

Fujitsu
Technology and
Service Vision
2018

Building a Human Centric Future

Our human story has been shaped by technology. It is the story of how we have used innovation to solve challenges and improve our wellbeing – from stone axes, to writing, to printing, to industrial machinery, fossil fuels, medicine, airplanes, computing. Innovation has changed the world, transforming how we live our lives. But always the deepest change is in the way people think and act.

When we hear that computers can now read pictures, drive cars or take part in conversation it seems incredible. But we are about to become a world where people no longer find these things surprising. A world where Artificial Intelligence (AI) has become the norm. How will people think and act in this world? How will businesses work? How will these be different from how they are today?

For a consumer, AI will be embedded in most of the things she uses in everyday life, from her car to her entertainment systems to her household appliances. Most of the time she will converse freely with technologies using speech, in her mother tongue naturally.

She will take for granted that these technologies always seem to know what she wants. In fact she will likely not be aware of the many ways these systems look after her, from resupplying her store cupboard, scheduling travel and appointments to organizing her finances and monitoring her health.

In her working life, AI will be even more empowering. It will take care of administrative tasks, filter correspondence, and assist with decision making. It will provide relevant information and knowledge and enable her to easily collaborate with other people. She will converse easily with people who speak different languages. As a result she will have more time to focus on higher value activities, like creating innovation, spending time with customers and solving new challenges.

If she is aware of recent history, she might even recognize the society she lives in works better than it ever has. Intelligent technology has enabled greater sharing of physical resources, meaning that people have much greater access to the things

that give them value. Services are better integrated and oriented around citizens. It is a safer, more sustainable world.

What does this mean for CEOs and business leaders today?

AI is happening now and it is happening rapidly. It was once said that 'software is eating the world'; now people are saying that 'AI is eating software'.^{*} This is not a trend that you can sit out, or play 'wait and see'. Those that develop these tools for their businesses will gain a major advantage.

Many business leaders already anticipate scenarios like those we have just outlined. In our global survey, 61% of CEOs and decision makers agreed that such AI-native generations would emerge.

But AI is not a magic wand or a silver bullet. It is a tool that helps people gain value from data. It doesn't in itself guarantee value, or the outcomes a business wants to achieve. The scenario we have just painted may be an attractive one, but it is only one possibility. There are many possible futures. Another scenario is that business leaders see the technology only as a way to automate process. An opportunity to remove cost from their business, in a race to the bottom.

This carries some important implications.

The first is we need to recognize it is up to us to choose the future we want to create. To realize the full potential of technology requires a sense of purpose. For a business leader it means recognizing the role your enterprise plays in society and where its potential lies. It means having a purpose and an intent and actively pursuing this path.

The second is to recognize that success will come from building around people. The creativity and imagination of people drive innovation. AI will empower people. Opportunities will come from exploration, from discovering unfulfilled 'jobs to be done' and innovating ways of delivering them.

And thirdly, delivering value from data requires a different



approach. Key is to combine data and human knowledge from different fields and industries. The borders of existing industries are being blurred or vanishing altogether. No business will be able to assure success by acting in isolation, or even at the head of a supply chain in a vertical industry. Success in the era of AI requires co-creation, where innovation is delivered more openly, the coming together of different skills, capabilities, ideas and expertise.

To accomplish all of the above, you need to become a different sort of organization. You need to become a 'Learning Enterprise'. Learning enterprises continuously learn from data to create knowledge and innovation. They are value-creating, agile, responsive and dynamic. They are human centric.

If you want to understand how to become a Learning Enterprise, and how we can help you to realize the future that you want for your enterprise and your customers, read on ...

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Related information and website

The Fujitsu Technology and Service Vision 2018 was created by a team of Fujitsu people from around the world. We are communicating it in booklets, web, and video globally.

This booklet sets out our vision and some insights on how business leaders can leverage in digital transformation along with real examples of successful digital transformations as well as our portfolio of products and services.

For a more concise view of the key messages, see our Executive Summary.

For more information, visit our website :
<http://www.fujitsu.com/global/vision/>

Or contact us on +81-3-6252-2220

Co-creation for Success

Co-creation is the right way to unleash the power of data and deliver success for your business.

In this ever more connected world, innovation is coming less from inside large corporations. Increasingly it is generated across agile ecosystems of companies of all types and sizes. Digital Co-creation is a way for you to leverage digital technology and deliver innovative value jointly with your partners and customers. We believe Digital Co-creation is now the fastest, most effective route to innovation and growth.

Digital technology is shifting our economy from supplier-centric, vertically integrated industries to customer-centric, distributed ecosystems. Fujitsu calls these Digital Arenas.

Business and industry boundaries are becoming blurred as a result, and this is disrupting the way that companies operate. The automotive industry is a good example. With a connected vehicle there are now multiple sources of customer value - from car-sharing to new insurance models - that are created outside the factory, its supply chain and the car showroom. The same applies to the financial services, where new communities are driving value from virtual currency, peer-to-peer lending to innovative forms of payment. This is not just about product or services, but enabling innovation in business models.

At its heart, digital technology is how enterprises transform data into value. Today, new technology like AI is opening up new possibilities for what businesses can do. AI is a powerful tool to create value from data. It can find useful patterns, reveal new insights and it can learn and improve. To realize these opportunities requires a coming together of different sources of knowledge, skill and expertise.

Many organizations have already conducted trials and pilots using co-creation. This year, and beyond, digital co-creation is moving into a new phase: delivery. Today, enterprises need to execute to deliver what their customers value - and expect.

What will you learn from the Fujitsu Technology and Service Vision 2018?

This year, our message is 'Co-creation for Success'. We want to show how you can turn data into value and deliver success through co-creation. Our story is in three parts.

Chapter 1 **Real Digital**

We start in the present. Organizations are telling us they are experiencing real challenges in delivering digital transformation. Why is it so hard to deliver concrete value and growth for the business? Here we explore what business leaders are finding, and we examine the key success factors organizations need to adopt to deliver 'Real Digital'.

Chapter 2 **Technology and Service for Success**

We are surrounded, overwhelmed even by the many types and sources of data. How can organizations navigate this 'data universe' and use it to deliver business outcomes? We talk about our strategy and explain the technologies, services and innovations we believe are the key foundations to drive value from data.

Chapter 3 **The path to a prosperous future**

Looking further ahead, we believe a new style of organization, called a Learning Enterprises, will emerge. People will collaborate with AI to learn from data, continuously creating innovation. Learning Enterprises are organically connected with ecosystems to co-create value through combining diverse knowledge and data. But how can we trust data in such a hyperconnected world? Blockchain and new security technologies have the potential to underwrite the trustworthiness of data, realizing Digital Trust.

Fujitsu's purpose is to realize a Human Centric Intelligent Society, our vision for the future. This is a learning society, leveraging data to continuously generate substantial social outcomes through co-creation. We are working toward this goal. We believe this is a path to a prosperous future, contributing to the achievement of the United Nation's Sustainable Development Goals.

We hope you find our ideas thought-provoking. We hope you enjoy reading our vision. And above all we hope we can work with you to co-create your success!

President's Message

Fujitsu has been engaged in many co-creation projects with our customers and partners. We have seen successful outcomes, ranging from improvement of quality and efficiency in manufacturing to transformation of customer experience in retail and financial services.

Today, digital co-creation is shifting into a new phase, from proof of concept to new business creation. Our unique capabilities in cutting-edge technologies such as AI and IoT, combined with cross-industry insights, are helping to enable this, delivering genuine innovation and business value.

Using innovative technologies, Fujitsu is focusing all our resources for co-creating significant value for business and society. Our global theme this year is 'Co-creation for Success'. This reflects our strong commitment to delivering positive outcomes together with our customers.

In January this year, I attended the Annual Meeting of the World Economic Forum in Davos. The participants discussed how to create a shared future in a fractured world. Today the world faces many difficult challenges, such as food shortage, welfare, urbanization and climate change. We strongly believe technology plays a key role in helping to resolve them. It is becoming ever more important for all stakeholders to align directions toward shared goals, represented in the Sustainable Development Goals of the United Nations.

Through co-creation, we will continue to work to realize a safer and more sustainable society.

April 2018

Fujitsu Limited

President and Representative Director

Tatsuya Tanaka

Tatsuya Tanaka



Our Values and the Journey of our Vision

Putting people at the center, building a prosperous society

Our view of the future is rooted in how we can help our customers to take the very best opportunities from technology. We passionately believe in innovation, making great technology and providing the services to accompany this. We think deeply about how we can use technology for the benefit of wider society, and the ideas that we bring into our vision are a reflection of that.

Our purpose is to realize a safer, more prosperous society, where people are empowered by technology and continuously create social outcomes. We call this a **Human Centric Intelligent Society**, and this is our vision for the future.

Human Centric is the belief that to get the best outcomes we must put people at the center. We think the mission of technology is to empower people and deliver outcomes for society. Genuinely, we want to increase happiness of people using technology. We also believe it is the creativity of people that

advances technology and drives innovation. For Fujitsu, everything starts and ends with people.

We launched the Fujitsu Technology and Service Vision in 2013, to articulate the future we wanted to see, and how we could realize it. Our vision is a fixed goal. But we publish this document annually to share our perspective with you about how technology is changing and what new possibilities and risks are emerging. It is an evolving story of how the building blocks are falling into place, and how we are working with you, our customers, to make this vision a reality. We outline

Human Centric Innovation in Action "Digital Ecosystems"

- MetaArc
- Human Centric AI Zinrai
- Knowledge Integration



Human Centric Innovation "Hyperconnected World"

- Human Centric IoT



Fujitsu Technology and Service Vision launched

"Human Centric Intelligent Society"



2015

2014

2013

2016

our thinking on how organizations can create and deliver innovation. Internally, for Fujitsu people, this is our journey of transformation.

In 2014 we launched the concept of Human Centric Innovation – which means that organizations can create innovation by empowering people with connected technologies and data-driven intelligence. This concept has continued to be the foundation of our future thinking.

Thinking about our future vision has helped us to develop the technologies and services that our customers tell us are most

2017

Human Centric Innovation
Driving Digital Transformation
"New Industrial Revolution"

- Connected Services
- Zinrai Platform Service
- Industry Platforms
- Digital Transformation Center



Human Centric Innovation
Digital Co-creation
"Digital Society"

- Strengthening AI / Cloud / IoT / Security
- Human Centric Experience Design (HxD)
- Contributing to SDGs



2018

Human Centric Innovation
Co-creation for Success
"Learning Enterprise"

- Explainable AI
- Digital Annealer
- Blockchain



relevant, useful and needed for their own business success. For example, we have developed 'MetaArc', our digital business platform, 'Zinrai' our Human Centric AI, and industry platforms to support specific business outcomes. We have developed a design thinking approach which we now use in many engagements with customers to drive innovation and the kind of outcomes that are most beneficial.

It is one thing to set out an ambitious vision, but we recognize we cannot do this alone. This is why collaboration has always been at the heart of our approach. We believe that working together with our customers and partners is most important of all.

As digital technology comes to dominate our world more and more, we believe that by working together and making the right choices we really can make a positive difference to the world.

Chapter 1

Real Digital

Uneven Digital Landscape

As a technology partner to thousands of organizations around the world, Fujitsu has first-hand experience of the challenges our customers face and the concerns they bring. We know that solving them is never easy - or obvious. There is no such thing as a one-size-fits-all solution.

Why are our customers' situations unique?

The digital landscape is uneven. Change is taking place at different speeds across different sectors of business. And different sectors are being impacted in different ways. For instance, the retail sector is focused on becoming more competitive in response to online growth. The automotive sector is being disrupted across several dimensions, from product features (self-driving, electric cars), to business model and the way customers use cars (vehicle sharing). In financial services, new payments technologies and business models like P2P banking and insurance are driving a new digital agenda.

Yet if their challenges are unique, organizations are also united in their desire to achieve success. Our customers tell us they want 'Real Digital'. They want to implement technology in ways that delivers real outcomes - real success - to their businesses.

To look more objectively at what success looks like for organizations, and the challenges and progress they have made, we commissioned a global survey of business leaders. The Digital Transformation Survey* canvassed the views of 1,500 business leaders from around the world. Roughly 60% of them manage traditional (non-internet) companies, and 40% lead online companies. We were particularly interested to find out about what was motivating them, and the outcomes their businesses delivered.

What could we learn from those who had achieved success? If one size does not fit all, are there any common principles or insights we could identify?

* We asked 1,500 business leaders from 16 countries for their perspectives on digital transformation. The survey was carried out in February 2018.





Motivation for digital transformation

We asked what was motivating companies to transform. As we might have anticipated, this was not a level playing field. Different industry sectors have different reasons for becoming more digital.

In the case of non-online companies, three out of the five sectors were primarily motivated by increasing efficiency, with growing business second. Finance was evenly motivated by increasing efficiency and growing business, while this sector was also concerned about competition. Transportation was motivated primarily by responding to competition. We might guess the rise of innovative Fintech companies and new digital-led mobility services could have affected these sectors. Manufacturing and Healthcare were strongly motivated by increasing efficiency, while Retail was similarly strongly motivated but by growing business.

Motivation for digital transformation (non-online companies)

Industry Sector	Motivation		
	Primary	Secondary	Tertiary
Finance	Efficiency (31%)	Growth (30%)	Threat (23%)
Transportation	Threat (30%)	Efficiency (26%)	Growth (23%)
Manufacturing	Efficiency (40%)	Growth (23%)	Innovation (22%)
Retail	Growth (40%)	Efficiency (25%)	Innovation (16%)
Healthcare	Efficiency (41%)	Growth (28%)	Innovation (21%)

Progress in digital transformation

Not surprisingly, close to 100% of online companies responded that they had started digital transformation. But we also found that two out of three traditional companies have also embarked on the transformation journey. And in spite of the challenges, many organizations reported they have delivered through digital projects and have achieved outcomes.

Within traditional companies, the financial services sector was the furthest advanced in transformation. Nine in every ten business leaders from financial services organizations reported they had begun digital transformation. One in three of their digitalization projects had delivered outcomes already. The manufacturing, transport and retail sectors followed, all at similar stages of progress. Around two in three organizations responded that they had already started digital journeys.

Digital journeys by industries (non-online companies)

Industry Sector	Started Digital Journey	Delivered Outcomes	Digital Maturity*
Finance	89%	29%	57%
Transportation	67%	25%	48%
Manufacturing	69%	21%	44%
Retail	62%	28%	41%
Healthcare	60%	14%	39%

* % of companies which responded they had capability in each of the six success factors

Overcoming Challenges

We asked the business leaders in our survey what their major challenges were. The results confirmed what we ourselves have experienced. Digital is not so easy. The biggest challenge reported by non-online companies is skill shortages, followed by internal resistance to change and lack of agility in their organization. But we also find cyber-security as well as integration of digital with existing IT are big concerns.

An interesting finding is that organizations face different challenges at different stages of transformation. At the planning stage, their primary challenges are skill shortages, lack of agility and leadership. But as digital projects move into the implementation stage, different types of challenges emerge. They face internal resistance and they need to demonstrate ROI as well as secure funding. They also have to deliver integration of digital with existing IT, and protect against cyber-attacks. To deliver real success, organizations have to overcome these problems.

A little surprisingly, leaders of online companies also reported facing many of the same challenges. They may be starting from a different base, but they still have to change to embrace new technology for growing business.

Digital Maturity

So how could these challenges be overcome? How could results be achieved? And what could we learn from the organizations who have delivered? We analyzed the results of our survey, looking to identify key success factors.

We found that organizations which had delivered outcomes showed strong capabilities across six factors: Leadership, People, Agility, Business Integration, Ecosystem and Value from Data. Those who were in the implementation stage or had not started posted much weaker scores across these factors. For instance, 81.8% of non-online businesses that had delivered outcomes to a greater extent said that they had the skills needed for digital transformation. For businesses that reported they had delivered outcomes to a lesser extent, this number was 56.7%. Those who were in the implementation stage or had not started posted much weaker scores across these factors. This number further reduced to 40.7% for businesses that were transforming but had not yet delivered outcomes, and to only 19.2% for businesses that had yet to start.

In other words, we found the digital maturity of an organization is strongly correlated with the capability scores in these six areas. We could therefore conclude that these are significant success factors.

We also looked at the digital maturity of different sectors. The financial sector had the highest average score (57%) across these 6 factors. This is in line with their fast progress in digital transformation.

Challenges of digital transformation

Planning Phase Challenges

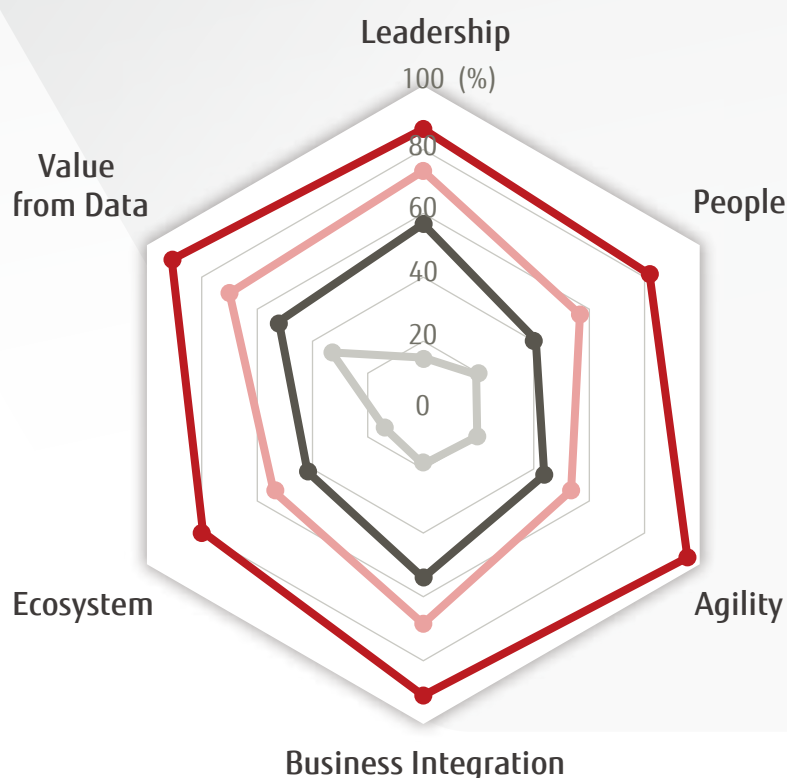
- Skill Shortages
- Lack of organizational agility
- Lack of leadership

Implementation Phase Challenges*

- Resistance from the organization
- Funding and Return on Investment (ROI)
- Integration of IT and Digital
- Cyber-security

* This phase includes Proof of Concept and Proof of Business

Delivery of outcomes correlates with higher capabilities in six success factors



Digital maturity

(non-online companies)

The numbers in the chart are % of companies which responded they had capability in each of the six success factors

- Implemented and delivered outcomes to a greater extent
- Implemented and delivered outcomes to a lesser extent
- Implemented but not yet delivered outcomes
- Not yet planned

Learning from online companies

When we looked at the responses of online companies, we found, not surprisingly, online companies had more advanced capabilities than non-online companies across these six factors. For instance, the proportion identifying skilled people was 38.9% for traditional companies and 62.7% for on-line companies.

But what did surprise us was that the difference between the average capabilities of online and non-online companies who had delivered significant outcomes was not all that marked. Not only are these same factors relevant for both online and traditional companies, but the most advanced traditional companies had nearly matched the online companies in terms of digital maturity.

We also analyzed the differences between organizations that delivered greater outcomes and those that delivered lesser outcomes within organizations that had delivered transformational outcomes. Three out of the six factors stood out: agility, skilled people and ecosystem. Online companies are more adept at these three factors than traditional companies. To deliver success, we think traditional organizations can learn best practices of these aspects from on-line companies.

Digital Journey

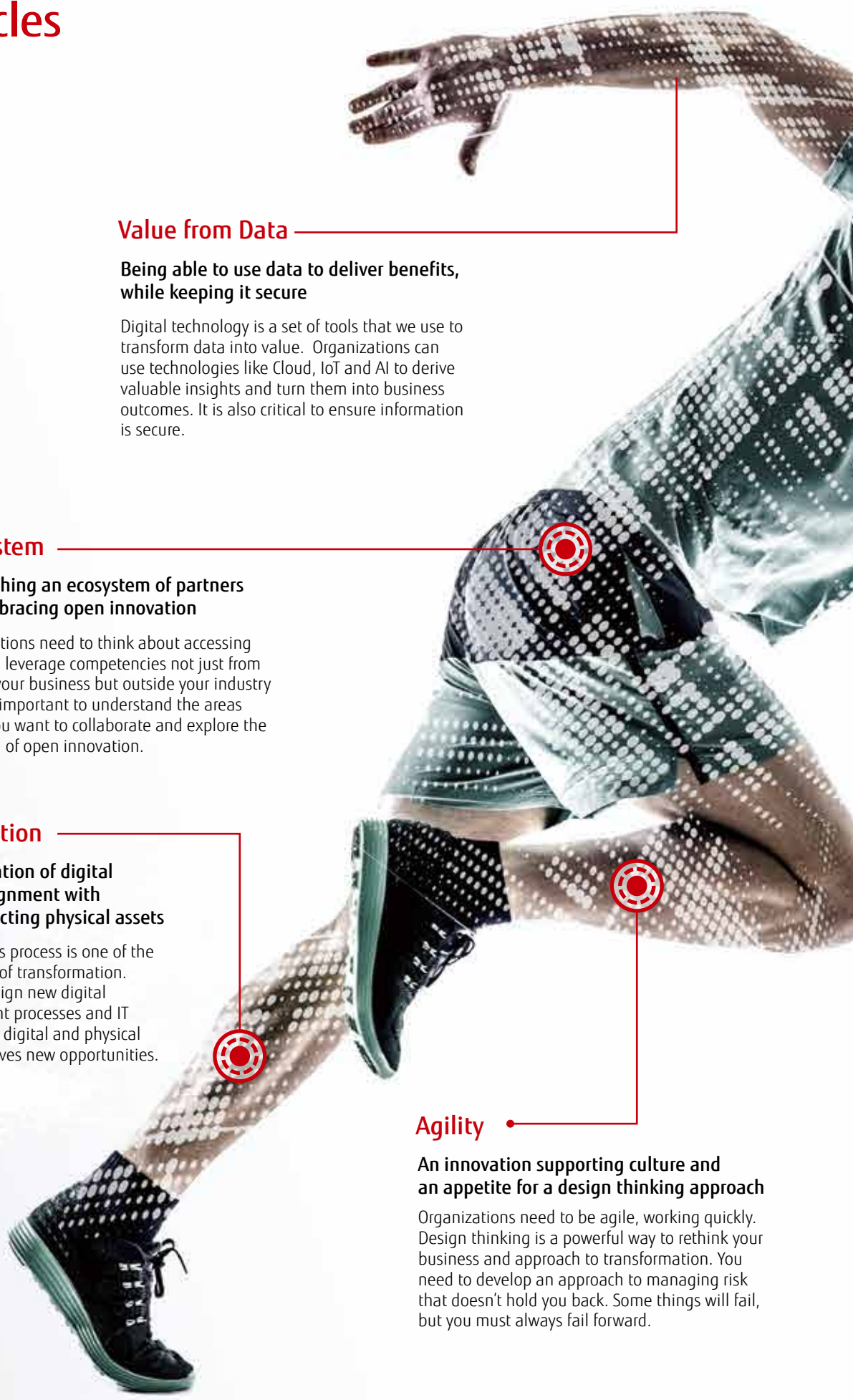
The results of the survey point to the fact that digital transformation is a journey. It affects every part of the enterprise, including its people, its culture, its approach and style as well as its interaction with partners.

This means developing and implementing digital technology, operating it, taking in feedback and continuing to innovate. But the survey confirms that digital is not merely about introducing technology. It is about integrating business and technology. Digital is the continuous reinvention of business.

The six success factors reminded us of something. When an athlete prepares for a race, he needs to build and develop muscles. He understands that this does not happen overnight, it is a process of building and strengthening. But if he wants to win, he commits to training with strong determination, to build and develop his body.

It is the same for organizations. If an enterprise wants to achieve success through digital transformation, it must commit to develop its own 'digital muscles'. The stronger your digital muscles, the better the likelihood of delivering success.

Digital Muscles



Value from Data

Being able to use data to deliver benefits, while keeping it secure

Digital technology is a set of tools that we use to transform data into value. Organizations can use technologies like Cloud, IoT and AI to derive valuable insights and turn them into business outcomes. It is also critical to ensure information is secure.

Ecosystem

Establishing an ecosystem of partners and embracing open innovation

Organizations need to think about accessing data and leverage competencies not just from outside your business but outside your industry too. It is important to understand the areas where you want to collaborate and explore the potential of open innovation.

Business Integration

Practicing the integration of digital into the business, alignment with existing IT and connecting physical assets

Digitalization of business process is one of the most complicated areas of transformation. Organizations need to align new digital initiatives and the current processes and IT systems. Connecting the digital and physical parts of your business gives new opportunities.

Agility

An innovation supporting culture and an appetite for a design thinking approach

Organizations need to be agile, working quickly. Design thinking is a powerful way to rethink your business and approach to transformation. You need to develop an approach to managing risk that doesn't hold you back. Some things will fail, but you must always fail forward.



• Leadership

Digital transformation is a priority of the CEO

Digital transformation requires strong leadership and clear-cut strategy. Innovation requires a different style of management and culture. Above all, a vision and a purpose are key for ensuring you deliver value from digital.

• People

Ensuring people having the right skills for digital transformation

It is critical to bring together the different types of people necessary to make transformation a success. For instance, how do you bring together business people, technology people and people with design skills? How do you develop new skills, and bring in new skills from outside? How do you encourage diversity?

The Path to Success

We started the chapter by reflecting how each company operates within a unique set of circumstances. However the six 'digital muscles' represent a common path to success that applies in any business context. To deliver 'Real Digital' requires these six muscles to be developed and trained. We believe these factors are universal, applying to all companies, regardless of industry sector or whether an online or non-online company.

Many of the challenges the business leaders reported in our survey were already familiar to us. Fujitsu has faced similar challenges. A key challenge is that the digital journey itself creates a dilemma of operation and innovation. Organizations need to deliver innovation, which may disrupt their ongoing business. Therefore, at the same time, they need to carefully control and manage all their activities. These two areas require different approaches and skills. Innovation invites risk whereas operation abhors it.

Fujitsu is tackling this critical issue by setting up a digital innovation organization and introducing a different management discipline and culture. We are also adopting lean innovation, using a design-thinking approach and leveraging open innovation ecosystems. We lay out some details of this strategy in Chapter 2.

The 'digital muscles' suggest that digital transformation is multi-dimensional. There are many resources and competencies that an organization needs to take account of and leverage – both inside and outside of the organization - in order to progress.

In our survey, the companies that had delivered outcomes placed the highest importance on technology partner, followed by their customers. The respondents wanted to work with technology partners that could be trusted, that were agile as well as having technology expertise and are able to deliver quality. It is also interesting that online companies value ecosystem partners, including startups, companies from different industries or consortiums, to a much greater degree than traditional companies.

We believe Digital Co-creation is the best way of achieving digital transformation. It enables you to focus more strongly on creating value for your customers, to bring out the best in your people, and leverage the skills and capabilities that exist outside your organization.

Digital Co-creation is a way for organizations to leverage digital technology and deliver innovative value jointly with your partners and customers.

Delivering Successful Outcomes

What kind of business outcomes have been delivered through digital transformation? Our survey indicated that there were five major outcomes: improving customer experience, increasing competitiveness, increasing efficiency, increasing agility and transforming business model. All of these five outcomes contribute to increase in revenue and business growth.

As we have seen, digital means different things to different industries. If we look into the outcomes of industry-specific digital solutions, we have also observed different characteristics in outcomes. The financial digital solutions marked high-

est score in agility, while the manufacturing solutions delivered efficiency and the retail solutions delivered customer experience.

Through co-creation, our customers across different industry sectors have also delivered these five outcomes. In many cases, we used agile approaches, including our design think-

Outcomes of digital transformation



Improving customer experience



Increasing agility



Increasing competitiveness



Transforming business model



Increasing efficiency

Belfius

The third-largest retail bank in Belgium looked for e-signature functionality for mobile banking, and selected the Fujitsu Sign'IT solution, a highly-secure biometric signature that is entered directly on the customer's smartphone.

Outcomes



- Sign-up can be completed in five minutes
- Gained an average of 1,000 new mobile banking customers a day
- Reduced the need for paper contracts

Please see page 62 for details.

Slingeland Hospital

Slingeland Hospital, a medium sized hospital in the Netherlands, collaborated with Fujitsu and deployed sensor technology to capture patient performance, realizing a new 'Sensing Clinic'.

Outcomes



- Reduced the need for bedside visits, while continuously monitoring patients' vital signs
- Enabled better informed decisions on treatment by medical staff
- Enabled early detection of any deterioration in patients' conditions

Please see page 56 for details.

Toyota Technical Service Division

Toyota's Technical Service Division wanted to design the direction of future workstyles of service technicians, and introduced Fujitsu's design thinking concept to create a vision map of the 'preferred future'.

