

Fujitsu Technology and Service Vision 2017

Book 1

Co-creating a different future

Digital disruption

What is the one thing you would change about your business if you could? What is stopping you giving your customers the best experience they have ever seen? What would your business look like in your wildest dreams?

The future is becoming increasingly uncertain. Our global survey*¹ revealed that 75% of business leaders thought that their sectors will fundamentally change in the next 5 years. Today, digital technologies are moving into the heart of everything we do, changing the way people work, live and how they innovate. A new industrial revolution has already begun. We discussed this last year, and it continues to gather momentum. The transformation of manufacturing industry with digital automation has gained widespread attention, and a wide spectrum of services are being impacted, from Finance to Retail and even the public sector.

To our surprise, business leaders are quite optimistic about potential consequences of digitalization. Last year 67% of business leaders told us they are enthusiastic or excited about digital disruption. The transformational power of digital may encourage new competitors to enter their industries with game-changing services. But it also enables companies to capture tremendous opportunities for growth. Digital can help realize higher productivity, better customer relationships, and new product innovation. Many organizations have embarked on the journey of digital and are already delivering outcomes. In our survey, 89% of the respondents told us they were

executing, trialing or planning various digital transformation projects. It is more striking that 34% of these digital transformation projects had already delivered positive outcomes such as increase in revenue and better customer relationships.

A digital society

Digital is opening the door to a new society. Looking back over our history, human beings have seen four types of societies. Primitive hunter-gatherer societies transitioned to more labor-intensive agricultural societies, enabling significant increase in productivity and population. The industrial revolution in the 18th century triggered the emergence of industrial societies. Big companies were organized to produce many things such as cars and home appliances in a massive scale, enriching the lives of people. To do so meant coordinating scarce resources such as labor, natural resources, plant and machinery and financial capital. More recently, we have experienced a dramatic shift to post-industrial information societies. Now services account for over 70% of the total value add of OECD countries. Human knowledge is driving the economy. IT, especially software, has fueled the growth of productivity, by helping people to create, communicate and use knowledge.

But today, digital technology enables people, things and processes to be hyperconnected, sharing information. Artificial Intelligence (AI) learns by using massive amounts of data,



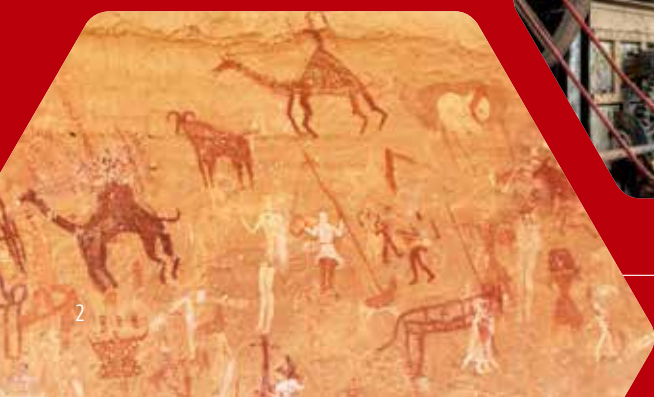
Agricultural



Industrial



Post Industrial
(Information)



Hunter-gatherer



Digital

helping us to work more creatively and make better decisions. Advanced robotics technology allows more autonomous operations. Blockchain provides a potential to drastically change the way businesses conduct highly trusted transactions. 3D printing has a promise to produce at an instance whatever people design in their minds. Hyperconnectivity and intelligence derived from data will empower people to create innovation.

The digital society means a change in the way value is created. Digital technology drives value to be oriented around people. This happens because in a digital world, technology liberates businesses from delivering standardized services to users. Instead, individualized benefits and experiences are co-created by suppliers of services and products, their ecosystem partners and the users themselves. We call these Digital Arenas. For instance, today, the healthcare industry is set up to provide a service of patient treatments. Digital can free it and its adjacent industries, like pharma and insurance to evolve into a human centric Well-being Arena. Similarly, the transport sector and its adjacent industries like logistics and finance can develop into a mobility arena. Personalized medicine and care will help people live longer and healthier. People will enjoy stress-free mobility.

Digital Co-creation

In this new digital society, digital co-creation becomes a business norm. Digital co-creation means blending your business expertise and digital technology, and creating new

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value together with ecosystem partners and customers to shape a different future. How do you position your products or services in an emerging Digital Arena? Which companies do you partner? (They may even be from different industries.) How do you embed digital technology into the heart of your business? How do you unleash the creativity of your workforce? These are key questions to ask.

Digital co-creation takes a different approach. Existing skills and experience are not optimized for the digital era, and a new type of Digital Workforce will emerge. Digital technology will augment the capability of people, enabling innovation and greater productivity. Now, people need to rediscover their human capabilities like creativity and empathy, as well as acquiring literacy in digital technologies.

Fujitsu wants to be your digital co-creation partner, together shaping a different future.

*1 Using an independent research company, Fujitsu conducted a global survey to CxOs and decision makers in September 2016. Fujitsu also conducted a follow-up survey in February 2017. In this second online survey, we received responses from 1,614 C-suite executives and business decision makers in 15 countries around the globe. For more detail please visit the each website.

Fit for Digital: Co-creation in the Age of Disruption : <http://www.fujitsu.com/global/about/resources/publications/digital-disruption-report/>
Global Digital Transformation Survey : <http://www.fujitsu.com/global/vision/>

*2 A system where multiple computers connected to a network share and mutually confirm information such as exchange records. Because it lacks a specific manager, it is resistant to tampering and attack.

A conversation with the President

Digital technology is transforming business, society and the everyday lives of people. In this new digital society, we continue to be a technology leader, striving to meet our customers' expectations. This is why we are investing in four priority areas. Those are AI, Cloud, IoT and Security.

Among them, AI and security are essential drivers. Fujitsu has been developing AI technology for over thirty years. Leveraging our experience, we are confident to lead this technology area. We will proactively use and test new AI technology for our internal operations to provide fully-fledged solutions and services for our customers.

Today, security technology is supporting every aspect of society. Using the knowledge of our security experts, we have experience of operating large-scale systems and networks securely for many years. We will continue to strengthen our teams of security professionals to meet the demand of our customers and society.

In a digital society, a new approach is required. Open innovation is key for realizing our customers' digital transformations. We are actively shaping strong ecosystems that our customers, startup companies, academic institutions and partners participate in.

