

The background of the entire page is a high-angle, aerial photograph of Earth from space. The image shows the curvature of the planet, with a bright sun on the right side creating a lens flare and illuminating the clouds. The sky transitions from a deep blue on the left to a bright yellow and white on the right. The clouds are dense and white, covering most of the visible surface.

Fujitsu  
Technology and  
Service Vision  
2021

# The World at an inflection point



Since the unprecedented disruption of 2020, organizations have been faced with a volatile, uncertain business environment.

Fujitsu's global survey\*<sup>1</sup> reveals that 53% of business leaders have had to take action in response to declining revenue during the pandemic.

During this time, digital transformation in organizations has accelerated, sometimes dramatically. Indeed, our survey indicates that 82% of business leaders have advanced the digitalization of their business. It's become clear that 'digital-ready' organizations are more able to manage the impact of the pandemic, with digital becoming a default mode of living and working.

As the world emerges from this period of upheaval, we have an opportunity to take stock and think about the future. We can question the way our organizations work. Are there better ways to do things?

Of course, many of the challenges we faced before the pandemic are still with us. Indeed, many have become more acute. For example, our relationship with the environment is entering a critical phase. Unless the right choices are quickly made, the damage to our lives, economies and our planet will be irreversible. We also continue to face long term global challenges such as an aging population and inequality. In this context, how can we build a stronger, more resilient society, where all people can enjoy a good quality of life?

Today we have reached an inflection point. A gateway from a world that once was, that we will not return to, to a world that has yet to be. The future of our world depends on what we do now.

\*1 Fujitsu global survey overview on page 16



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# Message from the CEO

COVID-19 has had a huge global impact, changing our lives and values dramatically. Infections are still increasing in some areas and many people are facing difficulties. At the same time, digitalization has progressed rapidly, transforming how we live and do business. Now is the time for companies and governments to accelerate their work together to restore normality for everyone as soon as possible.

Last year, during the pandemic, Fujitsu set our purpose: to make the world more sustainable by building trust in society through innovation. To align with this purpose, we also renewed the Fujitsu Way, which comprises the values and the code of conduct for all 130,000 Fujitsu employees, for the first time in 12 years.

To realize our purpose, we are transforming ourselves, working towards creating a better society in line with the direction of the United Nations Sustainable Development Goals (SDGs). We aim to enhance people's well-being and to enable a greener society, using digital technologies to deliver trusted value to our customers.

The Fujitsu Technology and Service Vision outlines our view of a future society based on our purpose, explaining how our technology vision will make it happen. We hope that you will find important insights to support your own transformation. We are keen to be your digital transformation partner, working together toward a better future.



June 2021  
Fujitsu Limited  
CEO & CDXO

*Takahito Tokita*



# Fujitsu Technology and Service Vision

The Fujitsu Technology and Service Vision (FT&SV) provides a foresight into the future we want to build together with our stakeholders. We use a backcasting approach, working out what we need to do now to achieve our stated vision of a desirable future society. At the same time, we use a forecasting method to explore possible future scenarios, looking at emerging signals in macro factors such as environmental, societal, economic and technological advancement. By connecting these two approaches, we identify the most important trends and make recommendations to business and societal leaders.

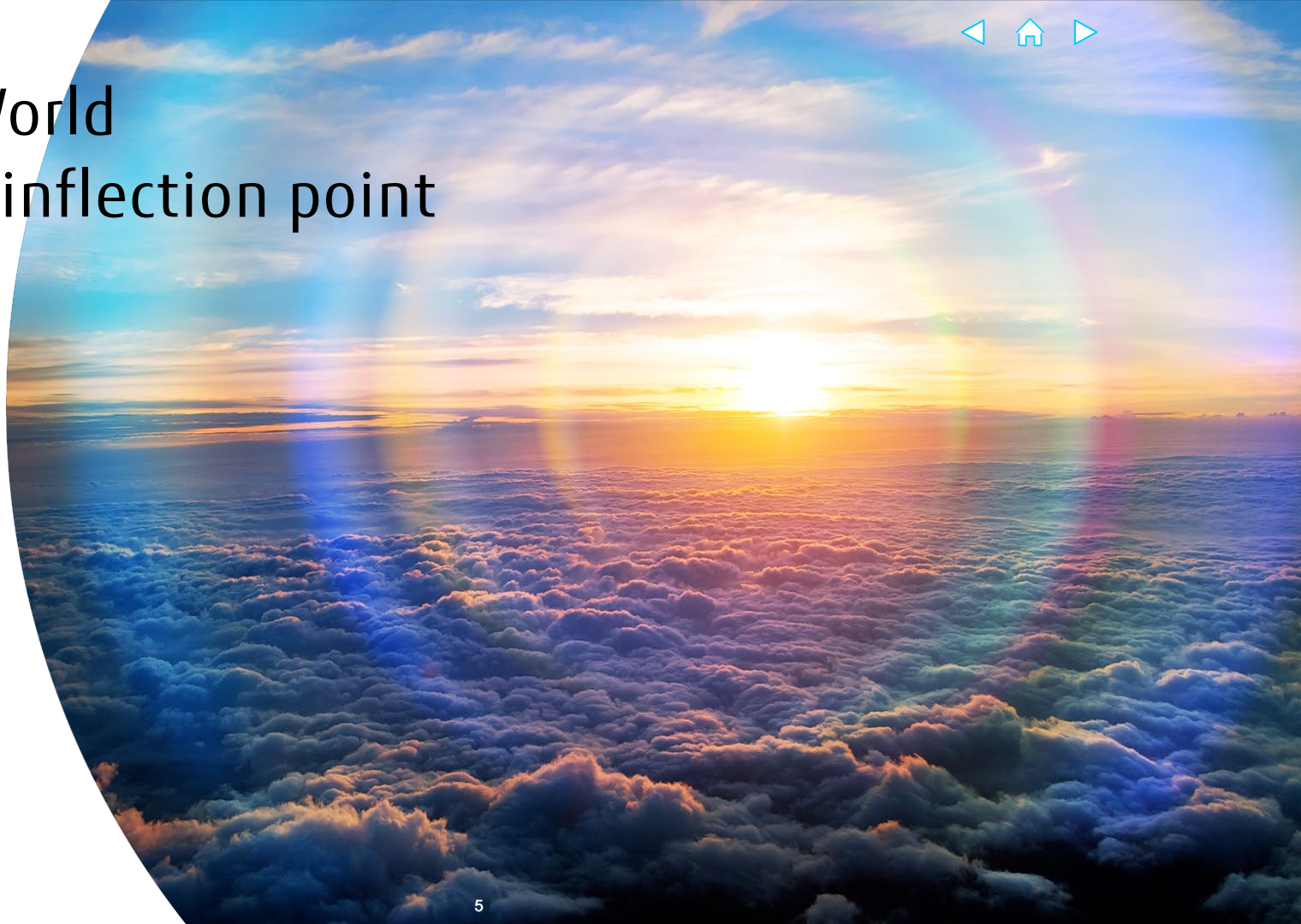
The first edition of FT&SV was published in 2013 and has been updated annually, taking into account ever-changing macro forces and technology advances. Our unchanged principle is 'putting people at the center of everything we do'. Based on this thought, we have explained how Human Centric Innovation will change business and society, and what we can do to make this happen.

In the 2021 edition, the ninth year of FT&SV, we introduce five important trends that will shape the new world after the inflection point. We also explain how our commitment to responsible business will help to build a more sustainable world. We share future scenarios in specific focus areas and outline how technology innovations are already making these future scenarios a reality.



1

# The World at an inflection point





# 2020: The World shut down

The COVID-19 pandemic has threatened our lives, and had a huge impact on social and economic activity. As of May 2021, over 170 million people have been infected, with more than 3.5 million precious lives lost.

Until the vaccine was available, there was no effective mitigation other than avoiding physical contact with other people. As a result, emergency lockdown measures were imposed on many cities around the world, creating major upheaval to both supply and demand. The global economy entered an unprecedented recession. In 2020, global GDP fell by 3.3%, with unemployment rising significantly in many countries. Inevitably, this increased the number of people living in poverty, following decades in which poverty has been decreasing. With an additional 88 million people now living in extreme poverty, more than 700 million people around the world are estimated to live on less than \$1.90 a day.

By restricting people's movement, the pandemic effectively reversed the trend toward globalization. The annual number of people traveling abroad decreased by 1 billion, with the tourism industry's total revenue hit by over \$1.3 trillion. Meanwhile, schools have been shut down around the world, with as many as 1.5 billion students unable to attend physical lessons.

This was a global phenomenon, with these upheavals occurring simultaneously in almost every country worldwide. As a result, an immense number of people experienced the loss and disruption of their normal, everyday lives.

\*1 WHO, \*2 IMF, \*3 \*6 World Bank, \*4 \*5 UNWTO

## Impact caused by the pandemic



# 2020: Responding to the crisis

How have people responded to this crisis?

As cities were shut down or placed in a state of emergency, a significant number of organizations around the world chose to adopt working from home. For example, Fujitsu's 80,000 employees in Japan shifted to remote working immediately upon the state of emergency being declared. We listened to our colleagues to find ways to fundamentally improve the well-being of over 130,000 employees around the world. This has led us to adopt a completely new hybrid working model that allows our people to work remotely.

Digital technology played a major role in responding to this crisis. Working from home has led to a rapid rise of online conference traffic worldwide. At the same time, online shopping at home has grown, boosting the annual global e-commerce market by 27.6%.<sup>\*1</sup> Many schools have also begun offering online education. A senior executive of a university told us, "What we've been discussing for years became a reality in just a week".

It is truly humbling and commendable that healthcare professionals have exposed themselves to the risk of infection while devoting themselves to the treatment of patients around the world. The pandemic has highlighted the critical importance of well-being. Senior executives have seen how the health and happiness of employees and their families, as well as customers and communities, underpins the ongoing success and sustainability of their businesses.

<sup>\*1</sup> Insider Intelligence





# Into the human era

## What should this future look like?

What is beyond the inflection point?

We believe it must be more firmly oriented around people. Until now, organizations have used rigid business structures to drive efficiency, increase profits and deliver value to a limited range of stakeholders. The future, however, is about flexible workplaces and flexible business processes. Organizations need to understand where they fit in society, delivering value to multiple stakeholders and being socially responsible.

Organizations have previously defined themselves as B2C (Business to Consumer) or B2B (Business to Business). But this new era will be 'Business to Everyone' (B2E), building everything they do around people.

B2E requires businesses to focus on the needs of all people, whether that's employees, customers, or citizens of society at large. B2E is about organizations becoming relevant to everyone.

### Providing human-centric value



## B2E Business To Everyone

# Priorities in a new world

## What are the priorities in the post-pandemic new world?

According to Fujitsu's survey, business leaders recognize the importance of resilience, the capability to respond to changes, as the top priority in the post-pandemic world. Many business leaders also noted that business process automation and data-driven management as well as providing seamless customer experience (where online merges with offline) were critical. In addition, human-centric management (empowerment) was cited as important, along with purpose-driven management, trust from customers and communities, and ecosystem business models.

Based on our survey and dialogues with business leaders, we have therefore identified five trends that will shape the new world. We introduce four trends that characterize how organizations will change, and the fifth trend that underpins and accelerates them.

Important to business in the new world after COVID-19





# 5 trends

1

## Sustainability first



- Sustainability is increasingly important for business.
- A positive contribution to society is now an indicator of business success.

3

## Borderless lives



- Borders between office and home, physical and digital, urban and rural are increasingly blurred.
- Maximizing people's potential and well-being.



2

## Finding resilience

- Shift to focusing on resilience instead of efficiency in the era of uncertainty.
- Flexible and agile management driven by real-time data.



5

## Trusted automation

- Integrating trust and ethics into the use of technology and enabling automation in collaboration with people.
- Prediction-based business becomes mainstream



4

## Business is ecosystems

- Ecosystems of organizations become the key mechanism for creating business value.
- Success is dependent on the co-creation of experiences across the ecosystem.



# 1

## Sustainability first

The challenges of climate change are threatening the sustainability of our planet. Creating an equal society where no one is left behind has become an urgent imperative that business can no longer ignore.

The pandemic changed the mindset of business leaders. In our global survey, 78% of business leaders said the importance of delivering value to society had increased as a result of COVID-19. We also found that 71% of organizations planned to increase their contribution to society in line with the United Nations Sustainable Development Goals (SDGs).