Outcomes



- Employees focus on what they want to do and what they want to be in the future, increasing the motivation to work
- An atmosphere of accepting diversity and being willing to actively cultivate new ideas is now emerging

Please see page 68 for details.

ing methodology, for finding out business objectives and developing digital solutions together in a short period of time.

Again, digital is not easy. Our customers and our Fujitsu colleagues have worked through close and intensive collaborations to overcome many challenges. Often through trial and error, which is necessary for creating innovation. But innovation scales through learning. We hope you can learn from the best practices of digital transformation, and achieve success.

Kawasaki Geological Engineering

Kawasaki Geological Engineering introduced Fujitsu Zinrai Deep Learning to identify cavities and potential sink holes by analyzing the vast amount of image data from sub-surface scans of roads.

Outcomes



- Introduced the deep learning technology in less than one month with close to 100% accuracy in anomalies detection
- Reduced the time to detect anomalies by 90%, and halved the total time for cavity identification

Please see page 48 for details.

Siemens Gamesa



Siemens Gamesa produces over 5,000 wind turbine blades every year. Siemens Gamesa and Fujitsu co-created an Artificial Intelligence platform for the quality assurance process using an agile approach.

Outcomes



- Completed the introduction of AI technology within 3 months
- Reduced scanning inspection time by 80 percent, which translated into cost savings, and reduced production lead times

Please see page 46 for details.

Lotte Card



Lotte Card adopted the Fujitsu palm vein authentication solution, which enabled users to make payments at stores simply by holding their hand over an authentication device.

Outcomes



- Made cashless, cardless purchases a reality, eliminating the need to carry purses, wallets or mobile devices, etc.
- Revolutionized shopping experience as well as transformed the business model of payment services.

Please see page 64 for details.

Chapter 2

Technology and Service for Success

Creating value out of data

At its heart, digital is about creating business outcomes from data. As we saw in Chapter 1, organizations need to build 'digital muscles' to succeed. 'Creating value from data' is one of these six digital muscles. How can organizations turn data into value to achieve success?

There are many different types of data. Operational data, data about your supply chain, your products, your employees, your finances, your customers, and your R&D. And different businesses use data in different ways. Mostly this business-related data is structured. Structured data is any data that is organized. For instance, logs, databases or spreadsheets.

However, structured data is only a small fragment of the data universe. Most data is unstructured, and the volume of such data is exploding. Text, speech, video, images, and sensor data, these sources all contain data that is not organized. It is not easy to deal with unstructured data. But developments in AI are delivering some breakthroughs. For example, deep learning has enabled autonomous recognition of images with extremely high precision. Often even better than people.

But exploiting these different types of data is not just a technology challenge.

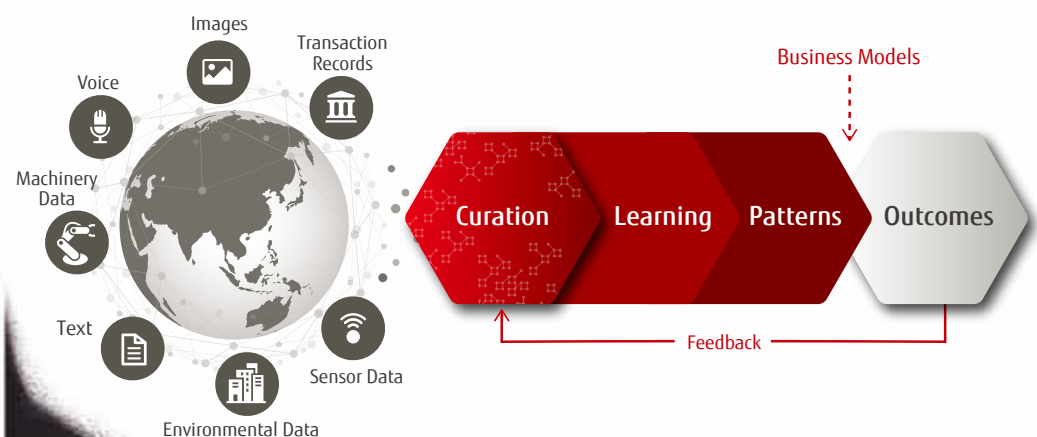
First, business domain knowledge is needed to understand which data is important and to prepare the data for learning.

Second, different types of data require different types of technology. Many people might perceive deep learning can be applied to any data. But in reality it is only good at handling specific types of data, for example, images and voice.

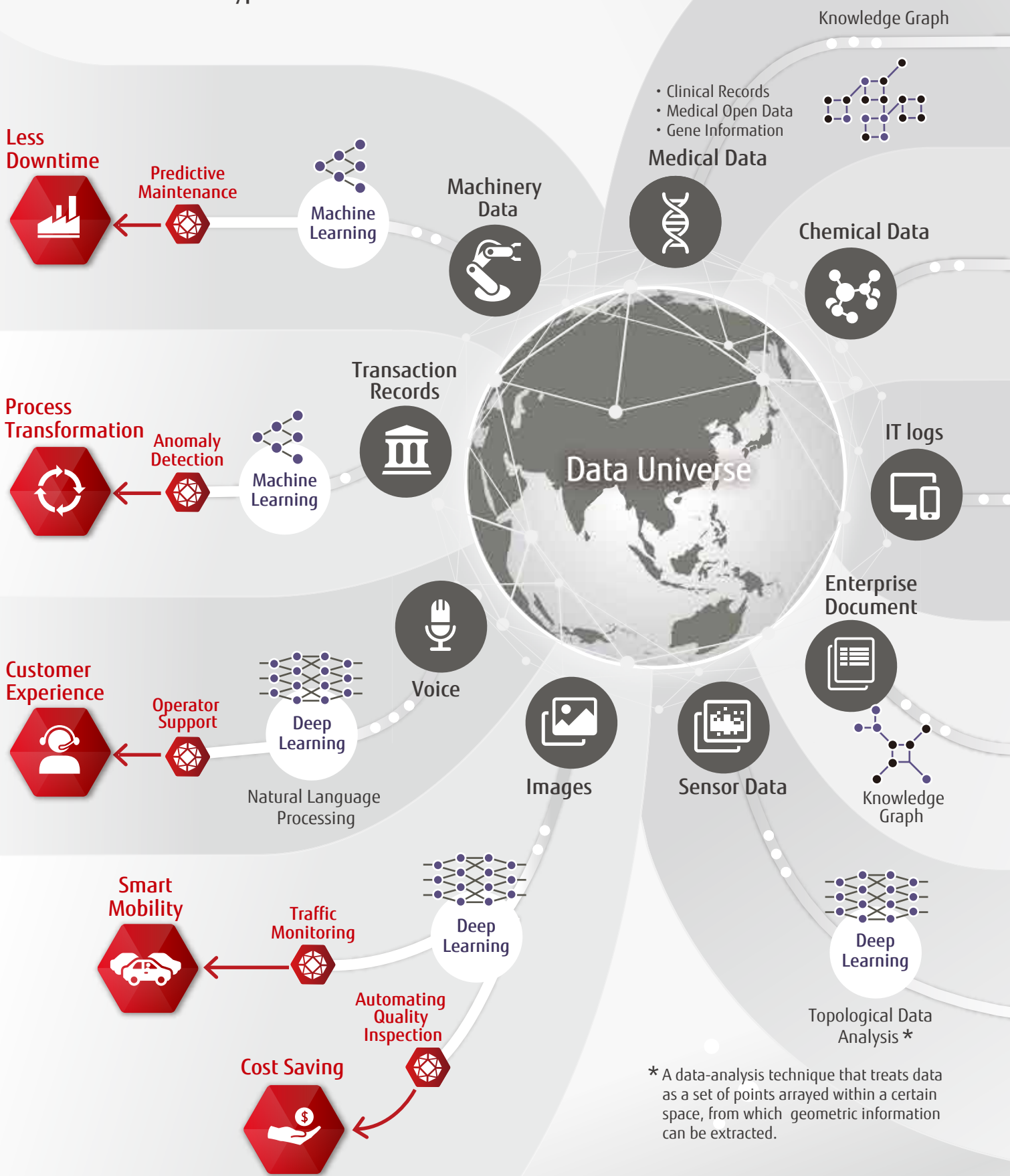
Third, even if insights are identified from data, you need to decide what you do with them. To monetize the insight may require a new business model, which needs business skills and an entrepreneurial mindset.

The whole process, from curation of data to delivery of a new business model, is a continuous learning process. Using data, many of our customers have already achieved substantial successes, such as improving operational efficiency and customer experience. We have cutting-edge technologies and professional knowledge and experience to help you realize this. In this chapter, let's look at how Fujitsu can help you achieve your success.

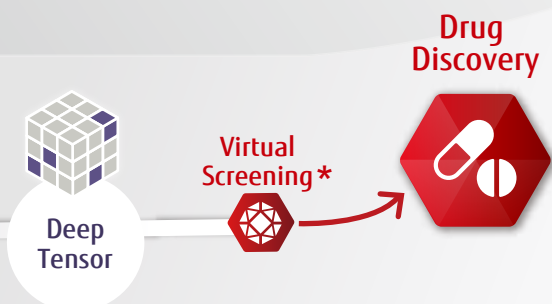
Data Universe



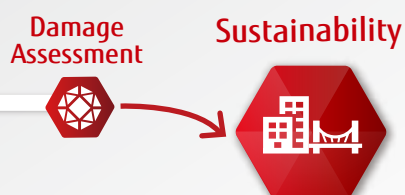
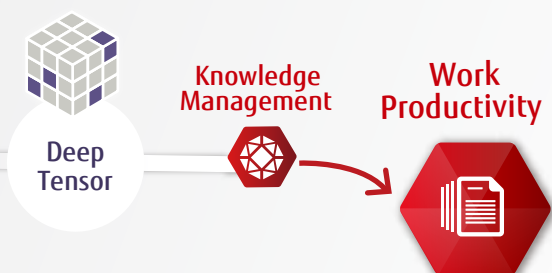
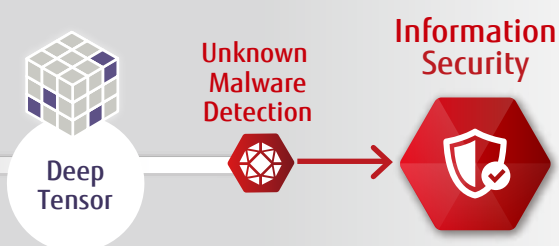
Achieving outcomes in business and society by applying the most appropriate AI technologies and knowhow to different types of data



* A data-analysis technique that treats data as a set of points arrayed within a certain space, from which geometric information can be extracted.



* A technique which searches for candidate chemical compounds for drugs on a computer.



Let's look at how different sources of data can be used and processed to create value, to solve challenges in business and society.

1. Curate and prepare data

To prepare data requires business domain knowledge. For instance in the healthcare sector, you may need to combine and analyze clinical records, gene information and medical research data. Data curation requires specialist knowledge.



Fujitsu Knowledge Graph

Fujitsu Knowledge Graph is a powerful tool to visualize such diverse data in a graph structure and analyze the relationship among the data. (See page 31)

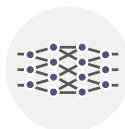
2. Use the most suitable AI technology to learn from data and extract insights

It is important to choose a right set of AI technologies appropriate for the types of data.



Machine Learning

Machine learning is a methodology to identify patterns from learning data repeatedly.



Deep Learning

Deep learning is a machine learning technique. It leverages neural network architecture, enabling to recognize complex patterns, for example, hand-written characters and naturally spoken voice.



Fujitsu Deep Tensor

Fujitsu Deep Tensor is our unique deep learning technology that can handle graph-structured data, such as chemical compounds for discovering new drugs. Our technology solves the problem of applying deep learning to large-scale graph-structured data. (See page 31)

3. Create solutions using the insights

Using insights gained from learning, create innovative solutions. For instance, a new way of making clinical decisions, detecting unknown malware activities, or predicting failures of manufacturing facilities.



4. Deliver business and social outcomes

Those innovative solutions will deliver substantial outcomes, such as saving more lives, protecting data and information systems, or reducing down-time of the factory.



Our Approach

Connected Services

Our strategy is driven by you. What you tell us about the challenges you have in your business and what opportunities you need to realize. At the same time we want to develop the technologies and services that help us to work more closely with you. Both in terms of our proximity to you and the type of outcomes we can help deliver for your business.

You have told us digital is not easy. Our focus is on helping you deliver success. We want to be your co-creation partner in your digital journey. Digital technology is built to deliver business and social technology is built to deliver business and social outcomes. This is realized by turning data into value.

As we have already described, AI plays a key role, providing a powerful method to learn from data and create insights. But AI is one of a set of tools. Before you can analyze you need to gather data. IoT technologies allow you to collect data from the physical world. Cloud technologies provide the foundation

for you to connect everything together, and for your business to act in the most agile way. And security technologies assure the trustworthiness of data and protect your information and assets.

To realize success, you need to exploit the connected capabilities of these digital technologies. Fujitsu connects AI, IoT, Cloud, and Security technologies to provide intelligent services for creating value from data. We call this Connected Services. This is our strategy.

We recognize that your digital journey does not reach a final destination, even if you finish building your digital system. Digital is a cyclical process of development and operation through which your business continually improves how it creates value. As your business partner, we want to support your continued transformation.



Fujitsu's strategic initiatives for digital transformation



Industry Transformation

- Knowledge Integration
- Industry Platforms



Platform and Ecosystem

- Digital Business Platform MetaArc
- Open Innovation



Breakthrough Technology

- Human Centric AI Zinrai 'Explainable AI'
- Digital Annealer, etc.

Value you can expect from Fujitsu

We want to help you deliver outcomes for your business. Our strategy has three objectives to help you achieve this.

First, we provide the technologies and services that can help you connect knowledge and co-create innovation. We call this Knowledge Integration. This is about enabling the transformation of industries and enabling organizations to explore and realize the benefits of digital ecosystems.

Second, we provide the platform technologies to enable your digital business, and for you to leverage an open innovation ecosystem. Organizations need a scalable platform for exploiting data and digitalizing their businesses. Fujitsu provides Digital Business Platform MetaArc. This cloud-based business platform offers suites of digital technologies as a service so that organizations can quickly create software and scale their digital business. Fujitsu proactively contributes to developing ecosystems of start-ups and software developers. Using a design thinking approach, we help our customers develop their visions and business ideas, and realize them.

And thirdly, Fujitsu pushes the boundaries of technology. We are developing unique technology innovations to exploit data to deliver previously unthinkable outcomes. For example, Fujitsu's Human Centric AI Zinrai has realized the implementation of Explainable AI. Furthermore, Fujitsu's new computing architecture we call Digital Annealer can solve difficult business and societal problems, which are impossible for conventional computer.

Let's explain what we are doing around these three strategic objectives in more detail.

Industrial Transformation toward Digital Arenas

From vertically integrated value chains to distributed ecosystems

Data is causing the transformation of entire industries. In the past, each industry supplied its products and services. Banks provided banking services. Insurance companies provided insurance. Automobile manufacturers produced cars. Pharmaceutical firms delivered drugs. They provided these products and services from their own vertical value chains, through a single point of exchange with their customers.

But today, data is enabling value to be created from outside of traditional value chains. The borders of existing industries are becoming blurred, and being replaced by emerging digital ecosystems. We call these Digital Arenas.

A Digital Arena is a shift from a vertically integrated value chain to a horizontal, distributed value-creating ecosystem. Value is co-created in a Digital Arena, with outcomes oriented around people. It is not something to happen in the future. It is happening today. Let us show you some examples.

Digital Arenas

The borders of existing industries are becoming blurred and disappearing, and being replaced by emerging digital ecosystems



Intelligent Mobility

From Auto and Transportation to Mobility Services

The automotive and transport industries are giving way to a Digital Arena of intelligent mobility. Intelligent mobility means for example that people can commute freely anytime without owning a car. It means that goods can be transported quickly and efficiently with less environmental impact. Rather than consuming a product or service, an individual consumes the outcome of 'mobility', the journey from A to B in the way that is most convenient to their needs.

Data is driving the change. For instance, location-data platforms have already allowed people to share cars and share rides in many cities in the world. Connected cars leverage a variety of information provided through the internet, enabling a new business model in finance and insurance linked with the driving data. In addition, data from in-vehicle laser, radar and cameras, combined with data from GPS, digital map and vehicle telemetry, is enabling self-driving. That is only the start.





Intelligent Wellbeing

From Treatment of Diseases to Healthy Lives

Even today, the healthcare data of each individual is mostly managed by multiple institutions separately, from hospitals and clinics, to care homes and to drug stores. But this is not the only data. Connected devices can now generate real-time data of an individual's vital signs and their physical activity. Bringing together these data across players enables truly human-centric intelligent wellbeing. The outcome is better quality of life, instead of the traditional, reactive value of curing diseases or treating accidents.

To generate innovative value, there are plenty of data available, including clinical records, open medical data, human gene information as well as chemical compound information for drug discovery. We can deliver social innovation by bringing together these data to reveal fresh insights. For example, the San Carlos Clinical Hospital in Spain and Fujitsu together built an advanced technology platform using Artificial Intelligence to help mental health patients by assessing key risk factors of drug and alcohol abuse and even suicide.



Intelligent Safety

From Response to Disasters and Crimes to Total Safety and Security

Safety is a key objective of cities and countries. In each country, its public sector and a set of enterprises provide the national infrastructure to support people in their lives and work, as well as to protect them from crimes, natural disasters or accidents. Use of data can help them to realize a safer society. For example, in Indonesia, Fujitsu supported a government initiative to counter the abuse of women by allowing people to report incidents using our location data cloud. To prevent failure of aging social infrastructure like bridges, we developed an AI technology to make an assessment of structural deterioration using sensor data.

But today an emerging challenge is that malicious acts in the digital world can now lead to real disasters in the physical world. To realize intelligent safety across the physical and digital worlds, ministries and supporting enterprises must shape an ecosystem to share real-time information and collaborate with agility.



Intelligent Trust

From Financial Service to Value Creation by Trust

As we have seen in the previous chapter, financial services is the most advanced industry sector in terms of digitalization and is shifting from a vertically integrated model to a distributed ecosystem model. For instance, many Fintech companies connect traditional financial institutions, businesses as well as individuals, to exploit data and deliver innovative services. Digital platformers like Amazon and Alibaba are providing financial services such as payment services for individuals and businesses.

Banks play a fundamental role of creating 'trust' to intermediate financial transactions and fuel the economy. We think this function will eventually become digitalized and embedded in every process of business activities and our everyday lives. For instance, we have already seen a business model of integrating the financing function into business supply chains.

These Digital Arenas are examples of upcoming industry transformation. We anticipate other sectors like manufacturing and retail to make similar shifts from vertical integration to horizontal co-creation. Enterprises will need to consider whether they continue their focus on their traditional product or service lines or explore new opportunities to create value, 'jobs to be done' for your customers. What kind of data will be essential for delivering such value, and which adjacent industries could be part of your co-creation plans?

Co-creating Innovation by Connecting Knowledge

Initiatives driving industry transformation

As industries are transforming, our customers are transforming their businesses and their IT. Fujitsu wants to be a Co-creation partner to help our customers drive their digital transformation. This is not an overnight change, rather, it is a journey. To enable this, Fujitsu is transforming itself, and undertaking various initiatives.

Knowledge Integration

Digitalization is changing Fujitsu's business model, shifting it from the traditional large system integration and IT infrastructure managed services to the co-creation of digital business centering on cloud. To respond to such changes, in 2015 we introduced the new concept of Knowledge Integration, for our system integration business.

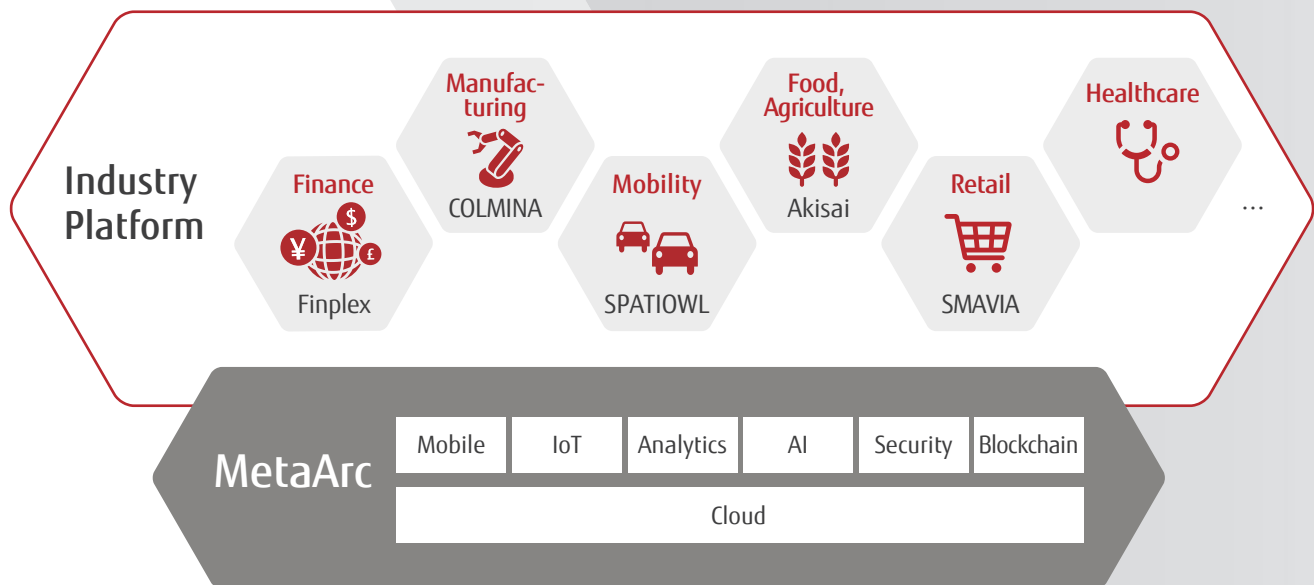
Knowledge Integration brings together our customers' domain knowledge with our own domain expertise to create new value, and enabling customers to develop the digital ecosystems with key stakeholders. To support this we are strengthening our design, development and delivery capability for digital, and delivering a new service framework for co-creation. Fujitsu will continue to deliver the systems that our customer rely on us for, like mission critical systems.

Digital co-creation requires a new approach, based more on experimentation and iteration than on delivering against detailed and pre-determined specifications. Last year in Japan, Fujitsu created a new Digital Transformation Business Group to add to our existing industry business groups.

Creating a new organization split from existing parts of the business allows us to set up new ways of working, new workplaces, as well as training and incentives that target digital business. We are increasing the number of 'Digital Innovators' – a role that drives co-creation initiatives with our customers. Our talent program has given a special focus to developing three types of roles. The first are 'developers' specialized in digital technology. The second are 'designers' who can help create new business. And the third are 'producers', skilled at leading co-creation with customers. These people work with customers under a new service framework for co-creation.



Fujitsu's Industry Platforms



Leveraging industry platforms

Fujitsu provides various industry platforms to accelerate the digital transformation of our customers' core business.

Finplex:

A platform accelerating the transformation of financial services

Our industry platform for financial services is called 'Finplex'. This platform offers APIs (Application Programming Interfaces) for finance-related services, enabling customers to create and quickly deploy new digital financial services. It also enables customers to co-create innovative services through the collaboration with companies in other industries.

For example, Mizuho Bank used Finplex to integrate FIDO authentication, a global standard for online authentication, into its mobile banking application. Finplex enabled Mizuho bank to introduce a secure biometric authentication application within six months and improve customer experience.

COLMINA:

A platform connecting knowledge in the manufacturing industry

Around half of our manufacturing customers are interested in implementing IoT technologies in their factories to gather data. A fifth are looking to implement AI to improve productivity.

Fujitsu's manufacturing industry platform service is called 'COLMINA'. It is designed to enable a manufacturer to connect all information regarding design, manufacturing and maintenance to transform its manufacturing business. For example, this platform enables data at the edge, from sensors in machinery for instance, to be collected and used to visualize the manufacturing operation real-time and improve efficiency.

Furthermore, on this COLMINA platform, business knowledge and knowhow related to the manufacturing industry can be brought together, and the supply chains across organizations can be seamlessly connected. In the future, COLMINA will create a place to share the knowhow of veteran engineers about design, manufacturing and maintenance, find and match talents, and provide greater support for collaboration and co-creation between organizations.

Other Platforms

We provide platforms for other industries, too. 'SPATIOWL' is a mobility platform for cities, which overlays and analyzes multiple sets of data including real-time information of moving vehicles. 'Akisai' is a platform for smart food and agriculture, and 'SMAVIA' is a retail IoT platform. All of these industry platforms are delivered as a service on Fujitsu Digital Business Platform MetaArc, which we describe in the next section.

Fujitsu Digital Business Platform MetaArc

Creating value from data to enable digital business

In Chapter 1 we drew an analogy between an athlete training to increase their physical performance and the 'digital muscles' that organizations need to develop. A digital business platform enables business to strengthen digital muscles: to make better management decisions, to empower people to work more productively, to be more agile, to integrate business and technology, to create value out of data, and to leverage the growth of ecosystems. The digital business platform is a key foundation to this journey of improvement, from the discovery of new markets to the agile development of innovative services.

Most organizations have long standing histories of delivering physical products and services. These businesses have been supported by traditional IT systems and processes. But digital companies that provide services through the internet owe much of their growth to scalable digital platforms.

Fujitsu delivers the value in scale and brings digital technology innovation to customers, while aligning digital technology with existing IT. MetaArc is our cloud-based Digital Business Platform. It is designed to help organizations to successfully drive their digital transformation journey.

Jumping into Cloud-native Business

Digital requires a new toolkit and an agile development methodology. This is different from existing IT. It isn't so easy for traditional companies to embrace such new methods. But

MetaArc offers a comprehensive framework for IT organizations and software developers to jump into a cloud-native development with confidence.

Digital technologies as a service

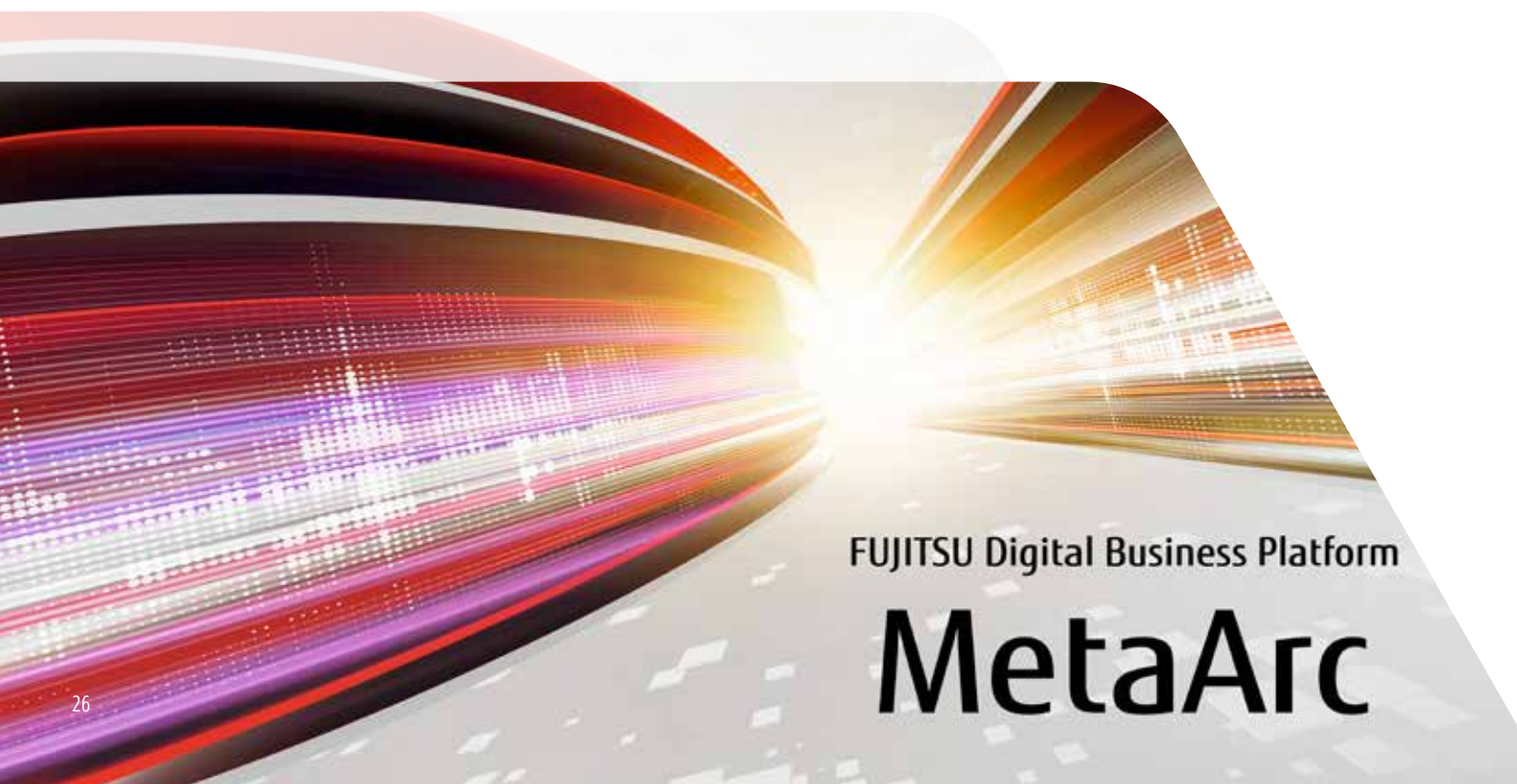
Digital business is about driving business with software. Digital business software is modular, like building with Lego bricks. Software modules can be connected using Application Programming Interfaces (APIs) which define the set of rules for how the software can interact.