At Fujitsu, we firmly believe that technology enables people's happiness and wellbeing. As technology plays a more important role than ever before, we must put people at the center of everything we do.

Our 156,000 people across the world are committed to Digital Co-creation with our customers. We are confident that this will deliver significant benefits for our customers and for society. Fujitsu will continue to collaborate with our customers and partners to innovate and realize a safer, more prosperous world.

April 2017

Fujitsu Limited
President and Representative Director
Tatsuya Tanaka

Tatsuya Tanaka



Human Centric Innovation

The Fujitsu Technology and Service Vision sets out our vision and is intended to provide insights to leaders of business and the public sector of how they can use ICT to create innovation and build a different future. We first launched this in 2013, and have updated it annually ever since. Our vision underpins all of our operations, from research and development to customer engagement and delivery.

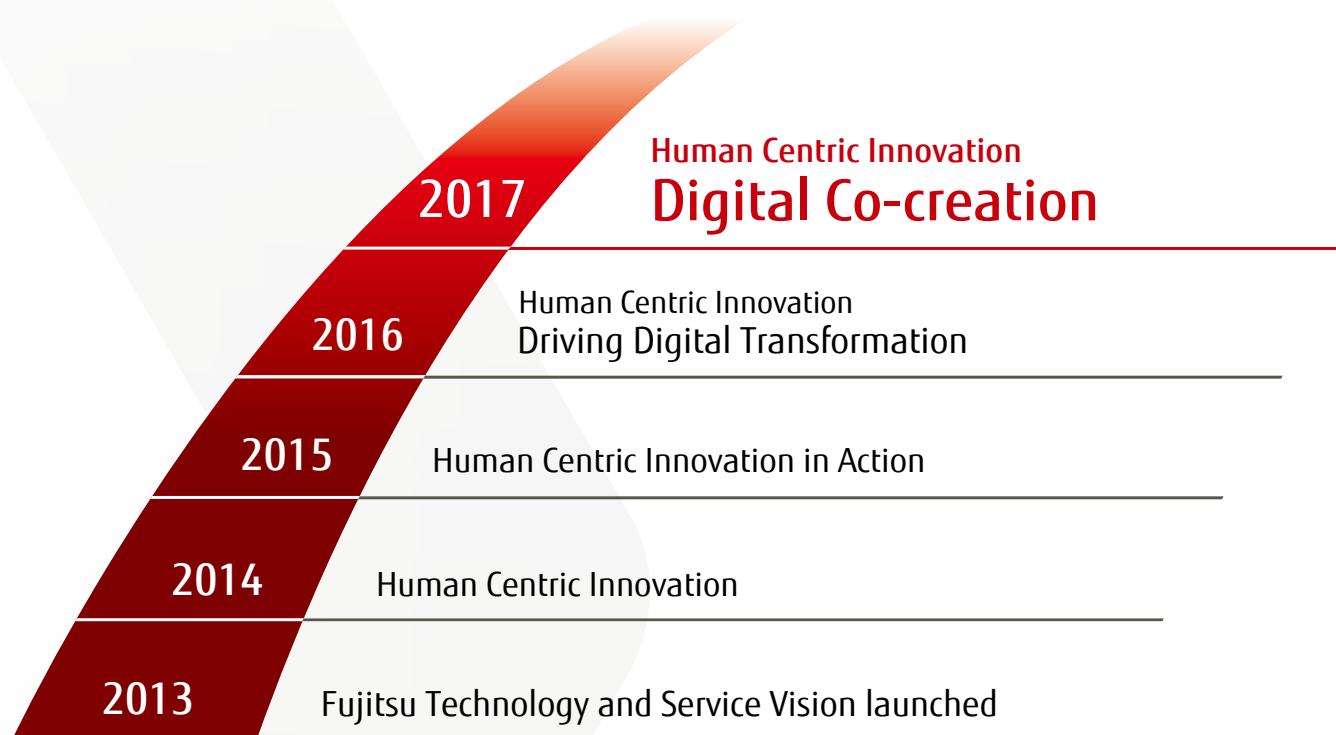
Fujitsu's key proposition is Human Centric Innovation. We first expressed this central idea in our vision in 2014, to describe Fujitsu's unique approach to creating business and social innovation by empowering people with advanced technology. It is realized by combining three key value drivers: the creativity of people, intelligence derived from information, and connectivity of things and infrastructure. Human Centric Innovation is also a journey. We have been working with our

customers and partners to deliver innovation and drive digital transformation.

The theme of this year is Human Centric Innovation: Digital Co-creation. In order to thrive in a new digital society, it is crucial to co-create innovative value with your customers and partners across industries. It is also essential to blend your business expertise with digital technology expertise.

We believe a human centric approach is the only way to deliver on the promise of digital. As AI and robotics become more mainstream, human characteristics like creativity and empathy become ever more important.

We hope this booklet will give you the insights you need to thrive in this revolutionary period.



Related Information and Website

The Fujitsu Technology and Service Vision 2017 was created by a team of Fujitsu people from around the world. We are communicating it in these formats:

- Book 1 (this booklet) sets out our vision along with some insights on how business leaders can leverage for digital transformation.
- Book 2 provides insights on how technology leaders can provide digital leadership. It also features real examples of their digital transformations as well as Fujitsu's portfolio of services, solutions and products.
- Executive summary
- Website : <http://www.fujitsu.com/global/vision/>
- Contact : +81-3-6252-2220

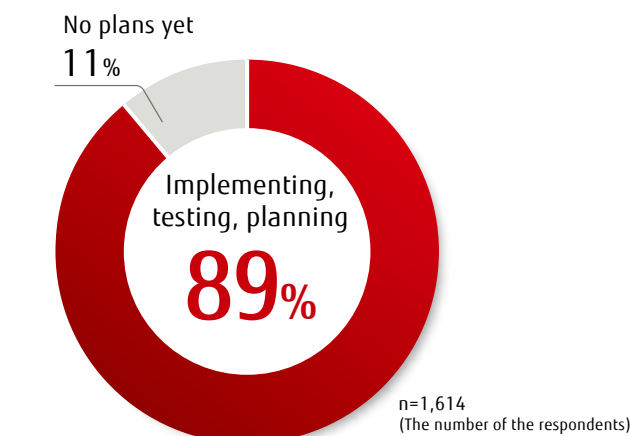
Digital outcomes delivered

Digital is already here, transforming many businesses. Many business leaders are saying their organizations have already started to achieve transformational outcomes across multiple functions, particularly marketing, workstyle and operations and maintenance in a variety of industries.