The stakeholders of organizations, including shareholders, customers, employees and the communities and wider society they support, are increasingly demanding ethical behavior and a greater contribution to solving environmental and societal challenges.

Business goals need to be aligned with societal goals. Purpose has a critical role to play. Being purpose-driven allows organizations to remain relevant to customers, employees and wider society.

How can we address these difficult challenges? In our survey, 91% of business leaders told us digital transformation had helped them to deliver societal value. Digital technology has rapidly become a key enabler of innovation, driving sustainability and wider benefits for society.

### Environmental and social issues are becoming more serious

Climate change	Aging society	Inequality	Food loss and waste	Plastic pollution in the ocean

### Sustainability is a management priority

- 78%** The COVID-19 pandemic has increased the importance the organization places on delivering value to society
- 71%** Plan to increase the organization's contribution to society in line with the United Nations SDGs
- 91%** Digital transformation helped the organization to deliver value to society

**Questions**

- ✓ What role will your organization play in driving sustainability?
- ✓ How can you ensure that delivering social value is part of the way your business operates?



## 2 Finding resilience

More than ever, organizations need to operate in a state of constant evolution. The pandemic was a once-in-a-lifetime shock, creating unprecedented turmoil and continuing disruption.

In amongst the chaos, new management priorities have emerged. In our survey, resilience was chosen as the most important objective for businesses in the post-pandemic world.

In the old world, organizations focused primarily on the efficiency of their operations. Maximizing output while minimizing cost. However, now, we need to put more weight on resilience than efficiency.

Resilience goes hand in hand with adaptability. In our global survey, organizations that responded effectively to changes caused by the pandemic cited three main reasons for their success. Firstly, they were agile in their response. Secondly, they had already digitalized their business or had accelerated the digitalization process. Thirdly, they had made employee well-being their top priority.

In these uncertain times, the capability and culture to enable agile transformation and human-centric management are crucial. In addition, it's essential to sense what is likely to happen outside the organization, using real-time data instead of relying on past experience.

### The reasons organizations have been able to effectively respond to changes caused by the pandemic

- 1<sup>st</sup> We were agile in how we responded to the changes 49%
- 2<sup>nd</sup> We were already prepared because of the digitalization of our business, or we were able to accelerate digitalization rapidly 42%
- 3<sup>rd</sup> We put employee well-being as our first priority 40%

Questions

- ✓ What measures are needed to increase the agility of your organization?
- ✓ What data would help you sense how your external business environment is changing?





# 3

## Borderless lives

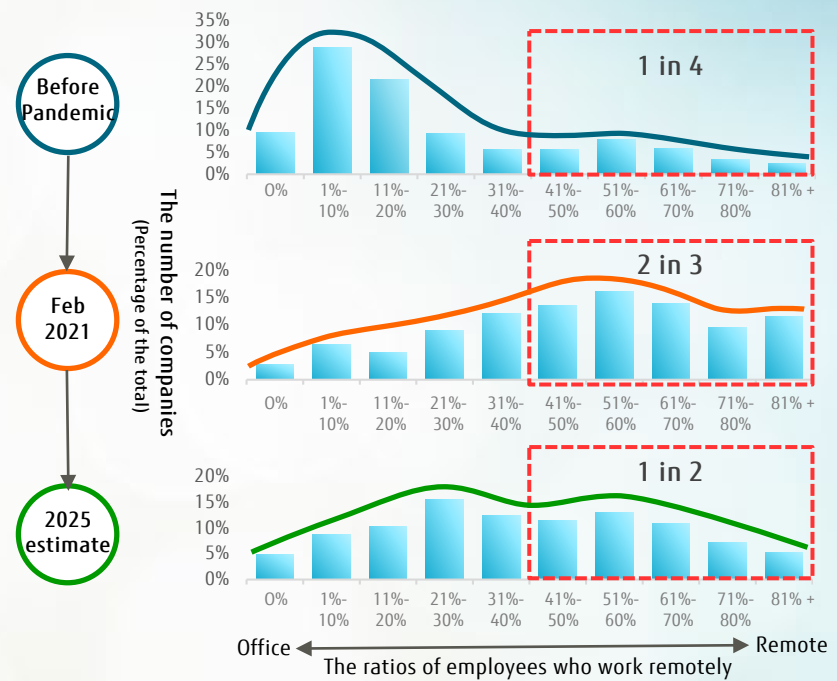
Work and home life were once completely separate. However, in 2020, home replaced the office as the workplace. According to Fujitsu's global survey, two out of three organizations reported that their employees are now working remotely for more than 40% of their total working time.

Of course, remote working has created fresh challenges. How do people still co-ordinate and collaborate effectively? How do you best manage a remote workforce? It's clear that people remain an organization's most important asset. In our survey, 89% of leaders said the well-being of employees will have a major impact on the mid to long-term performance of their business.

As we move past this inflection point, how will people live and work? In our survey, half of organizations expected more than 40% of employees to work remotely in 2025, even after the pandemic is over. Managers expect hybrid working to become the norm, rather than returning to traditional workplaces.

Physical experiences and digital experiences, and the concepts of office and home, are converging. What are the implications for our cities? The population in Tokyo decreased in eight consecutive months during the pandemic, the first time this had ever happened. Similar trends are happening in other countries, as people move to work remotely. Some companies are moving their offices away from urban centers. We have the opportunity to rebuild a more decentralized society, where people can work wherever they want to live.

### Shift to hybrid-working



- Questions**
- ✓ What new opportunities will come from hybrid working and how will we address the risks?
  - ✓ How will you use technology to get the best out of your people?



# 4

## Business is ecosystems

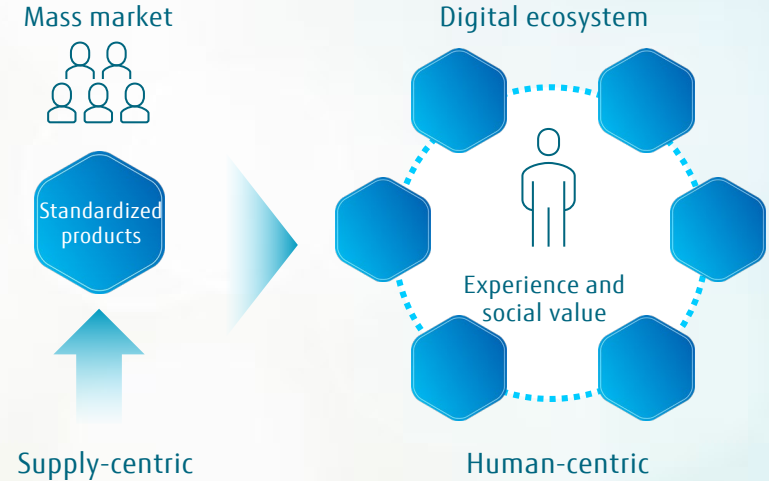
In the industrial era, businesses created supply-centric value chains within specific vertical industries, producing standardized products.

However, digitalization is rapidly breaking down vertical industry silos, replacing them with an ecosystem business model that co-creates services and experiences, built around people's needs and lifestyles. For example, financial services are becoming invisible through blending into other services such as education, healthcare and daily shopping or real estate transactions. Automobiles are becoming mobility services. Cross-industry ecosystems make this kind of transformation possible.

The pandemic accelerated digitalization significantly, making this transformation irreversible. In the new world, ecosystems with data and digital technologies are becoming the mainstream of business.

So, what should we do now? We have looked at environmental and social issues in the 'Sustainability First' trend. These difficult challenges are faced by governments, companies, as well as consumers across many countries and industries. Solving these systemic challenges is impossible with individual efforts alone. An ecosystem approach based on transparent and reliable data is essential. We need to share a vision for a new society where we can all co-create social value.

### Shift to an ecosystem business model that co-creates human experience and social value



- Questions**
- ✓ What organizations or industries are part of your ecosystem?
  - ✓ What data would you need to maintain and grow successful ecosystems?

# 5 Trusted automation

Technology and data underpin and enable all four of these trends.

In the post-pandemic new world, data plays a major role in every aspect of business processes. In our survey, 79% of organizations said that the use of data is now a key tool in responding to the challenges of COVID-19, while 83% reported that data-driven management is essential to stay competitive in the future. What will business operations look like in the new world? Our survey found that 82% of business leaders were planning to increase their investment in automation. Moreover, 44% of business leaders expect that more than half of business processes that had not yet been automated would be automated by 2025.

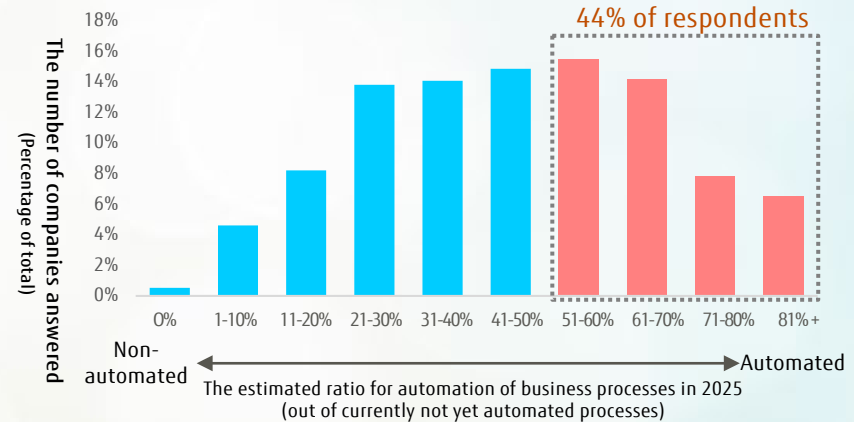
We need to redesign the way people and technology work together in these data-driven, highly automated businesses. Naturally, there are tensions between them, including the impact of automation on employment. How do we solve this challenge? Ethics are essential to good management, while technology must be trusted by people. People and technology need to collaborate to solve social issues and make the world more sustainable.

## Data-driven and Automation

**83%** Data-driven management is essential for the organization to stay competitive in the future

**82%** Intend to increase investment in automation of business processes

**44%** More than 50% of current business processes that are not yet automated will be automated by 2025



### Questions

- ✓ How do you ensure that trust and ethics are built into your plans for automation?
- ✓ How will you build stronger partnerships between people and technology?





# Survey Overview

Fujitsu has conducted a global survey to understand the status of digital transformation in organizations and the initiatives of business leaders in specific strategic themes.

This survey was conducted from January to February 2021, targeting 1,200 business leaders from 6 industries across 9 different countries. Results from the survey provide valuable insights into the changes in the business environment caused by the COVID-19 pandemic. The figures referred to in Fujitsu Technology and Service Vision 2021 are the results of responses from 605 organizations, excluding pure-online service organizations.

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	Target countries	Japan, US, Australia, UK, Germany, Spain, France, Singapore, China
	Industry	Manufacturing, Transportation, Wholesale/ Retail, Financial services, Healthcare, Government
	Organizations	More than 100 employees and more than \$100 million revenue in the last year
	Respondents	CxOs and decision-makers
	# of Samples	1,200
	Methodology	Online

# Purpose and Sustainability **2**



# Purpose-driven society

Aside from the obvious disruption caused by the global pandemic, we face many long-term societal challenges, from climate change and industrial pollution through to aging populations, well-being and inequality. These are complex issues that cannot be solved by individual governments alone. How should business leaders face these challenges?

The mindset of business leaders around the world is changing rapidly. According to Fujitsu's global survey in 2020, 92% believe that providing value to society is important for the mid-to-long-term sustainability of their business. It's clearly becoming essential to align business goals with societal goals. The United Nations Sustainable Development Goals (SDGs), set out in 2015, provide shared goals for a better world. We need co-ordinated, collaborative strategies to achieve these goals by 2030.

In this module, we introduce Fujitsu's purpose, steps on the transformational journey toward a regenerative society, and our commitment to responsible business, including our contribution to SDGs and a decarbonized world.



## SUSTAINABLE DEVELOPMENT GOALS





# Our purpose

*To make the world more sustainable by building trust in society through innovation.*



The world has become more interconnected with ever-increasing complexity, facing many difficult challenges. Technology has a great power to solve them. As a global company with a long history of delivering technology-based value to customers, it is our responsibility to contribute proactively to the transformation of society.

Fujitsu announced our purpose in 2020. We will focus all our resources on making the world more sustainable by building trust in society through innovation.