MetaArc offers a broad range of cloud-native infrastructure and platform services, ranging from computing, digital technology such as AI, IoT and Mobile.

Customers can create, test and run new business prototypes by connecting multiple services delivered as APIs on MetaArc. MetaArc makes it easy to develop a new service by running an agile process more easily than before.

Digital Marketplace

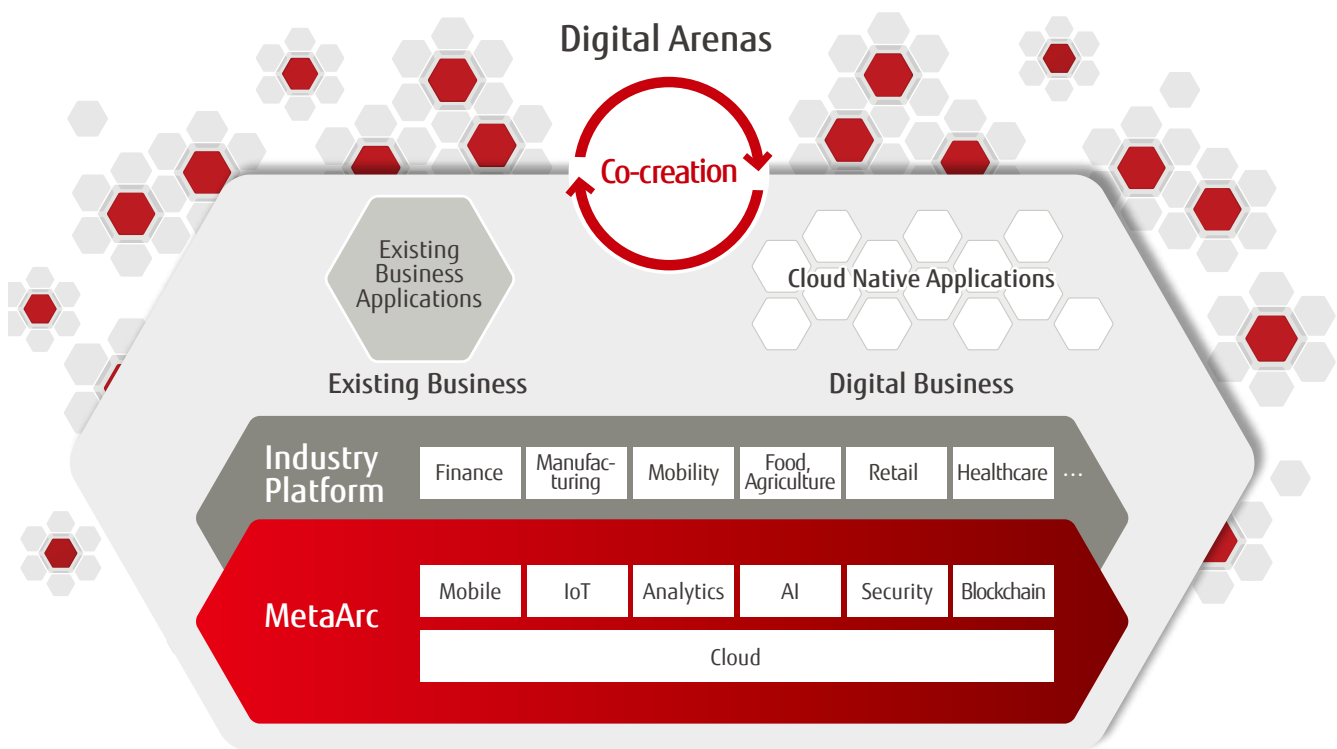
Fujitsu also provides MetaArc Marketplace, a co-creation place for cloud native business. This Marketplace handles not only our own cloud services and APIs but also many software services of large IT vendors such as Microsoft and Oracle, start-up companies and Fujitsu customers.



FUJITSU Digital Business Platform

MetaArc

Digital Business Platform MetaArc



Modernizing IT for digital transformation

In our global survey, 78% of the respondents told us that the integration of digital and existing IT is a key driver for delivering outcomes. For many enterprises, it is becoming an urgent priority to migrate their existing IT assets to a hybrid cloud environment. This allows organizations to cut the increasing burden of maintaining complex IT assets and systems which today accounts for 70% of IT expenditures. The migration to cloud also makes business more agile and responsive to the changing market.

Fujitsu offers a hybrid cloud solution which bridges cloud and non-cloud systems to create a seamless managed platform. We offer high speed network links so that customers can achieve the full benefits of both existing datacenter and cloud services. This is possible because we provide both datacenter service and cloud services.

We also provide a service to help customers modernize existing assets as well as managed services to help migrate existing IT assets to cloud. With our experience of developing and managing customers' existing IT, Fujitsu is well-placed to deliver these services.

Ecosystems for Open Innovation

Using design thinking to transform, harnessing skills and knowledge across an organization

As we have seen in Chapter 1, digital transformation is not just about introducing technology. It is driven by people. A key for successful digital transformation is to strengthen creativity and imagination. In addition, in order to make digital business into reality, a business model using an eco-system with partners plays an important role. An open innovation approach is necessary.

Global Co-creation initiatives

In 2017, Fujitsu set out our own design-thinking approach, "Human Centric Experience Design" (HXD). HXD is designed to bring success from digital transformation. We have used this approach to engage with many customers and partners, resulting in positive outcomes for their businesses. The process starts from the creation of a 'big picture' of their business. This is followed by idea creation for the new businesses, and then fast prototyping and business modeling in an agile way. The case of Toyota, as we saw in the Chapter 1, is an example.

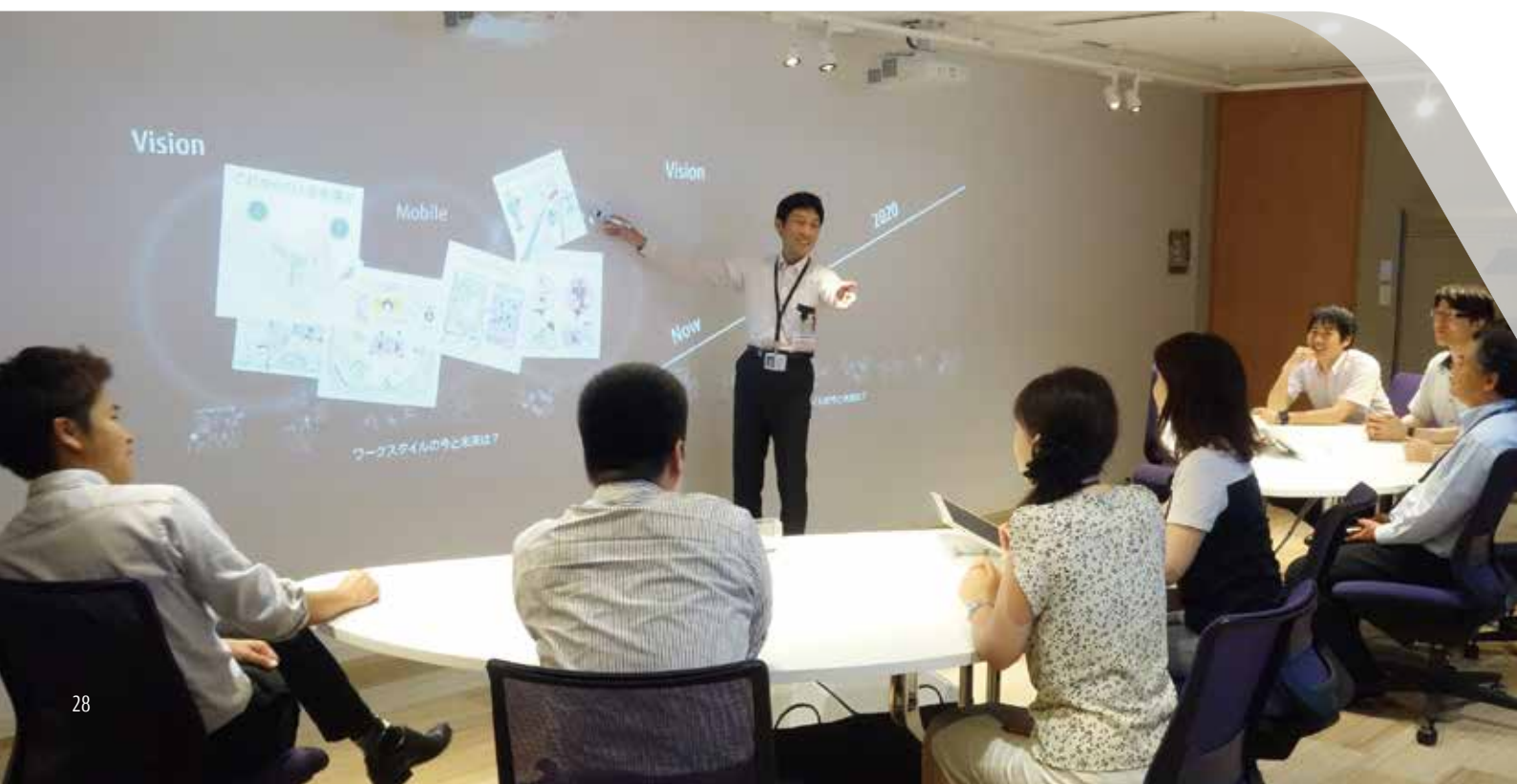
We think having the right environment is crucial for co-creation. Well-designed workshop spaces stimulate creativity and imagination. To this end, Fujitsu has set up several new co-creation facilities. Fujitsu opened HAB-YU, a co-creation place with design thinking in Roppongi, Tokyo in 2014, and FUJITSU

Knowledge Integration Base PLY in Kamata, Tokyo in May 2016. Over 30,000 visitors have already experienced co-creation at PLY. We also opened our first Digital Transformation Center in Hamamatsu-cho, Tokyo in 2016. This year, we are opening co-creation facilities around the world, starting in Munich, London and New York. In these locations, Fujitsu's designers, business producers and engineering experts work with customers and partners to turn their aspirations into realities.

Since 2015, Fujitsu has also been running a center for open innovation in Silicon Valley, called the Open Innovation Gateway (OIG), in Silicon Valley. 2,500 people, including many C-level executives of Japanese large enterprises, have visited the OIG and taken part in innovation and business transformation workshops. The OIG has a close relationship with the innovation community in Silicon Valley, including academics and industry experts, venture capitalists and start-up entrepreneurs. One of the OIG's ecosystem partners is Stanford d.school. They selected Fujitsu OIG as their industry partner, the first Japanese company they have partnered. Using this partnership, d.school, the OIG and a Japanese insurance company started a co-creation project regarding innovative user experience.

Digital Transformation Center

Create vision and business ideas by design thinking





Communities of Partners and Start-ups

Fujitsu has always worked with our large network of partners. Fujitsu is ranked Number One in four categories in the partner satisfaction survey 2018 by Nikkei Computer, the recognized technology industry publication in Japan. Our partners particularly recognize us for promoting their solutions with Fujitsu products and services. Outside of Japan, Fujitsu drives the SELECT Partner Program for its channel partners to help support customers together.

Fujitsu is also working to grow a start-up community. We started the MetaArc Venture Program in 2016. Twice a year, we organized matching events between start-ups and Fujitsu. Once matched, we engage on three-month intensive fast collaboration exercises. Today, the community has around 100 start-ups as members, and 40 co-creation projects are ongoing.

For example, a start-up called Unirobot embedded Fujitsu's Human Centric AI Zinrai technology into its communication robot, Unibo. Another example is a collaboration with a start-up called Asilla, which has unique image recognition technology for identifying people. Asilla and Fujitsu jointly developed a new support service that helps families and communities to monitor and look after people with mental health problems, like dementia.

Breakthrough Technology

Advancing technology frontiers and pushing the boundaries of innovation

The futurist Arthur C. Clarke once wrote 'the limits of the possible can only be defined by going beyond them into the impossible'. There is much that we can do with technology that would have once seemed impossible. The routing protocols that the internet was built on for example, were the brainchild of a US defense think-tank called DARPA. Today the same group are exploring computer-brain interfaces. How crazy would today's technology have seemed in the 1970s?

The technologies that will shape the future begin today. As a technology company, we understand the importance of pushing the boundaries of innovation. Exploring the edges of technology takes us to exciting new destinations, maybe even places we did not anticipate. It may not always be possible to predict the applications of a future technology. But if we want to empower mankind, technology is one of the best tools we have at our disposal.

Where are the edges of technology today? Quantum Computing is a technology that would fit with Arthur C. Clarke's reflection. There are many challenges in building a quantum computer, but many people expect the benefit of quantum computing to be materialized.

We have spoken much already about AI. We are still a long way from any sort of general artificial intelligence, but specific

aspects of this field are evolving rapidly. For example, the performance of AI in Natural Language Processing and Image Recognition is in many areas exceeding the abilities of people.

And Distributed Ledger technology, if it lives up to its potential, could radically change how the economy and society works. We will discuss Blockchain in more detail in the following chapter. But let's talk about our strategy for cutting edge technology, starting with AI.

Human Centric AI Zinrai

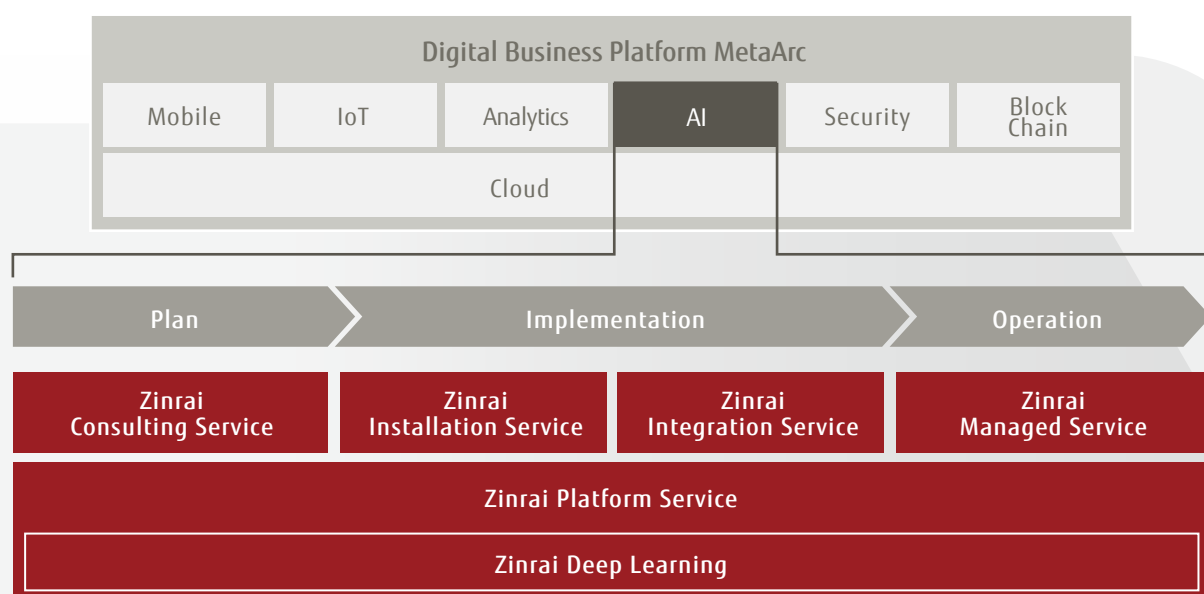
Fujitsu has researched and developed AI for over 30 years and registered over 200 AI-related patents. We are one of the leading vendors of AI in Japan.

Fujitsu has developed an AI knowledge and technology framework we call Human Centric AI Zinrai, now being delivered as services and products.

The Zinrai Platform Service delivers AI technology for business as APIs. Thirteen APIs including Image Recognition, Natural Language Processing and Forecasting have been released in 2017, and the number of APIs will be increased to 30 in 2018.

Zinrai Deep Learning delivers world class learning processing performance through the combination of high performance

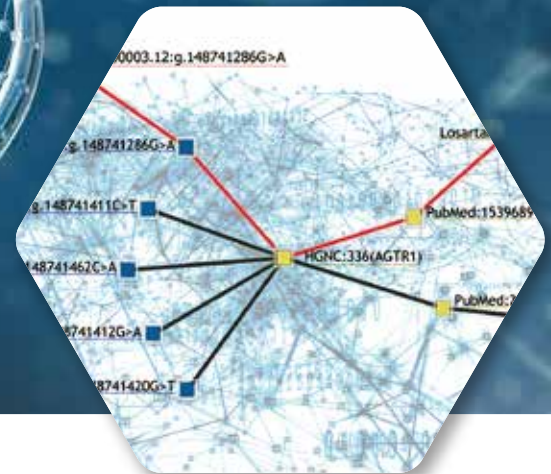
Services of Zinrai



Explainable AI, opening new possibilities for genome medical research

In a joint project with Kyoto University, Deep Tensor has learned from 180,000 pieces of disease-related genetic mutation data. Our Knowledge Graph embedded more than 10 billion pieces of knowledge from 7 million medical articles. From this basis Deep Tensor has been able to identify some of the factors that cause cancers, and Knowledge Graph is able to explain the reasoning behind the factors.

Knowledge Graph



GPU and Fujitsu's unique parallel processing technology, derived from our supercomputer development.

What makes Fujitsu's Human Centric AI Zinrai different from other AIs?

Fujitsu unique technology broadens the application of deep learning

Current deep learning technology is limited in the data types that it can be applied to. Fujitsu's unique technology, incorporated in Zinrai, has broadened the application of deep learning.

One area is time-series data. In the IoT era, massive volumes of time-series data are being created from devices. This data tells the status of these devices in real-time. However, deep learning techniques cannot classify complex time-series data with high accuracy. Fujitsu has developed the unique deep learning technology to automatically and accurately classify volatile time-series data. For instance, this technology can be used to analyze health data from wearable devices, predict failures of machinery or even identify invisible signs of wear and tear on large infrastructure like bridges.

Another area is graph-structured data, which expresses the relationships between people and things such as financial transaction logs and communication logs in an IT network. Current deep learning technologies cannot directly analyze graph-structured data, and need people to manually pre-identify the structure. Fujitsu has a unique technology called Deep Tensor, which can automatically extract characteristic features

out of graph-structured data through deep learning. This unique technology has already created outcomes for our customers, for example in better identification of high-risk financial transactions and in detection of cyber intrusion.

Explainable AI

Fujitsu is aiming to develop AI which is trusted by people, creates insights people can fully control and rely on. We believe this is most important when we envision the future evolution of AI. We are aiming to realize a society where people can use AI with confidence.

Many AI technologies can make decisions in new situations as a result of learning. However they cannot tell you how such a conclusion has been reached. This makes it difficult to exploit the full potential of the technology, especially in fields like healthcare and finance, where decisions must be open to scrutiny.

But our Human Centric AI Zinrai can explain the logic behind its insights, through the combination of our Knowledge Graph and Deep Tensor. Deep Tensor can identify factors that had a significant impact on the inference results through the reverse search of the output. And Knowledge Graph analyzes many different sources of information, identifies connections across multiple data sources and visualizes these connections. It explains the logical connection between inputs and inference results. The combination of these two technology is 'Explainable AI', a world-first technology that can be applied to many types of mission-critical decision making.

For instance, Fujitsu is working with Kyoto University to apply Explainable AI to genome medicine. We used our Deep Tensor to learn from 180,000 pieces of disease-related genetic mutation data. In addition, we successfully embedded more than 10 billion pieces of knowledge from 17 million medical articles and other materials into our Knowledge Graph. By inputting the genetic mutation data into this system, Deep Tensor was able to identify some factors causing cancers. Then, Knowledge Graph explains medical evidence to demonstrate the reasoning of how such factors are drawn. Medical experts simply need to review the flow of reasoning, reducing the time between analysis and report submission significantly, in this case from two weeks to a single day.

Not limited to healthcare, we are planning to implement this technology in other fields, such as finance, and other public sector services. We are confident that Fujitsu Human Centric AI Zinrai will significantly broaden the application of AI and deliver unimaginable outcomes.

The continuing need for bandwidth

The evolution of AI is driven by the combination of increasing volume of data for learning and the increasing computing and networking power. Data is growing all the time, both in terms of volume and varieties. For example, by 2025, between 100 million and 2 billion human genomes could have been sequenced. The data-storage demands for this alone could run from 2 exabytes to as much as 40 exabytes.*

As data grows, we need to continually push the boundaries of computing and networking. 5G, the next generation of mobile technology is set to bring us unprecedented speed and user experience. For example, at a big sports event, high-definition live broadcasting can be transmitted to thousands of devices at over 100 Mbps. Fujitsu is developing the key technologies to realize 5G.

The future of computing

We are reaching the limits of computing performance improvement, through the miniaturization of conventional semiconductor technology that has driven computing innovation for decades. What some people are calling 'the end of Moore's Law' seems to be approaching. To keep the same pace of innovation we therefore need to find a new architecture or computing paradigm.

Fujitsu is developing a next-generation architecture that can attain extremely high performance by specializing and optimizing its function in certain domains such as artificial intelligence, big data, security, and media processing. This is called domain specific computing. For each defined domain, the best computing architecture is selected and optimized. For example, in the area of artificial intelligence, Fujitsu is developing its original deep learning AI processor DLU™ (Deep Learning Unit).

DLU™ (Deep Learning Unit)

Fujitsu develops energy efficient processor specializing in deep learning by applying technology of the K computer, a super computer developed by Fujitsu and RIKEN (Available in FY2018)



Digital Annealer can solve complex combinatorial optimization problems in the real world



Digital Annealer

Quantum Computing, if materialized, is expected to be able to solve extremely complex problems in a fraction of the time it would take a conventional computer. It will create a breakthrough in the speed and accuracy of simulation. However, quantum computers remain in the nascent stages of development, their enormous potential may be many years away. If you could build one, it would need to operate at very low temperatures, close to absolute zero, and therefore require considerable space and underlying infrastructure to function.

Fujitsu Digital Annealer draws inspiration from the principles of quantum phenomena but implemented in current semiconductor technology. How is Digital Annealer different from conventional computers? It can compute complex combinatorial optimization problems. For instance, analyzing different permutations of twenty or more stock names in a portfolio result in an astounding number of possibilities - more than one quintillion - which no conventional computer can solve in any practical amount of time. By contrast, Digital Annealer can instantly find the least risky, diversified investment allocation

that maximizes returns, even from among 500 stock names, by grouping stocks that correlate with price variations. It is also expected to enable the discovery of new drugs for difficult diseases, the optimization of logistics and other challenges.

To drive innovation in this area, Fujitsu is working with 1QBit, a Canada-based quantum computing software company, the first company to commercialize the software for quantum computers. Fujitsu and 1QBit are collaborating to develop and provide applications which address problems of various industries. In March 2018, Fujitsu opened a new research laboratory, Fujitsu Co-Creation Research Laboratory at the University of Toronto, a development partner of Digital Annealer. Fujitsu and the University of Toronto jointly work on introducing Digital Annealer to solve challenges in smart transportation, network, healthcare and financial services. The year 2018 will mark the beginning of business use of quantum computing technology. As the first and foremost application, Fujitsu Digital Annealer stands ready to open up the future, realizing what was previously unthinkable.

Chapter 3

The path to a prosperous future

The New Digital World

In Chapter 1 and Chapter 2 we shared our perspective on how organizations can achieve success and how Fujitsu can help them.

But what about the future? How will the world change, and what will a successful organization look like in the next decade? Let's start by looking at how the world has been transformed by technology after the internet.

The internet, when it first arrived, was a new open, shared resource, a global place for communications and business transactions. New online businesses emerged as well as free services such as Google search or Wikipedia. This was the first phase of the digital era – the Network Economy.

In the Network Economy value is driven by connections. Businesses were able to exploit exponential scale and reach millions of people in just months or even days. Furthermore, the internet reduced transaction costs significantly. A net-based company could develop new services and scale them up in rapid cycles.

As the internet continued to evolve, companies like Google, Facebook and Amazon drove a new economic model, leveraging a scalable digital platform. This is the Platform Economy. This business model leveraged their centralized network connections, and effectively monetized the personal data of their users, using their profiles and behavioral patterns to tailor services such as advertising.





Today the advance of IoT and AI is driving further changes. This is accelerating the convergence of physical and digital spaces. Massive data is generated by connected sensors and smart 'things'. We can use AI to learn from the data these generate and create useful insights. But the processing of data must be ultra-fast and real-time.

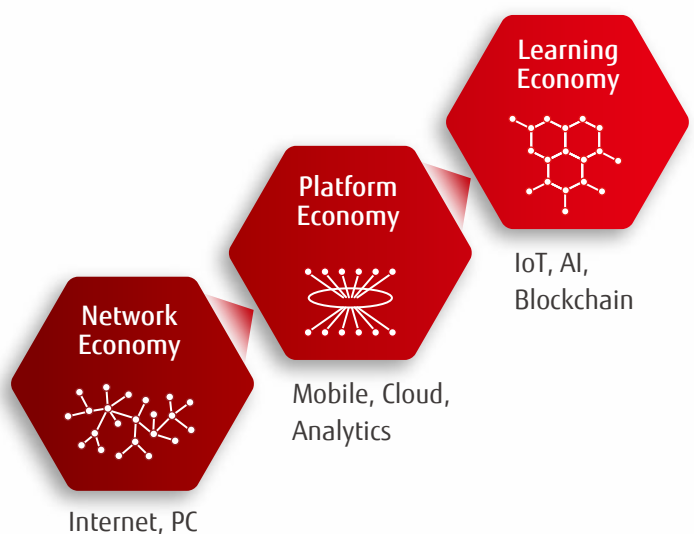


In this era of IoT and AI, we think business will be increasingly operated in a more autonomous and distributed form. The conventional scheme of collecting and controlling all the data centrally will not allow real-time responsiveness. Instead, what we will need is distributed AI systems across the network, which will autonomously learn from data and create insights to collaboratively empower people and deliver value.



We think in the near future a new type of economy will emerge, driven by a new type of organization. Empowered by AI, these organizations will learn from many different types of data and use them to deliver business outcomes. New value will be increasingly driven by knowledge, created from learning in both the digital and the physical worlds.

We are calling this the Learning Economy. In contrast to the centralized network of the Platform Economy, the Learning Economy will leverage knowledge flowing through an autonomous and distributed network. In the Learning Economy outcomes are continuously co-created by ecosystem partners in multiple Digital Arenas.



A Learning Enterprise

A new type of enterprise in the era of IoT and AI

We have seen, from the past right up to the present day, how changes in technology have drastically altered the way that organizations operate. Organizations today can reach markets, understand customers, manage supply chains, and adapt to change better than they could a generation ago. It is therefore reasonable to expect organizations are likely to operate differently over the next generation. How will they change? And what could they aim for?

Signals of the future

We think there are three 'signals' present today that can provide us with some clues.

First, as we have already seen in the previous chapters, the advance of AI is enabling companies to create value from data. We can use AI to learn from massive amounts of diverse data, delivering insights and empowering ourselves.

