focusing on these areas, we can best enhance Finland's competitiveness and future prospects.



1

Using biotechnology to secure the supply of food and materials

With biotechnology, food production can be partially separated from traditional agriculture.

Instead of relying on agricultural land and farmed animals, food would be produced in cell factories.

Food production methods must change radically to ensure that there is enough food for a growing global population and that the negative environmental impacts of production can be brought under control.

Using industrial biotechnology, food can be produced in cell factories in which microbes or other cells produce ingredients for food production. As a result, we no longer need to rely solely on agricultural land and farmed animals. This means that the environment is less burdened by food production and that environmental changes do not threaten food security.

Finland is advanced in biological food production. Finnish universities, research institutes, food companies and start-ups already possess strong biotechnology expertise in food production. We are therefore an excellent place for testing food technologies and innovations before they are introduced in international markets. In fact, using biotechnology in food production also provides a basis for completely new business operations.

To be able to use these opportunities effectively, we must be able to scale the process to the industrial level. National and international research institutes and industries should undertake joint research and development initiatives on scaling up biotechnology in food production and identify how it can be used as part of sustainable food production.

We cannot draw a direct line between using biotechnology in food production and existing legislation on genetic modification. We must dismantle legislative barriers and be a forerunner to take up the matter in the legislative debate in the European Union.

We must also engage stakeholders, especially consumers, in the process. They must be closely involved in the debate and the development work so that each actor in society is prepared for the introduction of this revolutionary food production method.

Case

Producing food and materials in cell factories

Cellular agriculture provides a basis for using biotechnology in the production of traditional agricultural commodities.

Industrial biotechnology has been used in the production of pharmaceuticals and chemicals for many years now. Now, biotechnology is being expanded to be able to produce food ingredients and leather-like materials. This emerging field is called cellular agriculture in which products are made using microbes or other cells instead of relying on agricultural land and farmed animals.

The focus of cellular agricultural research at VTT is on the comprehensive use of microbes and plant tissue cultures. We are approaching the development of microbes for food production from two different directions. Firstly, we are developing methods in which microbes are used to produce ingredients, such as proteins or fats for food and materials applications. Secondly, we are using mycelia to develop a leather-like material for industrial production. Solar Foods, a start-up with origins at VTT, is already producing edible microbial biomass protein from carbon dioxide, water and solar energy.

In addition to studying microbial processes, researchers at VTT are also examining how plant cells can be used in sustainable food production, taking



into account the environment and good nutrition. For example, we are studying the use of avocado cells as a raw material for food production.

Biotechnological food production does not burden the environment in the same way as existing production methods. Many of the additives used in the food industry are already supplied by cell factories, but now we are moving to produce the actual ingredients. For example, egg protein is one of the key raw materials in food production and it can be replaced with cellular agricultural methods. VTT has developed a method in which egg protein can be produced without chickens. Producing egg protein in cell factories would generate 75% less greenhouse gases and require about 90% less land than a chicken farm.

2

Quantum technology can lead to a huge productivity leap

Digitalisation will be followed by quantum technology, which will probably be one of the fields of science that revolutionises our lives in the 2020s.

Quantum computers are expected to bring about exponential growth in computational power in the near future. This new, unimaginable computational capacity could also lead to an exponential leap in productivity. As a result, the use of Earth's resources could be optimised to meet the needs of the growing global population.

In the future, huge systemic problems could be solved with a large quantum computer. For example, we could find sustainable ways to generate energy or develop materials that provide answers to the challenges arising from climate change or the adequacy of resources. The computational power of quantum computers could also provide a basis for extremely rapid pharmaceutical and vaccine development, which could in turn revolutionise global healthcare.

However, quantum computers are only one of the many applications of quantum technology. Other applications include sensing and communications. If Finland can gain a foothold in the emerging quantum industry, it could develop a new industrial sector worth billions of euros, which could in turn lead to thousands of new jobs that help to meet global needs.

We need a national quantum programme

Using quantum technologies in Finland would require both private and public investment in top-class manufacturing and research infrastructure. It would also have to be supported by a national research, development and innovation programme for quantum communications and sensing.

Finland's first quantum computer is only the start. In five years, quantum computers will probably be used more extensively, and in the 2030s, Finland may already be one of the world leaders in quantum technologies. By then, general purpose quantum computers will already be in use in different industrial sectors and Finnish companies will be exporters of quantum technology.

By the 2040s, quantum computers will be doing things that are unimaginable today.

In the 2030s, Finland may already be one of the world leaders in quantum technologies.

Case

VTT is building Finland's first quantum computer

The quantum computer now under construction for VTT will provide the basis for a new industrial sector. It will serve a wide range of companies in Finland and elsewhere in Europe.

Finland's first quantum computer will be placed in Micronova, a research facility located in the Otaniemi district of Espoo and jointly operated by VTT and Aalto University. Micronova also houses the cleanroom where components for the computer will be manufactured.

The quantum computer project will bring together the top quantum experts in Finland, and will allow the country to make a significant leap in quantum capabilities. The total cost of the project is estimated to be between EUR 20 and 25 million. The Finnish Government is supporting VTT's contributions to quantum technology and has granted EUR 20.7 million for the purchase of the computer early in the summer of 2020.

The project will be carried out in stages. In the first stage, which will last about a year, the aim is to build a five-qubit quantum computer, thereby demonstrating Finnish expertise in the construction of such computers. The overall aim is to deliver a 50-qubit computer by 2024. A device of this size can be used in the development of new

quantum algorithms that will provide solutions for demanding application problems in the future.

IQM, a Finnish company pioneering the construction of quantum computers in Europe, has been selected as VTT's co-innovation partner for the project. VTT selected its partner in an innovative public procurement process that was open to international tenders.

In addition to developing a quantum computer, it is also important for Finnish actors to strengthen their expertise in all areas of quantum technology, from the construction of the computer itself to developing algorithms and to solving practical problems with quantum computing.

VTT is also investing in quantum technology applications such as the development of the quantum computer and quantum sensors which may lead to higher-precision instruments for such uses as medical imaging and diagnostics. The company is developing the solutions required for securing information networks in the era of quantum computing.

"Investments in new technologies, such as quantum computing, are an investment in the future. They will largely determine our ability to solve global challenges and generate sustainable growth," explains **Antti Vasara**, President & CEO of VTT.

3

Small modular reactors can make industries carbon neutral

Small modular reactors are a major innovation in the efforts to reduce the emissions of energy-intensive industries.

In addition to power generation, nuclear energy could also have other uses.

Finland is determined to develop solutions that bring about carbon neutrality, which should be quickly followed by carbon negativity. This can only be achieved if energy-intensive industries based in Finland have access to a steadily growing supply of cost-effective and low-emission energy. Small modular reactors could serve as clean sources of the high-temperature heat required in industrial processes. Small modular reactors connected to industrial plants can supply reliable cost-effective and low-emission energy. Unlike large nuclear power plants, such small plants could be mass-produced. Because of their smaller size, the certification process would be less complex, and nuclear energy could also be used more extensively than how it is used now. A hydrogen-producing application using the heat generated by nuclear reactors is one of the technologies under development. Low-emission hydrogen could be used in the production of biofuels, fertilisers and steel, and thus, cleaning the production process would have a major impact on global greenhouse gas emissions.

Finland is well-placed to become a technology leader in this field. Not only have we set ourselves particularly ambitious climate targets, but nuclear energy is regarded as a viable future solution. Finland is also at the forefront of providing prerequisites for new types of small modular reactors.