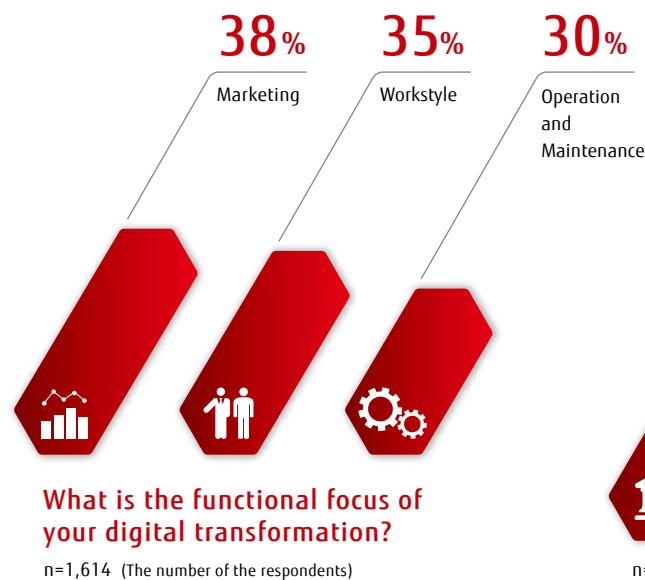
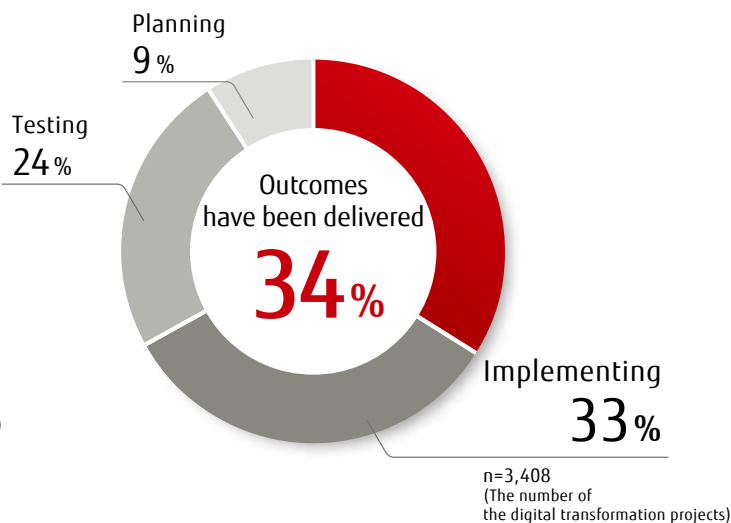
Earlier this year we carried out a global survey of 1,600 business decision makers, asking them for their views on digital transformation. The survey provides useful insights. See the graphic below.

We have also asked about what are key promoting and inhibiting factors for digital transformation, and how they perceive the potential of AI. We will refer to some of the findings in this booklet as we go. You can also read and download an executive summary of this survey on Fujitsu Vision website <http://www.fujitsu.com/global/vision/>.

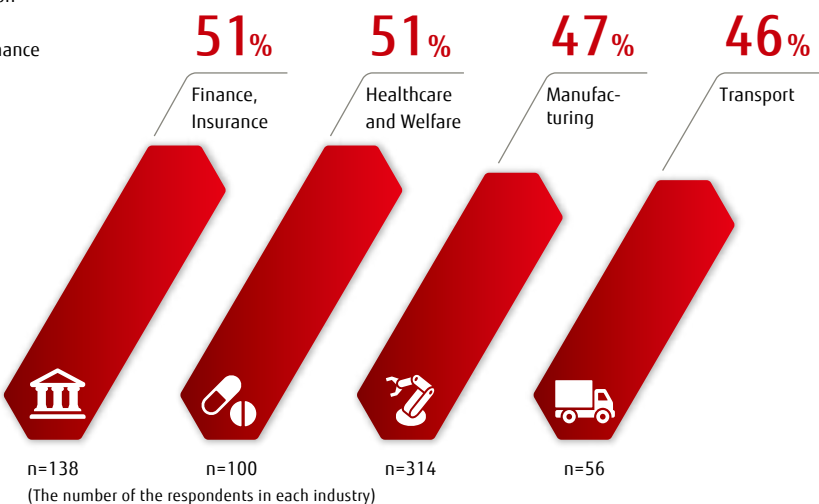
Have you started digital transformation?



What is your progress with digital transformation?



Have you embarked on digital transformation specific to your industry sector?



*The area of digital transformation in each industry which the respondents belong to.

What is your disruptive vision?

One of the most startling findings to come out of our survey was this: over half of the business leaders questioned thought their organizations would not exist in their current form in 5 years' time. In the same survey, 73% of business leaders said technology was at the heart of an organization's ability to thrive.

Digital disruption means that our organizations' futures will make radical departures from where we are today. Making incremental changes, looking for small improvements is only of limited value. What is called for is a rethinking of your business and how it creates value, based on the opportunities that now exist.

To do this requires organizations to be bold, both in thought and action. They need to create a disruptive vision of the future. What is your business going to become? Today, this is the most important question and organization can ask itself.

Monique Shivanandan, Head of IT at global insurance company Aviva told Fujitsu that organizations must "...connect the dots, between what they know technologically and the opportunity that exists for their organization in its business environment."

"IT is responsible for changing the way the business is going, changing the products that the business offers, changing the

culture of your organization, changing the way it interacts with customers and the brand that we want to present to them," she says. "Every business is [now] a technology company – whether they realize it or not." [from I-CIO*³]

Three Questions

Designing a digital business in this uncertain world is not straight forward. Before getting into the details, it is worth spending time and asking fundamental questions. Especially to think about people, business and society.

- How do you design your digital workforce?
- How do you design your value in a Digital Arena?
- How do you design the alignment of your value with a shared value of society?

We envision a future where relationships between workforce, enterprises and society will be interconnected. Workforces will be highly empowered and aligned with organizational goals of creating value for people. And organizational goals are achieved through digital co-creation aligned with a shared goal of society.