Second, industries are beginning to transform into Digital Arenas. The vertically integrated world is giving way to a distributed world, where value is co-created. It means that

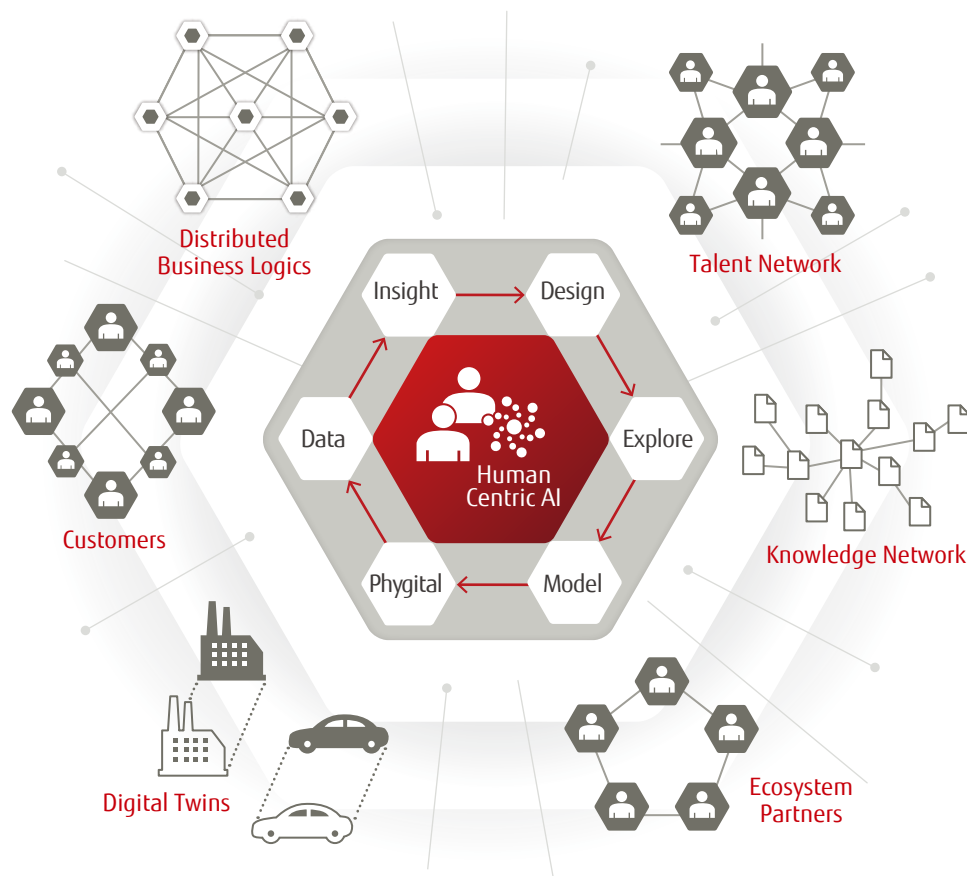
businesses will be increasingly operated in a distributed model, interconnecting with services of ecosystem partners.

Third, IoT and AI enable traditional companies that operate in the physical world, to act like digital companies. Companies like Netflix, for instance, are entirely data-driven, because they engage with customers only in the digital world. They use analytics to innovate and deliver better experiences for customers, by building up a good understanding of their needs and preferences, and the company's 'products' are rapidly engineered and executed to closely respond to these needs.

But today non-online companies can become 'phygital'. Digital technology enables these organizations to sense and respond to their customers as though they were digital, being able to 'see' what they do, understand their behavior and anticipate their needs.

In a hyperconnected world a centralized network cannot provide the real-time responsiveness necessary. For instance, a connected car needs to have its own decision-making capa-

Knowledge-driven organization that creates value for customers through continuous learning and co-creation with ecosystems



Digital Muscle	Pre-digital Company	Learning Enterprise
Leadership	Leaders must focus and spend more time on operational issues at the expense of business strategy.	The leadership does not have to focus on autonomous functions, but can envision, shape and plan the direction of the organization.
People	People must carry out many mundane, "robotic" tasks.	Empowered with Human Centric AI, people will work more creatively.
Agility	The business focuses on the on-going operations. Business logic exists as tacit knowledge in people and in non-integrated tools like spreadsheets.	The business explores new opportunities using a design-thinking approach. It rapidly adapts its business logic in response to new demands and competition.
Business Integration	IT typically supports back office process to improve productivity.	IT is directly linked with business outcomes. Physical and digital processes are integrated.
Ecosystem	The business creates value for customers using its vertical value chain. Innovation predominantly comes from within the organization.	The business creates value for customers through continuous learning and co-creation leveraging the full extent of ecosystems.
Value from Data	Data is used to support business process. Data exists in silos and is not integrated.	Human Centric AI continuously learns from data, and delivers insights which the business can leverage.

bility, it could not rely on a centralized decision making. But while many judgements may be made at the edge, important information must be delivered to the center. Similarly, many business operations will be programmed and decentralized, running in concert with central management who respond to insights raised and provide strategic oversight.

Pulling these signals together, we believe, results in a different type of organization to what we are familiar with today. A 'Learning Enterprise'. This concept is not entirely new. Peter Senge discussed a learning organization in his book, the Fifth Discipline, in 1990. But today the advance of IoT and AI gives a renewed emphasis on this idea.

A Learning Enterprise in the digital era is a knowledge-driven organization that creates value for customers through continuous learning and co-creation with ecosystems. It leverages Human Centric AI to empower people. The collaborative output of people and AI will deliver innovation. Its competitive advantage stems from how well and how fast it can learn, create new knowledge and convert this into business outcomes.

Continuously innovating

Organizational learning represents a change of emphasis and priority in business operation. Today's companies are mainly concerned with monetizing their core business process. A characteristic of a Learning Enterprise is a much greater

focus on exploration. It looks to find new and different sources of knowledge and combine these with what it already knows to deliver insights it can then leverage. As a result, it is much more focused on – and effective in – delivering innovation. Organizational learning is a continuous and cyclical process of design, exploration, modeling, integration between physical and digital, data analysis and delivery of insights.

Learning Enterprises bridge the physical and digital worlds. They leverage 'digital twins', virtual replicas of entities in the physical world. Digital twins exist in real-time data collected from sensors and the IoT. They will enable better business operations and public services. For example, a smart factory visualizes the real-time status of manufacturing machinery and processes to identify bottlenecks, predict failures and simulate potential improvements. City traffic can equally be modelled in a digital replica to enable better mobility. Digital twins of our bodies will enable medical innovation and personalized treatment.

In Chapter 1 we saw how 'digital muscles' were key to digital transformation. We can use these same six factors to show how an organization can mature into a Learning Enterprise.

A key challenge for becoming a Learning Enterprise is data. How can you trust data, how you can protect and secure data? We will look into this next.

Digital Trust

Digital technology for building trust across society

Trust 3.0

Trust is a key part of what it means to be human. It is a difficult concept to define, but we could think of it as a measure of our willingness to take on the unknown. If we are to build a successful future, trust is an essential foundation. We cannot underestimate the power of trust. Co-creation with your customers and eco-system partners will never happen without trust. If you and your business partner trust each other, collaboration will be faster and more effective, delivering real outcomes.

To understand trust, and examine what the future holds, we must take a brief digression into history.

In our primitive societies, the only form of trust was between people. Personal trust, or 'Trust 1.0' as we might term it, worked on the reciprocal paying of favours – I watch your back, you watch mine. It was a sufficient mechanism to ensure cohesion of small communities.

As mankind's horizons advanced beyond these communities, a new trust model was required. Social innovation provided the solution that enabled trust to scale. Institutional Trust - 'Trust 2.0' - emerged whereby people placed their trust in governments, banks, and other organizations. These institutions could be relied upon to honour financial and legal obligations, enabling a medium of exchange (money) and many other important social and business protocols. Today institutional trust underpins the governance for our modern, commercial society.

This is where we are today. Yet Trust 2.0 is entering a period of crisis, as the world becomes hyperconnected. The internet has created a world where billions of people are connected. Furthermore, trillions of things are being connected through the IoT. How can you trust the person you meet for the first time via the internet? How can you trust a connected car? And most importantly, how can you trust the data you receive from a third party? These are beyond the control of any single institution.

Digital is changing how we trust. Digital Trust, or 'Trust 3.0', uses technology to underwrite uncertainty for transactions and assure the trustworthiness of data.

Blockchain

Blockchain technology is still at its infancy, but holds a big potential for providing Digital Trust. It is a distributed ledger, securely protected by encryption. Because every transaction is transparent and once written cannot be erased or modified, there is no longer a need for a third-party or institution to underwrite or assure. The assurance – and therefore the trust – derives from the information in ledger. Blockchain could enable trusted transactions of virtual currencies as well as various values such as intellectual property or energy on a peer to peer basis.

Blockchain paves the way for new innovation. For instance, business process will be programmable. 'Smart contracts' become possible, digital agreements that can come into effect triggered by a specific action or that can automatically termi-

Trust1.0



Trust 2.0



Trust 3.0





nate or adapt based on specific events. Entirely new markets can be envisaged, for instance an autonomous vehicle automatically paying for parking. Of course, much development is required to make digital trust a reality. We are working with customers to drive innovation in this area and to overcome the many challenges.

For example, we are working with Japan's three largest banks, Mizuho, Sumitomo Mitsui and Mitsubishi UFJ, to develop and test a Blockchain platform to enable P2P money transfers between bank accounts. We have also built a Blockchain test-bed for the Japanese Banks Association to design and prototype Blockchain-based financial services applications.

To enable interoperability between different instances of distributed ledgers, such as interchanging virtual currencies, Fujitsu also developed our 'ConnectionChain' technology. This makes it possible to securely connect multiple blockchains and make them interoperable.

While virtual currencies have grabbed the headlines recently, Distributed ledger technology is not just about currency. It has a big potential to enable exchange of data between organizations securely and without compromising privacy. Fujitsu's VPX* technology uses a distributed ledger to allow organizations to access the data that they hold at their respective data centers. We are about to make this service commercially available, to support digital ecosystems for many organizations to create value from using data securely.

Trustworthiness of Data

New value is being created from data. This requires multiple sources of data, including even personal data, to be shared among ecosystem partners. But how can we make sure data is correct and usable without infringing on people's rights to privacy? Data is flowing outside the firewall of an organization. How can we protect these flows of data from cyber-attacks?

This is not easy at all, and security technology must play an important role for assuring the trustworthiness of data in the digital era. Fujitsu is working on this by developing technologies in three areas, as we describe in the next page.

The scenario of the digital future is exciting. Digital enables us to build a world that works much better and one which is more democratized. But we must also be cautious. We have to understand the implications of these technologies and how they impact on people, for instance their privacy and their jobs. We must be responsible in the way we design and implement digital trust, and ensure that it does not come at the expense of people's wellbeing.

Trust 3.0 is a foundation to drive autonomous, distributed operations of organizations. With trust in data, businesses will be able to scale ecosystems of co-creating innovative value from using data securely.

Fujitsu's security initiatives

1. Data security and privacy protection

Policies for data security, privacy protection and rules for data handling are becoming stricter globally. Typical of this trend is the EU General Data Protection Regulation (EU GDPR), becoming effective in May 2018. Even though this trend requires organizations to apply more stringent data protection measures than ever before, it also opens up new business opportunities by using securely protected data.

Fujitsu develops anonymization and advanced encryption technologies for personal data and sensitive data. We are engaged in joint projects for using data safely and securely. For instance, AEON Financial Service and Fujitsu conducted a Proof of Concept (PoC) for an Information Bank, where individuals administer and manage personal data, and earn returns in the form of Blockchain-based intra-company virtual currency according to the volume of the shared data.

2. Authentication and approval

Organizations want to use both internal systems and external cloud systems as a single service. They want to connect physical and cyber space securely and conveniently. These needs are emerging, as cloud grows and increasingly becomes the norm.

Fujitsu is developing authentication technologies and an authentication platform, which can use our unique biometric solution, PalmSecure, and the next-generation online certification standard, FIDO. We are also developing an authentication platform for federation, enabling the seamless login to multiple services as though they are a single service.

3. Cyber security

In May 2017, the WannaCry ransomware attack affected over 230,000 computers in 150 countries. Last year about 40% of organizations were damaged by cyber-attacks. The average cost of a cyber breach is now \$2 million* for large organizations.

Not only do organizations need to minimize damages of cyber-attacks, restore business and secure business continuity, they must comply with international and local rules. For example, the American National Institute of Standards and Technology (NIST) defines a cyber security framework of identify, protect, detect, respond and recover. Organizations need to implement security measures at each stage.

To help our customers secure their operations, Fujitsu conducts research and development in 5 areas:

1. Malware detection technology that identifies actions of hackers, 2. Technology for blocking malware within a company's network, 3. High speed forensic technology for detecting and identifying targeted cyber-attacks in a short period of time, 4. Sharing technology of cyber threat intelligence (information on malware and other attacks as well as counter measures), 5. Traffic analysis and protection technology in a virtual system

* https://www.trendmicro.com/ja_jp/about/press-release/2017/pr-20170913-01.html

Human Centric Intelligent Society

Realizing a prosperous society and contributing to SDGs

Our world is facing serious sustainability challenges. The population is now surpassing 7.5 billion, and is expected to reach nearly 10 billion in 2050. As a result, people will need more food and resources. How can we increase the productivity of agriculture and assure the quality of food in sustainable ways? How can we realize more efficient use of energy?

The world is polarizing. People are increasingly living in cities. Many mega cities will be born, and people will face urban problems such as pollution, congestion and the poverty of slums. How can we make our cities work better for everyone, friendlier and more resilient?

Digital Arenas such as intelligent mobility and intelligent wellbeing interconnect and have the potential to evolve into an autonomous and distributed networked society

Every year, a lot of people die as a result of incurable diseases like cancers or a lack of medical services. Today, there are around 1 billion people aged 60 or over in the world. This number is expected to double by 2050. How can we help these people live fuller lives, and with dignity?

We believe a prosperous and sustainable future can arise through the coming together of Digital Arenas, the digital ecosystems that co-create value oriented around people we have



talked about previously. For instance, intelligent mobility and intelligent wellbeing. As they mature, these Digital Arenas will start to interconnect. We believe they have the potential to evolve into an autonomous and distributed networked society. We call this a Human Centric Intelligent Society. This is our vision and goal. Fujitsu has been working to realize this vision for many years.

A Human Centric Intelligent Society is a learning society. People, businesses and governments are connected, learning from experience and data and finding out useful insights with the help of human-centric AI. Digital Trust protects and underwrites the reliability of data, and facilitates the use of data across the network.

It is people who create innovation. But empowered by human-centric technology, people can collaborate to deliver incredible breakthroughs and outcomes for society. For example, AI will help us develop new drugs effective against cancers, and make our cities flow smoothly without congestion.

This is a society oriented for generating and consuming human-centric value, instead of merely producing industrial products by exploiting resources. People can contribute to and benefit from a wide range of shared values instead of just dispensing physical goods and assets for consumption.

Achieving Shared Goals

But this doesn't happen on its own. We all have to make the right choices for this better future. We must have the right intentions and a sense of purpose to realize such a society.

The United Nations set out Sustainable Development Goals (SDGs) in 2015. These are shared goals to be achieved by 2030. We believe our vision of Human Centric Intelligent Society and SDGs are closely aligned. Fujitsu is committed to contributing to the SDGs through working toward our vision. Fujitsu is supporting many SDGs with our technology. In particular, we are proactively engaged in co-creation initiatives oriented for SDGs.

SUSTAINABLE DEVELOPMENT GOALS 17 GOALS TO TRANSFORM OUR WORLD





	Impact	Our initiatives (examples)
SDG2	 Sustainable Food and Agriculture Increase food productivity and resilience	- Over 400 businesses in Japan use Fujitsu's agriculture cloud service Akisai to increase productivity. It is also available in other countries like Vietnam. - We are operating our own precision agriculture facility and collaborating in smart agriculture with diverse industry partners.
SDG3	 Wellbeing of People Realize a high quality of life for everyone in an aging society, and eradicate difficult diseases by medical innovation	- Fujitsu connected 7,000 hospitals, clinics, care facilities and pharmacies to help realize wellbeing for everyone. - We co-created sensor-based monitoring services for patients and elderly people in Netherland and Singapore. - We are also collaborating with various research institutions in genome-based medicine and drug discovery, using our HPC and AI technologies.
SDG8	 Decent Work and Sustainable Economic Growth Accelerate innovation and realize a human-centric way to work	- Fujitsu helps organizations transform their ways of working, enabling their people to work more creatively with the support of Human Centric AI. - We provide a voice recognition and AI-based 19-language translation tool to support communications between diverse people including the hearing-impaired. - We are actively accelerating open innovation with start-ups.
SDG9	 Sustainable Industrialization Realize intelligent industrialization through innovation	- Fujitsu provides an industry platform to help manufacturing companies digitalize their businesses and accelerate intelligent industrialization through co-creation. - We are supporting smart manufacturing in China and Singapore and digital innovation in France. - We are also supporting the development of digital talent, for instance, through our Digital Business College.
SDG11	 Sustainable City Enable intelligent mobility, and increase safety and resilience to disasters	- Fujitsu co-created innovative services with many organizations, using our location information cloud service SPATIOWL as a platform for mobility. - We are jointly developing innovative solutions for urban challenges in Singapore. - We globally provide HPC-based disaster prediction solutions as well as solutions to prevent and mitigate the damages by earthquakes, tsunamis and floods. - UN Development Programme, Tohoku University and Fujitsu jointly developed a global database of disasters.

Customer Stories

Real examples of digital transformation where we have helped our customers achieve business success and address social issues.



- Siemens Gamesa Renewable Energy, S.A.**
46 Co-creation of an Artificial Intelligence solution to quickly identify flaws during quality checks
- Kawasaki Geological Engineering Co., Ltd.**
48 Using Artificial Intelligence to detect road cavities with the analysis time halved
- Shimadzu Corporation**
50 Using Artificial Intelligence to analyze mass spectrometer data, automating a highly labor-intensive process
- The Shinano Mainichi Shimbun Inc.**
52 Using Artificial Intelligence to automatically summarize articles, creating efficiency with cutting-edge technology
- The Kansai Electric Power Co., Inc.**
54 Using Artificial Intelligence to analyze smart meter data and detect lifestyle rhythm changes
- Slingeland Hospital**
56 Co-creating a real-time monitoring solution, ensuring better care and more informed medical decisions
- Siam City Cement Public Company Limited (SCCC)**
58 Thailand's First Smart Connected Factory, driving growth in an emerging ASEAN economy
- Mizuho Bank, Ltd.**
60 FIDO biometric authentication in banking application realizes twin benefits of higher security and better customer experience
- Belfius**
62 Belfius leads the field in mobile banking with Fujitsu Sign'IT
- Lotte Card Co., Ltd.**
64 HandPay Service using Fujitsu palm vein authentication enables cashless, card-less shopping
- Norsk Hydro ASA**
66 Hydro's Brazilian operations are migrated to their global IT platform using Fujitsu's services and hardware
- Toyota Motor Corporation (Technical Service Division)**
68 Envisioning the Future of Car Servicing, Kaizen meets Design Thinking (Innovation)



Siemens Gamesa Renewable Energy, S.A.

Co-creation of an Artificial Intelligence solution to quickly identify flaws during quality checks

Siemens must put each of the 5,000 blades it produces annually through a stringent quality assurance process. Any flaws when a blade is in operation could prove catastrophic and could inflict major damage to the company's reputation. However, manually evaluating Ultrasonic Testing (UT) scanning of each blade takes up to 6 hours. Working with long-term partner Fujitsu, together they co-created an Artificial Intelligence (AI) solution that could automatically detect flaws through machine learning and deep learning capabilities; it achieved 100% coverage of all defects and evaluation of each Nondestructive Testing scanning reduced by 80%.

“

Fujitsu's ground-breaking Artificial Intelligence technology dramatically cuts the time required for an inspection of turbine blades.

*Kenneth Lee Kaser,
Head of Supply Chain Management,
Siemens Gamesa*

”

Search for the best solution to scan any flaws or defects, maintaining high quality and security

Siemens Gamesa Renewable Energy (Siemens Gamesa) came into being in April 2017 with the merger of Gamesa Corporación Tecnológica and Siemens Wind Power. It is a respected leader in the renewable energy industry, whose mission is to provide cleaner, more reliable and more affordable energy to society, while creating lasting value for all stakeholders. Siemens Gamesa is committed to offering innovative solutions for the energy challenges of the future. Siemens Gamesa produces over 5,000 wind turbine blades every year for use in on/offshore wind farms. Each blade can be up to 75 meters in length and takes a highly-

skilled professional Quality Controller up to 6 hours to evaluate the UT scanning in the quality assurance process. This is because the structure can contain multiple defect types, including how fiberglass can wrinkle during the production process. This has the potential to be catastrophic if this makes the blade crash during operation.

“This process requires highly-experienced operators to evaluate the blade quality, and it can be difficult for humans to concentrate for extended periods of time,” explains Søren Rahmberg, Head of Global Quality Engineering, Siemens Gamesa. “We wanted to find a robust and effective solution to catch these errors without compromising the detection of in-material damage and risk a loss in reputation.”

These manual scans are time-consuming and costly; however, the company cannot afford any flaws or defects in its fiberglass blades. Therefore, it turned to technology for an alternative solution. After evaluating the machine learning specialists on the market, Siemens chose to partner with Fujitsu, and together they examined the potential for an AI approach to flaw detection.

“It's an innovative business and we are always eager to increase digitization wherever possible,” adds Rahmberg. “So, when it came to this project, we needed a partner with machine learning expertise, broad support and global reach. Fujitsu ticked all those

boxes and is well known in the industry as a world leader in AI."

Co-creating an Artificial Intelligence solution

Fujitsu Laboratories has been actively working on AI research and development for many years and so was ideally placed to help co-create a new solution that could identify defects. After the initial Proof of Concept, and the capture of the customer's main requirements for a production grade solution, Fujitsu and Siemens Gamesa used an agile approach. This breaks down work into key functionality and delivers them in 'sprints' of two-week periods, with the customer in a closed loop prioritizing developments in forthcoming sprints, and evaluating functionality after each sprint. This ensured developed functionality was evaluated and qualified throughout the entire development phase. When co-creating with the customer, the Fujitsu team focused on the real market opportunity – ensuring that every request was checked for wider commercial viability. "After contract negotiations, the project itself moved really rapidly, taking just 3 months to develop the application and algorithms," says Rahmberg. "It involved a lot of collaboration, workshoping and data sharing."

Fujitsu and Siemens Gamesa have trained the AI component to detect abnormalities in images. Siemens Gamesa created training samples with defects labelled. Utilizing the advanced Fujitsu machine learning technology, only a limited number of training samples were needed in order to secure 100% coverage of all defects, while providing the 80% efficiency gain needed.

Fujitsu delivered the complex and tailored AI software with a flexible licensing model, which meant that Siemens was able to minimize upfront investment. The solution is also designed to easily scale to include new models of wind turbine blades. "Flexible licensing means we can pay per plant with a predictable annual maintenance fee. It reduces the upfront CAPEX and gives us versatility," continues Rahmberg. "From a customer perspective, it increases value."

Aiming at applying this Artificial Intelligence approach to other production areas

The quality assurance process, which once took 6 hours to complete per blade, can now be carried out by the Fujitsu AI which detects abnormalities, and only leaves a fraction of the blade scanning to be inspected manually, reducing scanning inspection time by 80%.

With 5,000 blades produced every year, that adds up to a saving of almost 32,000 man-hours, which translates into significant cost savings, and reduced production lead times.

"We can focus our efforts on suspicious areas and disregard all clean data, we are not held back by tired eyes; humans only need to examine the blades that are flagged by the Fujitsu system," continues Rahmberg. "One of the key features of machine learning is that when we experience patterns we haven't seen before; the AI adapts to look for them in the future, embedding new learnings



systematically into our processes. Essentially, the longer we use it, the smarter it becomes."

This is just one example of how Fujitsu is co-creating with its customers to take solutions to the next level. Fujitsu listened to the customer to understand the problem, before jointly working on a solution that leverages AI deep learning, image and signal processing techniques during the inspection process.

"The Fujitsu development process has been impressively speedy; we honestly expected it to take longer because we are not used to the agile approach," concludes Rahmberg. "Longer term, we will explore introducing this AI approach to other application areas within our production as well."

Customer Profile

Siemens Gamesa Renewable Energy, S.A.

Address: Parque Tecnológico de Bizkaia, Edificio 222, Zamudio, Spain
Established: 2017

Employees: 27,000

Website: <http://www.siemensgamesa.com/gamesa/en/siemensgamesa.html>



Kawasaki Geological Engineering Co., Ltd.

Using Artificial Intelligence to detect road cavities with the analysis time halved

Kawasaki Geological Engineering Co., Ltd. conducts road surveys for local and national governments using proprietary technologies that are able to detect cavities below the road surface. But this is time consuming work. The company decided to adopt Fujitsu's AI solution "Zinrai Deep Learning System" to analyze the vast amounts of data that were previously handled manually. Using Artificial Intelligence (AI) to learn and recognize the signature patterns of cavities, the company brought objectivity to the process and reduced the time taken to detect anomalies by 90% and the overall time for analysis by more than half.

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Fujitsu understands our business very well. The rapid deployment of AI, and procedures for identifying highly accurate training data, were only possible because they fully understood every aspect of our business. Technical communication was effortless as well.

Toshihiko Sakagami,
CEO

Kawasaki Geological Engineering Co., Ltd.

”

Better instruments mean more data, but higher costs to analyze

As a pioneer in geological surveying, Kawasaki Geological Engineering Co., Ltd. conducts subsurface testing of roads at the request of national and local governments and others tasked with managing these assets.

When cavities form under a road, in a worst-case scenario they can result in catastrophic subsidence. An extreme example of this is a giant sinkhole that opened up near JR Hakata Station in the Kyusyu area in November 2016. While cavities can have many causes, the Ministry of Land, Infrastructure, Transport and Tourism

in Japan explains that the majority are caused by deteriorating sewage pipes. Cavities might not be noticeable because Japanese roads are well maintained. But in 2015 alone, road subsidence was apparently found at 3,300 locations across Japan.

The company has developed a range of technologies for subsurface exploration for detecting cavities below the road surface, which their mobile engineers use as they travel around the nation's roads.

According to Toshihiko Sakagami, CEO of Kawasaki Geological Engineering, "Conventional methods only enabled us to survey down to a depth of 1.5 meters, but the cavities caused by deteriorating sewage pipes develop further down than that. We applied our technologies and expertise to the problem and succeeded in developing a 'chirp radar system' able to detect return signals at greater depths. This has enabled us to survey at depths of between 3 and 5 meters without losing any efficiency."

By more than doubling the survey depth, the company has found itself with vast amounts of data. The data, when printed out, needs between 1,000 and 2,000 A3-sized sheets per 100km of road. To determine the presence of cavities, a team of 5 or 6 people spend about a month, each time, poring over pages and pages of radar waveform data printouts. They search for potential cavities and other anomalies, and then identify the actual cavities. Checking for

cavities therefore became more time-consuming and costly for them. They spent considerable time on these problems, and on reducing oversights as much as possible.

Improving accuracy and efficiency of analysis, where errors can't be tolerated

It takes experience to be able to identify cavities from the data. Beginners may sometimes overlook the cavities if the signal data is not immediately clear. More experienced people are therefore needed to crosscheck work and avoid oversights. At Kawasaki Geological Engineering, they focus most heavily on analysis to maintain the safety of the roads they survey.

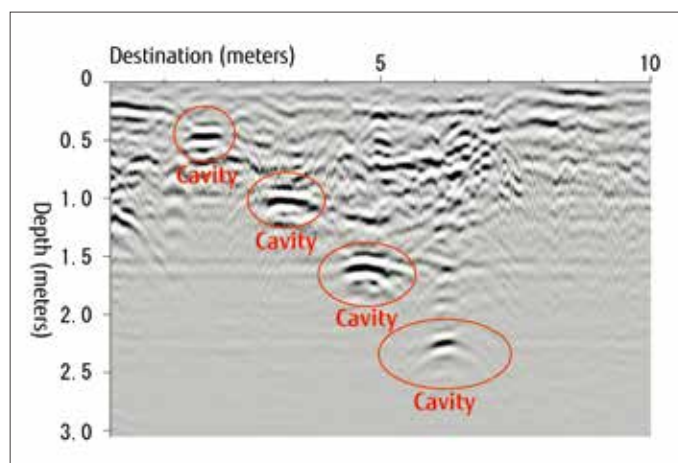
Fortunately, the company currently has many highly experienced workers who can perform this role easily. However, according to Toshihiko Sakagami, "Considering manpower and other factors, we could not continue working like this. That is why we started looking at AI. Some of our engineers were knowledgeable about AI, so we had a fair idea that we could apply AI to detecting cavities in the same manner as crosscheck work done by experienced people. The problem was that there was no commercial application to do our job, which meant we were unable to adopt the technology."

Artificial Intelligence reduces anomaly detection time by 90%, while the total time engineers spend on analysis has been halved

Knowing they would be unable to quickly deploy AI by themselves, the company received a proposal to deploy Zinrai Deep Learning from the Fujitsu Traffic & Road Data Service Ltd., a company with which they were already working. During discussions, they found they could deploy the technology in less than one month, and it was that speed of delivery that was the deciding factor for them. Kawasaki Geological Engineering proposed to Fujitsu that the scope of AI be limited to identifying anomalies that could be potential cavities; in other words, that it be limited to the stage prior to final determination by the company's engineers. Through close communication between the two companies, they were able to efficiently accelerate the deep learning process.

Commenting on the company's main objective, Toshihiko Sakagami says, "Our prerequisite was to catch every anomaly, to not miss a single one." Starting from this pre-condition, AI development took shape in less than one month, with a large volume of training data being created and immediately loaded into Zinrai Deep Learning. Through additional training data and fine-tuning, they succeeded in reducing primary detection time by 90%. The system is now able to detect anomalies to an accuracy of close to 100%. So, including time spent visually checking the results, total time spent determining whether there are any cavities below the surface has been halved.

Shigeharu Yamada, General Manager of Maintenance at Kawasaki Geological Engineering, says, "Honestly, our engineers



were doubtful at first but they are now very impressed with what AI can achieve." Toshihiko Sakagami quickly adds, "But that does not mean that we will not need people. Specialist engineers will always be needed. Developing AI and developing engineers are 2 sides of the same coin for our business." The most important thing is knowing how to use AI.