Expertise should be developed hand-in-hand with business operations

The technology of small modular reactors used in district heating is based on existing nuclear power plants. Industrial activities that rely on small modular reactors would be one of the first areas for which the Finnish nuclear energy sector could deliver practical applications. Developing expertise and technologies would be the next step. Promotion of the expertise and technologies required for industrial applications, such as high-temperature reactors and industrial-scale clean hydrogen production, would go hand-in-hand with the creation of business operations.

The resulting innovations could provide sustainable and low-emission solutions for challenges facing energy-intensive industries in both Finland and other countries.

Case

VTT is developing a small modular reactor for district heating

In addition to industrial purposes, small modular reactors can also be used to generate low-emission nuclear energy for heating cities and towns.

VTT has launched the development of a small modular reactor for district heating in Finland. The aim of the first stage is to prepare a concept-level plan for a nuclear power plant suitable for district heating networks of Finnish cities.

A plant tailored for district heating offers an economically efficient solution for heating homes in cities and other urban areas. Concepts designed for high-temperature industrial processes and electricity generation already exist in other countries, but the water temperature of 100°C required in district heating provides a basis for simpler and less expensive solutions.

The development of clean heating solutions for urban areas is a major climate challenge, and, in order to achieve a fossil-free future, we cannot rely on bioenergy-based solutions alone. The use of nuclear reactors for district heating will lead to substantial reductions in emissions. The greenhouse gas emissions generated by nuclear energy are relatively low and comparable with those of wind power. In addition to Finland, district heating is also widely used in Central and Eastern Europe.



VTT possesses solid nuclear energy expertise, and the computing systems developed at VTT and its strong multi-sectoral expertise will be used in the development of the small modular reactor.

“In the modelling of the reactor core, we will apply high-fidelity numerical simulation methods that have been made feasible by the advances in computer processor capacity and parallel computing,” explains **Jaakko Leppänen**, the research professor responsible for reactor safety at VTT.

Leppänen has developed software called *Serpent*, which is used in reactor modelling and applications related to radiation transport at 250 universities and research organisations across 44 countries. VTT is home to about 200 research scientists who work with nuclear energy and related applications.

4

Chemical plastics recycling

A significant proportion of plastic ends up in landfills and nature, which is a huge environmental challenge in global scale. Chemical plastics recycling is the solution.

We have the required world-class expertise, experimental capacity and industrial references.

A total of about 300 million tonnes of plastic is produced each year, and that figure is expected to double by 2030. Something must be done to reduce the effect of plastic on the environment, thereby tackling one of the most serious environmental challenges facing the world today.

Most plastic is recycled mechanically, which means that in the optimum situation, plastic is simply recycled into plastic of similar quality. Recycling rates can only increase if, in addition to mechanical recycling, chemical recycling is also used. In this method, plastic is broken down into monomers.

There are several potential technologies available for chemical plastics recycling. In these technologies, polymers are broken down into smaller structural units, which will then be used as a basis for new plastic polymers. Finland has strong expertise in two technologies that are well suited for this purpose: biotechnology and thermochemistry.

Over several decades, we have accumulated experience in the production of enzymes and in using them in industrial processes. The same applies to thermochemical processes: Finland boasts world-class expertise, experimental capacity and industrial references on gasification and pyrolysis processes, which are both well-suited for chemical plastics recycling.

We need a comprehensive plastics recycling system

To become a world leader in this field, we must boost the performance of the technologies, make them more tolerant of feeds and improve the yield from feedstock to products. We must improve the investment and operating costs of the technologies and make them more energy-efficient.

In the next stage, we must, in cooperation with the actors of the plastics value chain, demonstrate the functioning and reliability of different technologies and product quality.

We must build a comprehensive plastic recycling system comprising both mechanical and chemical recycling. In the future, it will also include carbon capture and storage technologies so that carbon dioxide can be used as a major raw material for plastic.

Case

Circular economy of plastics takes us closer to achieving climate goals

Transformation to circular economy of plastics requires new business operating models and eco-planning throughout the entire value chain.

VTT envisages a future in which the recycling of plastics is ensured through a variety of different technologies and operating solutions. All plastic will be produced and recycled in a climate-neutral manner, with none of it finding its way into the environment.

“We cannot create genuine circular economy solutions unless we overhaul the way in which we handle, use and process raw material flows, including plastic waste. At VTT, we have developed sustainable technologies and materials for industrial use. Using these technologies as a basis, we can bring together actors from different fields to develop a circular economy of plastics and at the same time create wellbeing and potential for growth,” says **Tuulamari Helaja** Vice President of a Research Area at VTT.

A sustainable circular economy requires new business models, and eco-planning is the key driver of this change. Reducing plastic waste calls for smart waste collection, sorting and separation techniques, a range of different reuse concepts and up-to-date recycling technologies.



Efficient sorting and separation of plastic waste is essential to ensure that the materials retain their value. VTT is in the process of developing smart mechanical recycling technologies that will make recycling more attractive economically. The lifespans of worn plastic products can also be extended by using techniques that repair their molecular structure.

Waste flows that cannot be made useful through mechanical recycling could be recycled through chemical methods instead. To solve this problem, VTT is developing thermochemical recycling technologies to produce monomers (direct components of polymers) and refinery feedstock. The advantage of thermochemical processes is that the feedstock can be of uneven quality and the product (gas or oil) can be processed into a wide range of different end products. Recycling rates can be significantly improved by using thermochemical methods.

5

Material optimisation provides a basis for sustainable use of resources

Materials development is at the core of sustainable circular economy. We are well-placed to be leaders in materials transition.

Materials are at the core of a sustainable day-to-day circular economy.

Materials are sometimes referred to as enablers of technological development, and with good reason. The transformation of materials science and technology resonate through industries and society.

Until now, major breakthroughs in materials development have usually happened by chance, as a result of errors. However, nowadays it takes several decades to convert the results of laboratory research into practical industrial applications. This is not enough if we want to ensure the adequacy of the Earth's resources and at the same time, slow down climate change.

The solution for materials optimisation can be found in the development of computational material technology and harnessing it for the circular economy. With digital material development, we can make the circular economy into a profitable business.

From random events to systematic optimisation

Computational technologies are changing the way in which we develop and study materials from a comprehensive perspective. By developing digital methods and by relying on cooperation between research institutes and companies, we can ensure that we study relevant matters and that the research results are quickly converted into commercial applications. Finns are cooperative, which is a prerequisite for materials science and technology in the future. We are therefore well-placed to be leaders in materials transition.

Developing autonomous materials technology with artificial intelligence

First, we must create a systemic circular economy and digital twins that describe the lifecycle of materials and products, in which materials design and its characteristics, replacement of raw materials, product design, use and lifespan of products, product re-use and repairs, remanufacture and recycling are all interconnected on the same digital platform. Next, we must harness artificial intelligence to optimise and find new materials solutions. Materials design will become a routine product-specific process and from 2030 onwards materials will be created autonomously in an AI-guided process.

Case

In the future, materials will be created on an on-demand basis

In the future, materials will be invented, developed and optimised on a case-by-case basis, using digitalisation and artificial intelligence.

VTT is investing heavily in Finnish materials research to keep it at the forefront of the field. At the start of 2020, VTT appointed **Anssi Laukkanen** as its first research professor in computational materials science.

Digital and computational materials research provides for more sustainable and efficient materials solutions in the manufacturing industry. Even relatively small advances in materials science are of major importance, let alone entirely new materials and solutions.

In its applied research, VTT approaches the field of materials science from three different angles. Firstly, it aims to discover new materials with the help of modelling. Artificial intelligence plays a key role in this process, and any resulting materials will be customised to product-specific needs.

Secondly, the research will focus on the optimisation of materials solutions, as well as on systematically developing them for industrial purposes. The third focus area is the management of complex, multi-level materials phenomena (materials challenges) which, because of their complex-



ity or functional requirements, are difficult or even impossible to tackle on an experimental basis.