But how can we empathize people's challenges, and collaborate and act with agility to create solutions that make a positive impact to the environment and society? This requires each one of us to deeply think about our purpose and internalize it as our own individual agenda.

To help our people to embrace our purpose, we have started a program called Purpose Carving. This helps individuals to carve out their own purpose, helping them think about how this intersects with Fujitsu's overall purpose. Starting with the Fujitsu management team, we are rolling this program out to our people around the world.

# Toward 2030

In order to build a sustainable society where no one is left behind, we need to connect people, communities, organizations, things and data, to deliver value that's focused around people and to generate innovation that solves societal challenges.

In accordance with our purpose, we're committed to delivering trust in society through innovation. We believe the following three elements are crucial for enabling such innovation. Firstly, a human-centric approach that improves people's well-being and respects their individual needs and dignities. Secondly, predictive and preventive methods to strengthen resilience against ever-growing uncertainty. Thirdly, connected services that can solve increasingly complex societal issues. We need to combine all three of these elements.

## Connected

Create a trusted digital society where people can enjoy secure, connected lives, co-creating innovative services by connecting data and knowledge.

## Human-centric

Provide personalized services that help people to maximize their potential without leaving anyone behind.

## Predictive and preventive

Build a digital society where people can live prosperous and healthy lives through predictive and preventive methods. Use real-time data to develop the most effective measures.



Trust in society

# Steps on the digital journey

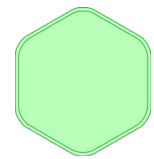
In order to transform into a more trusted society, we need a step-by-step approach that strengthens resilience, delivers greater value to society and co-creates new value through ecosystems.

In order to solve complex social challenges, it's essential to adopt an ecosystem model, in which many organizations share their knowledge and skills.

This is the roadmap to creating a more trusted business and society. If an organization fails to maintain the trust of their stakeholders, they will not be sustainable.

## 1 Strengthening resilience

- Strengthen resilience through digitalization.



## 2 Becoming more relevant

- Transform existing business to deliver greater value to society.



## 3 Evolving into an ecosystem business model

- Develop an ecosystem business model that co-creates social value.





# Regenerative society and connected ecosystems

As we move into the human era, traditional vertical industry structures are collapsing, replaced by new ecosystems capable of providing the value people need.

Connecting data from end to end is key to the success of these new ecosystems. This will enable transformation from a mass production and mass consumption economy to a circular economy, with the potential to address the environmental and social issues created by economic growth.

Until now, we've used financial value as a common global performance indicator. Our economy and society are deeply rooted in the flows of financial value. We now need to think about shifting to a more purpose-driven society, where non-financial, intangible value, as well as financial value, flows throughout society. Such non-financial value must correspond to common goals of society and has to be validated in a trusted way. For example, the amount of CO<sub>2</sub> emitted, and renewable energy used, by each organization in the entire global value chain needs to be evaluated as intangible value.

Fujitsu enables new ecosystem business models by connecting various services with trusted data and turning this data into value.










# Responsible business

As environmental and social challenges such as climate change, pandemics and growing inequality become more pressing, management must take all stakeholders into consideration. In order to fulfil our responsibility as a global company, Fujitsu sets out our key sustainability management agenda as Global Responsible Business (GRB). For each of the seven key agenda items, including human rights, diversity and inclusion, well-being, the environment, compliance, supply chain, health and safety, and communities, we have created clear visions, including annual KPIs for 2022.

We are confident that these activities will generate greater trust from customers and communities, as well as even stronger engagement with employees. To evaluate the success of these measures, we set non-financial indicators, including employee engagement, customer Net Promoter Score and DX indicators, in addition to traditional financial indicators like revenues and profits. In this way, we aim to achieve sustainable growth with well-balanced financial and non-financial performance targets.

## Global Responsible Business

Human Rights, Diversity & Inclusion	Well-being	The Environment	Compliance	Supply Chain	Occupational Health and Safety	Community
 <p>Give consideration to human dignity and conduct human-centric value creation in corporate activities; respect diversity and foster a corporate culture in which everyone can contribute while remaining true to themselves.</p>	 <p>Create an environment where all employees can work with vitality and provide employees with opportunities to realize self growth and to take maximum advantage of their talents.</p>	 <p>Help address environmental issues by implementing climate change counter-measures that contribute to the achievement of the Paris Agreement's 1.5° C target by providing innovative solutions.</p>	 <p>Ensure that employees of all organizations are rigorously informed about the Fujitsu Way Code of Conduct; cultivate awareness of higher levels of corporate ethics, including societal norms; and act with sincerity.</p>	 <p>Realize procurement in the Group's supply chains that is highly diversified and which takes responsibility for human rights, the environment, and health and safety.</p>	 <p>Give first priority to ensuring safety as well as sound physical and mental health and provide safe, healthy workplace environments that reflect the circumstances in respective countries and regions.</p>	 <p>Conduct activities with a heightened sense of empathy for societal issues and create favorable socioeconomic impacts; and connect created impacts to even greater value.</p>

# Contribution to the SDGs

To realize responsible business, we understand the importance of creating the correct mindset with our employees, including raising their awareness of global challenges. In 2020, Fujitsu rolled out a new SDG Community called Kizuna. This is now being extended across multiple regions including Japan. This is a platform for employees to voluntarily select one of the SDGs and allocate a portion of their time to collaborating and sharing relevant ideas and information with their colleagues. Here are some examples of activities already underway.



## Costa Rica

We partnered with Voces Vitales in Costa Rica to deliver a year-long mentoring program, focusing on gender equality in the workplace.



## Poland

We provide on-line learning tools to help our employees' children understand the importance of being responsible, caring citizens, covering topics such as human rights, the environment and mindfulness.



## Portugal

We have built a long-term relationship with the PIN Academy, delivering workshops and upskilling young people with neuro-diverse conditions.



## Malaysia

Our employees have held virtual cultural celebrations for employees and their families, helping all employees explore and celebrate different cultures.



## Russia

We provided vital supplies of food and cleaning equipment for animal shelters. As a result, we were proud to receive the Best Social Project award from Kazan City Council.



## India

We work with HelpAge India towards protecting the rights of India's elderly and providing relief to them to enable them to live better and healthier lives.



## China

We work with a Children's Welfare Home in Xi'an, with support and donations, including books, clothing, and toys.



## Philippines

Our education collaboration with The Makabata Foundation and SOS Children's Village has helped provide valuable life lessons ranging from IT skills through to Japanese culture.



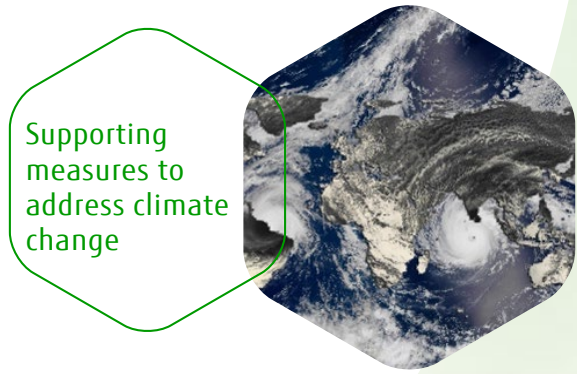
# Our approach to environmental issues

The world is moving toward decarbonization. Climate change is widely recognized as a critical problem that threatens human existence. More than 120 countries, including Japan, and the European Union, have already declared that they will reduce net CO<sub>2</sub> emissions to zero by 2050.

As a global technology company, Fujitsu is proactively contributing to a decarbonized society. We're working to achieve zero CO<sub>2</sub> emissions from our own operations, to help our customers and society decarbonize and to mitigate the damage caused by climate change.

In 2017, Fujitsu announced that we will reduce our CO<sub>2</sub> emissions to zero by 2050. We are currently working to accelerate this initiative. We've set out nine targets from the perspectives of climate change, resource recycling and co-existence with nature. Furthermore, we raised the target for reducing the total volume of greenhouse gas emissions at our business sites in 2030 from 33% to 71.4% of that in 2013. Our new target was certified as '1.5°C level' of SBT\*<sup>1</sup>, updated from 'well below 2°C', which we acquired in 2017.

\*1 Science Based Targets: A global initiative for setting corporate GHG reduction targets based on scientific evidence.



# Working for a decarbonized society

We're already implementing various activities towards achieving a decarbonized society. In February 2021, Fujitsu announced that 100% of the electricity required to operate Fujitsu's cloud service FJcloud in Japan will be renewable by FY2022. Customers using Fujitsu FJcloud will be able to achieve zero CO<sub>2</sub> emissions for their related operations, helping them to achieve their decarbonization goals. In addition, we're working with customers in various industries to reduce CO<sub>2</sub> emissions by optimizing production and distribution and by promoting the wider use of renewable energy.

In addition, Fujitsu is working on transforming logistics that will lead to reduction of CO<sub>2</sub> emissions. For example, we're collaborating with Toyota Systems using Fujitsu's quantum computing technology, Digital Annealer, and real data in North America to transform the efficiency of large-scale logistics. Digital Annealer solved the problem of searching more than 3 million routes to procure parts from hundreds of suppliers, distribute through several transit warehouses, and deliver them to dozens of plants. It helped to optimize the number of trucks, total mileage and sorting work. By carrying out a large number of optimization calculations in a very short time, we were able to identify new effective logistics routes, improving loading efficiency and reducing the number of trucks and total travel distance. We are confident that this technology will contribute to the reduction of CO<sub>2</sub> emissions in logistics operations.

We will also use digital technologies and data to strengthen resilience to natural disasters caused by climate change, helping create a society where everyone can live with peace of mind.







# 3 Scenarios for the future



# Toward a better future

**Fujitsu is keen to be your digital transformation partner, working with you to address the challenges facing business and society. By bringing together our integration capabilities and cutting-edge technologies, we can support your success and contribute to a more sustainable world.**

How will business and society change over the next five to ten years? If we look back from the future, what strategies will we need in the next two to three years? And how can Fujitsu help you in this process?

In this module, we explore transformation scenarios across manufacturing, consumer experience, healthy living, trusted society, and business management.

Sustainable Manufacturing



Consumer Experience



Healthy Living



Trusted Society



Business Transformation



# Sustainable Manufacturing

## The future of manufacturing

### Greener industry

Manufacturing is a very significant sector, accounting for 15% of global GDP<sup>\*1</sup>. In recent years, the environmental impact of manufacturing has become a major issue, accounting for 20% of CO<sub>2</sub> emissions<sup>\*2</sup> and creating significant waste through supply and demand mismatches.

On the other hand, global supply chains revealed vulnerabilities against unexpected turmoil caused by the pandemic and natural disasters.

What kind of transformation is required to minimize environmental impact? How can manufacturers gain the capability to effectively respond to changes under the extremely uncertain world? It is clear that entire ecosystems need to be rebuilt to embrace the principles of resilient, circular manufacturing.

1

Human  
augmentation  
by digital

2

Resilient  
supply chain

3

Circular  
manufacturing

\*1 \*2 World Bank





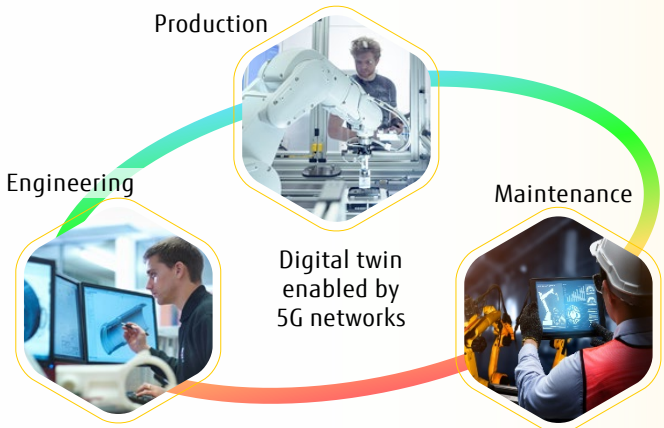
1

# Sustainable Manufacturing

## Human augmentation by digital

Digital technology will augment human capabilities. Bringing together people with a complementary digital workforce\*1 will change the landscape of manufacturing, improving productivity as well as well-being.

Trusted AI technology will empower people, allowing them to work more creatively and productively in various processes of manufacturing. In addition, technology will enable effective remote collaboration and process management even during a pandemic, supporting borderless work and lives.