In the following chapters, we explore mega trends and potential scenarios at each of the three levels of people, business, and society.

*3 A global web site for the elite of information technology management, sponsored by Fujitsu
<http://www.i-cio.com/>



People in the digital era

People are getting healthier and living longer. The advancement of AI and autonomous robots will continue to accelerate. Organizations need to design and create new digital workforces, which can combine the creativity of people with the insights delivered by digital.



What will our future life look like?

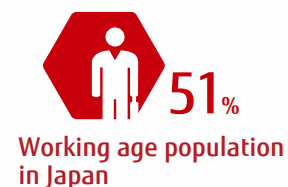


The average life expectancy has continued to rise, thanks to better medicine and living conditions. Professor Lynda Gratton of London Business School believes that today 50% of children born in developed countries could expect to live over 100 years.^{*4} But as a consequence people born in 1998 will have to work much longer – into their 80s – to save money for retirement. She told us that people will experience multiple stages of life. Instead of the traditional 3-stage life of 'learn, work and retire', people may spend some years exploring new possibilities, or have a portfolio of multiple jobs inside and outside their organizations. Such a long work-life will demand people to reinvest in new skills, knowledge, relationships and networks for transitions. But what kind of skills should they invest in?

At the same time, a new breed of technologies, AI-based algorithms and autonomous robots, that seem to provide human-like capabilities, are developing rapidly. Deep learning technology enables a cluster of networked computers to learn and identify patterns from huge amounts of data, acting on its own. The technology is particularly good at recognizing images or naturally spoken voices. Autonomous vehicles are already functionally proven in testing and it is expected that fully autonomous driving cars will be on the roads in some places by 2020. This digital innovation is expected to bring a large-scale of positive business and social outcomes. It could reduce traffic accidents and congestion significantly, while reducing pressure on the environment. It could also help people have more productive time while travelling.



However, it could also cause professional drivers to lose their jobs. A study of Oxford University in 2013 reported that 47% of jobs in the US will be subject to replacement by intelligent computers in 20 years.^{*5} There is a debate over the potential threat of AI and autonomous robots against job security. We should respect these views and take a cautious approach. But we also have to look at positive impacts these new digital technologies can deliver. New technology creates new jobs. Industry 4.0, a German initiative of manufacturing transformation, expects to increase both the number of robots and number of jobs. In Japan, the working population is actually shrinking. Japan's working age population is expected to decrease from 81 million (64% of the total) in 2010 to 44 million only (51% of the total) in 2060.^{*6} In this situation, the Japanese Govern-



ment and businesses are seriously looking to intelligent computers and autonomous robots to meet this shortfall. What strategy should business leaders take in such a revolutionary period? How can they design a future workforce that effectively balances the capability of people and the benefit of digital automation?

^{*4} Lynda Gratton & Andrew Scott "The 100 year life" 2016, and Fujitsu Executive Forum, Opportunities and Challenges in the 100-Year Life: A Discussion with Professor Lynda Gratton

^{*5} Carl Benedikt Frey and Michael A. Osborne, Oxford University "The Future of Employment: How susceptible are jobs to computerisation?" 2013

^{*6} Ministry of Internal Affairs and Communications. Japan "White Paper 2016 Information and Communications in Japan"

Digital promise and human creativity

Limits and opportunities

Business leaders are enthusiastic about the potential of AI and eager to use it for their businesses. In our survey, 77% of business leaders responded that they see AI as an opportunity. Regarding the implications of AI, 82% of business leaders agreed that AI would enhance the capabilities of people in the future. At the same time, 65% of them thought AI would substitute a work of people in the future.

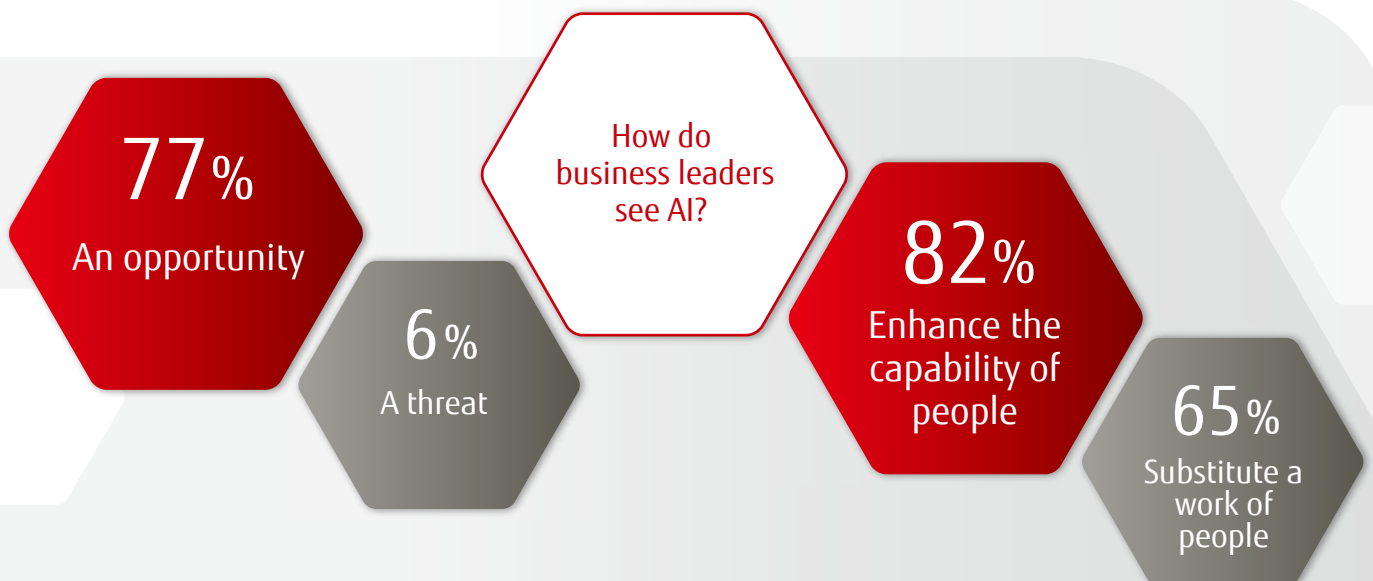
We should take a realistic look at what kind of tasks AI is capable of doing. Since 2011, Fujitsu has been working on an ambitious project with the National Institute of Informatics of Japan, called "Can a robot get into the University of Tokyo". The purpose of this project is to assess how far AI can do the cognitive tasks which humans can do. An entrance exam to the top-ranking university of Japan is a good benchmark. Fujitsu has been collaborating in the mathematics team, and in 2016, our software robot achieved a very high score at a practice entrance exam in mathematics. In fact, the score was sufficient to meet the standard required for the University of Tokyo in this subject. The overall scores of all subjects were high enough to pass the entrance to approximately 80% of Japan's universities. At the same time, however, the project faced a difficulty in making the leap required to raise scores for understanding English and Japanese languages to the very highest level. This is because AI technology cannot read and understand meaning. Although it can find the statistically

most suitable answers, it cannot develop context as people do. In other words, AI lacks the common sense which people have learned from day-by-day experience.