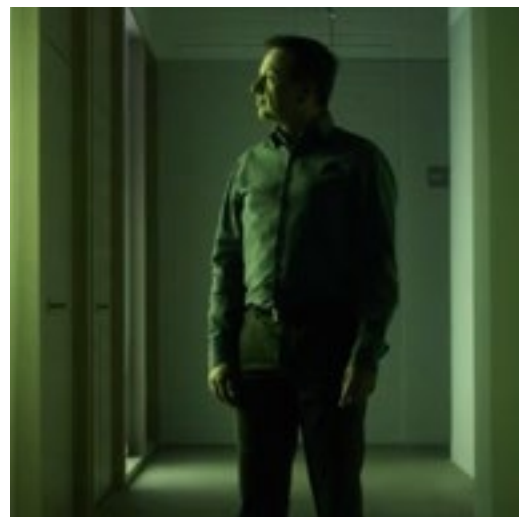
Customised materials will be developed systematically by exploiting materials hierarchies, from the atomic level to actual products.

“This will mainly be done using artificial intelligence. The digital twins created using our calculation methods will be fully integrated so that they can control autonomous physical manufacturing, characterisation and testing functions. The whole system will work in real time, discovering, creating and optimising new materials and materials solutions,” Laukkanen explains.

In materials modelling, VTT possesses internationally competitive areas of cutting-edge expertise, such as micromechanical modelling, modelling of additive manufacturing of metals, and materials modelling of various coatings and composites.

Strong year of customer relationships 2020

The solid basis for customer relationship management that we have established over the past few years kept us on the growth path well into the coronavirus year. Our customers felt that cooperation with VTT generates value and, despite the pandemic, many of them made further investments in the future.



“Cooperation is the only way to find solutions to climate change,” explains Petri Lehmus, Vice President, R&D at Neste on our Leaders of Innovation video.

[Watch more](#) ▶

Overall, VTT’s customer sales in 2020 were slightly above its results for 2019. Growth continued at a rate of over 20% until October, but as we entered the fourth quarter, many of our customers decided to postpone project starts to 2021. Exceeding on the previous year was a great achievement during the challenging months of 2020.

The ability of VTT to sustain growth showed that, despite the pandemic, many of our customers remain focused on the future and continue to make substantial investments. Despite cost-cutting programmes and freezing of long-term plans, there were actors that had the required resources and a long-term strategy to provide a basis for investments in sustainable growth.

Customer satisfaction remained at excellent levels and our customers felt that cooperation with VTT generates value for them. The already high net promoter score remained at good levels, and up to 83% of our customers* felt that cooperation with VTT had let to a boost in their knowhow and expertise.

Even though the impacts of the coronavirus pandemic were not felt equally around the world, the demand for our services remained strong in both Finland and globally. About half of all our customer assignments came from outside Finland, which means that, despite the pandemic, the ratio between domestic and foreign customer relationships remained unchanged in 2020.

Total number of customers

1,410

Domestic private sector customers

880

International private sector customers

350

Domestic and international public sector customers

180

50

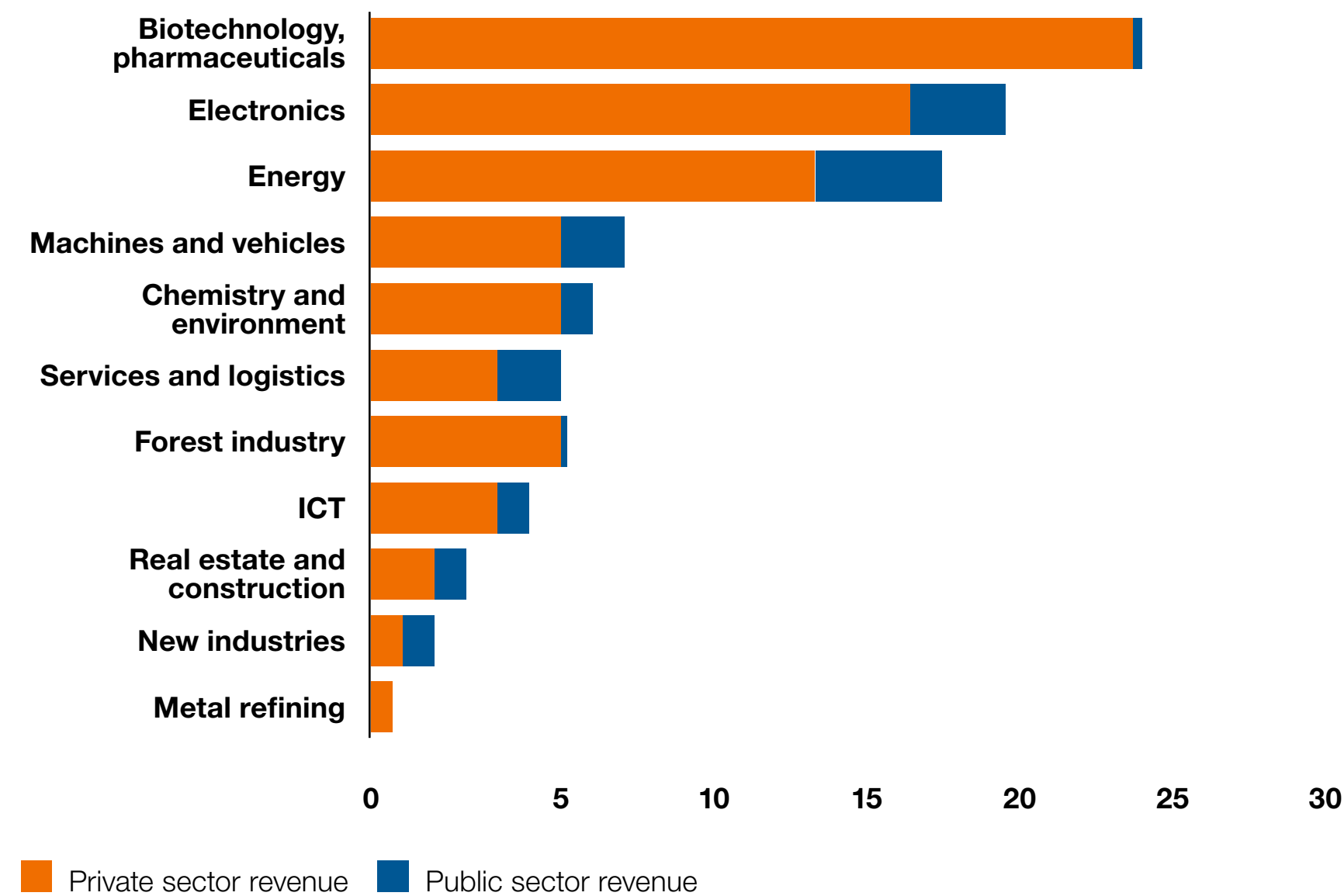
VTT’s net promoter score (NPS)*

93%

of customers say that cooperation with VTT has strengthened their knowledge base and expertise*

*The figures are based on an independent customer impact survey commissioned by VTT.

Customer solutions sales revenue* (%)



*Parent company, classification according to VTT's customer segments.

Case

Working together for a better world

Dyadic has chosen VTT as its research partner in developing a new platform for producing pharmaceutical products. As a result, pharmaceuticals and vaccines can now be produced efficiently, in larger amounts more affordably at flexible commercial scales.

Originally, Dyadic introduced the *Thermothelomyces heterothallica* C1 fungus to produce enzymes for use in stonewashing blue jeans. Currently, C1 is known as a highly efficient organism for producing industrial enzymes.

“For the past 25 years, we have been working with the world’s best scientists in engineering fungal cells to make our C1 technology suitable for producing industrial enzymes,” explains **Mark Emalfarb**, founder and CEO of Dyadic Inc., a Nasdaq-listed biotechnology company.