Shigeharu Yamada says, "Deploying Zinrai Deep Learning has enabled us to apply objectivity to the data. In addition to anomaly detection, if we can improve the accuracy of cavity identification itself, I expect we will be able to reduce analysis time by as much as 80% before long." The deployment has improved efficiency, more than halved the time taken for analysis and reduced costs. "And as a result we are able to take on many more jobs," comments Shigeharu Yamada.

Kawasaki Geological Engineering is already forging ahead with its next idea. They normally send out their specialized vehicles to take measurements. However, they are now considering installing sensors on the vehicles that local governments use for their daily patrols, which will make analysis much easier. Continually checking that data every day should enable discovery of dangerous cavities that much sooner.

Toshihiko Sakagami comments, "As professional geological surveyors, we not only detect cavities but closely examine the causes as well. Knowing those causes enables people to prevent the cavities from forming in the first place. We are proud of what we do." Using its own technologies in combination with Zinrai Deep Learning, Kawasaki Geological Engineering will continue making its contribution toward realizing a safer society for all.

Customer Profile

Kawasaki Geological Engineering Co., Ltd.

Address: Mita Kawasaki Building, 2-11-15 Mita, Minato-ku, Tokyo
Established: 1943
Employees: 300
Website: <http://www.kge.co.jp/> (Japanese)



Shimadzu Corporation

Using Artificial Intelligence to analyze mass spectrometer data Automating a highly labor-intensive process

Shimadzu Corporation develops and sells mass spectrometers for analysing pharmaceuticals, food and beverages as well as air, water, soil and others. Analysis of mass spectrometer data is based on identifying the peaks of waveforms in the data. Shimadzu has been working to improve the accuracy of the analysis. Shimadzu commenced research using Artificial Intelligence (AI) in collaboration with Fujitsu Limited and Fujitsu Laboratories Ltd. in 2016. Using AI, the program has sought to automate the 'peak picking*1' process. In order to do this, the partners needed to find ways to generate training data for the system to learn on, and to be able to convert waveform data into images that the system could read.

“

“Fujitsu and Fujitsu Laboratories understand the background of mass spectrometry and responded seriously to our special request. Through this three-way mutual collaboration, we are working to automate the peak picking capabilities of experienced operators.”

*Mr. Ryuji Nishimoto
Deputy General Manager
Analytical & Measuring Instruments Division General Manager
Research & Development Department
Analytical & Measuring Instruments Division
Shimadzu Corporation*

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Analyzing mass spectrometry data from complex samples is detailed and labor-intensive

Shimadzu Corporation provides products and services globally in a range of fields, including measuring instruments, medical equipment, aeronautical equipment, and industrial equipment. Medical equipment is its largest business segment, accounting for 61% of annual revenue (in fiscal 2016). Shimadzu's high-performance analytical instruments are used for research, technology development, and quality control in many industries.

One such analytical instrument is a high-speed liquid chromatograph mass spectrometer, which is capable of accurately measuring the types and amounts of compound molecules contained in a sample of matter. The instrument ionizes the sample for ultra-high-speed scanning to obtain waveform data, then measures the peak position and height of the waveform data obtained. The accuracy of measurement depends on how precisely the peak can be pinpointed. For this reason, the swift and accurate identification of the peak from complex waveforms has previously been a challenge.

According to Mr. Ryuji Nishimoto “In biological samples like blood, the waveforms are obscured by ‘noise’ due to the complexity of the substances they contain.” To suppress this noise, you need to set hundreds of parameters, many of which could not be handled through the automated settings of the equipment or the dedicated analytical software. Accordingly, experienced operators had to manually identify the peak position by looking at the screen produced by the dedicated analytical software. This was a major burden for researchers and site workers.

Creating training data to enable deep learning to learn

“To address the challenge of processing waveform data” says Ryuji Nishimoto, “we started by talking to Fujitsu, with whom our

*1: The process of reading the width and height of waveforms (peaks) from data acquired by a mass spectrometer

president already had a long-standing relationship. People working on Fujitsu Human Centric AI Zinrai, which systemizes AI technologies, came to our company, and that's where our joint research began." The idea was to use AI to potentially automate the entire peak picking process. This had been difficult to achieve with equipment and software enhancements, along with all the associated analytical work. Ryuji Nishimoto looks back, "Mass spectrometers are very specialized instruments with limited installations, so we could not easily resolve our challenge by introducing general AI." Shimadzu, Fujitsu, and Fujitsu Laboratories decided to conduct collaborative research, with each company bringing its own expertise in mass spectrometry techniques, equipment knowledge, and AI-based deep learning know-how. The collaborative research began in November 2016. Mr. Shinji Kanazawa (AI Solutions Unit, Technology Research Laboratory, Shimadzu Corporation) served as a leader of the Shimadzu team. He says, "We tried a number of approaches, with each team offering suggestions during discussions on requirements, such as training data needed for deep learning and how to apply deep learning to chemical analysis." Following repeated trial and error, the idea of using AI to resolve the problem began to take shape in June 2017. The Fujitsu and Fujitsu Laboratories teams found that converting the numerical values of measurement results into images and using the data to examine waveform contours were effective ways to achieve the specified accuracy. Meanwhile, the Shimadzu team developed technologies to automatically generate the training data needed to enhance the effectiveness of deep learning. After applying deep learning to more than 30,000 images, they succeeded in increasing the accuracy of peak picking. As of November 2017, work that required around two hours of experienced operator time was achieved in several seconds, thanks to peak picking using AI. Compared with manual peak picking results by an operator with more than 10 years of experience, the automated peak picking results using AI had a false detection rate of 7% and an undetected rate of 9%. By incorporating deep learning into the dedicated analytical software, they succeeded in automatically identifying peak picking with the same accuracy as experienced operators. Also, they managed to smooth out analytical precision discrepancies that occurred with different operators.

Reducing 'peak picking' processes and time Quality enhanced by reproducing the skills of experienced operators

"Fujitsu and Fujitsu Laboratories responded seriously to our special requests," says Ryuji Nishimoto when asked about the reason for the breakthrough outcomes of the collaborative research undertaken by the three companies. Trials are scheduled to begin in June 2018 at the "Osaka University and Shimadzu Analytical Innovation Research Laboratory," established by Shimadzu and Osaka University. Reflecting feedback from this collaborative



research, we expect several dedicated analytical software options to be commercialized and available as early as the spring of 2019. Ryuji Nishimoto concludes, "We hope to work with Fujitsu and Fujitsu Laboratories in the commercialization stages as well." Automation of peak picking is expected to reduce the number of processes and time required for work. It reduces the burden on researchers and site workers, and allows these people to devote their freed time to their own research and development projects. For pharmaceutical manufacturers, incorporating automatic peak picking into the drug discovery process enables them to conduct new drug research more efficiently. The combination of mass spectrometers and automated peak picking is therefore expected to help enrich people's lives.

Customer Profile

Shimadzu Corporation

Address: 1 Nishinokyo Kuwabara-cho, Nakagyo-ku, Kyoto 604-8511, Japan
Established: 1917
Employees: 11,528 (as of March 31, 2017)
Website: <https://www.shimadzu.co.jp/>



The Shinano Mainichi Shimbun Inc.

Using Artificial Intelligence to automatically summarize articles Creating efficiency with cutting-edge technology

The newspaper company The Shinano Mainichi Shimbun Inc. summarizes its news articles in order to offer them to external media outlets. However, the company found it difficult to attract enough people with the expertise required to perform this task, which put pressure on their existing front-line staff. So the company turned its attention to Artificial Intelligence (AI). By using automatic article summarization technology developed by Fujitsu and Fujitsu Laboratories, Shinano Mainichi succeeded in automatically generating summaries that were as good as manually created ones, and in a fraction of the time. This automatic summarization system is being used since April 2018.

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Thanks to our Artificial Intelligence-based automatic article summarization system, we can now generate articles containing limited numbers of characters for external media without the need for editorial staff input. We plan to use this system for various external media in the future.

Shunichi Furuta
Chief, Technology Development Center
Production Bureau
The Shinano Mainichi Shimbun Inc.

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Providing summarized newspaper articles to external media Difficult to attract people who could write good summaries

Newspaper articles based on serious interviews and in-depth investigations are often summarized for distribution to radio, TV, electronic bulletin boards, and the like. Recently, the value of summarized articles has grown as they are increasingly distributed to web portals, social media sites, and other internet-based media.

The newspaper company Shinano Mainichi Shimbun has been distributing articles to external media for some time. According to Shunichi Furuta, Chief, Technology Development Center, Production

Bureau, The Shinano Mainichi Shimbun Inc., “As a newspaper publisher, our main role will continue to center on paper-based newspapers, but we need to respond decisively to changes in our business environment. Providing summarized articles to external media is one of the new challenges that we have embraced.” At present, several full-time personnel with experience as reporters create and distribute summarized versions of the company’s articles for distribution to cable television, electronic bulletin boards, digital signage, and other external media outlets.

Whereas regular newspaper articles contain a large or small Japanese characters, articles for other media need to be shortened to, for example, 150 characters in the case of cable television and 80 for electronic bulletin boards. It is not easy to summarize an article in an easy-to-read format without losing important information.

This prompted Shinano Mainichi to look at AI. The idea was that perhaps the latest machine learning technologies could be applied to summarize newspaper articles into smaller versions with a specified number of characters.

Deploying Fujitsu Laboratories’ automatic article summarization technology to create a model for learning summarization methods

Shinano Mainichi has been using Fujitsu’s electronic typesetting

system to produce its paper-based newspapers for many years. In 2015, the 2 companies had been conducting workshops to jointly consider issues related to information systems, and listed various items for review. One such item was automatic summarization of newspaper articles using AI-based machine learning. Hiroshi Misawa, Managing Director, The Shinano Mainichi Shimbun Inc., says “We discussed a lot with editorial staff whether we could use AI as a new system or not. Fujitsu then explained about summarization technology. It was still undisclosed technology in Fujitsu Laboratories, but I could see a huge potential of this AI technology for not only article summarization but also writing electrical scoreboard news and headings.” Based on summarized editorial data from Shinano Mainichi, Fujitsu demonstrated how to learn summarization methods and thereby create a machine learning model that could be used to summarize general articles. Although the results differed somewhat from human-generated summaries, Shinano Mainichi concluded that the summarized articles could be used with a few adjustments.

The 2 companies then started field tests in 2017. Shinano Mainichi provided thousands of summarized articles distributed to cable television outlets in the past, as well as the original articles upon which they were based. Fujitsu used those two sets of data as training data to create a key sentence extraction model and a sentence abbreviation model.

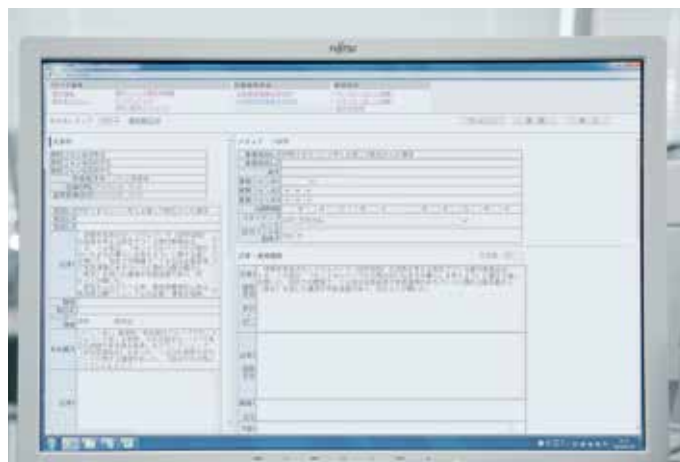
At first, the field tests involved analysis of the training data itself. It was found that, although the introduction portion of the article is the main target for summarization, some other parts, including event dates and contact addresses, can be extracted irrespective of where they appear in the article.

The next stage focused on reinforced learning. This involved increasing the volume of training data to create a key sentence extraction model for distribution to cable television outlets. The model was used to summarize regular articles from Shinano Mainichi and confirmed whether or not the quality was suitable for commercial use.

Shunichi Furuta, Chief, Technology Development Center, Technology Bureau says, “The LEAD method commonly used for computer-based summarization only picks up information from the beginning of the article. By contrast, the automatic article summarization technology of Fujitsu Laboratories enabled us to include in the summarized versions important information found at the end of articles, such as key dates and contact numbers. I was surprised.” When the model was applied to articles from “News Packs” from Kyodo News, it was possible to produce summarized articles of a similar standard despite the difference in training data.

Automatic article summarization for cable television outlets Work completed instantly that normally takes a person up to 5 minutes

Having confirmed the effectiveness of automatic article summarization based on machine learning, Shinano Mainichi decided at the end of 2017 to add the process to its editing system



for cable television outlets. To minimize changes to its existing workflow, Shinano Mainichi accesses the system via a web-based API.

Shunichi Furuta summarizes the testing, evaluation and decision-making processes. “Our Media Editing Department participated in the verification process and discussed how the technology’s implementation might impact our current workflow. After the proof of concept for 3 months, we confirmed that the summarized articles made sense and would stand up to scrutiny in a production environment.”

The Automatic Article Summarization System went into operation in April 2018. An average of 60 summarized Shinano Mainichi articles are now distributed to cable television outlets every day. Whereas it normally takes a person 3 to 5 minutes to summarize an article, the process is done instantly using AI. And the total time to summarize headlines and articles, which normally takes 10 minutes, has been halved – leading to major improvements in work efficiency and productivity. Shunichi Furuta adds, “There was practically no modification to our existing editorial system, and no need to alter the operations of our article summarization team.” He predicts that from now on it will be possible to automatically summarize articles for major metropolitan electronic bulletin boards and other external media outlets, in addition to cable television.

Fujitsu plans to provide similar article summarization technology as a component in its AI-based FUJITSU Cloud Service K5 Zinrai service. The service will be compatible with electronic bulletin boards, social media, and other media formats that have character-count restrictions.

Customer Profile

The Shinano Mainichi Shimbun Inc.

Address: 657 Minami-Agatamachi, Nagano City, Nagano
Established: 1873
Employees: 454 (as of January 2017)
Website: <http://www.shinmai.co.jp/> (Japanese)



The Kansai Electric Power Co., Inc.

Using Artificial Intelligence to analyze smart meter data and detect lifestyle rhythm changes

Deregulation of Japan's electricity market is causing the competition between power companies to intensify. The key to becoming a 'provider of choice' for customers is to create value-added services that match their electric power needs. The Kansai Electric Power Co., Inc. (KEPCO) uses data from smart meters to identify the lifestyle patterns of individual residents. When the resident's electricity use deviates from normal behavior, a message is sent to inform his or her family, who may be living elsewhere. This is the concept behind KEPCO's "Lifestyle Rhythm Notification Service." Following field tests undertaken with Fujitsu, KEPCO has started providing this service, which incorporates Artificial Intelligence (AI)-based technologies.

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When utilizing AI and other advanced technologies, it is more important than ever to strengthen collaboration with partners who have specialist expertise. We wish to provide increasingly high-value-added services, based on alliances with companies in sectors that serve individual households face-to-face; such as home delivery and home-visit nursing care.

Reiji Matsui
Manager, Living Sales Planning Group
Customer HQ
The Kansai Electric Power Co., Inc.

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Remaining the 'provider of choice' in the midst of electricity market deregulation

The electricity market deregulation in Japan began from April 1, 2016, and this allowed regular households, stores, and other general consumers to select their own electricity providers, services, and fee structures.

Prior to market deregulation, KEPCO was promoting a shift from analog electricity meters to smart meters, with information and communication functions that collect usage status data every 30

minutes. Smart meters enable providers to capture electricity usage data via their networks in real time, making monthly meter-reading visits a thing of the past. This has provided a huge benefit.

KEPCO has been pushing data visualization using smart meters for some time, and developed services accordingly. These include "Hapi e-Miruden," a web-based membership service that allows customers to verify their current electricity use and charges. Kazutaka Yamamoto, Living Sales Planning Group, Customer HQ of KEPCO says, "Using the features of smart meters, which can collect usage data of each household every 30 minutes, we pondered the possibility of delivering services that are even closer to our customers' lives. This prompted us to launch our 'Lifestyle Rhythm Notification Service' concept in 2016. Through this service, we monitor the electricity usage status of elderly or other people living alone, and notify their families living far away when the pattern deviates from normal behavior."

Using Artificial Intelligence to address decision-making logic, which is difficult to create patterns

Chronological changes in electricity usage closely reflect the lifestyles of each household. Identifying the usage patterns of each household, therefore, should enable providers to capture changes in lifestyle rhythms with greater accuracy. According to Mr.

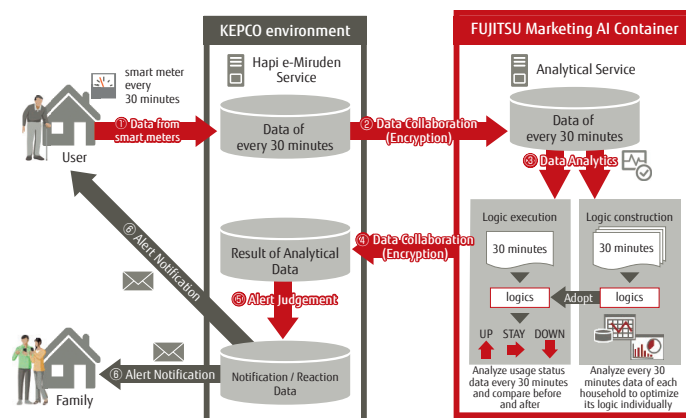
Yamamoto, “A look at the actual usage curves reveals numerous variations according to family. Even within the same household, we noticed major variations depending on the day of the week and the season. So we concluded that we could not simply create patterns to reflect changes in electricity usage, and we chose Fujitsu as our partner to help us incorporate high-precision analytical logic without deviating from real-life situations.”

There were 2 main reasons for choosing Fujitsu. The first was the excellent analytical track record of Fujitsu’s Data Curation Service. Fujitsu and KEPCO have also conducted joint research into the use of smart meters since KEPCO introduced its “Hapi e-Miruden” membership service, allowing customers to verify their electricity use in real time. The other reason was Fujitsu’s Marketing AI Container (a provisional name), a platform for efficiently realizing high-precision analytical logic using AI. Kazutaka Yamamoto explains, “Our ‘Lifestyle Rhythm Notification Service’ is for all homes that use smart meters. The fact that we can access Fujitsu’s highly reliable cloud, which enables the flexible scaling of data that comes in increasing volume with the spread of smart meters, was a major selling point.” Reiji Matsui adds, “We noticed the presence in Fujitsu of dedicated data scientists with extremely high levels of expertise, and we were very encouraged by Fujitsu’s development of AI algorithms for analyzing specific patterns in each household.”

Forging ahead to improve change-forecasting accuracy and diversify services

KEPCO then started field-testing its “Lifestyle Rhythm Notification Service.” KEPCO realized that the electricity usage status of each household was more complicated than expected. To address this, KEPCO used Fujitsu’s Data Curation Service to analyze the data. This revealed various patterns, such as (1) extremely low electricity charges, (2) the prominence of certain trends, (3) large variations between users, (4) high early-morning and daytime use, and (5) plenty of use at night. Using high-precision analytical technologies based on machine learning, KEPCO conducted ongoing analysis of data gathered and compiled over a one-year period. This enabled KEPCO to refine high-precision AI algorithms that can be applied to numerous patterns, as well as to enhance the accuracy of forecasts. During the field tests, KEPCO conducted regular questionnaire- and telephone-based surveys of the residents and their families. According to Kazutaka Yamamoto, “As a result, we confirmed our ability to issue AI-based alerts in a timely manner reflecting real-life situations. Several residents commented that they could live their lives naturally, without the feeling of being watched. And their families said they felt peace of mind knowing that their loved ones had a normal day, not just when irregularities occurred.”

The “Lifestyle Rhythm Notification Service” was launched in July 2017 for all households with smart meters installed. All you need is a smart meter and you can access the service free of charge, so there’s no added installation costs compared with regular monitoring services. And the increasing use of AI-based decision-



Mechanism of Lifestyle Rhythm Notification Service

making logic leads to better optimization tailored to each household, which is another big plus. “When utilizing AI and other advanced technologies, it is more important than ever to strengthen collaboration with partners who have specialist expertise. We wish to provide increasingly high-value-added services, based on alliances with companies in sectors that serve individual households directly, such as social issues which are home delivery and home-visit nursing care,” concludes Reiji Matsui.

In addition to forecasting lifestyle rhythms, information provided via smart meters can be used in other ways, such as the management of vacant residential properties. We believe that the measures taken by KEPCO can be expanded to promote interactions with people, maintain security in local communities, and otherwise address issues caused by Japan’s ageing population and urbanization.

Customer Profile

The Kansai Electric Power Co., Inc.

Address: 3-6-16 Nakanoshima, Kita-ku, Osaka
 Established: 1951
 Employees: 21,314 (as of March 31, 2017)
 Website: <http://www.kepc.co.jp/english/>



Slingeland Hospital

Co-creating a real-time monitoring solution Ensuring better care and more informed medical decisions

In the Sensing Clinic program, Fujitsu and Slingeland Hospital co-created an innovative sensor solution to capture the health status of patients 24/7. It allows nurses and doctors to remotely monitor conditions, reducing the need for bedside visits, allowing patients' treatment to be tailored to their needs, and thus improving the patient experience.

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With the Sensing Clinic program, we can monitor our patients 24/7, intervene sooner and use our bed capacity and personnel better. That is good news for the patients and for the hospital.

*Chrit van Ewijk,
CEO,
Slingeland Hospital*

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A New Sensing Clinic Study- an innovative approach to achieve a higher quality of care

In 2016 a new 'Sensing Clinic' study started at Slingeland Hospital, based in Doetinchem, the Netherlands. "When it comes to innovation, we discovered that we often notice too late that the patient's condition is worsening so we are looking for providers who can bring innovation and offer something extra in that domain," explains Chrit van Ewijk, CEO, Slingeland Hospital. The hospital wanted to understand how best to adopt sensing technology to support its medical staff with real-time information on patients' vital signs. The technology should provide medical staff with information about patients' performance, supporting

informed medical decisions and targeting a higher quality of care.

The Sensing Clinic study is the first trial of research outcomes from Fujitsu's healthcare research project KIDUKU, a three-year collaboration between Fujitsu Laboratories and Fujitsu Ireland to understand how best to integrate sensing solutions into clinical and community based settings.

"As a hospital, we don't have specific knowledge on sensors, but Fujitsu has. We set up the requirements and Fujitsu provided us with the resources to measure what we need," says Chrit van Ewijk.

Co-creation of an innovative technological solution to improve patient's care

Starting in September 2016, Phase 1 of the Sensing Clinic initiative deployed innovative sensor technology, co-created between Slingeland Hospital and Fujitsu. The sensors capture patient data in real time, allowing nurses to remotely monitor conditions and reducing the need for bedside visits, thus improving the patient experience. This phase ran until April 2017 with plans to make the sensors available to further departments within Slingeland Hospital thereafter. Phase 2 commenced in July 2017 focusing on monitoring vital signs of further patient groups within other departments, as well as the use of motion sensors to monitor and inform care plans for stroke patients.

"What we are doing is new. We used to take observations from the patient a number of times a day and, in between, we had to use our clinical judgement. We would make rounds to see how the patient was," says Chrit van Ewijk.

A rich set of sensors now provides medical staff with real-time information on patients' vital signs using a combination of ambient and wearable sensors. Chrit van Ewijk explains how the sensors are easy to put in place, "We stick a plaster, a so-called Health Patch, on the chest. We attach a wireless blood pressure monitor to the patient's arm and we place a sensor under the bed as well.

The patient has more freedom of movement than before. We receive continuous data from patients which is stored anonymously online and can be retrieved immediately. Now we can monitor the patient wherever he or she is. Thanks to Fujitsu's Smart Sensing technology, we can now continuously monitor certain parameters to keep an eye on the patient. If they worsen, we can intervene a lot sooner and prevent their condition from getting worse."

To present information back to clinicians Fujitsu collaborates with VitalinQ, a Dutch company which specializes in health and wellbeing solutions. All data collected is fed back to the medical staff through VitalinQ's Lifestyle Guidance application. In the same way, the data collected can be exchanged with Slingeland Hospital's electrochromic display (ECD) and Hospital Information Systems (HIS) in the near future.

"We don't try to change protocols, but we want to help nursing staff to perform their tasks in the knowledge that they are sometimes understaffed," adds Chrit van Ewijk.

More data leads to shift towards prevention deterioration and shortened treatment

The Sensing Clinic program will be a huge improvement for Slingeland Hospital. Not only will medical staff members be able to continuously monitor patients' vital signs such as ECG, blood pressure, heart and respiratory rates and sleep patterns, but also the program saves time that would otherwise be needed to perform manual measurements. This leaves more time to spend on patient care.

The real-time availability of patients' statuses on mobile devices like smartphones and tablets will make it possible for healthcare professionals to make informed decisions on treatment. Finally, perhaps the most important benefit of the program is the early detection of deterioration, preventing further damage, which translates to a better quality of care.

Chrit van Ewijk concludes, "We receive a lot more data about the patient much earlier so medical interventions can shift more towards preventing deterioration and towards accelerating and shortening the treatment. Looking at what this program does for our hospital, we will be able to raise nursing staff satisfaction. After all, what they really want is to focus more on their care for patients. Sensor technology enables them to take a step back and focus on



the data to make the best decisions for the patients."

Customer Profile

Slingeland Hospital

Address: Kruisbergseweg 25, 7009 BL Doetinchem, Netherlands
Established: 1975
Employees: 1,600
Website: <https://www.slingeland.nl/> (Dutch)



Siam City Cement Public Company Limited (SCCC)

Thailand's First Smart Connected Factory Driving growth in an emerging ASEAN economy

Fujitsu has been helping the Siam City Cement Public Company Limited (SCCC) and its ITC subsidiary, INSEE Digital Company Limited to accelerate digital transformation for years. An example of this partnership is the transformation of SCCC's cement factory in Saraburi Province, 2 hours' drive from Bangkok, into a smart connected facility. Rolling out such new technologies and processes like machine learning, predictive analytics, remote tracking and contractor management systems, the factory has substantially improved operational efficiency and safety, and lowered maintenance costs. Following the success of this smart project, the parties are planning to implement the same technologies in overseas factories in other Asian countries.

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The Digital Connected Plant is one of the major projects of SCCC that will drive efficiency and further cost reduction in our plant operations. Furthermore, SCCC hopes to contribute to the government's agenda on Thailand 4.0 and to the country as a whole. Leveraging strong partnership with Fujitsu, we are able to deliver and implement the Digital Connected Plant project faster than expected without compromising quality. Making SCCC the first mover in IoT and giving us a competitive advantage in the cement industry in Thailand.

*Siva Mahasandana
CEO, Siam City Cement Public Company Limited*

Innovation is crucial for the growth of SCCC. Digitization is a key driver and incubator for innovation, that's why we have such a strong focus on digital at SCCC. We drive our digital transformation across the full value chain, ensuring we capture all key innovation opportunities. Investing in industry 4.0, like our connected plant, is a great example of business, IT, digital and partners like Fujitsu collaborate and create exponential value.

*Dennis van Heezik
CEO, INSEE Digital - a subsidiary of Siam City Cement Public Company Limited*

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Complex and long-established processes: New level of transformation required

Committed to industrial transformation, Thailand has formulated a national strategy, dubbed “Thailand 4.0,” with the ambition of transforming heavy, lumbering industries into technology-driven, nimble companies, tradition-bound family businesses into smart enterprises and inefficient farms into smart agricultural operations. As if to serve as a national example, one Thai company has been driving digital transformation of its production plant, the Siam City Cement Public Company Limited (SCCC), the second largest cement producer in Thailand.

Since launching its business in 1969, SCCC has been regularly improving its plant operation, seeking to boost productivity and reduce the impact of its operations on the society and the environment. But because the company's plants operations consist of complex and long-established processes, including processing raw material, grinding, proportioning and blending, clinker kilning, cooling and final grinding, it has always been difficult to implement transformative change. In addition, maintenance of giant production machines and management of contractors with high turnover rates have presented thorny problems for plant managers. It required groundbreaking ideas and vision to

dramatically improve plant performance.

Understanding the challenges, SCCC kicked off its project for digital transformation in July 2017. "To continue to provide high quality products and services to our customers, with efficient and safe operations, we wanted to create the world's most advanced digital cement factory," says Amornsak Torot, Senior Vice President, Saraburi Operations. "We call it the 'smart connected factory,' because it connects people, processes and machines. We wanted to change the way our people work and create a sustainable workforce."

Rolling out IoT technologies to be the Thailand's first "smart connected factory"

To achieve the goal, Fujitsu started by identifying problems in the field. "Fujitsu's approach is very customer centric," says Eiji Furukawa, Managing Director of Fujitsu (Thailand) Company Limited. "We talked carefully with Siam City Cement to understand their operations, requirements and digital journey roadmap. I think dialogues with both factory and IT people are the key for success."