This has major implications for how to realize the true potential of these technologies. Intelligent computers are good at analyzing numerical and textual data statistically, autonomously recognizing images, or responding to voice queries through natural language processing. They can carry out specific tasks very well, thanks to the advance of computing power and methodology. For example, Fujitsu's computer vision^{*7} leverages deep-learning-based algorithm running on our high performance computing system. This technology innovation can, for instance, automatically recognize the rush-hour movements of vehicles and pedestrians across an entire city. But current AI systems are still not able to understand the complexity of context, which people can do all the time. If you believe AI can do everything, you will be disappointed.

People are key

If we imagine living in the future and looking back to today, the digital era may well have been labelled as the 'human era'. The advance of AI and autonomous robots is leading us to revisit who we are. Our brain is capable of flexibly processing complicated cognitive tasks. But it consumes ultra-low energy, which is about equal to what an ordinary light bulb uses. Our



^{*7} A technology enabling a computer to see as humans see, leveraging image recognition.



bodies are intricately woven systems of systems. We have emotions, intuitions and creativity. We don't live in isolation, but openly and socially with other people. We are able to carry out an extensive range of physical tasks unconsciously. All these are enabled by interactions of our brain, body and environments. AI and autonomous robots lack the rich tacit knowledge and intangible qualities we have.

In this digital era, we believe it is utmost important to put people at the center of everything. It is people who choose a future, set out a purpose and create innovation. The analytical power of AI and the creativity of people are complementary. Digital technology augments the capability of people to realize previously unimaginable breakthroughs. And people must be more human than ever, rediscovering our unique qualities.

Digital Ethics

AI has created widespread concerns about its potential to cause harm to society and individuals. At Fujitsu we believe that AI is not only complementary to human capabilities, but

has the potential to greatly empower people and promote positive and far reaching benefits across society. We design and develop AI technologies solely with this aim in mind. This belief in technology contributing to society has led us to develop many innovations, throughout our history. We appreciated the importance of putting people at the center, and this has become the central idea of our vision, Human Centric Intelligent Society.

In a digital society, every stakeholder must discuss technology's impact to society, and develop a common understanding of its consequences. It is people who make and grow AI. It all depends on what kind of future we will choose.

Digital Business Workforce

AI helps clinical decisions

Dr. Germán Seara Aguilar, MD, PhD, of the Institute of Sanitary Research of the San Carlos Clinical Hospital, Madrid told Fujitsu, “Establishing predictive analysis models for the next step will allow us to let patients and the public play a much more active role in their own health. An informed patient must be able to make decisions on what they want to do with their life. Medical practitioners will act as consultants who provide patients with advice, but it’s their life.”

*Fujitsu has been collaborating with San Carlos Clinical Hospital to develop an AI-based support system to help clinical judgement in the area of mental health. The risk assessment of alcohol and drug abuse or suicide is time-consuming work, requiring investigation and cross-referencing of similar clinical records and relevant research. Fujitsu developed a risk assessment algorithm, leveraging our unique AI technology. Our system learned the fully anonymized historical clinical data of 36,000 patients as well as non-clinical data such as medical research papers to provide effective assessment. We conducted a trial of using this algorithm to analyze the clinical data of thirty patients. We compared the assessment by the AI algorithm and the assessment by five experienced clinical doctors, achieving over 85% accurate matching between the two assessments. The system frees up doctors from time-consuming research and improves the productivity and quality of clinical assessment. We are now working to commercialize this service.*⁸*