Mr. Emalfarb concluded, “VTT has the premiere group of scientists using fungi for pharmaceutical protein production. So, when we began to evolve from the industrial side of biotech to pharmaceuticals, VTT was a natural choice. VTT scientists had the skills, expertise and knowledge to leverage this technology for human pharmaceutical use and our results have shown that we made the right choice.”

Quicker and more efficient

Currently, a total of 20 expert researchers are working at VTT to modify the C1 fungus, and to develop a faster, more efficient pharmaceutical manufacturing production process. The joint development of biological production of pharmaceuticals and proteins has been going on for approximately four years.

Until now, the pharmaceutical industry has mainly relied on Chinese hamster ovary cells (CHO cells) to produce more complex pharmaceutical proteins. The C1 fungus offers a quicker and a more efficient way to produce pharmaceutical proteins. The biotechnological production process involved is much more efficient than the processes with traditional organisms used in pharmaceutical production. Joint efforts by VTT and Dyadic in 2020 were used in cooperation with leading pharmaceutical companies, to develop more efficient pharmaceutical and vaccine production methods.

“In addition to protein production, we have extensive expertise in synthetic biology and in bioprocess engineering. We are able to apply this to other fields, such as the food and enzyme industries and we have achieved great results in speeding up the development and manufacturing of pharmaceutical proteins with the C1 fungus,” says **Chris Landowski**, Research Team Leader at VTT.

Working for the good of humanity

Dyadic’s mission is to make large quantities of pharmaceuticals and vaccines available to patients more quickly, efficiently and affordably, by using its C1 technology, than could otherwise be achieved with existing cell expression platforms currently available. VTT is further developing C1 to make Dyadic’s mission a reality, which includes a production method for COVID-19 vaccines.

Mr. Emalfarb further commented, “It is obvious that VTT scientists have the same vision as Dyadic to succeed in the science, and see the science turn into products that benefit humankind”.

Commercialisation of technologies and IPR protection

In 2020, VTT invested heavily in IPR at the core of its own business operations and the business operations of its customers.

Particularly rapid growth in IPR revenue was registered in food technologies of the future.

In 2020, VTT invested heavily in patent acquisition, a total of EUR 2.1 million, in order to create new business opportunities for its customers. For example, we boosted the protection related to quantum technology.

VTT owns a total of more than 440 patent families containing more than 1,600 patents and patent applications. In 2020, VTT received 201 invention disclosures and submitted 62 priority patent applications.

Commercial IPR agreements on the increase

As in 2019, health technology, process simulation software, optics, and spectroscopy were the technology sectors generating the highest revenues. Particularly rapid growth was registered in food technologies of the future. The number of commercial IPR agreements is on the increase and VTT-owned IPR also makes it easier to attract customer projects. IPR investments based on the overhauled model also got off to a good start. At the same time, however, commercial revenue from intellectual property rights (EUR 2.7 million) was lower than in 2019, which was mainly due to the coronavirus crisis.

Stronger IPR expertise also benefited customers

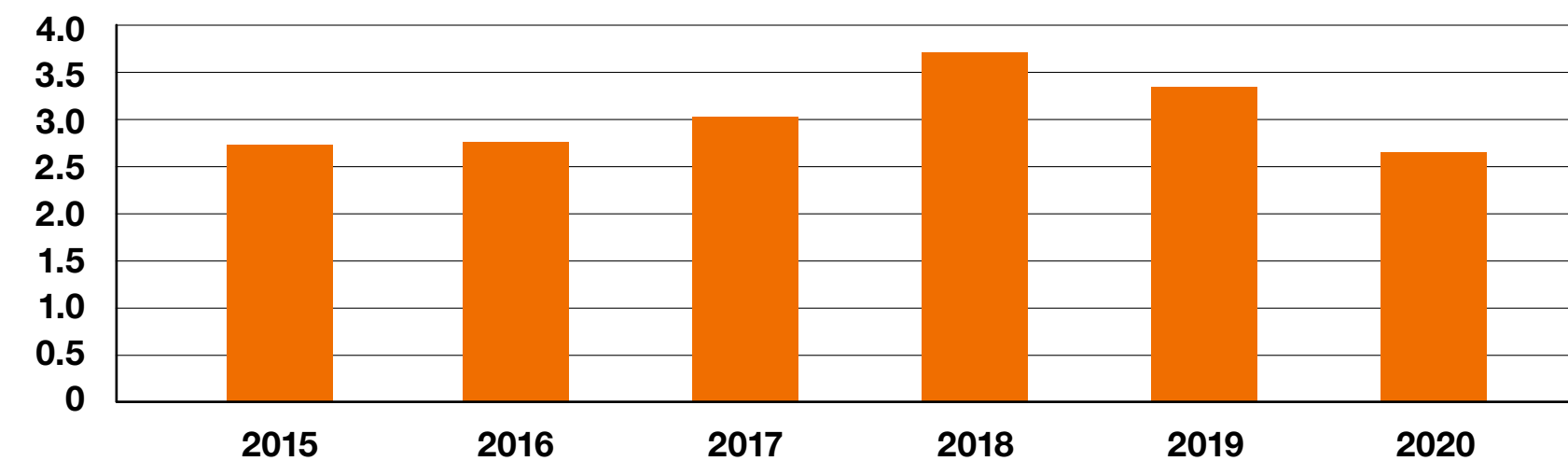
A new web-based IPR training package was launched at the end of the year to support the IPR expertise of all VTTers. In the same connection, measures were also taken to clarify the role of IPR in the activities of VTT and the criteria for IPR protection. Proper understanding and management of IPR provides a better basis for co-operation with customers. In its value creation, VTT is making increasing use of the extensive multidisciplinary expertise of its employees.



Chipmetrics Oy, a spin-off of VTT, will soon start commercialising the PillarHall test chip, which opens up new opportunities for semi-conductors, memory circuits and smart devices.

[Read more](#) >

VTT's IPR revenue, MEUR



2.7

EUR million in IPR revenue

62

priority patent applications

> 440

patent families in the patent portfolio

Cooperation and networked activities are at the core of VTT's work

VTT carries out research and innovation work in cooperation with a large number of national and international partners and networks. In 2020, the coronavirus pandemic posed a novel challenge for VTT and its partners.

VTT is the largest single recipient of EU research funding in Finland.

VTT is a key player in Finnish society. We actively cooperate with a variety of Finnish partners, such as companies, universities, other research institutes, providers of research funding, ministries, organisations and local and regional government. In this way, we contribute to the formulation of joint views in nationally important issues requiring research and technology expertise.

We are closely cooperating with companies in projects promoting the renewal and sustainable competitiveness of Finnish and European industrial value chains. In cooperation with public-sector actors, we prepare reports and statements supporting decision-making, while VTT employees also serve as experts in advisory working groups. Our research and innovation work generates visible added value for Finnish society and business operators.

In 2020, VTT played a visible role in the combating of the coronavirus pandemic. We supported public authorities and societal actors in a variety of different areas. We channelled our technical expertise to the development of health technologies by, for example, studying the spread of coronavirus through the air. We tested the usefulness of protective equipment and helped in the launching of production of protective equipment in Finland. We also took part in a campaign in which Finnish companies joined forces to find ways for Finland to recover from the coronavirus crisis as a stronger country. The focus of the effort was on boosting the capabilities of manufacturing industries.

Research infrastructure and innovation ecosystems as enablers of cooperation

Research and innovation require experimental research and technology infrastructure, demonstrations and piloting. VTT's unique research infrastructure and develop-



ment environments are an important part of Finland's national innovation infrastructure. Companies can also take part in the shared use of infrastructures and in this way create new export products and services.