Fujitsu provides the COLMINA service platform for digital transformation in manufacturing. We help organizations build new processes, using digital technology to empower people across the entire scope of their operations.

### Innovating production line

We are helping engineers to calculate the optimum positions of human workers and robots, assessing their movement in the digital space to evaluate and continuously improve actual workflows. Training in the digital space is also effective in responding to decrease of experienced workers in an aging society.

### Integration of AI

Our AI-based solutions detect the early signals of abnormalities, enabling preventive maintenance to take place. AI is also widely deployed in quality inspection. For example, by using AI to detect defects in aircraft parts, GKN Aerospace has successfully created new levels of production and service efficiency.

### Engineering in the digital space

By enabling engineers to use 3D digital mock-ups, we help them front-load their remote design reviews and therefore optimize production processes. High-speed low-latency 5G networks enable use of video and other data across the entire processes.

Module 4 P53, 54  
Borderless Experience

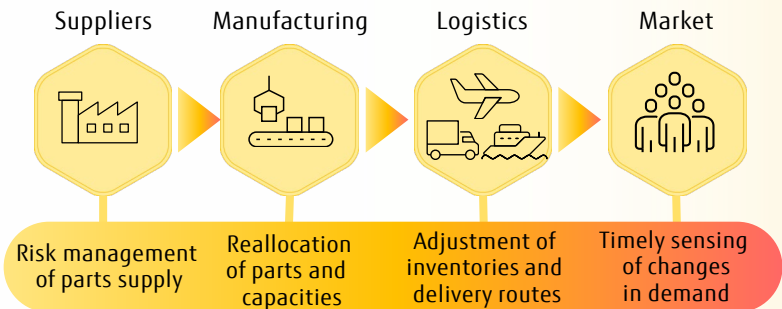


\*1 Software robots driven by digital technology like AI

# 2 Sustainable Manufacturing Resilient supply chain

To grow in an uncertain world, it is imperative to drive the entire value chain of manufacturing using digital technologies, responding to unexpected changes with agility and flexibility.

It is key to sense changes in demand in the market and occurrences of disasters in supply chains in real time. By exploiting data and digital technology, organizations can dynamically manage modularized processes of supply, manufacturing and logistics, improving the anti-fragility of their operations.



Fujitsu helps organizations to visualize their operations across their entire value chains. We further support modularizing their processes, enabling dynamic management of operations and strengthening resilience.

### Responding to demand volatility

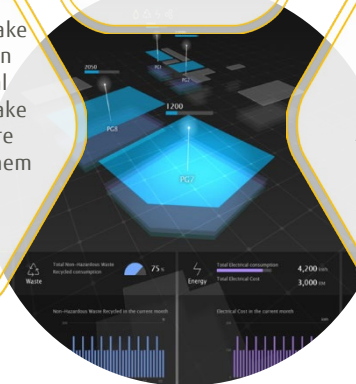
We help organizations to quickly and dynamically adjust procurement of parts and modular production processes, in response to change in demand.

### Visualizing risks

We help organizations to make an immediate assessment on the likely impact of a natural disaster such as an earthquake or flooding across their entire supply chains. This allows them to quickly take counter-measures including use of alternative suppliers.

### Optimizing manufacturing and logistics operations

Fujitsu's quantum computing technology Digital Annealer and AI technology enable immediate optimization of complex production scheduling, warehouse operations as well as delivery routing.

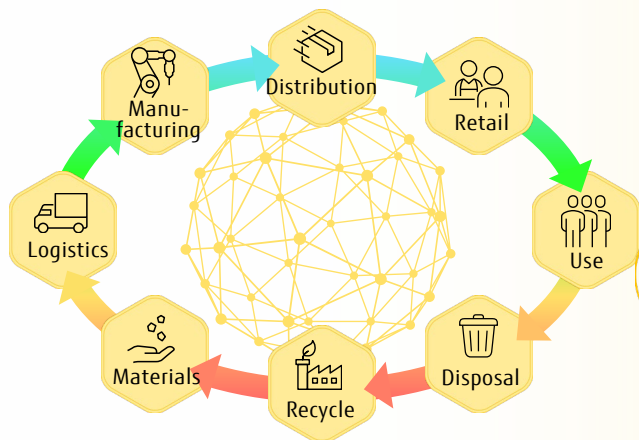




# 3 Sustainable Manufacturing Circular manufacturing

By connecting end-to-end ecosystems, from production to consumption, reuse, disposal and recycling, we can transform manufacturing to protect the global environment.

Transparent traceability is essential to visualize where and how materials are made for products. In order to reduce food loss and waste, industrial waste and CO<sub>2</sub> emissions, all ecosystem players, from producers to consumers, need to collaborate using trusted data.



At Fujitsu, we implement a responsible, green approach to procurement and environmental management across our global operations. We are also pioneering design engineering techniques focused on environmental protection, while using digital technology such as blockchain to connect trusted data, helping to realize the potential of circular manufacturing.

### Engineering for a greener world

We relentlessly pursue environmentally-conscious product development, focusing on material selection and end-to-end value chain planning to achieve the best possible recycling outcomes.

### Green procurement

As a member of the global Responsible Business Alliance, Fujitsu promotes CSR procurement, together with our partners, and provides a range of green procurement solutions, including chemical substance management.

### Traceability

Fujitsu helps organizations realize end-to-end traceability using blockchain technology. AB InBev, one of the world's largest brewers, is building a blockchain solution that links each part of the brewing process from barley farms to breweries, giving consumers transparency into what goes into making their beer. The project provides a full end-to-end view of the supply chain and it can also help to advance agricultural development by improving growers' yields, water, and energy efficiency, as well as soil health.



## Consumer Experience

# The future of customer experience

## Centered on individuals

The global pandemic has significantly shifted people's buying behaviors toward digital. According to Fujitsu's recent survey, 72% of companies said their customers wanted online access, with 83% having recently strengthened their online services through mobile and the Web.

How will the customer experience change in this environment? From Fujitsu's survey, 78% of business leaders believe that the offline and online customer experiences will merge seamlessly. On the other hand, we cannot discount the value of physical experiences. 64% of online companies told us that there is unique premium value in face-to-face experiences, which are not possible online. And 79% expressed their intentions to pursue offline business, for example, through opening physical stores. Once separate entities, it is clear that the border between the physical and digital worlds is disappearing. The key for success is how we can deliver a converged customer experience, reflecting individual needs and preferences.

**1**

Physical and digital convergence

**2**

Meeting unexpressed needs

**3**

Ecosystems for people's lives





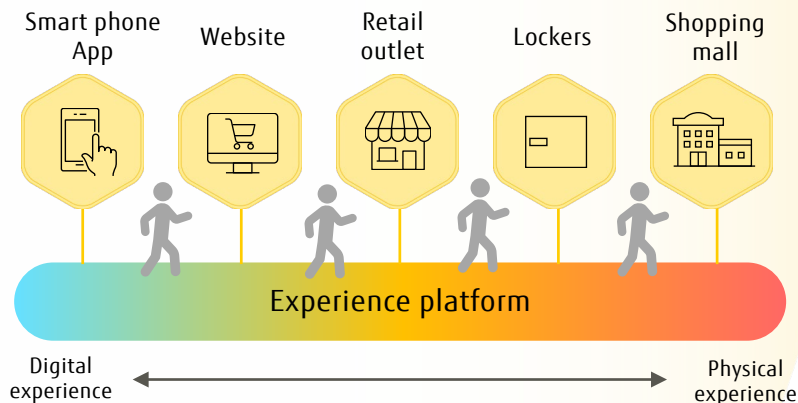
1

# Consumer Experience

## Physical and digital convergence

In the modern world, customers are always connected to digital. It is essential to provide them with a borderless, human-centric experience that spans both the physical and digital spaces.

The online experience is merging with offline experience. For example, many people already order online and collect in-store, even using their smartphones to make purchases while inside a store. What will come next?



While digital is becoming a default mode, the importance of face-to-face communications is being re-evaluated. Fujitsu uses digital technologies to connect physical and digital customer touch points, helping businesses to transform their customer and employee experiences in a balanced way.

### Improving employee experience

We also provide IoT, AI and robotics solutions to automate in-store operations, enabling staff to spend more of their time helping customers.

### Innovating customer experience

We are already enabling converged physical and digital customer experiences; for example, creating unmanned store solutions using sensors and AI, as well as a walk-through checkout solutions using smartphones.

In Korea, Be Good Friends combines Fujitsu's PalmSecure authentication solution and AI technology to realize the vision of an unmanned convenience store.



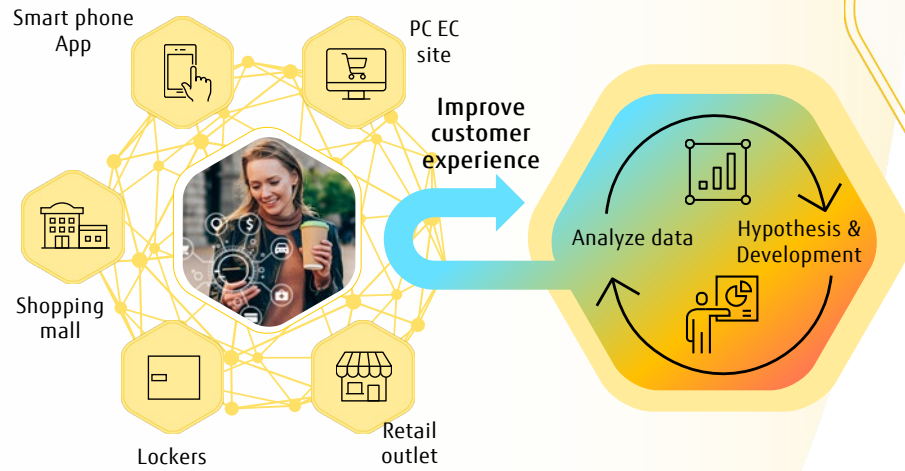
Module 4 P53, 54  
Borderless Experience



# 2 Consumer Experience Meeting unexpressed needs

**By being always connected with customers, you are better placed to anticipate their potential needs and satisfy them.**

It is becoming extremely important to predict what a customer might want at a certain place and time, instead of waiting for an expressed demand. Continuous analysis of individual behavioral data enables you to meet these unexpressed needs, helping you realize customer success.



A key feature of digital business is the ability to engage continuously with customers, using data to improve their experiences in an agile fashion. Fujitsu provides data analytics and video analysis solutions to find what customers might want to do.

## Forecasting and automatic ordering

Fujitsu provides an AI-based automatic ordering solution that manages inventory and forecasts demand based on real-time data. This helps solve challenges like food loss and waste, through improving supply chains.



## Customer behavior analysis

The behaviors and attributes of customers can be identified from real-time video images using Fujitsu's AI technology. We enable analysis of customer behaviors while also protecting individual privacy. AEON Retail, the largest retailer in Japan, uses our AI-based video analysis solution to detect store congestion and quickly identify customers who need assistance. This allows them to notify their staff accordingly, so that they can maintain safe and secure store operations and improve customer experiences. AEON Retail is already working on further areas of data-driven in-store transformation.



# 3 Consumer Experience Ecosystems for people's lives

Various services are being digitally integrated in other services, to support individuals in their daily lives.

The borders of existing industries are falling away. Increasingly, many services are being connected and delivered based on the needs of individual consumers. The development of new ways to connect services and exchange data between different sectors is accelerating. At the same time, self-sovereignty identity is becoming important to properly protect private data.



Fujitsu has deep experience and expertise in deploying technology across a wide range of sectors, from retail, distribution, finance and manufacturing through to public services and healthcare. By linking different sectors with digital technology and trusted data, we are helping to develop ecosystems that support individuals in their daily lives.

**IDYX (IDentitY eXchange)**

Fujitsu has pioneered a self-sovereignty distributed ID technology based on blockchain. JCB, Mizuho Bank and Fujitsu jointly conducted a proof of concept based on distributing digital IDs using IDYX. Our intention is to enable people to share their private data with confidence.

**API economy**

Fujitsu is also developing and deploying an innovative cloud-based Banking as a Service (BaaS) platform. By providing a rich set of APIs, this enables organizations across various sectors to easily integrate financial services into their products and services.

**Multiple biometric authentication**

Fujitsu provides a multi-biometric authentication solution that combines our PalmSecure vein authentication technology with facial recognition and other technologies. With this rapid, contactless solution, we are contributing directly to the creation of a safe and secure global digital society.