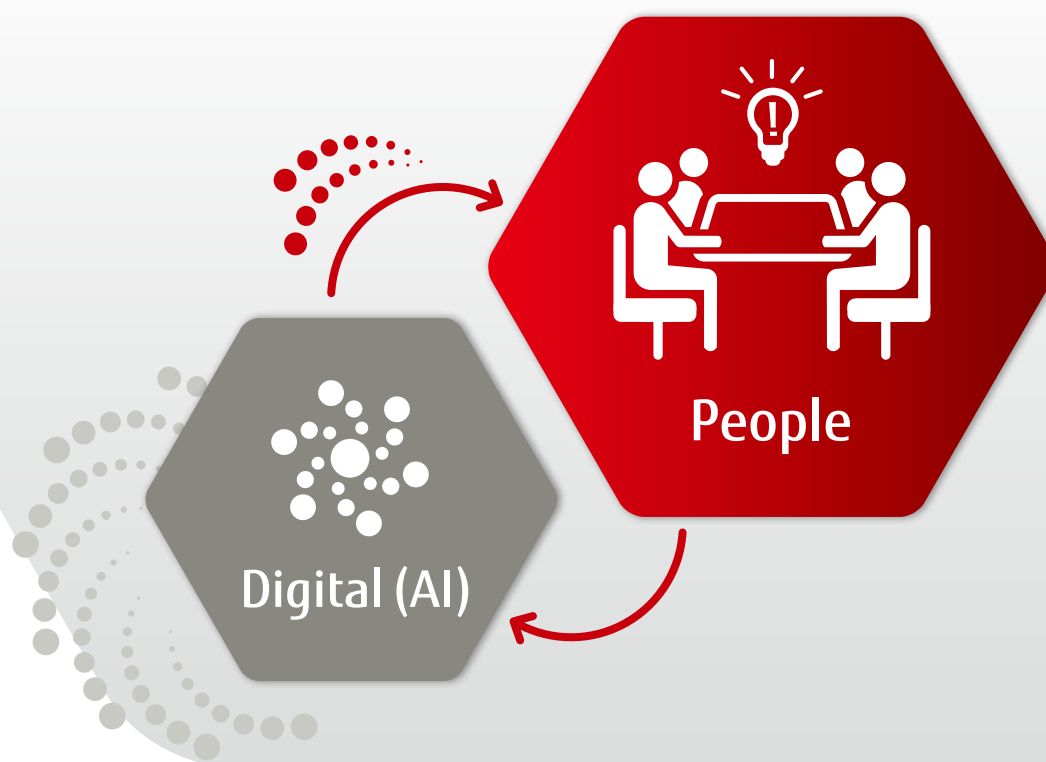
Hybrid Learning

Organizations can continuously generate innovations by institutionalizing the flow of creating and accumulating new knowledge. Organizational excellence of learning is exceptionally important. They apply the acquired knowledge to improve their products, services and operations. They also use the acquired knowledge to transform their business and create innovation. In this process, people also use their intuition and tacit knowledge. For example, customer-facing staff communicate and interact with their clients, understand their concerns and expectations, even if these are not explicitly delivered.

AI-based intelligent systems allow organizations to learn from data, acquire new insights and apply these insights to help their people to make better decisions. Digital can search huge amounts of data and find out the most relevant information instantly. Digital can provide unbiased and even unique recommendations based on statistical analysis. And digital can make useful predictions.

We foresee the future digital workforce working closely with the help and advice of AI-based intelligent systems, together processing a wide range of tasks. This is a hybrid learning process. People will be assisted by an intelligent system for useful information and recommendations. People may acquire new strategies or see new possibilities as a result. For example, in chess and shogi, human players have learned new





strategies and techniques from observing how a machine plays. As Dr. Seara of San Carlos Clinical Hospital told us what could happen in the future, people will be able to make a better decision on what to do.

On the other hand, an intelligent computer will be given a purpose and guidance on the correct answers from people, further raising the accuracy of assessment and predictions. These continuous interactions and learnings accelerate the flow of new knowledge, combining data-driven intelligence and human wisdom, and driving new innovation.

Connected Open Workforce

Unirobot, a Japanese robotics developer, is working with Fujitsu to develop a 'personal partner robot', to support individuals by learning their personal interests, preferences, and lifestyles. Taku Sakai, their president, told "Together with Fujitsu, we are jointly developing a human centric AI engine that even recognizes subtle conditions of their minds. The partnership with Fujitsu gives us technology resources as well as opportunities of expanding business and ecosystems".

In a digital society, borders of organizations are blurred. Open innovation is already very popular. To complement internal resources and create innovation with greater agility, many enterprises are working with external partners, research institutions and startup companies. Fujitsu is also expanding collaboration with global technology companies, industrial

companies as well as universities across the globe. We are also rapidly developing a community of start-up companies through our MetaArc Venture Program.*⁹ This program provides unique opportunities for collaboration between enterprises in various industries, Fujitsu's lines of business and start-up companies. Unirobot is just an example.

Beyond open innovation, digital technology is enabling organizations to tap vast external resources through the cloud. This is not limited to digital start-ups and small to medium size enterprises. Big enterprises also have to seriously look at leveraging the creativity and knowledge of crowds. Intelligent systems will facilitate such collaboration.

Taku Sakai, President of Unirobot and the partner robot 'unibo'



*⁹ MetaArc Venture Program <http://www.fujitsu.com/jp/innovation/venture/>

Designing your future workforce

Overcoming a common dilemma

In our survey, we asked business leaders what are the key factors for their successful digital transformations. They answered that “talented staff with right skills”, “streamlined organizations/processes for transformation” and “strong leadership” were the most significant factors. Asked what was hindering their transformational processes, they cited a lack of the above factors, also adding a “fear of change and internal resistance to transformations”.

We believe many organizations have a common dilemma: their culture and procedures are too well suited for their existing businesses and the environments they operate in. In pre-digital societies, businesses are working to produce standardized goods and services. Enterprises compete to improve the value of goods and service in terms of quality, costs and delivery. For this objective, people are motivated to work for incremental improvements and minimize risks, where failures are punished. These are not bad principles for encouraging excellence. Fujitsu is no exception. But in digital societies, enterprises must also learn a different organizational skill. Agility is crucial for successful digital transformation. This is more commonly found in start-up digital companies, where failures means ‘not trying’ instead of ‘not succeeding’. A change of approach is required. People need to have a more balanced view over opportunities and risks. They need to draw a big picture vision first, and constructively learn from failures to capture opportunities.

Your disruptive vision for your workforce

How should we approach the transformation of our workforce to become fit for digital? What skills do our people need to realize the full potential of digital?

Business leaders chose “professional knowledge of digital technology” and “creativity and imagination” as the most important capabilities that people need to strengthen in the digital era. Industry and business-related professional knowledge follow after these two. It means that we need balanced skills of digital technology, creativity and business to drive digital transformation.

To undertake your journey of workforce transformation, we believe a design thinking approach is the best way to start. Design has been used for various fields from fashion, buildings, cities and industrial goods to hardware and software. Recently, design is increasingly applied to drive innovation, business models as well as social transformation. We believe the best approach is to start by discovering who you are and to create a vision of the future. Then, to work backwards from there to arrive at your innovative strategy for today.

Fujitsu has developed a unique design methodology to achieve this. We call it Human Centric Experience Design. It is used for designing user experience, business innovation and, of course, workforce transformation. It comprises three steps:



01 **Creating a vision**

Find out what values and experiences you want to realize in the future

02 **Creating an innovative concept**

Craft new ways of realizing these values and experiences by co-creation with ecosystem partners and customers.

03 **Developing an execution model**

Develop a prototype in an agile, interactive manner, and refine it with ecosystem partners and customers

Co-creation workshops are very effective at unleashing the creativity of people. Fujitsu is now working with many of our customers in this way. For example, Fujitsu worked with a leading bank in Spain to transform their branch business and create their workstyle vision. We jointly held an emerging technology workshop with them to see how technology could impact their future. It was followed by design thinking workshops to create concepts. The bank proceeded to deploy prototypes, and is currently scaling them out commercially. The project is a perfect example of Digital Co-creation, participated in by the bank, Fujitsu's professionals and designers, and external professionals.