One of the most important openings in this field during 2020 was the decision by VTT and its partners to construct Finland's first quantum computer. A piloting platform for process chemistry was also opened in the Bioruukki piloting centre to speed up the bioeconomy and circular economy projects of companies and research organisations. The modernisation and digitalisation of processes offer better tools for developing such technologies as chemical plastics recycling.

Innovation ecosystems have proved to be an effective operating model in solving complex challenges. In innovation ecosystems, a wide range of actors such as universities, universities of applied sciences, research institutes, and companies, cooperate to develop new sustainable and systemic solutions and to generate new business on this basis. The codevelopment of innovation ecosystems with partners and customers is at the core of VTT's operations.

In 2020, VTT also launched the construction of a circular economy ecosystem in collaboration with Aalto University, the Geological Survey of Finland, the Natural



The Nordic Drone Initiative, which involves partners from four Nordic countries, is seeking more sustainable and lower-emission solutions for passenger and goods transport. VTT is contributing to the project with its expertise in icing mitigation, battery and fuel cell technology.

[Read more](#) ▶

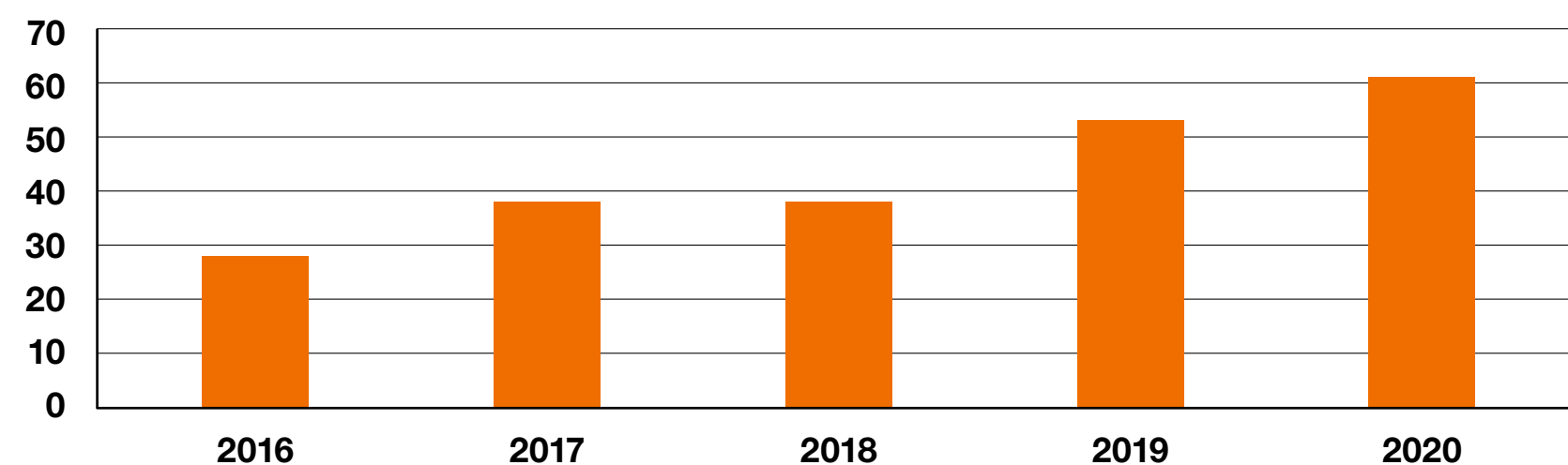
Resources Institute Finland and the Finnish Environment Institute. The purpose of the cooperation is to create circular economy solutions for textiles, packaging, batteries, food systems, construction, metals, minerals and electronics. The ecosystem arranged the Circular Design Challenge competition and many of the ideas presented on this platform were selected for concrete project preparation.

VTT's networks as accelerators of international cooperation

VTT is an active and highly recognised network actor. In addition to national networks, we are also members of many European and international innovation communities. For example, we are actively engaged in the work of European technology communities, public-private partnerships and four innovation clusters of the European Institute of Innovation and Technology (EIT). As an active member of EARTO (the European Association of Research and Technology Organisations), we are well-placed to influence the European research and innovation policy.

Our strong role in the EU Framework Programme for Research and Innovation is reflected in the extent and international impact of the cooperation. We received a total of EUR 238 million from the 2014–2020 Horizon 2020 programme (Business Finland/October 2020 stats). This was 18% of all Horizon 2020 funding granted to Finland and made VTT the largest single recipient of EU research funding in Finland. All funding received by VTT was granted to cooperation projects. On average, each of the projects we coordinated had, in addition to VTT, 14 other participants (half of them being companies). About 60% of all VTT-coordinated H2020 projects have included Finnish companies as partners.

Share of Open Access articles (%)



During 2020, we also played an active role in the construction of the Horizon Europe 2021–2027 research and innovation framework programme. The work was carried out as part of the national RDI system and in European partnerships and a number of different working groups.

Using our strong networks, our customers and partners are able to benefit from international research and expertise. According to our customer impact survey, VTT has played a major role in providing Finnish companies with access to international markets and it also supports the growth of its customers outside the framework of joint projects. Most of the customers taking part in the survey are of the view that VTT has helped them to improve their expertise level and made their product development processes more efficient.

Making more publications universally accessible

VTT carries out its research work in order to find solutions to global challenges and the results of the research is published in scientific articles and other publications. In 2020, peer-reviewed articles in scientific journals totalled about 500, which was slightly above the previous year's level. More than one third of these articles were published in international top journals. We also published conference presentations, books and articles in trade magazines

Open science and open access publishing make high level scientific information universally available. More than 60% of all scientific articles published by VTT were published in open access journals or paid open for all in traditional subscribed journals. (In 2019, the figure was 53%.) Even though the proportion of open and free available publications is growing each year, researchers still also need older and subscription publications. About 80% of all scientific articles downloaded by VTTers for its own use are behind paywalls.

[The VTT Research Information Portal](#) contains information of 60,000 publications produced by VTTers. Using a variety of different search criteria, you can find the experts, their areas of expertise and cooperation networks by topic and theme. All open access publications can be directly read in the system.

All EU research funding received by VTT was granted to cooperation projects.

Corporate responsibility

Our responsibility work is reflected in our research and the solutions we develop. We are doing important work to promote sustainable development. We ensure our competitiveness by investing in multisectoral expertise.



Corporate responsibility through solutions

Content of research is at the core of corporate responsibility at VTT. For this reason, VTT plays a major role in the promotion of sustainable development.



We examined the effectiveness of coronavirus face masks and the best way to clean them, took part in the development of a novel coronavirus alert app and contributed to the development of a robot examining the spread of coronavirus through the air. In March, most VTTers switched to remote work. Special arrangements were introduced to ensure the continuation of experimental work.

[Read more](#) ▶

VTT's core mission is to develop sustainable solutions for its customers and for society. We have incorporated the principles of sustainable development into our research and service activities, reporting and internal activities.

Research content and solutions is at the core of responsibility at VTT. Our research agenda is based on a challenge-driven (outside-in) approach: the research is steered by external factors and we do not rely on our existing expertise. The challenges facing our customers and their growth opportunities have a strong impact on our research agenda and the development of our competences.

Studies show that the utilisation rate of our research findings is extremely high. Our professionals and the results of our research are used extensively in public decision-making on the journey towards a more sustainable society. For this reason, VTT plays a major role in the promotion of sustainable development.

Stakeholders value our work to combat climate change

During the year, we conducted surveys and interviews to determine how our key stakeholders (customers, scientific community, media, political decision-makers, providers of funding and our own employees) view corporate responsibility at VTT.