## Longer and healthier lives

The pandemic has reminded us of the importance of health. It is also important to remember that older and lower-income groups were affected more seriously. What should we do to allow everyone to live healthy, fulfilling lives?

It is forecast that, by 2050, one in six people in the world will be 65 years or older. The aging of Japanese population, for example, presents a specific challenge, as it is expected that one out of every 2.5 people will be 65 years or older by 2050, up from one out of every 3.5 people today.

It is a common global challenge that people will live longer and healthier lives. The combination of medical and personal health data with digital technologies will play an important role in improving the well-being of all people.

1

Personal  
health

2

Life science  
innovation

3

Smart health  
ecosystem

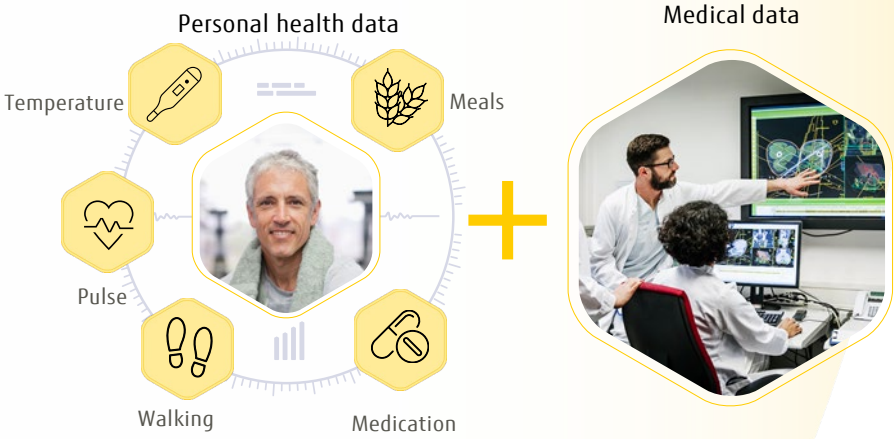


1

# Healthy Living Personal health

Healthcare will evolve into well-being services that not only treat medical conditions but also improve the health of individuals.

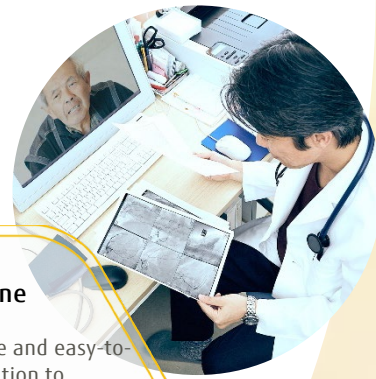
It is important to connect personal health data monitored through wearables and behavioral data like eating habits with medical records and genome information. By analyzing the combined data, we can prevent some medical conditions by improving lifestyles and providing more personalized treatment plans.



Fujitsu is supporting the development of personalized medicine and the improvement of individual health by connecting various data sources that are currently located separately. In this way, we contribute to achieving a society where everyone can live a healthy life.

### Well-being

By linking medical data such as electronic medical records with health data held by companies that provide health-improvement services, Fujitsu is helping the development of new personalized treatment and well-being services.



### Telemedicine

Fujitsu provides a safe and easy-to-use telemedicine solution to support healthcare, with particular relevance during the pandemic. This smartphone-based solution enables remote booking, video calls and payment, connecting with Electronic Medical Records in order to streamline hospital operations.



2

# Healthy Living Life science innovation

The fusion of life science and computer science is creating significant innovation in drug discovery and medical treatment.

For example, the time-consuming drug discovery process can be shortened by deploying quantum computing technology and supercomputers to quickly process large amounts of data in the digital space. In addition, trusted AI technology will help analyze medical big data and genome data to find effective new treatments for intractable diseases, including cancer.



In addition to world-leading supercomputers and explainable AI technology, Fujitsu has developed innovative quantum computing technology – the Fujitsu Digital Annealer - that can solve combinatorial optimization problems instantly. We are applying all these technologies across the life science field, co-creating innovations for drug discovery and genomic medicine with research institutions and our enterprise partners.

### AI technology

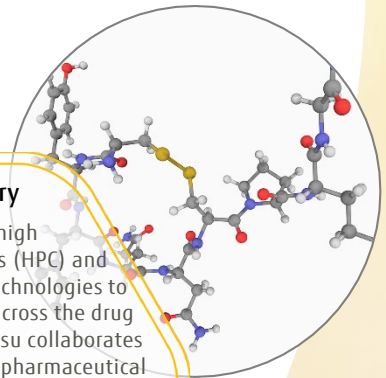
Our explainable AI technology is contributing to advancing genomic medicine for cancer. We have also developed an AI-based CT-scan image recognition solution with Tokyo Shina-gawa Hospital, with the aim of supporting more rapid diagnosis of COVID-19.

➔ Module 4 P57, 58  
Genomic medicine by AI

➔ Module 4 P59, 60  
Quantum computing

### Drug discovery

We are leveraging our high performance computers (HPC) and quantum computing technologies to help drive innovation across the drug discovery process. Fujitsu collaborates with PeptiDream, a biopharmaceutical provider, to innovate drug discovery processes using Fujitsu Digital Annealer and HPC. In addition, PeptiDream, Fujitsu, Mizuho Capital, Takenaka Corporation and Kishiida Chemical have established a joint venture to develop a new drug for COVID-19.

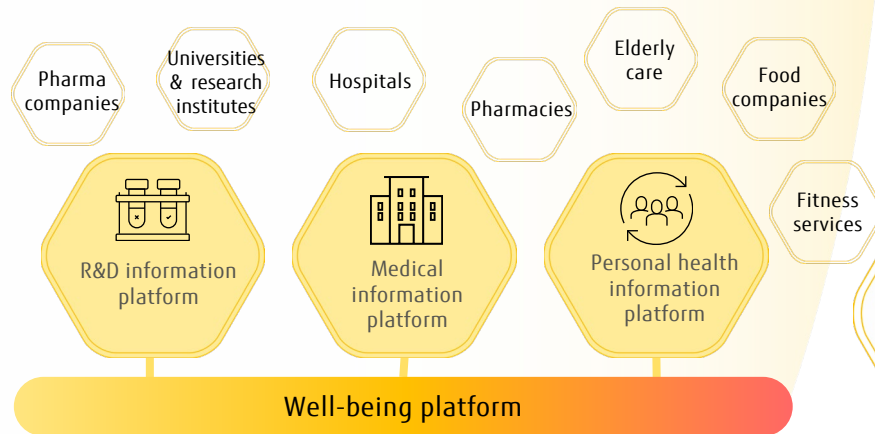




# 3 Healthy Living Smart health ecosystem

We continue to support innovation by creating mechanisms for organizations across different sectors to exchange medical and health data in a trusted way.

To accelerate innovation, we need to develop medical and health databases that can be used by universities, research institutions, pharmaceutical companies and start-ups. We believe various organizations will co-create innovative well-being services on highly secure and trusted data platforms.



Fujitsu has provided research and development information systems for pharmaceutical companies, in addition to delivering Electronic Medical Record systems and regional healthcare networks. We are also contributing to the creation of well-being platforms that connect information from pharmaceutical companies and medical institutions to the various agencies that support people's health.

## Regional healthcare networks

In Japan, Fujitsu has helped build networks connecting over 7,000 hospitals, clinics, care facilities and pharmacies.

## Co-creating well-being services

We are conducting joint research with National Cancer Center Japan to provide real-world data such as Electronic Medical Records data to pharmaceutical providers to facilitate the development of new drugs, clinical trials and preventive medicine. We aim to co-create new services contributing to personalized cancer treatments as well as preventive medicine.

## Pharmaceutical systems

Fujitsu provides comprehensive IT solutions to support ongoing research and development into new drug treatments.

## Human-centric sustainable society

The world faces ever-increasing uncertainty and difficult challenges, from environmental issues through to aging populations. Facing these challenges, how can we realize more inclusive public services for everyone? What is needed to protect our cities from pandemics and frequent natural disasters? How can we enable people to live with peace of mind?

Cities are increasingly complex ecosystems in which many people live and work. Public and private organizations across a wide range of sectors are now creating value together. To sustain and grow cities, we need to share a clear purpose and goals and to co-create human-centric value together.

Digital technology is a key tool. In our global survey, 91% of business leaders told us that digital transformation has helped them to deliver value to society. They cite safety and security, the development of smart cities, and the improvement of well-being as key outcomes. To deliver digital transformation for society, we need to connect generated data and enable people and organizations to use this data safely.

1

Human-centric public services

2

Resilient society

3

Smart city ecosystem





1

Trusted Society

# Human-centric public services

To realize a society where no one is left behind, it is important to provide personalized public services that meet the needs of individuals.

The private data of citizens must be protected and connected across public-sector organizations via secured distributed networks. We also need to ensure that the private sector and citizens participate in co-creating inclusive public services based on achieving common goals.



Human-centric services, created from connecting data generated in many fields

Co-creation of public services with private companies and citizens

Fujitsu continues to support public services by developing IT solutions for governments and public service organizations across many countries. We are using data and digital technology to enable the ongoing transformation of public services, helping to realize human-centric public services.

**Human-centric services**

Digital is becoming a default mode. Fujitsu helps organizations to provide intuitive, easy-to-understand and inclusive public services that integrate both physical and digital experiences. We will help organizations to anticipate the needs of citizens, to provide key information, for example, through digital touchpoints such as smartphones, and to empower citizens to receive services digitally.

**Data connection**

We provide digital trust technology, helping to connect citizens' data across organizations while protecting privacy.

**Co-creating services**

Fujitsu uses design thinking to help organizations create their vision for the future, including the opportunity to co-create new public services through collaboration between citizens and both the public and private sectors.

2

# Trusted Society Resilient society

The analysis of real-time data enables us to predict what may happen in the future. This helps to mitigate the impact of natural disasters and pandemics as well as to address environmental challenges.

It will become possible to project the dynamics of society into a digital twin by processing real-time data from multiple sensors on an ultra-high-speed, large-capacity computing infrastructure. This digital twin will enable us to predict risks and allow people to live safer and more secure lives.



Fujitsu delivers trusted solutions using cutting-edge technologies including computing, AI and digital twins, contributing to the creation of a more resilient society.

### Disaster prevention

Fujitsu helps local governments to prevent and mitigate flood damage. We provide an AI-based solution to forecast the water level of rivers for six hours ahead, based on the past rainfall data, the current water level and the rainfall forecast.

### Supercomputers helping solve societal challenges

Fugaku, a supercomputer jointly developed by RIKEN and Fujitsu, became fully available for use by various organizations in March 2021. Fugaku has already helped deliver significant outcomes, for example, in the research of tsunami simulation and responses to COVID-19.

### Urban mobility

We help to optimize logistics and address environmental challenges by using our AI, 5G, digital twin and quantum computing technologies. For example, the City of Montreal in Canada has used our AI technology to control their traffic lights dynamically, helping to reduce traffic-related issues. The City of Dublin in Ohio, USA, has also conducted a successful smart parking project, combining 5G with AI-based video recognition technology.

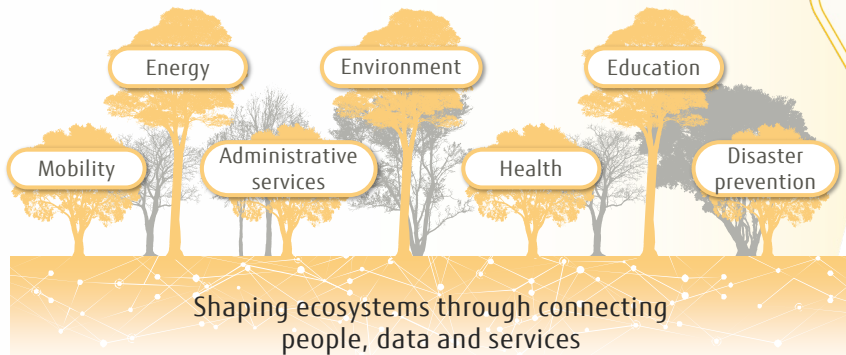


3

# Trusted Society Smart city ecosystem

In order to realize a trusted smart society, we need new regulatory systems that ensure the flow of trusted data as well as a new enabling technology architecture.

By connecting data generated across different domains, from administration and mobility to energy and health, we can help to enable sustainable city ecosystems. We need distributed data platforms that governments, public institutions, companies and citizens can use with confidence.