Summary

- Set out your vision for your future workstyle.
 - Design a model that leverages a combination of human creativity and insights delivered from AI.
 - Grow and nurture talent for the digital era, focusing on digital expertise and creativity. Be agile in preparing for changes.
-

Important capabilities
in the digital era

18%

Professional knowledge
of digital
technologies

17%

Creativity and
imagination

Co-creating Digital Business

Digital is becoming incorporated right into the heart of business, delivering transformational outcomes. The best way to grow business in the digital era is to co-create value with ecosystem partners and customers in Digital Arenas.

Your business in the future?

What would it mean if you could read your customers' minds? What would it be like having x-ray vision over your business, so that no asset or activity was hidden from your view? What would it mean if you could predict the future? What if you had an intelligent assistant to help you make the right decisions? What if you could solve complex problems, like understanding what turns a boom into a burst? What if smart robots could do all your painstaking tasks for you?

Such imaginations are perhaps more familiar to readers of science fiction than business leaders. But science fiction is becoming a reality. Over the next couple of decades, advances in technology will enable transformational outcomes that would have been previously unthinkable. We are already seeing the seeds of a digital future, and in certain places can already experience what it might be like. 'The future is already here—it's just unevenly distributed', William Gibson, a science fiction writer famously remarked.

For instance, Fujitsu has applied AI technology to security protection. A big limitation of today's security systems is they can only detect against known threats. By converting system data into pictures, the AI 'learns' what the patterns of information look like. When a new threat comes along, the picture suddenly looks unfamiliar. So the AI can respond to the anomaly, raise an alert and prompt an intervention.

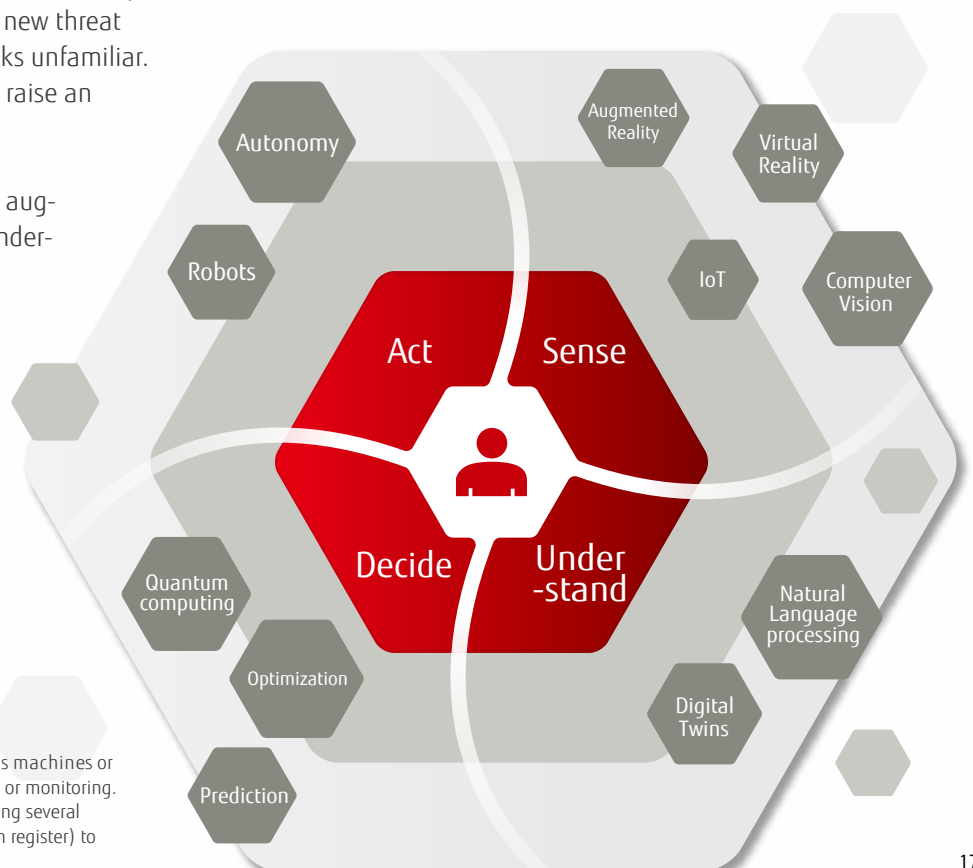
The potential is there in technology to augment our human capacity to 'sense, understand, decide and act'. For instance, computer vision could allow us to sense things we can't see. Augmented reality vision could help us to easily work out difficult tasks by putting relevant information directly into our field of view.

Digital technology also has the potential to broaden our under-

standing. Intelligent voice recognition could enable you to know your customers' feelings. The physical and digital worlds are converging, which means we can now make 'digital twins'*¹⁰ of physical things. We can use these to simulate anything from manufacturing lines or even to human organs. By simulating what could happen tomorrow, we can prevent failures in real time and deliver huge improvement to how things work.

Advances in technology will change our concept of decision making. AI could eliminate the human task of searching relevant information and provide predicative insights directly. Quantum computing,*¹¹ which is close to being realized, holds the potential to answer types of questions that are currently impossible. For instance, it could enable us to find out the most effective measures for easing traffic congestion in mega cities.

Digital technology will also make the world more autonomous. AI and robots will take over many menial tasks safely and efficiently. Intelligent robots could provide an engaging means of providing support to elderly people, or people with illnesses or disabilities.



*¹⁰ Digitalized companions of physical assets such as machines or facilities that can be used for product simulation or monitoring.

*¹¹ A computer that processes information by coupling several quantum bits into an array (known as a quantum register) to perform various computations.

Digital: Business = IT

Growth delivered by digital

In our survey, 46% of business leaders cited digital contributed to increasing revenues. 44% of them acknowledged their customer relationships improved as a result of digital. These were followed by other outcomes, namely strengthening product competitiveness, improving efficiency or reducing costs, and transformation of business model or processes. This finding has big implications for business.

The top priority of CEOs is business growth. Multiple factors influence how organizations grow. But if we need to pick up the most relevant, they are better customer intimacy, operational excellence and innovative product and service, and the ability of transforming the business model. For instance, digital can help retailers better understand what their customers are thinking and tailor the way they engage. Digital can help manufacturers digitalize operations, improving productivity. Digital can help financial institutions use Fintech startups to deliver innovative services. Most importantly, digital can help transform your business model into a shared platform model, shaping rich ecosystem partners and serving significantly more customers.