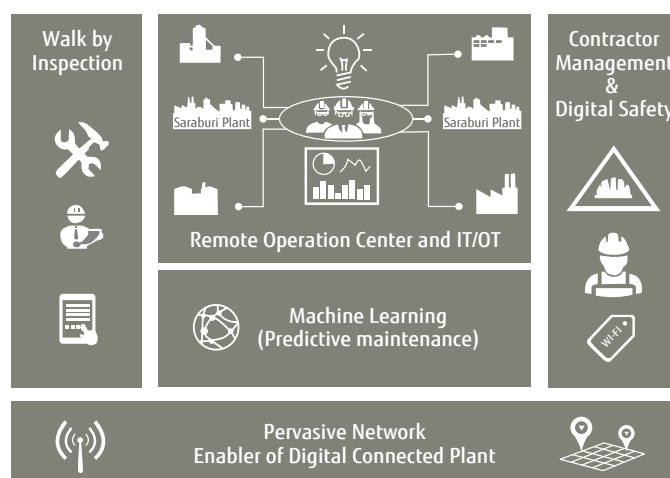
Interviews identified a number of problem areas, including the need for updates or enhancements in the deployment of digital devices, ICT asset management, worker training, contractor management, communication and collaboration across the facility as well as machine maintenance and repair. Fujitsu turned to IoT technologies to address these problems and set out to create a roadmap for SCCC to build a smart connected factory connecting people, processes and machines.

Based on the roadmap, SCCC and Fujitsu worked together to build a pervasive network by deploying 374 Wi-Fi access points across the vast facility to help supervisors monitor and track the entire plant's operation for enhanced communication. SCCC and Fujitsu built a Remote Operation Center and integrated IT/OT together as well. They also implemented machine learning and predictive analytics for failure prognosis and a contractor management system for contractor registration, profiling and work assignment, as well as location-based control and safety measures for plant maintenance. The Remote Operation Center is equipped with a video wall display and an IT/OT staging database for centralized monitoring. This enables to control and remote support for plant maintenance and operation as well as enables managers to track contractors in real-time. "The Remote Operations Center allows experienced staff to remotely support onsite staff," says Chaiyan Sakulsaowapakkul, Plant 2 manager, SCCC. "Now we can make the right decision to fix the problem faster."

These technologies enabled SCCC to substantially increase operational efficiency while enhancing safety, giving managers the information they need to aim for even higher goals of improving plant operational and performance excellence.

Expanding this connected factory to other countries to accelerate innovation with Fujitsu

SCCC's smart connected factory launched operations on schedule



The conceptual diagram of SCCC's 'Smart Connected Factory'

in December 2017. Torot recounts, "Early results promise a 2% improvement in annual OEE (overall equipment efficiency) and maintenance costs to decrease by 10%." Dennis van Heezik, CEO of INSEE Digital, and Hans Keril Ante, Department Manager, Infrastructure Services and Security Management, who has been collaborating with Fujitsu for two years on building the ICT infrastructure for SCCC, sees the successful project as an important step toward ensuring the cement company's future growth. "Smart Connected Factory creates power not only for cement production but also for business. Integration of people, processes and machines enables the management to have a clearer view of production and to quickly make a next move with accurate decisions."

SCCC is planning to deploy the smart connected factory processes and technologies to other Asian countries, including Vietnam, Sri Lanka, Bangladesh and Cambodia. "Innovation is crucial for the growth of SCCC. So we cannot stop digital transformation in any aspect of our business," says Heezik. "That's why we partner with Fujitsu."

Customer Profile

Siam City Cement Public Company Limited (SCCC)

Address: Column Tower, 3rd, 10th - 12th Fl., 199 Ratchadapisek Rd., Klongtoey, Bangkok 10110, Thailand
 Established: 1969
 Employees of the Group Company: 5,900
 Website: <https://www.siamcitycement.com/en/home>



Mizuho Bank, Ltd.

FIDO biometric authentication in banking application realizes twin benefits of higher security and better customer experience

Online services generally require a username and password for access. Recently, however, the leaking of passwords and the inconvenience of needing to remember multiple passwords have become issues. To resolve them, Mizuho Bank has introduced biometric authentication to its online banking offerings with the deployment of 'Finplex Online Authentication Service for FIDO', which is available via Fujitsu's MetaArc platform. Mizuho Bank also plans to roll out this offering to cover wide-ranging services beyond online banking.

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Fujitsu has a proven track record in building banking systems, and we regard them as a highly reliable company. In the future, we plan to promote the use of biometric authentication in other areas, such as when transferring funds and also in our ATMs and internal systems. We are also considering its adoption as an authentication platform.

*Taiji Sudou
Senior Manager,
IT & Systems Control Department No.1,
Mizuho Bank, Ltd.*

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Adoption of FIDO as an authentication standard to replace passwords

Today most people prefer the convenience of online banking. According to Kazunori Suhara, Personal Marketing Department, Mizuho Bank, "The use of internet banking is increasing at Mizuho. Rather than visiting a branch, more and more customers are accessing banking services via digital channels."

Cybercrime, and especially preventing the impersonation of a user to gain access to their accounts has become a major challenge. Traditional online banking services require user names

and passwords for authentication. If a password becomes known to a third party, there is a significant risk that party will be able to access the customer's account.

To address this issue, Mizuho Bank, Ltd. (Mizuho Bank) has deployed the 'Finplex Online Authentication Service for FIDO', which is available via the FUJITSU Digital Business Platform MetaArc. Through this service, the Bank has been offering highly secure biometric authentication since October 2017. FIDO (Fast IDentity Online) is a new international standard for swift online authentication that replaces passwords. It is expected to become the de facto standard for online authentication.

Taiji Sudou, Senior Manager of IT & Systems Control Department No.1 at Mizuho Bank adds, "The greatest attraction of FIDO is that the Bank doesn't need to retain biometric data of its customers. This is because the customer sends only a digital signature to the server after completing authentication from his/ her smartphone. Since biometric data is not transmitted via the internet, the risk of leaks is low."

Rapid delivery of a platform to handle diverse biometric data Attention to customer experience at the development phase

Mizuho Bank embarked on this project in December 2016. Prior to that, it had been investigating the potential of Fintech, Artificial

Intelligence (AI), and biometric authentication, and had made arrangements with several vendors. Fujitsu recommended FIDO, which Mizuho Bank decided to adopt in February 2017.

Kazunori Suhara explains the reason for implementing the FIDO standard from Fujitsu, "We chose it because it allows us to quickly address the full line up of biometric authentication protocols, including fingerprint, facial, and iris recognition."

Taiji Sudou adds, "Fujitsu has a proven track record in building banking systems, and we regard them as a highly reliable company. Also, Fujitsu is a founding member of the FIDO Alliance, and it has a business tie-up with Nok Nok Labs, a leader in FIDO standardization. Fujitsu's support of all of the standards specified by Nok Nok Labs was also an important factor. And Fujitsu has experience in smartphone development and so has superior technological capabilities to address the different characteristics of various smartphone devices."

With a view toward a future global rollout, Fujitsu organized a team to participate in the project, consisting of members from Japan and overseas. To maximize user convenience, Fujitsu decided to incorporate existing banking application rather than develop biometric authentication components apart from the application. The system development began in April 2017 and it was completed in just 6 months. The FIDO-based biometric authentication is now available via the 'Mizuho Direct App' login screen.

In addition to fingerprints and irises, the system supports facial recognition from smartphone cameras as biometric data for authentication, which means a wide range of camera-equipped smartphones can be used. Once registration is complete, the user only needs to select 'Log-in with biometric authentication' to permit the reading of his/her biometric data. It is a simpler and more secure authentication system that does not require a password.

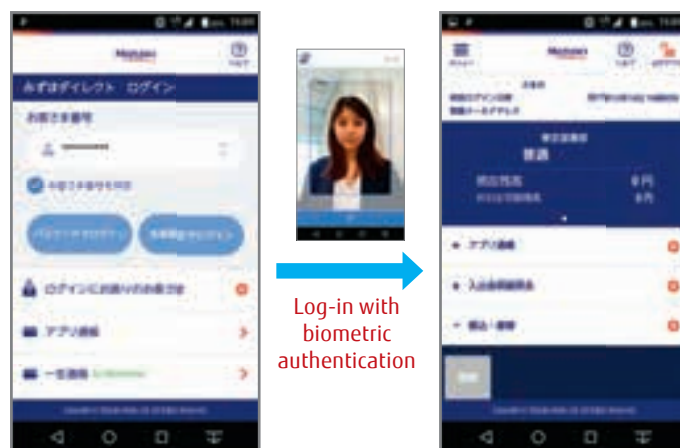
Sharp increase in registered users thanks to positive social media feedback

Applications beyond online banking are on the horizon

The number of registered users has been rapidly increasing, even without any major advertising campaign. From the beginning, many users posted positive comments about the system's ease of use and convenience on social media platforms and so on. This is one of the reason which drove up the number of users in a short timeframe.

Kazunori Suhara continues, "We reached 60% of our target in the first month. We were also surprised ourselves that this new services succeeded in being widely used among many customers in such a short period."

Taiji Sudou adds, "In the future, we plan to promote the use of biometric authentication in other areas, such as when transferring funds and also in our ATMs and internal systems. We are also considering its adoption as a 'Mizuho' authentication platform." Mizuho can use FIDO to address their diverse needs because the



The device screen of logging-in with biometric authentication

FIDO standard can be adapted easily to new authentication methods. Another key reason for choosing FIDO is that Mizuho is willing to deploy it in other services that evolve from the latest authentication technologies.

Kazunori Suhara concludes, "Our ultimate aim is to remove the need for passwords. We wish to build such service together with Fujitsu."

Customer Profile

Name: Mizuho Bank, Ltd.

Address: Otemachi Tower, 1-5-5 Otemachi, Chiyoda-ku, Tokyo
Inauguration: July 2013
Employees: 29,848 (as of March 31, 2017)
Website: <https://www.mizuho-bank.com/index.html>



Belfius

Belfius leads the field in mobile banking with Fujitsu Sign'IT

Belfius wanted to position itself as a leader in mobile banking and selected the Fujitsu Sign'IT solution, a highly-secure biometric signature that is entered directly on the user's smartphone without the need for a stylus or paper – in 5 minutes the user safely opens an account, signing the contract with their finger. It connects with core banking applications to enable new account establishment. Belfius is gaining an average of 1,000 new mobile banking customers a day.

“

Fujitsu committed to an ongoing collaboration to bring our vision of paperless account-opening to life. Our goal was a mobile account-opening and contract-signing solution that can be completed within five minutes.

*Benoit Speybrouck,
Head of Digital Projects,
Retail & Commercial Banking,
Belfius*

”

Mobile-first strategy leads to excellent customer experience and transforms mobile banking

Since 2015, Belfius has established its digital strategy, based on a mobile first, omnichannel approach. Innovation has already earned Belfius first place for growth in mobile banking, worldwide, in independent benchmarks. Mobile banking services are proving popular among the bank's one million-plus mobile customers, who each make an average of 26 connections per month.

“It was clear that mobile was going to be a huge factor in our success, however, signing methods are important whenever a customer opens an account,” explains Benoit Speybrouck, Head of

Digital Projects, Belfius.

“It was a question of lagging behind or staying in front with a strong digital offer. That required e-signature functionality.”

Although handwritten signatures are still the most popular technique – and often a legal requirement in the financial industry – printing paper copies of documents just to sign them is a waste of environmental resources, time and money. Belfius issued an RFP and benchmarked numerous solutions according to the following criteria: performance, quality, ease of integration and cost. After careful consideration, Fujitsu was selected to incorporate its Sign'IT solution.

Stylus and paper-free, secure e-signing improves customer experience

Fujitsu Sign'IT works by capturing a handwritten signature on an electronic device, along with important identification information, such as how quickly the user moves the pen, pen angle, and how much pressure is applied to each segment of the signature. Together, these parameters form the unique fingerprint of the signatory's highly secure biometric signature, which is non-transferrable. Signature data is embedded into the bank account opening form, ensuring that it is authentic, non-reusable, and cannot later be altered.

"The Fujitsu team spent four months integrating its Sign'IT solution with our applications," continues Speybrouck. "Fujitsu has enabled us to focus above all on regulatory aspects and the customer experience of opening a bank account digitally. Sign-up can be completed in five minutes from anywhere, without filling in any paperwork."

Identification is carried out using real-time scanning, recognition and verification of a customer's electronic ID card, and Fujitsu Sign'IT technology to confirm the customer's finger-based signature on the smartphone screen. This makes it simple for anyone to open a new account without the need to visit a branch to physically sign documents.

Reached the fastest growth in mobile banking users worldwide

Belfius is gaining an average of 1,000 new mobile banking customers a day. By simplifying the account creation process, Fujitsu Sign'IT is also helping the company to gain new customers via the mobile channel, accelerating growth which has now surpassed more than one million mobile users.

"It is clear that an innovative mobile app contributes to the satisfaction of clients and creates a positive brand image; if you offer a poor user experience, customers simply won't come back," says Speybrouck. "The ratings speak for themselves: the Belfius Mobile app is rated 4.6 in both Android and iOS markets, the highest in the Belgian banking landscape."

Belfius is the first bank to offer new customers this fast, secure and user-friendly method for establishing a new account. As a result, it has seen conversion rates increase significantly.

"It was a major breakthrough for us as a company – the number of people who entered and actively opened an account doubled," comments Speybrouck. "At the same time, the need for wasteful paper contracts, often up to six pages long, has reduced. This lowers our operational costs while making the process much faster."

This innovative approach to on-boarding new customers has placed Belfius at the forefront of international finance; a recent independent benchmark confirms Belfius has the fastest growth in mobile banking users worldwide. Conversion rates have doubled, which, when benchmarked against other EU banks, is markedly ahead. The next step is to further integrate Fujitsu Sign'IT across other platforms.

"The principal advantage is that it is an omni-channel solution, which means we can replicate it across the business, whether in the local branch or on the road using tablets," concludes Speybrouck.

"Furthermore, we're looking forward to co-creating a white labelled version of the app that we can together sell on to other financial institutions – or anywhere that a legal signature is required."



Customer Profile

Belfius

Address: Bd Parheco 44, 1000, Brussels, Belgium
Established: 1996
Employees: 10,000
Website: <https://www.belfius.com/EN/index.aspx>



Lotte Card Co., Ltd.

HandPay Service using Fujitsu palm vein authentication enables cashless, card-less shopping

Lotte Card adopted the Fujitsu palm vein authentication solution which allows users who registered their biometric information to make secure payments at stores simply by holding their hand over an authentication device. This innovative approach achieves cashless and card-less shopping and improves experience for shoppers. In addition, This made Lotte Card a leader in the competitive Korean credit card industry.

“

Fujitsu has a keen understanding of Korea's regulations and unique environment, and answered our request with its extensive experience and technological expertise.

*Mr. Kim,
Smart Business Team Head,
Lotte Card Co., Ltd.*

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Fujitsu and Lotte Card co-create card-less payments for shoppers

Established in 2002, Lotte Card Co., Ltd. (Lotte Card) is a credit-based finance business focusing predominantly on the credit card and instalment payment industries. With total assets reaching over 10.2 trillion KRW (approx. \$9 billion USD) the company has emerged as a market leader in the rapidly expanding mobile financial services industry. With the Korean government striving to proactively promote the Fintech industry, the mobile financial services industry has seen rapid expansion. In line with this, the biometric authentication market saw a two-fold increase between 2012 and 2016, with the industry now worth approximately \$270

billion USD a year. Wanting to take the lead in this area and gain an edge of its competitors, Lotte Card has set out to provide safe, user-friendly services to credit card users.

The safest, convenient payment solution driving Korea's financial industry

Adopting the Fujitsu palm vein authentication solution, Lotte Card enables users to make payments at stores simply by holding their hand over an authentication device. Explaining why the company is targeting this area, Mr. Park, Managing Director, Marketing Head Office, Lotte Card, says, "Lotte Group is a corporation that proactively implements the latest technology ahead of our competitors. We may not be Korea's No.1 company in the credit card market, but we take the initiative when it comes to adopting AI and big data analytics. We aim to become a leading corporation in the financial services industry in Korea, one that utilizes the latest technology."

Palm vein authentication is far less susceptible to fraud compared to fingerprint recognition, as authentication is only given after analyzing special components found within a person's blood vessels. The vast number of veins found in the palm and the complexity of their shapes offer a huge amount of information, resulting in a false identification rate of 0.00008% and an

identification failure rate of just 0.01% - making it far more reliable than other methods of biometric authentication. Furthermore, there is no need to touch the sensor surface of the device itself, which many people prefer. Wanting to make the process as simple as possible, users first have their palm biometric information scanned and registered at a card center. This information is then converted into encrypted data before being related to the user's individual credit card information. What this means is that when a user wants to make a purchase, they simply enter their mobile phone number into the payment device and place their hand over the scanner. Once verified, payment is complete.

Card-less payment revolutionizing not only shopping but also the business

Lotte Card's HandPay Service is fully deployed, making card-less shopping a reality - eliminating the need to carry purses, wallets or mobile devices, and so on. Discussing the contributing factors behind the scheme's success, Mr. Kim highlights the close relationship formed between the 2 companies. He states, "Fujitsu has a keen understanding of Korea's regulations and unique environment, and answered our request with its extensive experience and technological expertise." It is now introduced into more than 30 stores, including 7-Eleven, which has a major presence as the convenience store in South Korea and it is progressively being implemented across Lotte Group's retail division.



Customer Profile

Lotte Card Co., Ltd.

Address: 3, Sowol-ro, Jung-gu, Seoul, South Korea
Established: 2002
Website: www.lottecard.co.kr (Korean)



Norsk Hydro ASA

Hydro's Brazilian operations are migrated to their global IT platform using Fujitsu's services and hardware

Hydro wanted all their operations in one standardized, global IT platform, to ensure consistency and availability. They turned to their long-time service and technology partner, Fujitsu, for advice. By transferring their Brazilian operations' managed infrastructure services to Fujitsu, Hydro got a fully modernized operation and reached 20% reduction in operational costs. Threats were minimized and the overall security increased thanks to a dedicated Managed Security Service and FUJITSU PalmSecure biometric access for user ID.

“

Fujitsu became our best performing vendor in recent years with high user satisfaction. It was the clear choice to deliver a standardized environment in line with the rest of the business.

*Jo De Vlieghe,
Chief Information Officer,
Hydro*

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Standardizing on a single vendor solution

Norsk Hydro ASA (Hydro) is a fully integrated aluminum company with 35,000 employees in 40 countries on all continents, combining local expertise, worldwide reach and unmatched capabilities in R&D. Hydro is present within all market segments for aluminum, with sales and trading activities throughout the value chain serving more than 30,000 customers. Based in Norway and rooted in more than a century of experience in renewable energy, technology and innovation, Hydro is committed to strengthening the viability of its customers and communities, shaping a sustainable future through innovative aluminum solutions.

Hydro has partnered with Fujitsu for many years, with the latter

providing a full set of IT services both on-site and remotely across all the company's business areas, covering server and storage system hosting and administration (RIM), End User Support (EUS), Network Operation Center (NOC), 24/7 multilingual service desks, collaboration systems and security services (SOC).

“Fujitsu became our best performing vendor in recent years with high user satisfaction. Following the acquisition of a mining, refinery and smelting site in Brazil, it was the clear choice to deliver a standardized environment in line with the rest of the business,” explains Jo De Vlieghe, Chief Information Officer, Hydro. “Having 2 discrete set-ups in Brazil and globally was proving problematic because everything had to be engineered twice and the release cycle is always getting faster.”

With 5,000 users spread across 3 locations in Brazil, this project posed unique challenges for Hydro and Fujitsu. Power and network capacity are vulnerable in the heart of the Amazon delta and delivering the necessary infrastructure was not straightforward. Moreover, Hydro wanted to incorporate security measures on a biometric level while also ensuring adequate support.

“We have a very clear digital strategy built on 4 pillars: efficiency, cybersecurity, innovation and change management. Fujitsu was already helping us meet those goals across the wider business so this was an opportunity to bring the Brazilian operation up to

speed,” adds De Vliegheer. “It is a harsh environment with vulnerable connectivity so we certainly had our work cut out.”

Co-creating a robust IT platform in the heart of Brazil

Fujitsu configured the servers and storage equipment in Germany before shipping it to the Brazilian mines, 2 hours’ drive from Belen in the Amazonian rainforest. At the same time, Fujitsu’s Indian team performed data migration remotely. After 6 months, the new infrastructure was ready to go. This infrastructure is wrapped in multiple Fujitsu services, such as NOC and SOC, which make up a major share of the deal.

“Fujitsu was able to leverage its global resources as well as its local Brazilian team to transition the business, which made it a less complex task,” continues De Vliegheer. “By standardizing on one consistent company-wide platform, it makes it easier to manage and simpler to roll out cloud services and new applications.”

Hydro also deployed FUJITSU PalmSecure to manage employee access to terminals. This uses the unique biometric signature of each person’s palm to allow them to log on to PCs and thin clients.

“We had 3,000 users who had never used a company PC before but we wanted everyone to have access to a digital platform. However, passwords are easily forgotten and swipe cards can be lost or stolen,” comments De Vliegheer. “Fingerprint ID might work in a clean office environment, but in the dusty conditions of the mine, FUJITSU PalmSecure provides a robust, accurate non-contact solution.”

Fujitsu also provides 24/7 first and second-line helpdesk support from its Polish Global Delivery Center (GDC), where calls are answered also in Brazilian Portuguese.

User satisfaction improved by agile IT framework and driven by collaboration between Hydro and Fujitsu

Hydro’s user satisfaction ratings are now at 93%, reflecting the consistent delivery of IT services across the business – in Brazil and beyond. Moreover, local operational costs have reduced by 20% through standardizing on a single vendor platform.

“We can re-use documentation and best practice across the business which leads to lower costs, while at the same time productivity has increased due to better reliability and performance,” remarks De Vliegheer. “This makes us more competitive and able to respond to market demands more quickly.

“Cybersecurity is becoming more complicated; we are not large enough as an organization to have our own internal SOC, however, Fujitsu provides the best all-round offering which integrates with all existing services,” says De Vliegheer. “Knowing we have that layer of global protection is a comfort.”

Hydro and Fujitsu have built together a solid partnership based on years of collaboration, leading to a global, single vendor IT environment that boosts performance, ensures security and optimizes availability. Based on this success, the 2 companies are now looking at areas they might further explore.



“I’ve visited Fujitsu’s Japanese headquarters and seen promising technology in a number of fields, such as machine learning, employee sensors and predictive maintenance,” concludes De Vliegheer. “These are the cutting-edge technologies that will help define us as a company as we continue to evolve.”

Customer Profile

Norsk Hydro ASA

Address: Drammensveien 264, NO-0283, Oslo, Norway
Established: 1905
Employees: 14,177
Website: <https://hydro.com/en/>



Toyota Motor Corporation (Technical Service Division) Envisioning the Future of Car Servicing Kaizen meets Design Thinking (Innovation)

Toyota Motor Corporation's Technical Service Division, which supports around 40,000 service technicians nationwide, opened its Tajimi Service Center to enhance the training of service technicians and to expedite R&D on vehicle repair technologies. The Center has introduced Fujitsu's Design Thinking concept to create a vision map of the 'preferred future' for service technicians. It also set up the Technical Service Development Laboratory (TSDL) as a venue to trigger innovation aimed at realizing this future. These activities have led to changing ways of working and have fostered a climate for actively encouraging new ideas. Using a combination of Kaizen (incremental improvement) and innovation brought about by Design Thinking, the Technical Service Division aims to create new ideas and unlock the future for automobiles and services.

“

We attach equal weight to Kaizen and innovation brought about by Design Thinking. They help improve the motivation of each and every division member. I hope we can use the TSDL to realize ideas obtained through Design Thinking and create a solid future for our service technicians.

*Jingo Ohashi,
General Manager (formerly), Technical Service
Division, Customer First Promotion Group, TMC*

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Methodology to set out the future workstyles of service technicians

Since its establishment in 1937, Toyota Motor Corporation (TMC) has sought to 'create a prosperous society through automobiles.' In Japan alone, Toyota has some 5,000 service centers with 40,000 employees nationwide; all committed to ensuring that customers can continue driving cars with peace of mind. Its Technical Service Division provides a range of support facilities to make full use of the skills of its service technicians. In January 2016, the division opened its Tajimi Service Center to enhance personnel development and provide better services to customers around the

world. According to Jingo Ohashi (General Manager (formerly), Technical Service Division, Customer First Promotion Group, TMC), "The aim of setting up the Tajimi Service Center was to train leaders in auto servicing to a level that would give them greater skills and depth of experience, and enable them to return to the field to deploy their enhanced knowledge." Tatsuya Inoue (General Manager (formerly), Project Management Dept., Technical Service Division, TMC) recounts, "The main challenge was trying to decide what sort of novel things we could do at the Tajimi Service Center. We knew we needed to think deeply about the future and pursue our tasks accordingly. We were struggling to understand the direction of future workstyles of service technicians and what we needed to do to discover the answer."

Teaming up with Design Thinking to clarify "preferred future" for service technicians

Technical Service Division struggled to decide how to go about setting its own tasks. The division then received a proposal from Fujitsu centred on 'Design Vision', a concept that leverages Design Thinking^(*). This proposal involved creating a vision map of the 'preferred future' rather than the 'ideal future' and visualizing what the service technicians wanted to do. Because this was consistent with issues recognized by the Technical Service Division, Fujitsu set

(*)1 Creative strategies designers use during the process of identifying and solving problems to design it that anyone can take advantage of.

up Vision Design workshops for the division. To make the workshops more effective, the Fujitsu facilitation designer carried out preliminary fieldwork^{*2} and conducted the workshops at Fujitsu's co-creation space, intentionally separated from day-to-day work environments in order to generate new ideas.

Participants in the workshops employed a process called 'back-casting,' where you create a preferred future (vision) then translate it to what you can achieve now. The approach is aimed at realistic methods that anyone can embrace to create perspectives and ideas in order to create a preferred future. The designer transformed the results into a vision map, and the Technical Service Division used the map to brief others in the company on its future aims and aspirations.

The Technical Service Division set up the Technical Service Development Laboratory (TSDL) in April 2016. This created a new space for open innovation to develop future-oriented services and to work towards realizing the preferred future set out in the vision map. The main focus was HR development. As part of this, the Technical Service Division encouraged activities that would inspire participants to think about the things they wanted to do at TSDL and thus incorporate Design Thinking into their daily work routines. The main theme of the workshop, held once a week, is Workstyle Innovation for Service Technicians of the Future. For example, their current focus is on brainstorming ideas and developing prototypes of the auto repair tools to be used in the service bays of the future. These activities are producing prototypes and some of them may become reality in the near future.

"Incremental Improvement x Innovation" to unlock the future for workstyles and corporate culture

Design Thinking also plays a part in changing the workstyles of the Technical Service Division. According to Akira Shinada (Assistant Manager, Technical Service Division, TMC), "When I first became involved in Design Thinking, I was surprised to find that such a methodology existed." He says that by focusing on what he wanted to do and what he wanted to become in the future, his motivation to work increased and every day was enjoyable. The corporate culture is changing too. The Technical Service Division now hears fewer and fewer negative remarks, and an atmosphere of accepting diversity and being willing to actively cultivate new ideas is now emerging. Tatsuya Inoue comments, "The Design Thinking proposed by Fujitsu was extremely motivating for us. To get things done, you need a place, a time and a method. Together with the place and time provided by the Tajimi Service Center, Design Thinking played an important role as the methodology for triggering free thinking." The Technical Service Division aims to continue its focus on Design Thinking, led by TSDL, and introduce the methodology to other people in the company and have them become involved. Jingo Ohashi concludes, "Kaizen (Toyota's area of expertise) and innovation brought about by Design Thinking both



carry equal weight for us. We'll be able to create new value by integrating these concepts. This is what we will use to usher in the future for our service technicians, as well as the future for cars and car servicing."