Fujitsu contributes to the development of trusted data flows and smart city operating systems, essential to underpin the provision of human-centric public services. In addition, we are collaborating with partners across a range of projects to create future cities, including Japan's Super City initiative.

### Digital trust

Fujitsu has developed a Trust as a Service (TaaS) technology that ensures the authenticity of data. We are now collaborating with partners to implement this technology.

Module 4 P62  
Trust as a Service

### Energy

Fujitsu is promoting distributed Virtual Power Plants (VPP) to expand the use of renewable energy and realize a decarbonized society.

### Environment

Proventia is using Fujitsu's IoT technology to provide a solution that collects and analyzes real-time data on vehicles' CO<sub>2</sub> emissions. The solution is already in use with a public bus network in London.

### Future City

In Osaki-Kamijima Town, Hiroshima Prefecture, Fujitsu conducted a proof of concept to develop a new transportation and distribution infrastructure for isolated islands. The project, which uses on-demand transportation technology and self-driving vehicles, aims to support elderly residents who have difficulty in driving.

# Business Transformation

## The future of management

### B2E (Business to Everyone)

Passing the inflection point, also known as the Great Reset, business management is now undergoing dramatic change. In this context, we need to strengthen resilience, adapting to this uncertain environment with agility. We also need to deliver value to everyone, to all our various stakeholders.

Fujitsu's global survey reveals that 83% of organizations are working on digital transformation, with 39% already having delivered business results. Digital transformation is not just about introducing digital technology, it is about transforming business. How can you enhance value to wider groups of stakeholders, such as employee well-being? How can you ensure business continuity, adapting to unexpected changes in a crisis? In addition, how can you embrace an increasingly borderless society, connecting internal and external ecosystems while protecting data privacy and security?

1  
Digital Shifts

2  
Business Applications

3  
Hybrid IT



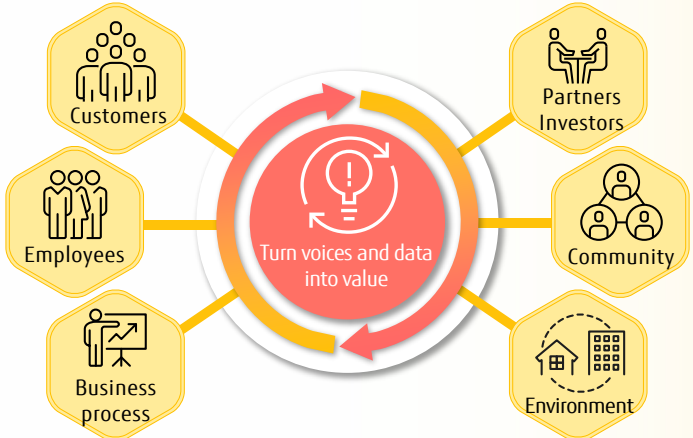


# 1

## Business Transformation Digital Shifts – shifting to a digital business

**In this fast-changing world, there is a growing acceptance of the need to help people maximize their individual potential, using data to continuously improve value for all stakeholders.**

For example, improving the well-being of employees is essential to help them unleash their creativity. Organizations need to collect and understand the feedback from their stakeholders, using data generated from business processes to gain insights in real-time.



Fujitsu is embracing data-driven management, using the voices of our customers and employees. We also integrate and analyze a wide range of data generated across operations to create insights. We are using these voices and insights to transform how we work (Work Life Shift) as well as to enable fast decision making. Using the experience gained through our own transformation, we are now helping many customer organizations transform their businesses.

### Work Life Shift

Fujitsu has listened to the voices of our people who support the work from home model, and have subsequently introduced our global Work Life Shift program. We aim to enhance the well-being of all our employees both in their work and private lives. This program enables flexible working styles and drives the underlying culture change. We are also providing Work Life Shift solutions to help our customers.

### VOICE

We continuously collect voices from customers and employees, helping us identify issues and take actions to achieve the success of stakeholders. We aim to allow all employees to proactively participate in the decision-making process.

### Value from data

Combining large-scale data platform technologies, Fujitsu helps organizations to analyze a wide range of their internal and external data. Using our own experience, from business management to spare parts optimization, we help them become data-driven businesses.

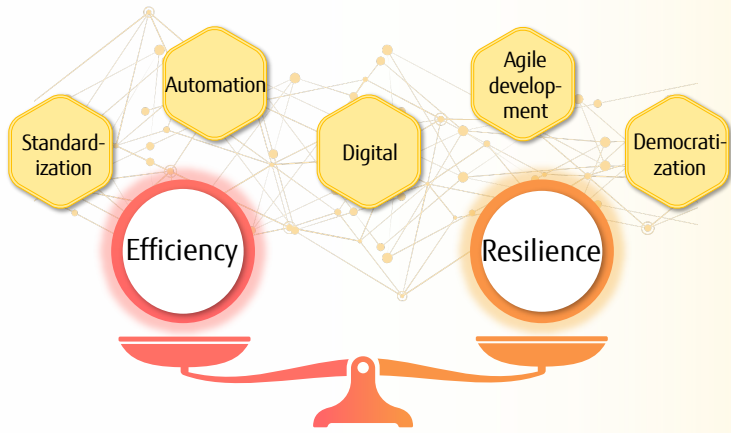


# 2

## Business Transformation Business Applications – achieving efficiency and resilience

**In this uncertain world, we all need to adapt to unexpected changes flexibly, while maintaining our business efficiency. By strengthening resilience, we can help our businesses survive, even at times of unexpected crisis.**

This requires focus on users, when developing and operating applications across both on-premise systems and the cloud. You need a technology partner that can drive efficiency and resilience through business process automation, digitalization and agile development.



Over 40,000 people across Fujitsu’s Global Service organization collaborate as one organic team to enable agile development that is essential for digital innovation as well as to deliver standardized services to achieve efficiency. As your trusted partner, they work together to support your business.

### Strategic partners

We collaborate with our global strategic partners, including Microsoft, SAP, ServiceNow, Salesforce and others, to deliver services to our customers.

### Global Services

Fujitsu’s regional delivery organizations, near-shore organizations like Japan Global Gateway and Global Delivery Centers located in 8 countries collaborate as one team. They pursue enhancement and standardization of key service offerings, ensuring trusted delivery across all regions in the world.

### Cloud integration

Fujitsu uses the latest technologies to enable agile development of both front-end systems and large-scale complex mission critical systems. In addition, we will provide development frameworks and platform to support organizations with their own applications development activities.

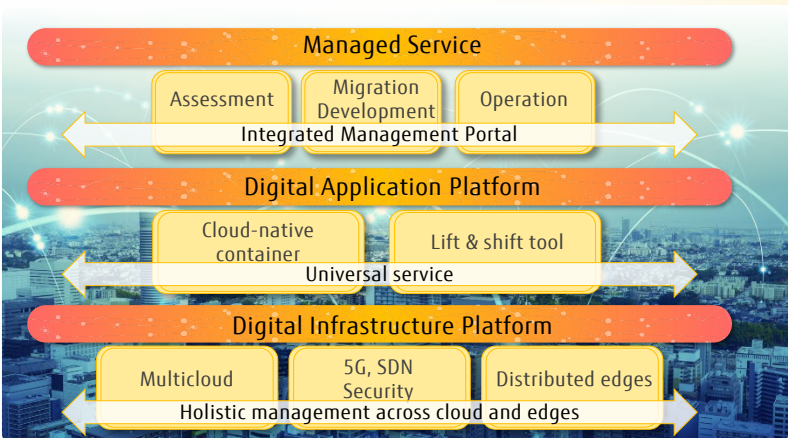


3

# Business Transformation Hybrid IT – enabling borderless lives

We need to build digital infrastructures that connect people, data and services, helping deliver new value, while protecting security in an increasingly borderless society.

It is important to develop not only hybrid IT infrastructures that can process data both in the multi-cloud environment and at on-premise data centers in a trusted, distributed way, but also digital application platforms and integrated management portals for managed services.



Fujitsu provides Hybrid IT that integrates multicloud infrastructure with digital application development platform. We also provide managed security services for multi-cloud security and borderless work and lives to help realize customers' digital transformation. We will continue to advance predictive and preventive automation based on AI and other technologies, to deliver resilient infrastructure services for business and society.

### Hybrid IT

Fujitsu provides digital infrastructures that seamlessly connect multi-cloud and on-premise data centers. We are also strengthening agile digital application platform and managed services encompassing from assessment to operations. We also explore to augment edge processing with high-speed low-latency 5G networks.

### Security

Fujitsu provides security solutions and managed services to ensure security by design and protect multi-cloud environments. In addition, we help organizations to adopt a hybrid workstyle with confidence, based on the concept of zero trust.

# 4 Technology Vision





# Making the impossible possible

Technology has the power to help us solve the world's most difficult challenges, transforming societies for the better. Business and society will increasingly be driven by data and technology. The dynamics of the physical world can be projected in the digital space, and AI technology helps predict what may happen in the future. This empowers the creativity of people, ensuring the safety and security of our daily lives.

Fugaku, a supercomputer jointly developed by the Institute of Physical and Chemical Research (RIKEN) and Fujitsu, achieved four crowns in the world's supercomputer rankings twice in a row. Fugaku has already demonstrated its ultra-high-speed processing power in a large-scale simulation of the physical world as well as cancer gene network analysis using Fujitsu's explainable AI technology.

Fujitsu also delivered the AI-Bridging Cloud Infrastructure (ABCI) for the National Institute of Advanced Industrial Science and Technology (AIST). The ABCI achieved the highest performance in the MLPerf HPC benchmark that measures large-scale machine learning processing. Our intention is to enable a wider community of researchers and organizations to use ultra-large computing platform like these and produce significantly positive impact on society. Furthermore, we hope photo-electronics convergence technology as well as quantum computers will deliver breakthroughs in the future.

We'll continue to focus on developing technologies to make the previously impossible possible.



# Human Centric Innovation

While technologies continue to advance, we also face their negative side effects. Can we trust the huge amounts of data continuously generated around the world? How can we find the right balance between protection of private data and its positive value for economy and society? Can we trust the judgements of AI? What kind of potential impact will AI and robotics technologies have on employment and human dignity?

Fujitsu is developing and implementing technology based on our human-centric principles. We set out the Fujitsu Group AI Commitment and established the Fujitsu Group External Advisory Committee on AI Ethics to ensure the safe and secure deployment of AI in society. We are collaborating with international organizations, contributing to the development of AI ethics guidelines. In addition, Fujitsu is developing digital trust technologies, to help use data for a better society while ensuring privacies.

To contribute to a trusted society that will continue for many generations, we create human centric innovation by bringing together people with data and physical things.





# Technology vision

We'll contribute to rebuilding trust and creating sustainability by realizing technology-based innovations with our partners.

Fujitsu Technology and Service Vision 2021 introduces five visions of technology innovation.



## Human + Technology

People collaborate creatively with AI, testing new hypotheses from data and enabling new discoveries.



## Extended present

A digital twin for society based on real-time data that helps us to anticipate what may happen next.



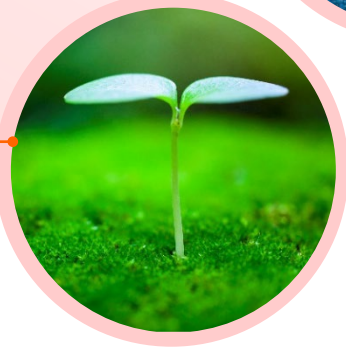
## Overcoming complexity

Quantum computing technology helps to solve complex micro and macro problems, helping us to address societal challenges.



## Borderless experience

A human-centric experience across physical and digital spaces that frees people from restrictions of location and time.



## Regenerative society

Trusted data and intangible value circulate throughout society, enabling people to solve systemic, global-scale challenges.

# Borderless experience

## Anytime, anywhere

The pandemic has accelerated a shift to a hybrid working model. Traditional lifestyle models defined by location, where people worked at offices and lived their private lives at home, is rapidly becoming a thing of the past. This shift is not just about work. Shopping, learning and many other things are also being disconnected from fixed locations. What kind of seamless experiences will be available in the future? How can this help us all live fuller lives?