According to the respondents, impeccable research ethics, an ethical approach to activities in general, and careful management of information and property are the most important factors in this respect. A materiality analysis shows that in VTT's own view, too, these factors generate the strongest impacts. The respondents placed great emphasis on the fight against climate change.

VTT updated its corporate responsibility framework

In addition to consulting stakeholder groups, we also approached corporate responsibility with external and internal benchmarks and management workshops. The



Our work is used extensively in public sector decision-making on sustainable development.

work was guided by the Government Resolution on State Ownership Policy issued in spring. We decided to join the Global Compact initiative of the United Nations, made our own Code of Conduct more specific and prepared a Supplier Code of Conduct for our partners.

Our new corporate responsibility framework is built around four themes: personnel, customers, society and operational basis. The updated strategy places greater emphasis on corporate responsibility and sustainable development. We will next update the indicators describing corporate social responsibility.

We also overhauled our safety and security policy and prepared an online course on data protection and information security for all staff members.

The foundations of corporate responsibility are in good shape

We observe the Finnish Corporate Governance Code with certain exceptions, which are described in our own Corporate Governance document. Our tax policy is on a responsible basis and we report on our tax footprint transparently as part of our financial statements.

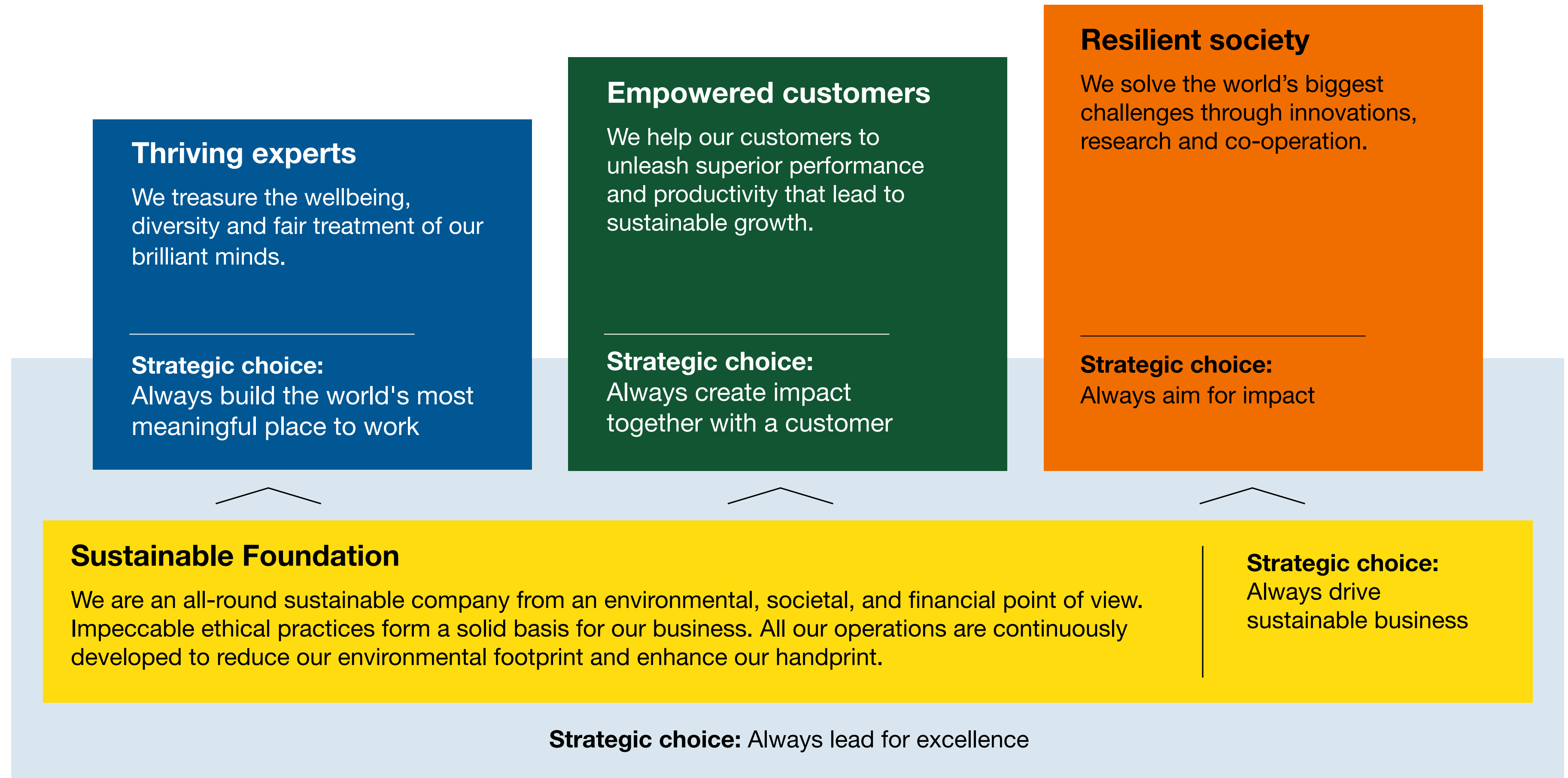
VTT is a member of the FIBS corporate responsibility network. We observe the Responsible Conduct of Research (RCR) guidelines of the Finnish National Board on Research Integrity.

Sustainability priorities serve as incentives towards sustainable impact

Sustainability is an important part of the VTT strategy for 2021–2025. One of our five strategic choices is that we always drive sustainable business. Our customers and partners also require that we constantly extend the scope of sustainability.

At the end of 2020, we defined our four sustainability priorities. These priorities guide us towards an extensive corporate sustainability program, and a better world.

VTT's sustainability program



Building competitiveness by developing expertise in a wide range of different fields

In 2020, we took a huge digital leap to boost the expertise of our employees. We invested in mental wellbeing and work capacity enhancement and helped VTTers to cope with the challenges arising from the coronavirus pandemic.

Continuous learning and competence development are core areas at VTT.

VTT is an expert organisation. Continuous learning and the development of competences are key to our success, which is built on excellence in our core areas.

In 2020, we took a huge digital leap in the competence development. We converted the coaching programmes planned for the year into virtual packages and added new self-study options to our Opinet platform. We also piloted virtual coaching and prepared virtual leadership coaching courses for VTT supervisors.

The focus in the development of leadership was on coaching-oriented leadership. VTTers taking part in the Coaching & Feedback programme produced a Workplace Big Five™ (WPB5) self-assessment to support their own development. We also launched the first WPB5 360-degree feedback processes.

We continued to use project coaching sessions and mentoring as development tools. A total of 80 people took part in our internal and external mentoring programmes. The Commercial Excellence for Researchers coaching programme attracted about 300 participants and we also used it as a basis for a self-study course intended for all VTTers.

We warmly welcomed new VTTers even though we were unable to do it face-to-face. Six of the eight Discover VTT induction events were held virtually and a total of 170 new VTTers took part in the inductions.

A record number of employees took part in the Compass personnel survey in the spring (with a response rate of 87%). On a scale of 1 to 5, our total score was 3.9, and the results showed that we have made excellent progress in key areas. A total of 87% of respondents were satisfied with their supervisors and felt that they can be trusted. We also made substantial progress in wellbeing at work.



In our wellbeing activities, the focus was on supporting mental wellbeing and work capacity.

Focus on mental wellbeing

In wellbeing matters, the focus was on supporting mental wellbeing and work capacity. We provided VTT supervisors with work capacity support training in cooperation with our occupational health service and the employment pension insurance company managing our pension security. In recognition of our efforts, the association Mieli ry designated VTT as the first 'hyvän mielen työpaikka' (a feel-good place to work) in Finland. We also arranged two 'Mieli työssä' coaching sessions to support mental health at VTT in cooperation with Mieli ry.