Customer Profile

Technical Service Division (Tajimi Service Center), Toyota Motor Corporation

Address: 1-1-1 Yamabuki-cho, Tajimi City, Gifu
Opened: January 2016
Employees: Approx. 800

Information for Customers (headquarters) Toyota Motor Corporation

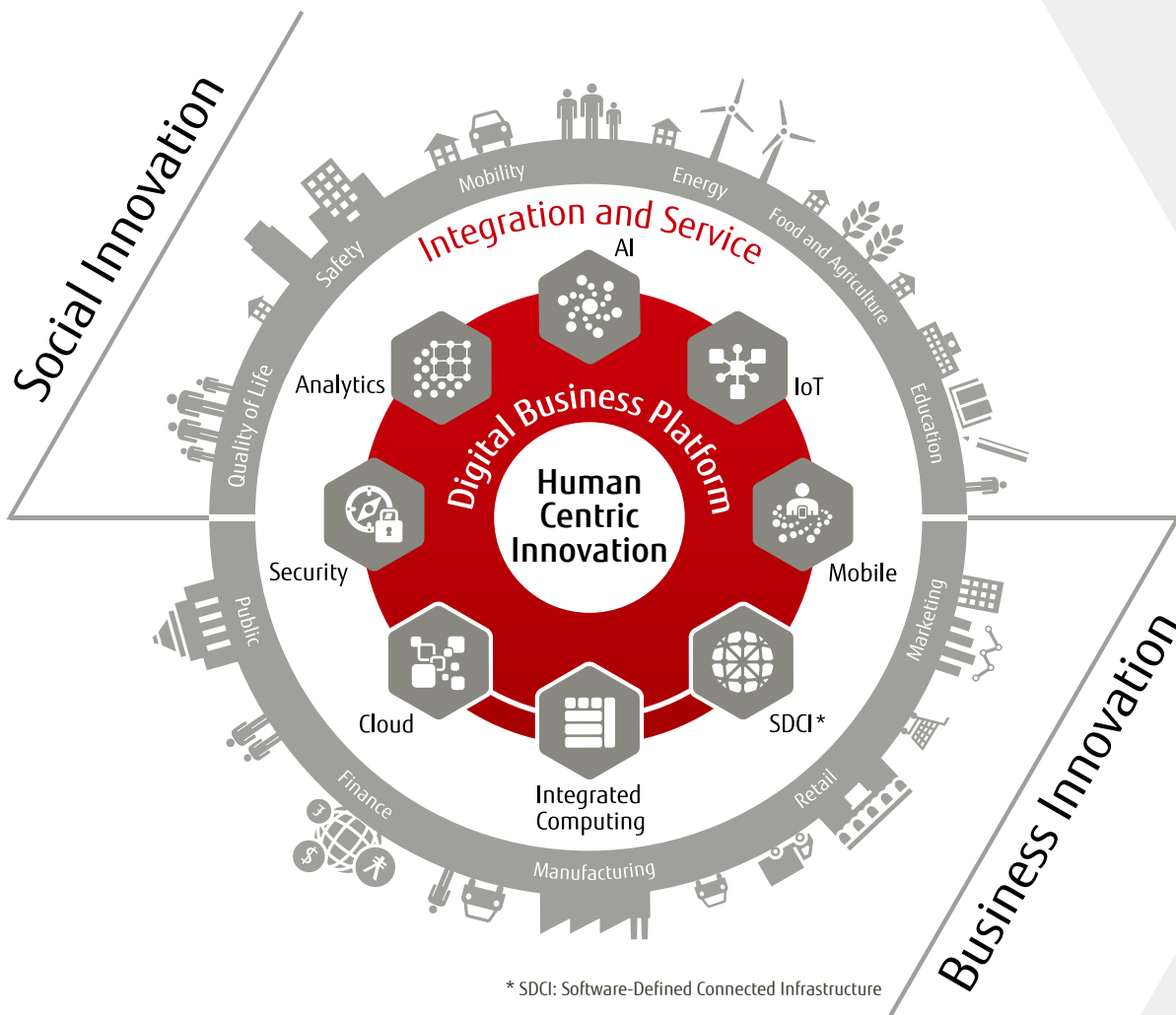
Address: 1 Toyota-cho, Toyota City, Aichi
Established: 1937
Employees: 364,445 (consolidated; as of March 31, 2017)
Website: <http://www.toyota.co.jp/>

(*2) Collection of information by interviews and survey outside of the workshop (in this case, this was at service factory of stores) to get objective ideas

Fujitsu's Broad Portfolio for Connected Services

To meet the needs of customers in the digital era, Fujitsu provides Connected Services, which create value by connecting everything and learning from data to generate intelligence. Fujitsu's MetaArc is the framework enabling these Connected Services.

Now, Fujitsu is investing heavily in digital technology to deliver digital services through MetaArc. In addition, we provide a range of Hybrid IT products and services, combining our long experience in highly reliable systems and our cutting-edge expertise in scalable digital technologies. Fujitsu securely integrates a diverse spectrum of digital services and Hybrid IT to enable our customers' digital business.



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Integration

When you do a jigsaw puzzle, as, one by one, you fit the pieces together, you see the picture emerge. But imagine if the pieces were made by different manufacturers, based on different standards of shapes, and even used different pictures.

Today, most enterprises rely on systems that are patched together – like pieces from different jigsaw puzzles, sometimes in different locations. A lot of the challenges with so-called Hybrid IT landscapes come from the complexity of making everything fit together, without the need to abandon perfectly adequate infrastructure simply because it no longer fits the big picture.

At Fujitsu, our job is to make sure that everything fits together and works in alignment. One key factor that sets Fujitsu apart is we are technology agnostic. Our goal is to make everything work regardless of the brand or the provider. Our approach ensures that we support our customers in choosing the right solutions that work for them. What's more, Fujitsu is uniquely able to partner with the major providers, including Microsoft, Oracle, SAP, VMware, Citrix and NetApp – to consolidate and harmonize technologies, and hybrid cloud landscapes.



Services

■ Business Consulting and IT Consulting

Fujitsu's Business and IT consultants work with organizations to achieve excellent customer experience, operational effectiveness and business performance to stay ahead in a rapidly changing digital world. We focus on providing the maximum return on investment from existing and new business strategies and technology implementations. We formulate transformation strategies through the development of business cases, road-mapping and assessment services. We advise on the best current and emerging technology to help customers achieve their business objectives, through comprehensive consulting services addressing areas including IT Strategy and Effectiveness, Agile Delivery, Enterprise Architecture, IT operating model, and Service Strategies. We optimize business processes using LEAN thinking and automated discovery approaches, and advise on the deployment of Robotic Process Automation (RPA). During implementation, Fujitsu manages every aspect of business change to ensure that employees can embrace transformation. Throughout the process, we follow an output-focused consultancy approach called XpressWay to provide cost-optimized consulting impact.

■ Innovative Application Services

To help customers benefit from digitalization, Fujitsu addresses specific industry challenges via a rapidly expanding range of innovative, sector-focused offerings. These include Retail Analytics, Smart Ticketing for the transportation sector, Artificial Intelligence (AI) for quality control in manufacturing and Enterprise Wearables to monitor well-being in the workplace.

■ Application Development and Integration

Application Development and Integration Services help enterprises to respond to change by defining and delivering new services to delight their customers. Our experience in dealing with complex multi-vendor environments and emerging trends/technologies ensures that projects are managed professionally and within budget. Offerings include (Mobile) Application Development, Systems Integration, Application Modernization and Transformation, DevOps Consulting and Implementation, Cloud Native Application Development, Rapid Application Development, Application Managed Services, and Testing.

■ Application Modernization and Transformation

Comprehensive Application Modernization and Transformation services enable customers to more easily migrate or modernize legacy applications and reap the benefits of cloud services, minimizing risk and cost and providing greater future flexibility.

Application Transformation comprises:

- Application Assessment - discovery of application landscapes, identification and planning of application modernization, cloud deployment and (business) process optimization opportunities.
- Application Modernization - modernizing legacy applications to future proof technology and platforms, utilizing cloud capabilities without moving entire applications to the cloud, for example, moving just a front end application or database.
- Application Migration - migrating entire applications to hybrid cloud environments.
- Robotic Process Automation - automation and optimization of business processes and (human) application interactions.
- Innovation - adoption of innovative technologies such as AI and mixed reality (augmented and virtual reality).

■ Enterprise Applications

Fujitsu provides scalable services for leading software applications such as SAP and Oracle, covering core business functions including finance, HR and supply chain management.

■ **SAP Services** - The combined power of innovation which energizes the strategic partnership between Fujitsu and SAP enables customers to successfully shape digital transformation: rationalizing and reducing the complexity of IT environments with comprehensive services, solutions and innovative platforms such as SAP S/4HANA and SAP Leonardo, to respond to market and business demands faster and more efficiently. Our end-to-end SAP portfolio is based on three key pillars to achieve digital transformation: Simplify, Transform and Digital. This ensures that we can identify the right solution after taking a holistic view of individual customer needs and challenges.

■ **Oracle Services** - Based on a 30-plus year strategic relationship, Fujitsu is a Platinum end-to-end Oracle Solution, Managed Services Partner and a certified Oracle Specialist for more than 40 elements across the Oracle stack, encompassing Cloud, Hosting and Hardware, Systems Integration and Application Managed Support. Fujitsu helps organizations successfully accomplish key transformation initiatives with Oracle technology, balancing business requirements for Fast IT, digital transformation and cloud with existing technology commitments. Fujitsu and Oracle Cloud Applications transform back office processes to make operations agile, efficient, attractive and profitable. Fujitsu has transformed its own HR department across 38 countries with the Oracle HCM Cloud Module, and can draw on this expertise to help customers migrate to cloud applications.

■ **ServiceNow** - As a world leader in Enterprise Service Management (ESM) and a ServiceNow Gold Sales & Services Partner, we combine years of experience and know-how with the power of ServiceNow to deliver ESM processes that improve efficiency, reduce cost and enable staff to focus on business operations. Fujitsu is the only full lifecycle ServiceNow partner able to deliver end-to-end services tailored to specific business needs. Our dedicated and highly-skilled teams support customers at all stages along their journey, from implementation to consulting, and from training to providing 24/7 support. Our highly flexible and easily scalable solutions provide the right sized configuration, regardless of business size, and help determine whether an off-the-shelf solution is suitable, or if an individually-created solution is required.

■ **Intelligent Enterprise Services** - Due to digital transformation and demographic challenges in the workforce, organizations must both adapt at speed and utilize insights to power customer engagement and business operations. To master enterprise productivity means adopting new ways of working, within new organizational structures supported by more modern, flexible technologies. Intelligent Enterprise Services address these challenges through Advanced Analytics, Collaboration Solutions, Enterprise & Web Content Management, and Case & Document Management supported by Business Intelligence, Social Intelligence and Secure Integration services. Fujitsu provides partner technologies like Microsoft Office 365 and Azure alongside its own solutions, which include Valo and CaseM.

■ Data Center Managed Services

Fujitsu's Data Center Managed Services provide the complete range of services to ensure IT systems are fully operational for users, as well as improving flexibility, efficiency and performance, and reducing cost. The range of operational Data Center Services comprises:

- **Data Center Outsourcing** where customers pass on the responsibility for managing and transforming services.
- **Remote Infrastructure Management (RIM)** for servers, storage and other data center and cloud-hosted infrastructure.
- **Managed Hosting** for cloud and non-cloud systems: backup and recovery services as well as data center network services.
- **Technical consultancy and project services** to provide data center assessment, advisory, migration and transformation projects - either as part of a wider outsource or as part of a customer's journey towards cloud infrastructure.
- **FUJITSU Cloud Service K5** is designed for organizations that require a choice of services on demand, K5 allows enterprises to take any workload into the cloud, whether this is a trusted public, private hosted, private or hybrid cloud environment.
- **Platform as a Service (PaaS)** supports the migration of mission-critical applications to cloud, integrating new digital initiatives with existing IT infrastructures as well as developing new cloud native applications. Customers can transition and transform applications thanks to blueprinting, orchestration, native application development and API integration services.

■ Digital Workplace Services

Fujitsu's Digital Workplace enables enterprises to keep pace and evolve with technology change and take into account the transformational needs of business and end users. Digital Workplace brings together workplace and support services to empower a more agile, collaborative and productive workforce, creating value that businesses need, and ensuring a workforce ready to drive innovation rather than struggling to keep up.

■ Workplace Anywhere

Workplace Anywhere brings people, systems and information together in a secure, always connected and personalized environment. It is a first step in providing a unified experience across multiple devices. For further details, please see page 74.

■ Next Generation Service Desk – Social Command Center

Fujitsu's Next Generation Service Desk, the Social Command Center (SCC), does far more than resolve issues. It identifies the underlying cause and impact of problems, to prevent them from ever happening again, or to mitigate their impact. The Fujitsu SCC is powered by AI and features a virtual assistant and cognitive learning. It delivers a 24/7 personalized support service, through a single point of contact, empowering users to self-serve. Covering everything that a business needs, from human resources to IT, the SCC can be integrated into the wider portfolio of end-user services, or provided as a standalone. In addition, customers can balance cost and service by choosing either a dedicated or shared service desk, or a combination. The Fujitsu Global Delivery organization underpins the SCC, delivering support services around the globe. The Global Delivery network is comprised of five Global Delivery Centers (GDCs), providing multilingual support in more than 40 languages and delivering local services support in more than 160 countries.

■ Technical Support Services – Intelligent Engineering

Designed to perfectly align with customers' business priorities, Fujitsu Technical Support services are both predictive and preventative. We recognize the negative impact that outages can have on revenue, business reputation and customer satisfaction, and take an Intelligent Engineering approach, providing proactive and dedicated support focused on business outcomes. We can ensure that businesses always stay up and running through using analytics to predict potential problems and resolve them through automation. As one of the largest IT support service providers in the world, we draw on more than 35 years of experience in delivering technical support to customers. Our philosophy of continual improvement and innovation is demonstrated through services such as the Connect IT Bar, providing end users with a walk-up service in head office locations, and the CARE service, where expert engineers deliver proactive issue resolution, training and support at retail locations. Fujitsu IT support includes multivendor hardware and software products, as well as specialized retail systems. A Managed Rollout & Lifecycle Support Service delivers the right systems to the right place, at the right time, including mass rollouts, automated and customized installations, de-installations, relocations and upgrades. This expertise also covers localization analysis, system disposal, data migration and training.

Solutions

Industry Solutions

Fujitsu's long and comprehensive global experience means we have been able to develop expertise across a number of industries. Working together with customers we drive value by utilizing industry specific expertise.

■ Retail Solutions

Fujitsu is delivering comprehensive value for over 500 retailers in 52 countries and powering over 82,000 stores worldwide. With more than 30 years' experience in retail and a broad portfolio of retail solutions backed by enterprise ICT products and services, we are focusing on three core capabilities that ultimately deliver retailers a differentiated customer experience under the ethos of "Connected Retail":

- Innovative retail solutions - to support and future-proof the customer experience in today's multichannel world; this includes Fujitsu Market Place (our omni-channel PoS application) and new solutions from our innovation labs around the world.
- Connected enterprise - linking applications, information and communication within the store, between the front and back office, and between multiple vendors to deliver a seamless and integrated customer journey, including enterprise solutions, and outcome-based enterprise services.
- Global delivery - the assets and capabilities to deliver consistent cross-border solutions.

■ Financial Services Solutions

For over 4 decades Fujitsu has been a trusted technology partner for financial service providers around the globe. Our years of experience working within the financial services sector has led us to develop an in-depth understanding of the demanding climate in which our customers operate, and their need for agility, flexibility, and security in serving their customers.

Today's role of financial service providers is evolving at an unprecedented rate, and this pace of change is further exacerbated by increased regulation, increased competition, rapidly changing customer demand and low interest rates driving fierce competition. Customer expectations and demand for new digital services are rising, with customer retention becoming less about loyalty, and more about the ability to provide innovative 24/7/365 services with high levels of transparency and security. Fujitsu's financial service IT solutions are helping our customers with their digital transformation journey, enabling them to act quickly, scale rapidly, remain agile and keep pace with changing customer and regulatory demands.

■ Manufacturing Solutions

Industrial revolutions are characterized by how we manufacture the goods that people need and desire. Every Industrial revolution has had its own enabling technology and its impact on horizontal and vertical integration of value chains. The Fourth Industrial Revolution – or Industry 4.0 – is no exception to this but the impact and speed is superior to any previous Industrial Revolutions. Based on IoT as enabling technology, Industry 4.0 will provide new means for individual production down to lot size one at costs similar to mass production and for new, smart services.

With our “Co-Creating the Digital Factory” approach we are at the forefront of that historic change. Not just because we are experts in the digital technologies that are transforming manufacturing, but because we are an active, global manufacturer.

Some of the key themes of our generic manufacturing approach are:

- Ensuring automation complements the skills of the workforce ensuring humans and machines can work together, side-by-side, and hand-in-hand, and will be empowered by digital transformation to be more productive and focus on high value tasks.
- As production lines become more automated and Industrial IoT becomes more prevalent, we are working to ensure security at every stage of the production process to protect both IP and output.
- We are seeking to protect networks without hindering their operations within the factory and across the supply chain.
- We are working to make supply chains more transparent and frictionless so that lean manufacturing can be leaner, and customers can be assured of their products and services.
- Leveraging the power of the cloud is vital, and we work with you to choose the right model for your objectives.

Innovative Solutions

■ Sustainability Solutions

Balancing economic, social, and environmental sustainability presents both opportunities and challenges for modern-day businesses. Organizations that understand the need to use their ICT innovatively while focusing on its optimization, resource and energy efficiency will gain from both a business advantage as well as social responsibility. Fujitsu helps your organization optimize the efficiency of its ICT equipment and data centers, saving you money and reducing greenhouse gas. Our Enterprise Sustainability Solutions align your sustainability objectives with your business goals for sustainable growth.

- FUJITSU Enterprise Sustainability Consulting
- FUJITSU ICT Sustainability Framework
- FUJITSU ICT Sustainability Benchmark

■ Transport Solutions

In today's digital age, transport operators face a unique challenge - how to deliver a truly seamless, high quality, reliable and affordable passenger-controlled journey while using capital-intensive physical infrastructure. At Fujitsu, we believe the way to achieve this goal is through the co-creation and deployment of innovative digital transport solutions. It's our belief that co-creation with an expert partner is a far more effective way of developing new solutions than working in isolation. By working closely together, we can help you understand how integrating digital technology can enhance your passenger experience, lower your costs and gain insight into your passengers' behavior and needs.

With our digital technology we connect business, technical and operations to enable operators to deliver a seamless end-to-end travel experience. We have the capability to connect every stage of your passenger's journey – from planning and booking tickets through to the on-time arrival at your destination. Our portfolio of digital transport solutions includes:

- Aviation Scheduling;
- Big Data Solutions for Intelligent Mobility;
- Digital Car Park Management;
- Digital Traffic Flow Management;
- Digital Customer Information Systems;
- Digital Noise and Emissions Monitoring;
- Digital Safety and Compliance;
- Digital Ticketing Solutions;
- Driver Alertness Monitoring;
- Mobile Ticketing Solutions;
- Rail Crew Rostering and Disruption Management;
- Smart and Integrated Ticketing and Loyalty Schemes.

■ Technical Computing Solution

Building on our long-standing history of innovation, 30 years of experience in the development of supercomputers and the exceptional depth and breadth of our offering, we provide the enabling technologies and services for a wide range of aerospace, meteorology, astronomy, healthcare and industrial projects. We have also teamed up with numerous prominent research agencies to design bespoke solutions for the most varied and challenging technical computing applications.

- GREENAGES Citywide Surveillance
- GREENAGES Parking Analysis

Products

Software

Fujitsu is the only Japanese vendor with a systematic software product lineup. Fujitsu integrates optimal systems according to customer needs and objectives, based on a core lineup of proprietary technologies and products combined with supplementary partner software products and open-source software.

■ Fujitsu Software Enterprise Service Catalog Manager

Enterprise Service Catalog Manager is your self-service portal for IT services in the cloud. In your corporate store, you can offer virtual machines and storage as well as Web-based business applications. The integration platform for IT services guarantees for high flexibility, low costs, and a rapid, standardized provisioning and chargeback of services running in private or public infrastructure.

■ FUJITSU Software Infrastructure Manager

FUJITSU Software Infrastructure Manager (ISM) enables organizations to drive towards the path of achieving software defined infrastructure, by automating and simplifying infrastructure operations across compute, storage and networking.

■ Middleware

■ **FUJITSU FlexFrame Orchestrator Management Software** enables operating SAP applications, databases and the SAP HANA platform easier, faster and more effectively. It simplifies the management of complex SAP environments, optimizes planning, operation and change management and reduces costs by up to 90% while increasing agility by up to 50%. Comprising most advanced orchestration and administration capabilities, FlexFrame Orchestrator is an optimized operational concept for the entire SAP landscapes.

Integrated Systems

Under the name of FUJITSU Integrated System PRIMEFLEX, Fujitsu provides a broad lineup of Integrated Systems. For a full description, please see the “Integrated Systems” section on page 78.



Mobile

Fujitsu's mobile solutions help to empower people and raise productivity – anywhere, at any time – by delivering a personalized experience. Using desktops, laptops, or smart devices, employees can access the applications, data, and tools they need, while organizations can have peace-of-mind about security.



Services

■ Workplace Anywhere

Workplace Anywhere is an integral part of our Digital Workplace Services. With Workplace Anywhere people inside and outside your organization can use digital services to connect with the applications and data they need and do so in a way that feels personal to them. Once they're connected they can start to collaborate and innovate more effectively. Workplace Anywhere encompass Cloud, Virtual and Managed Workplace services and we have securely combined these workplace services to get the right blend for your organization.

■ Cloud Managed Workplace Services

With these services, we use cloud-based tools to create a modern, secure and agile platform for your business. One that's securely managed, and optimized by our experts to deliver the best results. It's an evergreen service that draws on: Enterprise Mobility Management (EMM); Identity as a Service (IDaaS); and Microsoft 365 (Office 365, Azure AD and Win10). By getting the right blend of technology and features, we make sure you achieve the right level of security. In a cloud-managed workplace, you can manage all your devices – on any operating system – from one platform. It puts you in control, and helps you get new services to market faster.

■ Virtual Workplace Services

Through our Virtual Workplace Services, we can help you find the best way to virtualize your infrastructure – using public, private or hybrid cloud. We offer a range of virtualization options, including: virtual desktop infrastructure (VDI); virtual Desktop as a Service (vDaaS); hosted shared desktops; and applications solutions. Virtualization has many benefits. Beyond improving security, it can also introduce layers of control that take the user's context into account including location

data and what device they are using. This makes it an ideal way to meet local data rules or to give contractors temporary access.

With our Virtual Workplace Services, you can also ramp up resources swiftly and cost-effectively; while your data stays in the data center. You can instantly update your apps and desktops, safe in the knowledge that you can roll back a change in just a few minutes. At the same time as making it easier to manage your estate, you can ensure staff get the right user experience. They can get the information they need on the go – with the same look and feel as they're used to. And by matching user profiles to the right virtual resources, you can significantly improve productivity.

■ Managed Workplace Services

We can manage your standard desktops with the same model as cloud or virtual desktops. Our modern version of the managed desktop service combines on-premise tools to manage your devices with cloud-based services. It gives you up-to-date IT that you and your people can rely on. Options include full configuration, change, lifecycle, security and vulnerability management services. Microsoft Windows Image Lifecycle Management is also part of the service. Whichever version of Windows you use; we can customize it to suit your environment. And we test each update before we deploy it to minimize risk. A Managed Workplace helps you manage change – at the right pace for your business. By testing all changes before you deploy them, we manage risks and help prevent costly incidents. You achieve high levels of service and availability, and ensure your IT stays evergreen. Our Managed Workplace offering also supports self-service. Staff can download applications from a store and set them up themselves. With end-user analytics, you can get new insights and enhance the user experience over time.

Products

Client Computing Devices

Fujitsu empowers organizations to meet the requirements of today's social and demographic trends which result in new ways people live and work. This also helps businesses to reach out to a new generation of employees, while gradually moving toward digital work processes and enabling employees to reach a satisfactory work-life balance. Fujitsu's tablets have become the standard in a wide variety of environments including government, healthcare, sales force automation, and education. Fujitsu offers a complete range of environmentally conscious products and uses environmentally friendly technologies and processes throughout the entire product lifecycle.

■ Notebooks and Tablets

The FUJITSU LIFEBOOK Notebook and STYLISTIC Tablet portfolio empowers the user through powerful performance wherever the workplace, whatever the industry. Premium technology, unique biometric security, a comprehensive family concept, configuration options and innovative solutions interconnect to grant customers the freedom and reassurance to work with competence, stamina and style.

■ Desktops

The FUJITSU ESPRIMO family brings a complete range of fully featured and highly expandable desktops that dependably run the office applications of today and tomorrow. Their superior reliability comes from best-in-class Fujitsu development and outstanding production quality. The world's most efficient power supplies lower your energy bill and reduce your environmental footprint.

■ Workstations

Thanks to the end-to-end capabilities from design, engineering to production, CELSIUS workstations have gained a great reputation for being whisper quiet, offering ingenious thermal management and cooling as well as reaching world-leading benchmark results. All mobile, desktop and rack workstations are optimized for use with a host of leading workstation applications, like Autodesk, Dassault Systèmes, Siemens PLM or PTC.

■ Thin Clients

For optimized server-based computing or desktop virtualization, choose customizable FUJITSU FUTRO Thin Clients. Every device is designed and engineered to support best performance, security, easy manageability and cost-effectiveness. They also deliver significantly lower TCO over their lifecycle compared with a standard PC. Plus, ease-of-use, standardization and quiet operation ensure maximum user comfort.

■ Smart Devices

Fujitsu offers a diverse lineup of smart devices that can be tailored to customer needs. Fujitsu's smartphones and tablets are equipped with proprietary human centric technology that enables ultimate connectivity and smart functions for daily lives, such as 4G/LTE connectivity and intuitive touch-panel operation, and other features.

■ Peripheral Devices

Fujitsu delivers a comprehensive range of intuitive, useful peripheral products covering displays, human input, storage, connectivity, carrying cases, biometric security, multimedia, dot matrix printers and wearables. All peripheral products guarantee optimal compatibility across all Fujitsu systems.



IoT

IoT is a key driver of digital transformation and business innovation. Hyperconnectivity is enabling people, information and things to come together in unique ways that are fundamentally changing business and society. Fujitsu helps organizations to become hyperconnected businesses and take full advantage of this shift.



Services

■ IoT Consulting Services

Fujitsu' long and comprehensive global experience means we have been able to develop expertise across a number of industries. For customers exploring how to transform their business using IoT, we work with them to co-create solutions specifically for their needs. To support our co-creation approach we have invested globally to build out our design thinking capabilities, digital transformation spaces and industry consulting teams.

■ Industry 4.0 Services

Manufacturers have pioneered the use of sensors and data-based monitoring, but today's advanced networking, real-time controls and machine intelligence are taking the sector to a new level of sophistication and productivity. It is becoming a hyperconnected industry. That's what the term Industry 4.0 describes. It goes far beyond automation and is reinventing manufacturing. Hyperconnected technologies are enabling manufacturers to better understand their operations in real time to optimize and transform any interaction with suppliers, partners and customers.

Co-Creation of Industrial Value Networks is in center of our Industry 4.0 approach. As well as consulting on the implementation of Industry 4.0, our approach is focused on three main pillars:

- Collaborative Engineering - Engineering Cloud Orchestration, Design & Simulation Tool Integration, Design-Data Management.
 - Information Creation at the Edge - Asset Tracking & Tracing, Supply Chain Transparency, MRO Optimization, Work-in-Progress Management.
 - Industrial Analytics - Predictive Maintenance, Quality Assurance, Machine Utilization and Demand Forecast, are part of our Industry 4.0 portfolio.
- All underpinned by our Integrated Industrial Cyber Security expertise and experience.

■ IoT Infrastructure Services

Key to successful IoT deployments is being able to manage devices and sensors both centrally and at the edge. Fujitsu has access to a vast range of sensors to meet the needs of many use cases. In edge computing Fujitsu has its GlobeRanger iMotion platform and Intelliedge gateway and appliances. M2M solutions, including those supporting LPWAN allow us to offer global IoT connectivity. As an established IoT Systems Integrator, we use these Infrastructure Services to support the rapid creation of IoT solutions.

Solutions & Products

■ IoT Infrastructure Solutions

Fujitsu provides a range of connected service solutions including remote asset monitoring, global asset tracking, connected field force, and facility management and safety services built around the IoT Infrastructure services. Our Cloud IoT Platform sits in our Public Cloud Service K5 providing data management, aggregation, and analytics alongside application development and device management capabilities. All these are provided as E2E Managed IoT Solutions.

■ Retail Engagement Analytics

Fujitsu's Retail Engagement Analytics (REA 2.0) puts real-time operational information at retailers' fingertips. Using RFID and IoT technologies to capture, monitor and analyze real-time in-store customer behavior, REA allows retailers to effectively manage everything from staff allocation and store layout to product placement and checkout queue traffic levels.

■ GlobeRanger

GlobeRanger addresses real business problems and helps organizations to overcome the challenges that they face by connecting devices, people, processes and resources. A series of IoT platforms and devices enable businesses to gain full visibility over their manufacturing processes and coordinate disparate parts and assets, in addition to managing maintenance and tracking the whereabouts of assets – usually physical equipment.

■ Fujitsu Manufacturing Industry Solution COLMINA

COLMINA links data on the location of people and products, on factory equipment, and all systems and know-how throughout the manufacturing process, as well as data among companies in the supply chain.

■ Fujitsu INTELLIEDGE™

Available as a gateway or appliance, it combines the right mix of hardware and software components that provides organizations a platform to understand in real-time the "enterprise" data being generated at the edge for greater awareness and faster decision-making.