Connected technologies are breaking the boundaries between physical and digital spaces, enabling new, human-centric, digital experiences. Digital experiences will be enhanced almost to a physical level, while physical experiences will be augmented by digital. Reality is no longer just one physical experience, or two distinct physical and digital experiences. People will be able to move flexibly between the different realities.

### Human experience

Virtual Reality (VR) enhances digital experiences, while Augmented Reality (AR) brings digital experiences into a physical space.



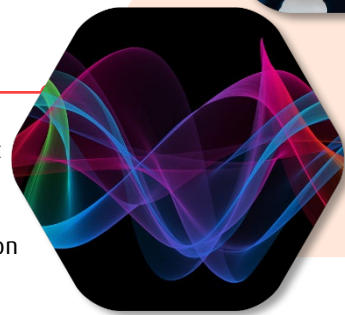
### Sense computing

Based on real-time data from sensors, AI technology understands a person's contextual situation, reading emotions from their facial expressions and voices to deliver personalized experiences.



### 5G and beyond

Ultra-high-speed, low-latency, multi-connection 5G technology and the subsequent beyond-5G/6G technology will connect people, things and data, enabling the transmission of massive amounts of video data and the creation of teleportation-like experiences.

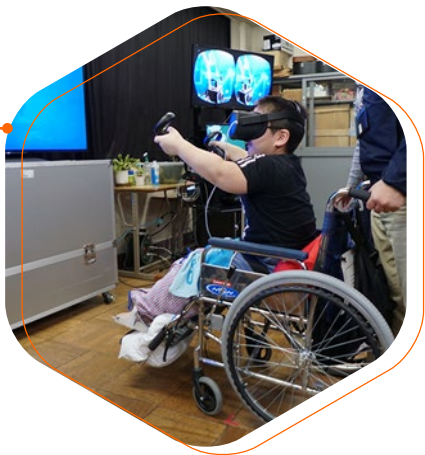


# Borderless experience

## Impact on society

### Inclusive experiences

We can create more inclusive experiences, for example by helping the elderly and people with disabilities to enjoy collaboration, leisure, shopping and traveling while staying at home.



### Borderless collaboration

Mixed reality and 5G technologies will allow people to share a single collaboration space, regardless of their individual location, including offices, laboratories or on the move. This will open exciting new possibilities for joint research by talented people from all over the world, as well as concurrent engineering across a wide range of functions.



## Our approach

Fujitsu is working with various partners to co-create innovative experiences using 5G technology. For example, in collaboration with Kwansei Gakuin University, we used 5G technology to trial off-site learning at an aquarium for students who were hospitalized. Children wearing head-mounted displays were able to observe giant whale sharks, with the virtual experience of swimming in the same aquarium waters.

We provide remote collaboration spaces where anyone can participate from anywhere. Team members can work together, virtually sharing the same space. We're also enabling remote engineering work at a factory using 5G and VR technologies. We'll continue to promote open innovation with partners, developing technologies that enable borderless lives.

# Extended present

## Prediction first

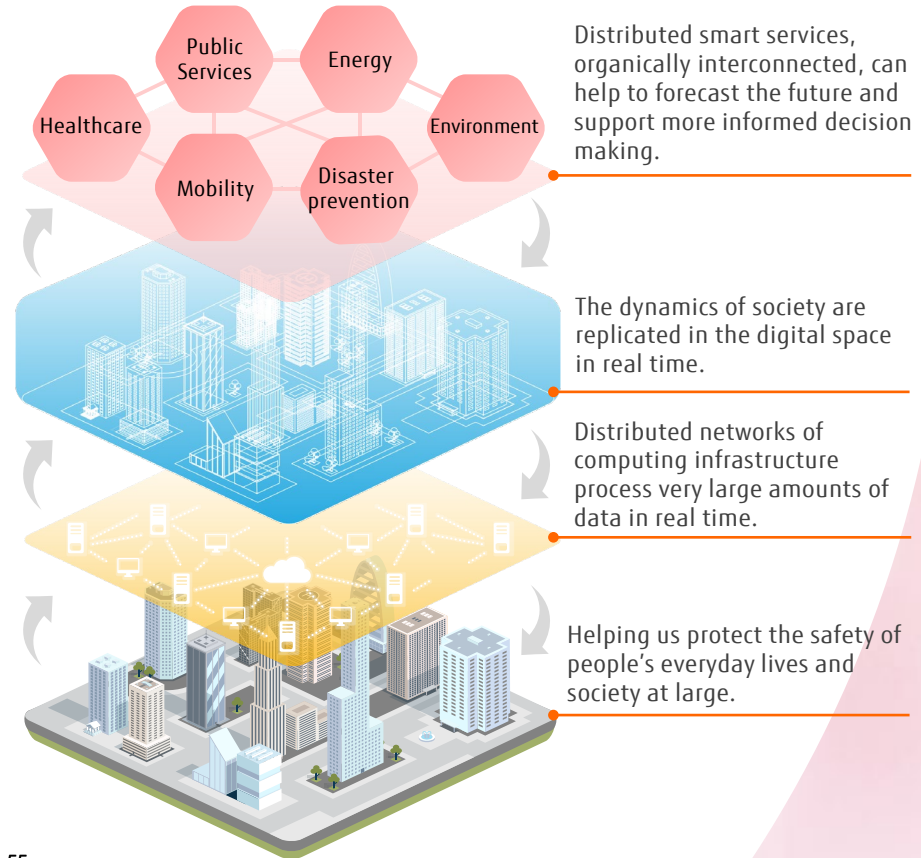
Previously, we have relied heavily on past experiences to create a view of the future, as if the future is an extension of the past. However, the pandemic and recent natural disasters have been unlike anything we had experienced before. What we need in this increasingly uncertain world is resilience, the ability to respond quickly to unexpected change.

What if technology could extend the present so that we can see into the future? We believe this 'Prediction First' approach will become a dominant style of business decision making.

The key is a large-scale digital twin, which projects the dynamics of society into a digital space. In order to forecast accurately what will happen in the next few minutes or hours, real-time data must be processed instantly. We need to digitize and capture the dynamics of people, organizations and whole environments. We have to process these ultra-large scale data sources while recognizing their complex inter-relations. This requires the integration of sensors both with low latency 5G and optical transmission networks and with the distributed computing infrastructures that can process data at high speeds.

The challenge is to increase network speed and capacity, while reducing power consumption. Photoelectric fusion technology is expected to provide a solution, enabling high-speed input and output of large amounts of data with very low power consumption.

## Digital twin for society





# Extended present

## Impact on society

### Resilience to disasters

The high-precision simulation of how heavy rain causes floods can help to create a model for assessing potential damage. Using ever-changing, real-time data as a disaster unfolds, the model can help people make the best decisions and take the right actions, ultimately saving lives.



### Safe and secure mobility

A mobility digital twin monitors real-time traffic and calibrates what may happen next. This can assist drivers, reducing congestion and preventing the occurrence of accidents.



## Our approach

We are combining the ultra-fast large-scale computing power of supercomputers and cutting-edge AI technology. For example, Fugaku was used to simulate tsunami conditions, developing a high-quality AI model through rapid learning of high-resolution simulation data.

Using Fujitsu's real-time stream data processing technology, we're developing a digital twin that will support next-generation mobility services. This can already process the data traffic from around one million connected cars.

We're now enhancing the technology to enable a whole-city digital twin platform, capable of processing large-scale data from over 10 million connections.

Fujitsu supports IOWN initiative proposed by NTT. In April 2021, we agreed a strategic business alliance aimed at the realization of a sustainable digital society. We're now working together to develop new photo-electronics convergence manufacturing technology, promoting the next-generation open network solutions required to realize a large-scale digital twin for society.

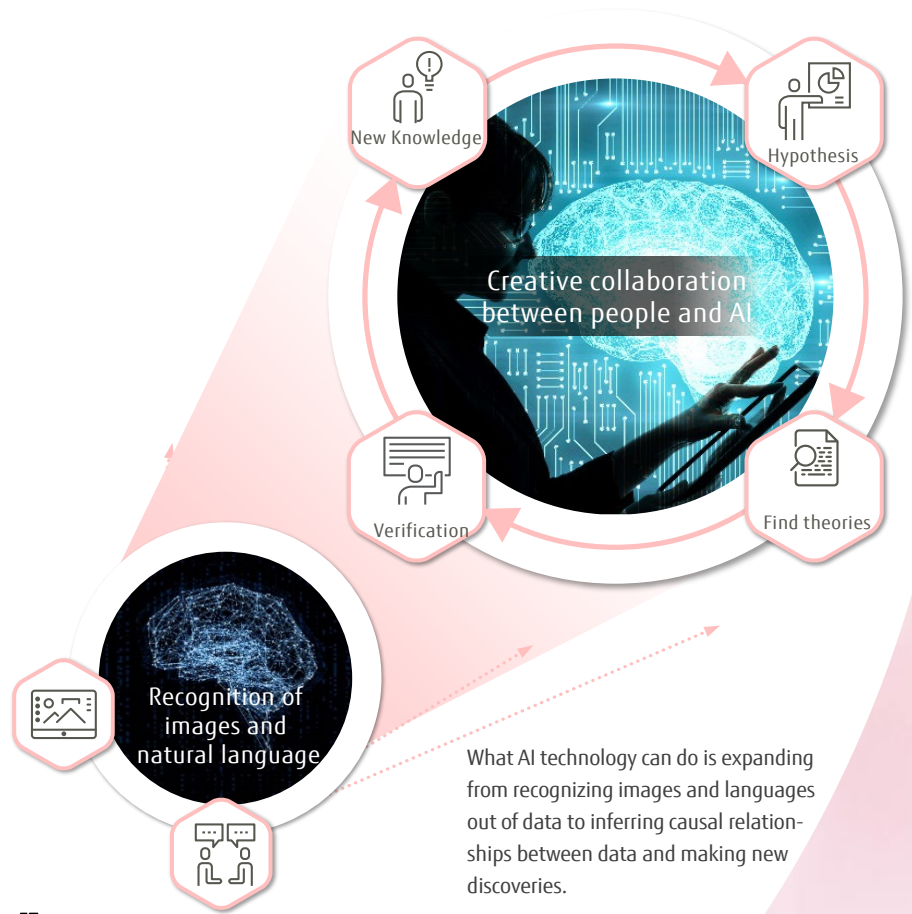
# Human + Technology

## AI that can make new discoveries

The progress of humankind is marked by a history of new discoveries. We have developed hypotheses to solve problems, created new knowledge in science and engineering through trial and error and delivered innovations that have transformed society. Without doubt, the creativity of people is the driving force behind these discoveries.

But what if technology could support and dramatically accelerate this discovery process? Deep learning technology can already find correlations of vast amounts of data that cannot be handled by humans. This kind of AI has enabled computer vision and natural language processing. However, current AI technologies are still not able to infer causal relationships. What we need is a new AI technology that finds causation, making hypotheses that lead to the validation of new discoveries.

Over the next 10 years, we expect human creativity to be augmented by technology, opening the way to new discoveries from data and breakthroughs that solve difficult problems. Creative collaboration between people and AI can be expected in many fields, enabling us to find how cancer is being caused by gene mutation and lifestyles, and an innovative way to develop new materials, for example. To achieve these, AI technology must be highly trusted and transparent so that people can use it with confidence.



What AI technology can do is expanding from recognizing images and languages out of data to inferring causal relationships between data and making new discoveries.

# Human + Technology

## Impact on society

### Personalized genomic medicine for cancer

In the future, AI technology will be able to analyze the entirety of human genomic information and infer causality. By combining related clinical data and analysis of lifestyles, it will be possible to help medical researchers identify the factors that cause specific cancers. Ultimately, AI technology will help clinicians find personalized treatments with the fewest side effects, contributing to the extension of healthy life expectancy for individual patients.

## Our approach

Fujitsu has already achieved technology breakthroughs in the field of cancer genomic medicine in collaboration with leading universities and research institutions. We successfully demonstrated the world's first explainable AI technology. We deployed Fujitsu's knowledge graph technology to map medical knowledge, using our deep learning technology to identify the genetic mutation and related factors that cause particular cancers. This technology will be applied to clinical medicine very soon.



Recently, Fujitsu calibrated a causal relationship between different types of colorectal cancer and approximately 300 related genes. From the data only, we succeeded in rediscovering the genes that were related with a particular type of colorectal cancer. We'll continue to work on applying AI technology to infer causal relationships of the entire human genomic information, contributing to the advancement of cancer treatment through creative collaboration between medical professionals and AI technology.