We established the Wellbeing Champion network for VTTers from different parts of the organisation who are keen to promote wellbeing in their own workplace communities. Solutions were sought in team workshops to tackle fragmented work patterns, promote community spirit in knowledge work and boost wellbeing through self-management.

At voluntary morning health checks arranged in the early part of the year, VTTers could have their blood sugar levels, compression force and mobility measured. The step competition held in spring motivated us to be physically active.

We offered VTTers Firstbeat stress analyses measuring their recovery capacity and added the Firstbeat Life service to the package in autumn. Nearly 200 VTTers started using the new mindfulness application, while 1,900 employees used the ePassi (76% of them used it for physical fitness services). We put our physical fitness and cultural services out to tender, and Smartum will start as a new VTT partner from the beginning of 2021. Even though gyms remained open, the coronavirus pandemic led to rules that restricted their use. A total of 1,070 VTTers took influenza vaccination in autumn.

There was more emphasis placed on ergonomics due to the remote work. We compiled a support package for remote workers and arranged ergonomics briefings and relaxation breaks to facilitate recovery from work. We highlighted cognitive ergonomic issues and encouraged VTTers to engage in physical exercise during breaks.

Employer image

Our employer image is based on our employer promise: Join us in building a brighter future. VTT is an encouraging and inspiring workplace community for top talent. We focus on wellbeing.

In spring, Universum surveyed students on employer image, and VTT ranked 16th among natural science students and 20th among engineering students. In the professional survey carried out in autumn, VTT ranked third among engineering professionals

and 11th among natural science professionals. Being a responsible employer is also one of the cornerstones of our employer image, and in summer 2020, VTT took part in the The Responsible Summer Job -campaign (Vastuullinen kesäduuni) organised by Oikotie.

Rewarding

Rewarding help us to implement our strategy and to achieve our goals. Rewards comprise financial rewards, wellbeing at work, corporate culture and competence development. Most of the financial rewards are granted as recognition rewards in which the focus is on promoting excellence and boosting impact. In 2020, a total of 307 VTTers received recognition rewards. We launched a revamped Customer Excellence award, the purpose of which is to encourage teams to achieve excellence in customer work. The criteria for the new Leadership Excellence Reward created for VTT management comprise company-level and personal targets.

Coronavirus pandemic

At the start of the pandemic, VTT established a coordination group which, in addition to management representatives, also has members from all parts of the organisation. The group met between two and three times each week and closely monitored the Covid-19 situation. VTTers were provided with updates and instructions on the intranet and guidance was also available through a separate email address. From the outset, our main message was that priority is given to the health and safety of VTTers.

Most of the VTTers switched to remote work in March on short notice. Special measures were taken to ensure the continuation of experimental work in the research facilities. As the pandemic continued, we invested heavily in supporting both physical and mental wellbeing and in work capacity. We provided supervisors with training in good remote leadership and emphasised that presence and contacts are also important in a virtual workplace community.

We acted in close cooperation with the occupational health service and encouraged employees to take coronavirus tests as soon as symptoms appear. The number of infections in 2020 was extremely low and no work-related infections were diagnosed.

Security policy

Our aim is to ensure the comprehensive wellbeing of VTTers and within this framework, we put special focus on safety and security issues. In accordance with our occupational safety programme, a good level of safety is the minimum requirement in all our activities.



The New Work @VTT programme launched at the end of the year is shaking up established work patterns and encouraging VTTers to adopt new approaches to work.

[Read more](#) ▶



Our safety objective is to ensure that all VTTers come to work healthy and leave work healthy.

1. VTT offers meaningful work that factors in the capabilities, resources and weaknesses of individuals (physical, psychological and social stress).
2. VTT provides a healthy and safe working environment.
3. Taking risks, deviating from safe procedures and ignoring instructions are forbidden.

The security and safety policy adopted by VTT in 2020 also sets out our key principles in the field of occupational safety.

VTT is a member of the Zero Accidents forum. For us, the Zero Accident policy is not just about injuries but also about the following:

- Zero occupational illnesses
- Zero tolerance for bullying
- Zero sick days resulting from work
- Zero unaddressed incidents of violence and harassment
- Zero burnouts
- Zero managers and employees who are unfamiliar with occupational safety issues

In accordance with our policy, anyone who works on VTT's premises must have a valid occupational health and safety certification. In the spirit of our common workplace safety practices, this requirement applies to all work performed by VTT employees and representatives of our partners (except for office work).

The Group-wide accident frequency stood at 0.54 accidents per million working hours and the corresponding figure for the parent company was 0.54. No lost time injuries were recorded in VTT's subsidiaries.* Physical impacts, slips, falls and chemicals were the most common causes of injuries and accidents requiring first aid. The positive trend in the number of serious workplace injuries was broken by a bone fracture (no serious workplace accidents were reported between 2017 and 2019). Our KPI for the seriousness of workplace injuries was 5.50 sick days per accident within the parent company (across VTT Group: 5.50).

The 'monthly safety observation' procedure helps to raise awareness of safety issues. The individual who reports the featured incident wins a small prize. The incidents observed concerned the flow of information, oil baths, emergency showers, field work, induction and storing of chemicals.

*(Does not include the figures for VTT SenseWay)

For us, 'zero accidents' also means no occupational diseases, no harassment and no burnout.

Environmentally friendly technology

We create our most important environmental impacts through the technologies that we develop, and we also deal with the immediate impacts of our own activities. VTT aims to achieve carbon neutrality by 2030.

We must have better tools to assess the positive environmental impacts of our activities.

VTT has set itself the following environmental policy goals:

1. We create sustainable solutions to major societal challenges in our research projects.
2. We support our customers in the development of environmentally friendly innovations.
3. We encourage our staff to make sustainable choices.
4. We comply with the statutory requirements and other binding obligations that apply to our operations.
5. We continuously improve our management system to enhance environmental performance.

We have set the achievement of carbon neutrality by the year 2030 as our strategic objective. When overhauling our strategy, we realised that we must have the capacity to evaluate the positive environmental impacts of our activities (especially our carbon handprint). As a result, we included this in our 2021 task list together with the definition of detailed environmental targets and indicators.

One of the Executive Vice Presidents, also a member of the VTT Executive Leadership Team, is responsible for the overall development of environmental management at VTT. The head of each research area is responsible for meeting the environmental obligations applying to its work. As members of the QEHS team, our own quality, environmental and occupational safety and health experts are responsible for ensuring that environmental matters in our organisation are properly coordinated and that VTT complies with the ISO 9001, ISO 14 0001 and BS OHSAS 18001 standards.

The distinctive features of our operations, particularly the nature and extent of experimental research, impact the way in which environmental matters can be best



considered in different parts of the organisation. As a result of a review, we were able to identify best practices and improve the capabilities of the people responsible for specific tasks.

We also provided other parties with expert assistance in environmental matters. Our researchers took part in nine parliamentary committee hearings on energy and environmental issues as invited experts or by submitting written statements.

Our facilities serve as a research platform for energy solutions

VTT FutureHub, our new multipurpose office inaugurated in 2020, is a Smart Energy Living Lab serving as an office that meets the latest requirements and a research platform suited for a wide variety of different purposes. Using the extended infrastructure of the building and the research equipment housed in the facility, we can conduct research on renewable energy generation and develop sustainable solutions for the following challenges:

- How to save costs through smart adjustment of heating and air conditioning so that working conditions are not affected
- How to control renewable energy production using such instruments as solar panels in a smart way and optimise the flexibilities arising from the production
- How sensing and sensor technology can contribute to the optimisation of energy generation
- How to use building automation systems and monitoring of electricity consumption in smart energy generation
- How to use the data generated in the charging of electric vehicles in the work to reduce vehicle traffic emissions to zero
- How to use the 5G network in mobile, IoT and rapid response applications
- How to develop indoor tracking methods and demonstrate services using indoor and outdoor tracking systems

The coronavirus pandemic was reflected in environmental impacts

The coronavirus pandemic, which characterised 2020, was reflected in environmental impacts as well. In March, all work that could be done outside was categorised as remote work and all work-related travel stopped. This was reflected in the amount of air travel (-81%) and in office paper purchases (-74%).