■ Enterprise Wearables, Devices, Sensors

Fujitsu offers a broad range from embeddable sensors from smart tags and badges, to fully integrated Vital Sensing Bands and Head Mounted Displays. These form part of the UBIQUITOUSWARE portfolio delivered as

the front-end interface for Human Centric IoT with proprietary algorithms held on the IoT platform delivering actionable business insight from the wearables platform.

- **Driver Safety** is a wearable solution to alert drivers when attention/drowsiness is detected. The sensor is worn round the neck of drivers measuring their biorhythms and identifying a loss in attention. It also allows the organization to optimize route planning.
- **Worker Safety** is a wearable solution for lone/field workers. This solution is delivered as a combination of Sensor and Algorithm - The Vital Band links through the IoT platform which contains Fujitsu proprietary algorithms to help highlight levels of risk.
- **Worker Efficiency** uses HMD and Web application Augmented Reality solution to deliver improved worker efficiency and help bridge the engineering skills gap.
- **Intelligent Care** is a Remote Monitoring device to support home living. The solution monitors the environment using sensors and based on this real time information it allows care givers to respond intelligently based on the needs of residents.

■ Intelligent Society Solutions

Utilization of ICT has gained popularity in social infrastructure fields such as Food, Agriculture, Health & Medical care, Transportation, Education and Energy. Aimed at addressing various social challenges in these fields, Fujitsu is continuously creating new value through innovative ICT such as cloud and mobility solutions.

- **FUJITSU Intelligent Society Solution Akisai** cloud for food and agriculture is a service that has been designed to provide comprehensive support to all aspects of agricultural management, such as for administration, production, and sales in open field cultivation, horticulture, and in animal husbandry.
- **FUJITSU Intelligent Society Solution SPATIOWL** is a solution for the integrated management of many types of transportation-related data using Big Data analytics and Cloud Computing technology.
- **FUJITSU Intelligent Society Solution RFID and Sensor Solution** is based on advanced Automated Identification Technologies (AIT). It is designed to optimize asset management by increasing visibility and traceability of individual parts in the internal manufacturing and the supply chain processes.



AI and Analytics

Fujitsu co-create business solutions within an ecosystem of customers and partners based on a growing end-to-end set of services, solutions and technologies for AI, based on Zinrai and partner technologies. Fujitsu delivers end-to-end smart data and analytics approaches, based on advanced technology and analytical expertise.



Services

AI and Analytics Services

■ Analytics Services

Fujitsu helps organizations to ensure their business is generating maximum ROI across their customers and operations by placing data at the heart of what they do. Our services align to tackling key data issues within organizations, from customer engagement, operational efficiency to risk & fraud. Fujitsu co-creates with your organization to understand your business requirements and needs and how you can truly leverage the power of advanced analytics. Using the best of breed technologies, Fujitsu provides a range of use cases matched to your requirements which can be deployed on premise, cloud or hybrid and all supported by our SMART Analytics Services.

■ Zinrai AI Consulting and Services

Fujitsu Human Centric AI support customers to find new ways of working in a context of responsible business. Fujitsu works with the customer to understand their business and to determine the feasibility of our solutions to meet your business need. Activ8, Fujitsu's approach to Design Thinking, helps clearly identify the business opportunity.

Combined with our business consulting tool XpressWay, Fujitsu can determine how the solution will deliver business value to your organization targeting cost efficiency and revenue growth.

■ FUJITSU Quantum-inspired Computing Digital Annealer

Digital Annealer is an innovative approach towards computing that embraces the advantages of quantum and classical computing. It uses a digital circuit design inspired by quantum phenomena, and can be utilized right now for actual problems in our societies such as route optimization, placement of equipment, marketing and scheduling, etc.

- Digital Annealer has a fully connected architecture enabling freely exchanging signals. 1024-bit full interconnections make it possible to solve combinatorial optimization problems of larger-scale ever, and achieve high accuracy of 65,536 scale.
- Digital Annealer can fit into a datacenter rack, and works at normal temperature that realizes stable operation.
- Technical Services by Fujitsu engineers are available from system implementation to operation phases.

Solutions

AI Business Solutions powered by Zinrai

Through Zinrai Human Centric solutions, which can be used either via the cloud or on-premise, Fujitsu provides complete support over the lifecycle of a customer's AI journey, from consulting and co-creation through to deployment and operation. The early phases of customer engagement (consulting and co-creation) are available immediately through our XpressWay approach, with later phases employed as needed according to customer needs.

■ AI Predictive Maintenance powered by Zinrai - Keeping the Lights On

This solution predicts the timing of failures in advance of it occurring with a higher level of accuracy leading to reduced business disruption.

■ AI Customer Flow Analysis powered by Zinrai - Making the Invisible Visible

The solution helps to target customers with right products at the right time through behavioral analytics of customers' habits and behaviors and to spot risky behaviors and hazardous situations for an earlier intervention.

■ AI Quality Control powered by Zinrai - Making it Right

The solution uses advanced image recognition technology to recognize product defects during the inspection process. The time for manual process is reduced drastically by highlighting the main area to be considered for potential anomaly detection.

■ AI Social Infrastructure Maintenance powered by Zinrai - Keeping Things Moving

The solution improves safety and maintenance of social infrastructure: Bridges, highways, tunnels, airports, parking facilities, etc. It helps to make early detection of degrading infrastructures.

Products

Software

Fujitsu provides a systematic lineup of software products designed to facilitate the use of Big Data. This lineup features software products that customers can easily use on-site. Fujitsu has developed, through implementation of Platform Services for Data Utilization, a cloud service for utilizing Big Data. In addition, we have helped customers to utilize Big Data by making it simple to install and operate, and by providing an ecosystem that makes it easy for customers to combine software with other products including open-source software.

■ Middleware

- FUJITSU Software Interstage Big Data Parallel Processing Server
- FUJITSU Software Interstage Big Data Complex Event Processing Server
- FUJITSU Software Interstage Terracotta BigMemory
- FUJITSU Software Symfware Analytics Server

Servers

The FUJITSU x86 based servers of our PRIMERGY and PRIMEQUEST portfolio are designed for AI typical use cases like data intensive workloads such as the analysis of unstructured data, transaction databases as well as massive parallel computing power from today's high performance computing (HPC) applications in fields such as scientific research, product development and business intelligence.

■ Excerpt of associated hardware

- FUJITSU Server PRIMERGY CX400 M4
- FUJITSU Server PRIMERGY RX4770 M4
- FUJITSU Server PRIMEQUEST 3400E
- FUJITSU Server PRIMEQUEST 3800B
- FUJITSU Server PRIMERGY CX600 M1
- FUJITSU Server PRIMEQUEST 3800E

Integrated Systems

Under the name of FUJITSU Integrated System PRIMEFLEX, Fujitsu provides a broad lineup of Integrated Systems. For a full description, please see the "Integrated Systems" section on page 78.



Hybrid IT - Cloud

Fujitsu Hybrid IT seamlessly blends private, public and managed cloud with existing on-premises IT, to improve business agility, accessibility and deliver better business outcomes. All of this is delivered simply and efficiently, to ensure that your Hybrid IT integration is as cost effective as possible.



Services

■ Fujitsu Cloud Service K5

Fujitsu Cloud Service K5 is a next generation cloud platform. Cloud Service K5 combines the value of open source technologies and Fujitsu's expertise and experience. The integrated Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) functionality supports both robust IT and fast IT through the same platform. Cloud Service K5 is a single standard platform which is available globally – it is based on a common architecture and can flexibly be deployed as private or public cloud, on premise or in a Fujitsu data center. Cloud Service K5 is the most open, agile and compatible enterprise cloud platform in the market today. It offers a solution for organizations aiming to drive operational efficiency, digital transformation and Hybrid IT across public, virtual private and private clouds. K5 can also be integrated with more traditional IT systems, enabling the value of legacy data to be maximized. Powered by OpenStack technologies, K5 uniquely offers IaaS and PaaS services to support both Systems of Record and Systems of Engagement. This means you can not only trust your critical business systems to run more effectively in your choice of cloud environment, but also embrace digital transformation through:

- Modernization – converging systems into cloud based technologies for greater efficiency.
- Extension – building API services to connect cloud and legacy systems, driving growth from existing data.
- Interoperation – co-creation of digital micro-services that reuse common resources securely.
- Innovation – rapidly develop, deploy and scale new apps and services to increase competitiveness.

■ Hybrid IT Transformation Services

Fujitsu Hybrid IT Transformation services enable organizations to transform their traditional data center based IT systems into a more efficient and agile hybrid environment. Within many organizations, existing enterprise IT solutions have evolved over many decades and are fundamental to the way that the business operates. However, many of these legacy solutions have since turned from being a key enabler to a key business issue. Transformation to Hybrid IT doesn't need to be a daunting, risky and or an uncertain process. With Fujitsu's Hybrid IT Transformation Services, it can enable your organization to plan, deploy and manage modern, efficient IT environments that deliver business value that traditional data centers cannot match. Fujitsu recognizes that the best mix of traditional data center environments and public/private cloud requirements will always be different for each customer, which is why our Hybrid IT Transformation Services provide flexibility and impartiality. Fujitsu has one of the most mature transformation methodologies in the industry. Its methodology harnesses our deep experience across hosting, cloud provisioning, server and storage, security, networking and applications. By removing the risk and complexity of Hybrid IT Transformation, Fujitsu helps organizations to create and run cost-efficient, flexible Hybrid IT.

■ Hybrid IT Managed Services

Digital technology is rapidly changing and improving our world. As organizations adopt and adapt to this technology, what they require

from Managed Services will be wildly different than before. To meet these changing and emerging needs, Fujitsu have re-imagined Managed Services for the digital age. It's designed to cater for complex Hybrid IT estates, reduce costs, improve agility, and above all, help you maximize the value for an organization's investments. With our full portfolio of services across multiple platforms, we'll work with you to define a service that meets an organization's individual business challenges. Whether they have a traditional platform or one integrated with cloud technologies, our modular approach means they only pay for what you need, at the level of service required. Through working closely with multiple cloud providers, Fujitsu offer you total freedom and a seamless user experience across complex multi-cloud and data center estates.

■ Hybrid IT Service Orchestration

Fujitsu Service Orchestration aggregates disparate services, and provides a single, seamless solution for managing multiple platforms, technologies, services and suppliers. Ours is an holistic approach to Orchestration. Fujitsu deliver a full suite of solutions that enable organizations to retain governance, remain in control, maintain compliance and gain enterprise-wide visibility within the entire hybrid cloud estate. Only by bringing everything in your Hybrid IT environment together can you achieve true, complete cohesion between all elements. No matter what area of orchestration organizations need help with, Fujitsu's service orchestration encompass everything – from the technical layer right up to the service and business layer. Fujitsu helps ensure that once organizations take control of the environment, they can start realizing the maximum value from it immediately.

■ Data Center Managed Services

Fujitsu's flexible Data Center Managed Services focus on high availability, high levels of security, cost effectiveness and high levels of efficiency that scales with business needs. A Data Center is a considerable investment for any business. This, coupled with rising IT demands, has seen a shift from traditional business models that involve a large capital expenditure to a more flexible operational model. The need for highly secure, highly available and energy efficient facilities is greater than ever and Fujitsu is well placed to address these challenges and provide more for less. Whether organizations want to reduce capital investment, reduce the operational headache & risk or increase the levels of service with improved availability, security and efficiency – Fujitsu will deliver.

For further details, please see page 72.

■ Fujitsu RunMyProcess Cloud Platform

Fujitsu RunMyProcess offers a unique cloud platform that enables hundreds of leading companies in over 45 countries to remove the technology barriers to digital transformation. RunMyProcess empowers customers to rapidly automate their workflows and create, deploy, and run highly customized enterprise and mobile business applications designed to meet their specific needs and connecting people, systems, and things. RunMyProcess supports end-to-end digital change with its four pillars of unifying user experiences, connecting the digital supply chain, delivering at digital speed and scale, and empowering innovation.

Products

Integrated Systems

Under the name of FUJITSU Integrated System PRIMEFLEX, Fujitsu provides a broad lineup of Integrated Systems. For a full description, please see the "Integrated Systems" section on page 78.

Adding Enterprise Service Catalog Manager, turns all Integrated Systems we offer for virtualization and SAP environments into private cloud infrastructures. For more information, please see the "Fujitsu Enterprise Service Catalog Manager" section on page 73.



Hybrid IT - Integrated Computing

By delivering the latest IT technologies and combining them into complete and fully-serviced IT infrastructure solutions, Fujitsu supports our customers to build and operate IT infrastructures in an efficient, flexible and reliable way.



Products

Integrated Systems

Under the FUJITSU Integrated System PRIMEFLEX brand, FUJITSU provides a broad line-up of Integrated Systems. Servers, storage, networking and software are pre-defined, pre-integrated and pre-tested; this reduces the complexity of building data center infrastructures, simplifies and accelerates deployment, minimizes risks, reduces cost and increases operational efficiency.

The PRIMEFLEX family includes both, systems based on a classical architectures and hyper-converged systems. PRIMEFLEX encompasses factory-installed solutions which are ready-to-run and reference architectures which can be easily adjusted to customer-specific requirements. Both options are supplemented by services throughout all lifecycle phases. PRIMEFLEX offerings are available for various use cases, such as Virtualization, Private Cloud, Big Data and Analytics, as well as High Performance Computing. Furthermore, PRIMEFLEX includes solutions addressing SAP and Oracle environments.

■ Virtualization

- **PRIMEFLEX for VMware vSphere** is a converged system based on virtualization technology from VMware and ETERNUS storage from Fujitsu. Network switches, cabling and rack infrastructure are included.
- **PRIMEFLEX for VMware vSAN** is a hyper-converged system based on VMware vSphere and vSAN. The system is available in various vSAN Ready Nodes configurations, such as All-Flash, hybrid and high density, with software pre-installed.
- **PRIMEFLEX for VMware Cloud Foundation** is a ready-to-run, hyper-converged Software-Defined Data Center based on VMware vSphere, vSAN and NSX. The additional SDDC Manager acts as an automation engine for provisioning, monitoring and lifecycle management.
- **NFLEX** is a factory-integrated, ready-to-run converged system based on FUJITSU Server PRIMERGY, NetApp storage, and networking switches from Extreme Networks, ready for VMware vSphere. Also included is FUJITSU Software ServerView Infrastructure Manager (ISM), a converged lifecycle management of all components, which seamlessly integrates with VMware vCenter. NFLEX has been jointly developed by Fujitsu and NetApp and is marketed by both vendors.
- **PRIMEFLEX for Microsoft Storage Spaces Direct** is a hyper-converged system based on software-defined storage technology (Storage Spaces Direct) integrated in Windows Server 2016 Datacenter Edition. Various WSSD (Windows Server Software-Defined) certified configurations are in place including hard disks, Solid State Disks and high-speed NVMe (non-volatile memory express) disks that allow for setting up a 2-tier and 3-tier storage infrastructure.
- **PRIMEFLEX Cluster-in-a-box** is a ready-to-run hyper-converged system based on Microsoft Storage Spaces – a feature of the Windows Server Standard Edition. The system comes with 2 server nodes and is expandable to 4 server nodes, all in a 2U chassis. It is designed for continuous availability at affordable costs to small and mid-market organizations.

■ Private Cloud

- **PRIMEFLEX for OpenStack** provides an OpenStack cloud infrastructure based on either the Red Hat or SUSE OpenStack platform. A range of validated configurations and extensions covers software-defined storage, software-defined networking, advanced monitoring, cost management, an enterprise portal, as well as application delivery and migration.

■ High Performance Computing

- **PRIMEFLEX for HPC** is a set of validated reference architectures for compute-intensive applications, such as simulation and modeling, High Performance Data Analytics (HPDA) and Deep Learning. The integrated HPC Software includes all ingredients you need for deployment, management and efficient operation. FUJITSU Software Gateway, an intelligent application platform which enables organizations to scale out their activity, federate dispersed operations, and integrate business processes. In combination with a comfortable and intuitive desktop layout, users will have at hand the most productive and coherent HPC workplace in the market today.

■ Big Data and Analytics

- **PRIMEFLEX for Hadoop** is a powerful and scalable platform analyzing large data volumes of various types from diverse sources at high velocity. It is based on open source software by Cloudera®, Hortonworks® or MapR® and data analytics software by Datameer®.
- **PRIMEFLEX for SAP HANA** enables simplified, fast and secure implementation and operation of SAP HANA. The single node and multi-node configurations are based on SAP-certified components and supplemented by a broad services portfolio.
- **PRIMEFLEX for SAP Landscapes** optimizes entire SAP landscapes to enable flexibility and scalability for future business growth. Powered by Fujitsu FlexFrame® Orchestrator Management Software, PRIMEFLEX for SAP Landscapes facilitates the management of complex SAP environments including SAP HANA, minimizing administration effort and costs, allowing you to focus on delivering value to the business.
- **PRIMEFLEX for Oracle Database** delivers extreme performance by running Oracle Database on high-performance Fujitsu SPARC M12 servers based on technologies adopted from Fujitsu supercomputers and mainframes.

Servers

The FUJITSU server line represents one of the broadest portfolios in the market. This enables us to talk with our customers as a trusted advisor with the target to provide them with the right combination of systems, solutions and expertise to guarantee maximum productivity, efficiency and flexibility, delivering confidence and reliability for challenges in any direction: Standard data center tasks, ERP, Database, HPC, Artificial Intelligence or Mission-Critical Computing and more.

■ Industry Standard Server

Industry's most complete x86-based portfolio for companies of all sizes, across all industries and for any type of workload.

- FUJITSU Server PRIMERGY

■ Mission Critical x86 Server

New levels of x86 server performance for in-memory computing, resource-intensive applications and mission-critical x86 uptime.

- FUJITSU Server PRIMEQUEST

■ Unix Server

Unmatched scalability of up to 64 processors together with highest RAS features and a modular architecture.

- FUJITSU Server SPARC

■ Mainframe

Highly scalable systems with top-level performance and flexibility for the simultaneous operation of several operating systems for failure-proof IT-landscapes.

- FUJITSU Server GS21, VME
- FUJITSU Server BS2000

■ Supercomputer

Fujitsu's supercomputer provides the ability to address high magnitude problems by delivering over 100 petaflops, a quantum leap in processing performance.

- FUJITSU Supercomputer PRIMEHPC FX100

Storage

ETERNUS – storage solutions for all data scenarios. Fujitsu's ETERNUS storage portfolio balances storage capacity, performance and costs for the complete lifecycle of data - from production, business analytics and big data to backup and long-term archiving.

■ Hybrid Disk and Flash Storage Systems

- FUJITSU Storage ETERNUS DX series

■ All-flash systems

- FUJITSU Storage ETERNUS AF

■ Storage Management Software for ETERNUS DX and AF

- FUJITSU Storage ETERNUS SF suite

■ Hyper-scale and software-defined storage

- FUJITSU Storage ETERNUS CD10000

■ Tape Systems

- FUJITSU Storage ETERNUS LT series

■ Data Protection Appliances

- FUJITSU Storage ETERNUS CS series

Software

Fujitsu is the only Japanese vendor with a systematic software product lineup. Fujitsu integrates optimal systems according to customer needs and objectives, based on a core lineup of proprietary technologies and products combined with supplementary partner software products and open-source software.

■ BPM/SOA/XBRL

- FUJITSU Software Interstage

■ Operation Management

- FUJITSU Software Systemwalker

■ Database

- FUJITSU Software Enterprise Postgres
- Oracle
- Microsoft

Network

Fujitsu supplies optimal networks for each customer to rapidly meet their diversifying needs, for a full description please see 'Hybrid IT – Software-Defined Connected Infrastructure (SDCI)' on page 80.

Services

Product Support Services

In addition to cutting-edge products, Fujitsu delivers worldwide Product Support Services. A comprehensive product support portfolio containing standard break/fix services as well as proactive support helps our customers save time and money and reduces the burden on internal IT staff. Fujitsu delivers product related services through certified support engineers for individual products as well as for IT infrastructures as a "one-stop shop" support offering. The services range from installing new products to providing fast and responsive support for Fujitsu hardware, software and IT infrastructures for solution business. A Hardware-as-a-Service offering completes the portfolio for customers looking into compelling way of product & service delivery models.



Hybrid IT – Software-Defined Connected Infrastructure (SDCI)

Connectivity is fundamental to digital transformation and the network is a business critical component of any modern organization. Fujitsu's Software-Defined Connectivity solutions bring the network into the world of Fast IT. They can connect clients anywhere, offer automation and orchestration with proactive monitoring to ensure the business stays connected.



Service

■ Managed Network Services (Managed WAN, LAN, Wi-Fi, SD-WAN and Virtual Edge)

Today Managed Network Services are about zero touch provisioning and policy driven connectivity, this is revolutionizing the way networking is thought about. SD-WAN solutions allow enterprises to simultaneously use multiple networks (MPLS, broadband, 4G) to maximize cloud-based application performance and business productivity. With Fujitsu's Virtual Edge solution it is possible to deploy network services with local applications anywhere in the world and have them instantly connect to cloud services over the internet. There is no longer a need to wait for network connectivity and once deployed any solution can be completely changed without ever visiting the site where it is deployed. Fujitsu complement these new technologies with a deep understanding of how to design, configure, deploy and manage network services in a Hybrid IT environment. Fujitsu can also provide tailored end to end solutions for vertical markets that blur the lines between network and applications to bring fast IT to the WAN and the LAN. Underpinning all of this is an advanced network infrastructure designed to optimize the end user experience regardless of whether they are using public or private cloud services. Fujitsu bring all of this together with a highly automated management toolset that is able to offer a single pane of glass view of the global network, with customized dashboards so that Fujitsu's customers can see at a glance how

well their network is performing.

This allows Fujitsu to provide an agile and reliable service independently of the underlying service provider services that it is delivered over.

■ Network Infrastructure Services

The new software defined and orchestrated network that has emerged means that existing infrastructure needs to be re-thought. Existing facilities such as data centers and communications hubs must change as the network flows change. New Points of Presence now need to be built to meet increasing demand for the edge computing capability that is needed to support the new IoT applications such as video analytics. The key to the development of these new infrastructures, is to apply technology to reduce power, space, and cooling required by networking equipment to overcoming the hostile environments where they are built. Fujitsu has a long history in the design and development of infrastructure to enable high speed network connectivity. Today Fujitsu is providing new flexible optical transport products that meet these challenges and is heavily engaged in industry initiatives such as the Central Office Re-architected as a Data Center (CORD) project. This brings together software defined networking, open optical transport and virtual networking in a compact and environmentally friendly solution.

Products

Network Software

The confluence of rich video content, Hybrid IT, IoT and ubiquitous broadband (either wireless or wirelines) are driving more data over the network while changing the service needs. Services were previously tightly coupled with the network, making service guarantees and operations relatively straight forward. Today's over-the-top services create new requirements on service providers to innovate services faster, automate operations and create new insight to sustain quality of service. These requirements are driving a digital transformation in the Operations and Business systems, moving from legacy technology to cloud native architectures. Fujitsu provides network service management software that enables operation and management and quality assurance for next-generation networks, using technologies like Software Defined Networking, Network Function Virtualization, Microservices among others.

■ Network and Element Management Software for Telecom Carriers

- FUJITSU Network Proactnes series
- FUJITSU Network Netsmart series

■ Network Service Management Software for Enterprise

■ Dynamic Resource Management Software

- FUJITSU Software ServerView Resource Orchestrator

■ Network Operation and Management Software

- FUJITSU Software Systemwalker Network Manager
- FUJITSU Software Systemwalker Network Assist

■ Network Service Management Software

- FUJITSU Software Systemwalker Service Quality Coordinator

■ SDN/NFV Network and Control Software

- FUJITSU Network Virtuora series

Network Products

Fujitsu supplies a comprehensive range of network products, including communications systems for carriers and network devices for enterprises. The former constitutes the backbone of our ICT-driven society, such as core networks, metro networks, and access networks. The latter is used to integrate internal networks within enterprises.

■ Optical Networking

- FUJITSU Network 1FINITY open disaggregated platform
- FUJITSU Network FLASHWAVE packet optical platform

■ High-end Router

- Fujitsu and Cisco CSR series
- Fujitsu and Cisco XR12000 series

■ Optical Network Platform

- FUJITSU Network FLASHWAVE series

■ Radio Access Network System

- FUJITSU Network BroadOne series
- FUJITSU Network FRX series

■ Router

■ LAN Switch

■ Security

■ Bandwidth Control

■ Load Balancer

■ IP Telephony

■ Unified Communication



Security

Fujitsu helps organizations to manage their information security and continuity risks effectively, in line with their business strategy, providing flexibility in the way they work and enabling secure and resilient business. Fujitsu offers a full range of security services backed by our own security products and solutions such as the biometric identity and access management solution Fujitsu PalmSecure.



Services

Cyber Security Services

Digital transformation can give businesses a competitive edge. IT can also potentially expose them to new cyber threats. So how do you allow your organization to thrive while keeping it secure? Cloud computing, Internet of Things, and software-defined networking, among others, have ushered in a new era of IT. These new threats call for new ideas and approaches in Cyber Security. Businesses need to adopt a whole lifecycle approach to how they deal with security. To keep up with the aggressive pace of change within an ever changing digital world and to counter the ever expanding threat landscape businesses need to continually evolve their information security capabilities.

By answering your information security requirements with both our local and global Security Operation Centers, we offer Cyber Security tailored to your business and based on our experience in highly secure environments of more than 40 years. Fujitsu provides guidance on the most appropriate security controls to protect organizations, ongoing management of Cyber Security capabilities on behalf of customers and undertakes 24/7 security monitoring from its global Security Operations Centers (SOC).

Fujitsu provides Cyber Threat Intelligence and Threat Response services to proactively mitigate against threats as well as providing timely and expert response services to mitigate the impact of Cyber Security incidents to our customers. As a global Cyber Security and service integrator, Fujitsu provides Cyber Security and resiliency consultancy services across the full delivery lifecycle delivered with the expertise and experience gained from years of security and service integration.

Fujitsu Cyber Security Services provide essential security capabilities to our clients, supporting their drive to protect information assets in the face of emerging strategic and operational business challenges. We are a critical component of our clients' approach to their regulatory and legislative demands, assisting them in managing their information security risks flexibly and effectively.

- **Fujitsu Managed Security Services** take responsibility for the ongoing management of specific security capabilities on behalf of customers. We use market leading Cyber Security products and expert professional services to support the assessment of risk, define requirements, provide technical and service design and architecture, as well as ensuring effective deployment and operation of the Managed Security Service. All our services give customers the 24x7x365 cover needed to protect their business.
- **Fujitsu Security Professional Services** serve as trusted advisors to customers – offering independent advice and expertise to help address their challenges. Our team consists of Cyber Security specialists, Business Continuity and Identity and Access management experts to provide advice to both public and private sector clients. We also have one of the largest practices of accredited specialists to provide advice to public sector clients. Our professional services can be tailored to meet specific requirements.
- Fujitsu has its own intelligent **Security Operations Centers**. Our analysts and engineers have access to the Fujitsu Threat Intelligence toolset and platform – based on many man years of expertise and experience, with an attacker's mind's eye to think like a perpetrator and thwart their intentions.

Solutions

Business and Technology Solutions

■ Security Solutions

■ FUJITSU Biometric Authentication Solutions – based on PalmSecure technology.

We provide high reliability and security for a wide range of applications and market segments. This hygienic, contact-less technology uses unique vascular patterns as highly secure personal identification data, increasing user safety and comfort. PalmSecure ID Match is a two-factor authentication matching biometric palm vein authentication with ID Cards or PIN codes. This biometric device can perform the biometric matching directly on device providing the result to an application using network interface. It also is available to be integrated into financial transaction services as POS device using a SDK. It is compliant to EMVCO and PCI standards.

The PalmSecure ID Access device is a biometric physical access terminal which can perform time and attendance processes. It is an off-the-shelf solution. Integration into an existing building security infrastructure can be done easily as it supports WIEGAND 26/34 protocols. In addition it supports multi factor recognition like combining the palm vein biometric templates with pin or smart cards. Fujitsu PalmSecure ID Login software offers a higher biometric security level for Windows log on using PalmSecure sensors. These can be either external PalmSecure sensors or sensors which are

integrated into notebooks, thin clients, desktop PCs or into keyboards. ID Login provides the integration into Microsoft Windows using its active directory. PalmSecure ID Mobile has been designed to use biometric authentication with a smart phone as a second factor. Palm vein templates will be registered on the PalmSecure ID Match device, which then stores them on the mobile phone. Using an App on the smart phone the biometric palm vein templates will be transferred via a wireless connection to the point of biometric palm vein recognition.

Together with leading partners we open the field for biometric authentication into new application landscapes. Examples are:

- valantic bioLock™ for use with SAP® ERP, powered by Fujitsu PalmSecure™, enables the monitoring and controlling of a SAP System by biometric recognition with customizable security check-points based on management policies and business rules on a user-by-user basis during SAP operations.
- BioSec solutions, based on Fujitsu PalmSecure, allows the biometric identification of large numbers of visitors at sports stadiums, it prevents that unauthorized people can access the stadium, ensures that the visitors can only access the sector they are permitted to enter and prevents that stolen or found tickets can be used by other people.

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