# Overcoming complexity

## Solving difficult problems

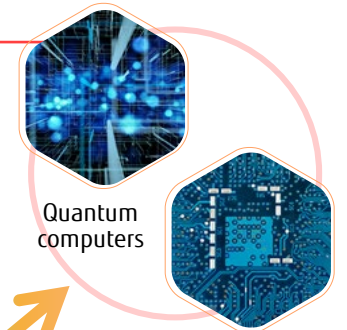
There are many problems that are too complex for conventional computers to solve within a practical time. Extreme complexity can be found both in microscopic fields like invisible molecules as well as in macroscopic fields like the dynamics of whole cities.

For example, in order to develop new drugs for infectious diseases, it is necessary to find molecular compounds that have the potential of effectiveness against pathogens. However, it typically takes 4 to 6 years to search for these compounds using trial and error. Similarly, it takes many years to explore innovative materials. For example, how can we discover new materials that will improve the efficiency of solar power generation?

However, quantum computing technology is making rapid progress. Fujitsu's Digital Annealer, a quantum-inspired computer, is the first step in the quantum era. We can use Digital Annealer to rapidly and accurately discover candidate compounds for middle-molecular drugs and help accelerate the drug discovery process. This can be combined by a supercomputer like Fugaku to simulate and identify the most likely molecular compounds. In the long term, gate-based quantum computers will be developed, achieving breakthroughs to solve even the most complex problems.

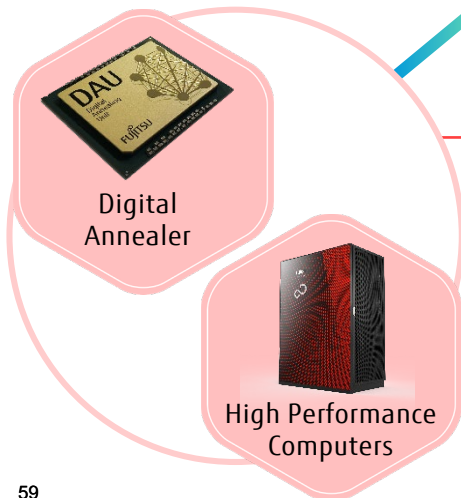
### Next step Evolution of computing

Quantum computers are expected to start working on practical applications from 2030 onwards, enabling high-speed quantum mechanical simulations. Combined with high performance computing, this will bring breakthroughs in many areas, including the development of new materials.



### First step Current frontier

Digital Annealer can instantly solve complex combinatorial optimization problems that are difficult for conventional computers. For example, it can be used for optimizing urban traffic, or searching for molecular compounds in the drug discovery process. Combined with high performance computing, Digital Annealer helps solve real-world problems.



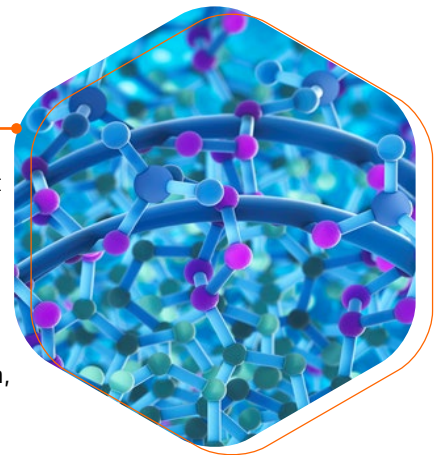


# Overcoming complexity

## Impact on society

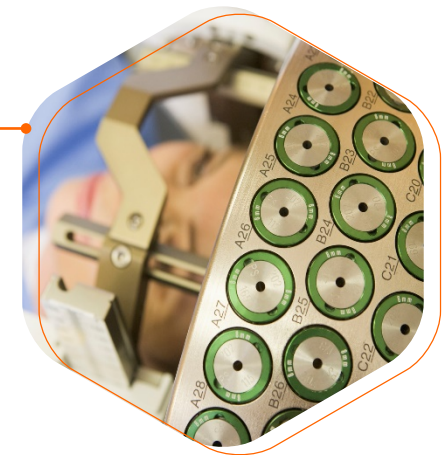
### Reducing CO<sub>2</sub> emissions by developing new materials

Quantum computing technology is expected to accelerate the development of new materials supporting our decarbonization objectives. These potential new materials include more effective solar cells, catalysts for artificial photosynthesis and catalysts for synthesizing ammonia and hydrogen, for example.



### Medical breakthroughs

Digital Annealer not only helps to accelerate the search for chemical compounds in the drug discovery process. It's also proving to be effective in the field of radiation therapy for brain tumors, where it has exciting potential to extend healthy life expectancy.



## Our approach

Fujitsu is collaborating with leading global organizations to build an ecosystem and deliver co-innovations. For example, in joint research with the University of Toronto, Digital Annealer was used to calibrate a large number of combinations of gamma radiation from different angles for the treatment of brain tumors and arteriovenous malformations. This enables clinicians to develop treatment plans in minutes instead of hours. This is expected to significantly reduce treatment time, reduce the dose of radiation and reduce the burden on patients.

Fujitsu has jointly set up a collaborative center with RIKEN to carry out research and development of hardware and software technologies, aiming to enable superconducting quantum computers. We're also conducting joint research with Osaka University, focusing on the error-correction technology that is crucial for the development of quantum computers. In addition, Fujitsu is collaborating with leading international organizations. We are engaged with Quantum Benchmark to jointly research the error suppression technology. We're also working with Delft University of Technology on the diamond spin method to explore the potential for greater scaling.

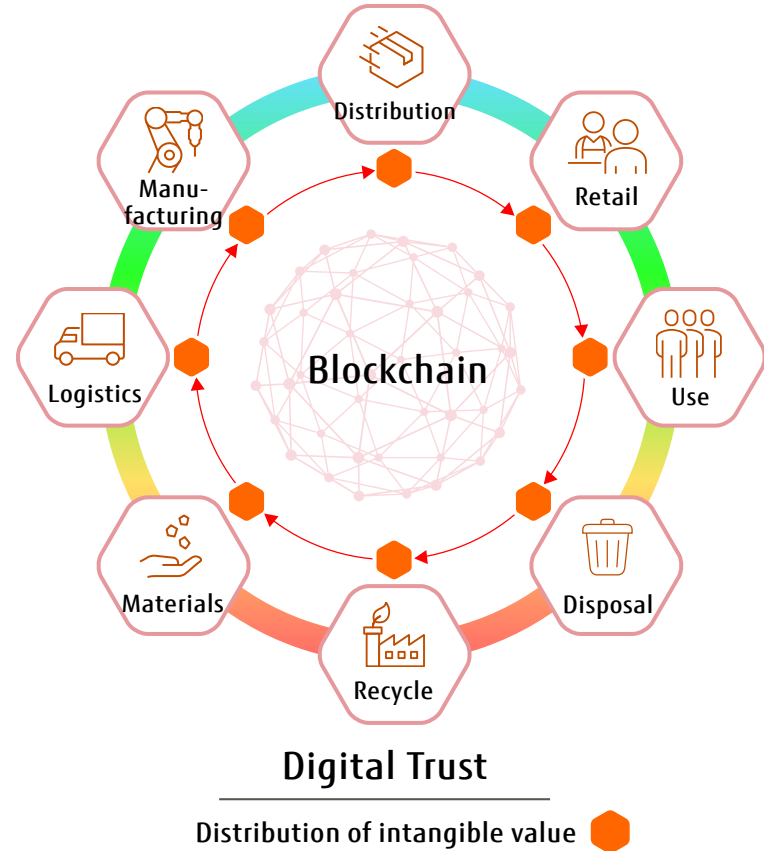
# Regenerative society

## Addressing systemic global issues

The world is facing difficult challenges such as decarbonization, industrial waste and food shortages. These are complex and systemic social problems across borders and industries. The efforts of individuals and individual organizations are of course important, but we cannot solve society-wide, global-scale problems purely by addressing small pieces of the big picture.

Circulating trusted data in the end-to-end extended ecosystems will help solve complex problems. Sharing of trusted public and industrial data, validated by independent organizations, can accelerate the co-creation of new value. Furthermore, information such as CO<sub>2</sub> emissions at each stage of the value chain can be tokenized as intangible social value. These tokens can accompany the flow of products from producers to sellers and consumers. Through this process, organizations and consumers can transparently evaluate the intangible social value of products, helping them make transaction decisions and changing their behaviors to produce better outcomes for the environment and society.

The key for this process is the digital trust technology that ensures the trustworthiness of data. Global mutual authentication beyond countries and regions will also be required. Distributed ledger technology like Blockchain should evolve to support distributed platforms that not only support commercial and financial transactions but also the exchange of intangible social value.



# Regenerative society

## Impact on society

### Reduction of food loss and waste

Blockchain technology helps develop transparent food value chains, from producers to consumers, enhancing food safety as well as reducing food loss and waste.



### Economy based on intangible value

We can imagine new token-based evaluation systems whereby intangible social value, such as CO<sub>2</sub> emissions and compliance with regulations, is tokenized and distributed, contributing to the sustainability of the environment and society.



## Our approach

Fujitsu's connection chain technology can securely link different blockchains. Using this technology, we promote an open source software community called Hyperledger Cactus together with Accenture. We're already working on research, development and implementation in collaboration with various organizations. We'll continue to explore the development of new blockchain technologies in order to realize a reliable token economy, where not only money and ownership but also various intangible values can be exchanged.

We've developed a new digital trust management technology called Trust as a Service (TaaS) that will ensure the authenticity of business data exchanged between private and public organizations. The technology can verify when and by whom the data was created, and whether it has been tampered with, to ensure trusted data exchange. We're also participating in the Japan Digital Trust Forum, contributing to the development of a common TaaS architecture and the verification of early use cases.



# Solving societal challenges and making the world more sustainable

## Sustainable Manufacturing



### GKN Aerospace UK

Fujitsu has developed an AI-enabled defect recognition solution to support GKN Aerospace's technical staff and shorten the inspection time by automating the quality inspection process.



### AB InBev Belgium

Fujitsu has helped AB InBev to build a blockchain solution that links barley farmers to breweries to improve productivity and reduce environmental impact.

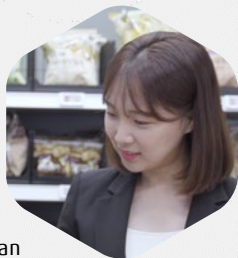


## Consumer Experience



### BGF South Korea

Fujitsu provides palm vein authentication technology and an AI solution that recognizes products and customer behaviors automatically. This has helped BGF to open their first unmanned convenience store and create an innovative customer experience.



### AEON Retail Japan

Fujitsu's AI image analysis allows AEON Retail to identify store congestion, enabling their staff to improve customer experiences. AEON Retail is also working on data-driven in-store transformation.



## Healthy Living



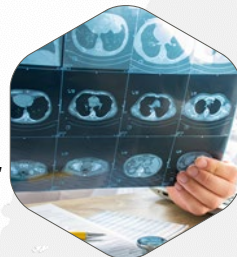
### PeptiDream Japan

PeptiDream uses Fujitsu Digital Annealer, HPC and other technologies to innovate the process of drug discovery. They also set up a JV with Fujitsu and other partners to develop a new drug for COVID-19.



### Tokyo Shinagawa Hospital Japan

Tokyo Shinagawa Hospital and Fujitsu have jointly developed an AI technology to support CT-scan lung image diagnosis for COVID-19, contributing to reducing the burden of doctors and verifying the possibility of diagnosis by non-specialists.





## Trusted Society



**Proventia**  
Finland

The combination of Proventia's retrofit exhaust systems and Fujitsu's IoT platform enables real-time monitoring of exhaust emissions, contributing to lowering CO<sub>2</sub> emissions.



**City of Dublin, Ohio**  
United States

Fujitsu helps monitor the congestion of parking spaces using 5G/LTE private network and AI-based video recognition technology. This solution contributes to Dublin's smart city vision.



**City of Montreal, Quebec**  
Canada

To reduce traffic congestion and snow removal processing time, the City of Montreal and Fujitsu collaborate in implementing AI-enabled real-time traffic analysis and dynamic traffic light management.



**Osaki-Kamijima Town, Hiroshima**  
Japan

Osaki-Kamijima Town conducted a smart mobility project by combining on-demand transportation management services and autonomous driving technology to help people living on isolated islands.



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