The pandemic had less impact on energy consumption, which is strongly dependent on the experimental research work. These activities continued by introducing special arrangements and the market demand was high. Our electricity consumption increased by 7% and heat consumption by 8%, whereas water consumption decreased by 5%.

VTT also promotes environmental protection issues as a member of the Climate Leadership Coalition. Our company bought and cancelled emission allowances from its EU emissions trading quota equivalent to the CO₂ emissions of VTT's rental cars in 2019 (52 tonnes). VTT does not operate in groundwater areas, but our facilities in Espoo are located close to the Laajalahti Natura 2000 Nature Reserve.

Remote work impacted the amount of work-related travel and the amount of office paper.

GRI index

Standard	Indicator	Reported fully ● partly ① not included ○	Link or explanation
102 (GRI 2016)	Organisational profile	●	AR = Annual Report 2020 , CoC = Code of Conduct , MA = Management approach annex
102-1	Name of the organisation	●	Key facts of VTT
102-2	Activities, brands, products and services	●	Research results, AR 7, 13-18, 20 Key facts of VTT
102-3	Location of headquarters	●	Key facts of VTT
102-4	Location of operations	●	Key facts of VTT
102-5	Ownership and legal form	●	CoC 4
102-6	Markets served	●	AR 20
102-7	Scale of the organisation	●	AR 6, 8, 19-21
102-8	Information of employees and other workers	●	Total number of employees by contract type and gender
102-9	Supply chain	①	MA VTT uses Hansel's services in procurement. Responsibility Supplier Code of Conduct was introduced.
102-10	Significant changes to the organization and its supply chain	●	VTT Memsfab Ltd merged to parent company 30.10.2020. This does not change the scope of the GRI-report.
102-11	Precautionary Principle or approach	●	The State owned bodies are following the precautionary approach although it is not any more explicitly mentioned.
102-12	External initiatives	●	CoC 4
102-13	Membership of associations	●	Because of corporatization VTT has joined to Palta ry.
102-14	Statement from senior decision-maker	●	AR 4
102-16	Values, principles, standards, and norms of behavior	●	CoC
102-18	Governance structure	●	Tax footprint, management and control annex VTT's Corporate Governance The administration code of Finnish listed companies VTT's Board has audit and remuneration committees.
102-40	List of stakeholder groups	●	Stakeholders
102-41	Collective bargaining agreements	●	Essentially 100%, only top management is outside collective bargaining agreements.
102-42	Identifying and selecting stakeholders	●	Stakeholders

Standard	Indicator	Reported fully ● partly ◐ not included ○	Link or explanation
102-43	Approach to stakeholder engagement	●	MA Stakeholders
102-44	Key topics and concerns raised	●	Stakeholders Materiality matrix
102-45	Entities included in the consolidated financial statements	●	Annual Report 2020
102-46	Defining report content and topic Boundaries	●	MA Government ownership steering requires government-owned companies to submit reports in a specific format. Ownership policy Materiality matrix
102-47	List of material topics	●	201-1, 201-4, 203-1, 207-1, 301-1, 302-1, 303-5, 305-1, 305-2, 305-3, 305-5, 306-3, 307-1, 401-1, 403-2, 403-3, 403-4, 403-5, 403-6, 403-7, 403-9, 404-1, 405-1, 406-1, 408-1, 409-1, 415-1, 416-1
102-48	Restatements of information	●	No major changes.
102-49	Changes in reporting	○	
102-50	Reporting period	●	Calendar year 2020
102-51	Date of most recent report	●	31th March 2020
102-52	Reporting cycle	●	Annually, typically on March/April
102-53	Contact point for questions regarding the report	●	kirjaamo@vtt.fi
102-54	Claims of reporting in accordance with the GRI Standards	◐	This material references partly to Global Reporting Initiative GRI Standard 2016/2018/2019/2020. The scope is 'Core'-option, however not all criteria are met. Those have been marked in this table as ◐.
102-55	GRI content index	●	This table
102-56	External assurance	○	There are identified non-conformities, no external assurance is used. Situation will be reconsidered each year.
200 (GRI 2016, except 207 (GRI 2019))	Management approach		MA
201-1	Direct economic value generated and distributed	●	AR 6, 8
201-4	Financial assistance received from government	●	AR 8

Standard	Indicator	Reported fully ● partly ① not included ②	Link or explanation
203-1	Infrastructure investments and services supported	●	Annual Report 2020
207-1	Approach to tax	●	Tax footprint, management and control annex
300 (GRI 2016, except 303 (GRI 2018) and 306 (GRI 2020))	Management approach		MA
301-1	Materials used by weight or volume	①	Amount of printings Consumption of paper reams Destruction of white paper
302-1	Energy consumption within the organization	①	Consumption of electricity Consumption of heat
303-5	Water consumption	●	Consumption of water
305-1	Direct GHG emissions	①	Total GHG emissions
305-2	Indirect GHG emissions from energy	①	GHG emissions according to sources
305-3	Other indirect GHG emissions	①	GHG emissions according to sources
305-5	Reduction of GHG emissions	●	VTT purchased CO ₂ -emission allowances from the European emission trading scheme corresponding the amount of VTT's car fleet CO ₂ -emission - 52 tonnes (2019), calculated based on car fleet's specific emission and kilometres driven. This amount has been eliminated from the quota. This is an offset and has not been reduced from VTT's GHG emissions.
306-3	Waste generated	●	Amount of waste Hazardous waste to Ekokem by road (ADR) No hazardous waste exported nor imported. No hazardous waste treated. No hazardous waste shipped internationally.
307-1	Non-compliance with environmental laws and regulations	●	No compliance breaches has been identified.
400 (GRI 2016, except 403 (GRI 2018))	Management approach		MA
401-1	New employee hires and employee turnover	①	New employee hires by age group and gender (no screening by region)
403-1	Occupational health and safety management system	●	MA Whole VTT Group personnel (with the exception of VTT SenseWay Oy personnel) are within OHS management system.

Standard	Indicator	Reported fully ● partly ◐ not included ◑	Link or explanation
403-2	Hazard identification, risk assessment, and incident investigation	●	MA
403-3	Occupational health services	●	MA VTT provides more comprehensive health services than required in legislation.
403-4	Worker participation, consultation, and communication on occupational health and safety	●	MA
403-5	Worker training on occupational health and safety	●	MA
403-6	Promotion of worker health	●	MA AR 27-28
403-7	Prevention and mitigation of occupational health and safety impacts directly linked by business relationships.	●	MA
403-9	Work-related injuries	◐	Frequency and gravity of accidents (not including non-VTT workers)
404-1	Average hours of training per year per employee	◐	Training expenses and days (Education and training costs)
405-1	Diversity of governance bodies and employees	◐	Age structure and gender distribution Share of men and women In VTT's Board there are two women and five men.
406-1	Incidents of discrimination and corrective actions taken	●	No discrimination cases identified.
408-1	Operations and suppliers at significant risk for incidents of child labor	◐	MA Coc 11
409-1	Operations and suppliers at significant risk for incidents of forced or compulsory labor	●	MA Coc 11
415-1	Political contributions	●	No contributions has been rendered
416-1	Assessment of the health and safety impacts of product and service categories	◐	Research concerning health technology and foodstuff, AR 14

beyond the obvious