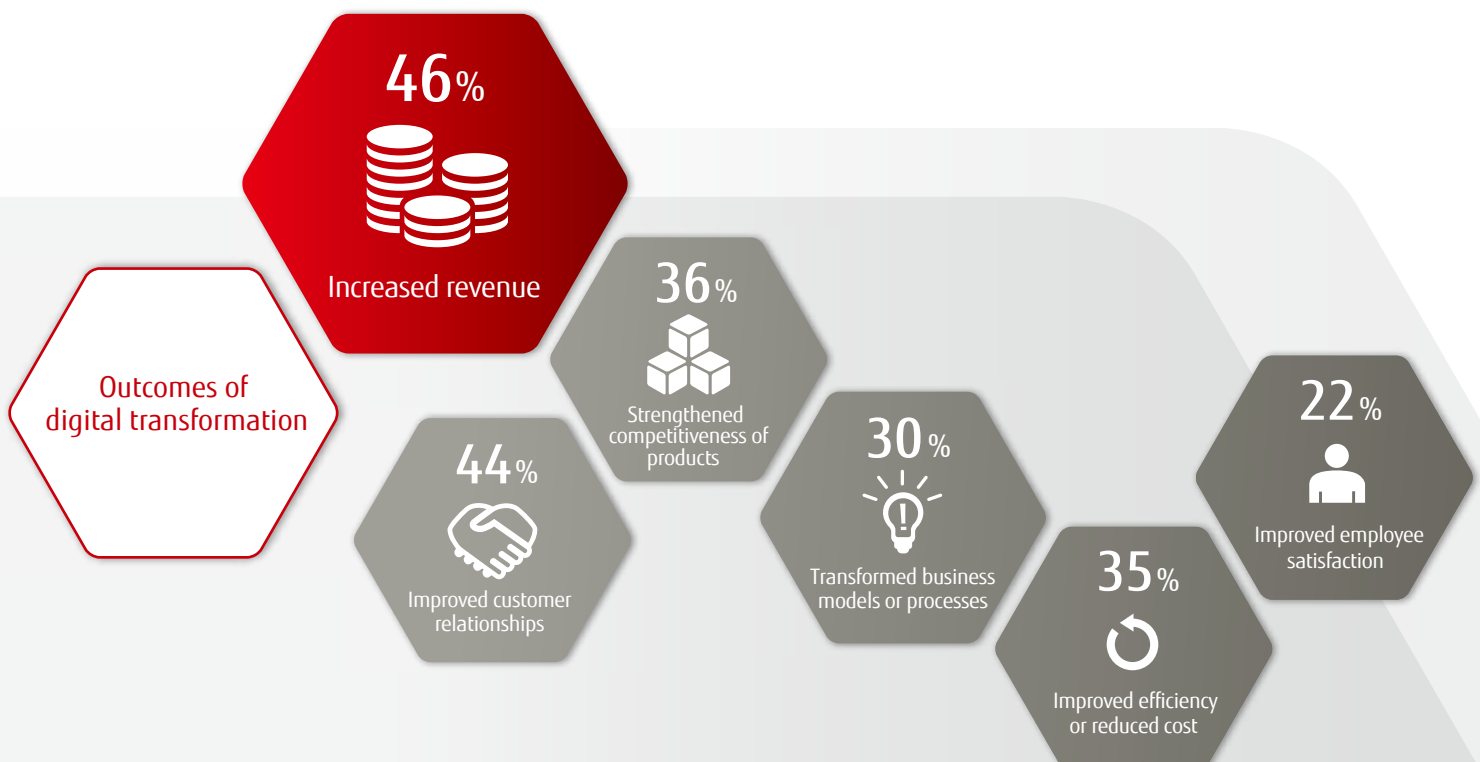
As we discussed before, every business is becoming a technology company. In a digital society, organizations are embedding digital technology into their core value-generation processes.

These encompass customer facing, R&D, production, logistics and more. In a new digital society, organizations are required to take different approaches to create value. Let's look at three big transformational forces which digital will bring.

Intelligence makes a difference

In the traditional, industrial society, organizations create value by leveraging mass-production technology and inexpensive labor, which migrates into cities from rural areas. In this society it is the use of industrial technology and the competitiveness of labor cost which makes the difference. As we enter the post-industrial information society, organizations generate new value by leveraging the knowledge of people. Unique knowledge makes a solid difference in characterizing their services. Today, software is embedded in many things and processes, and IT empowers people to create new knowledge, fuelling growth.

In a digital society, AI is advancing to learn from massive data and generate insights. A key difference between the digital society and the post-industrial information society is volume of data. Data can be created and associated with virtually anything – whether that is a person or an object or a process. So for almost any activity or transaction, we can capture a set of data that can be interrogated and analyzed. Now, intelligence makes a significant difference for any businesses and public services.





It is important to think how you can augment the creativity of your people with data-driven intelligence. Similarly, how can you acquire relevant data and prepare it for a machine learning process? Furthermore, intelligent algorithms can be used through the cloud or even embedded in a variety of products and services. How can you design your products and services incorporating such intelligence?

Connectivity changes the way of business

As things and processes are increasingly digitalized and connected to networks, transaction costs will continue to drop to near zero-marginal costs. Organizations will benefit from connecting their internal operations from end to end – in fact it will become requisite. Furthermore, it will be far easier to connect external services through digital interfaces. Digital systems leverage connected architectures built through digital interfaces called Application Programming Interfaces (APIs). This is happening in many sectors already, for instance financial institutions and Fintech start-up companies are connecting their services through digital interfaces to build innovative services. The borders of existing industries are becoming blurred. This could mean more new entrants from totally different fields. Similarly, organizations are becoming more open. We could see some disintegration of functions, leading to a more distributed business model.

It is important to ask how to connect your entire business

processes digitally, and how you could leverage external digital services. Which adjacent industries can augment the value of your products or services?

Everything from the customer's viewpoint

Digitalization also demands us to shift our viewpoint from supply-side to customer-side. Digital has enabled our customers, either consumers or business users, to directly search vast amounts of information available on the web. They can acquire more relevant information through their social connections. Users even proactively participate in making products and services. We see for instance in users of music platforms curating and sharing content. Or by sharing data which can be used to make better services, for instance connected cars. Digital transformation naturally orients around the experience and values of individual customers. As a result we are seeing the emergence of organically shaped digital ecosystems. Multiple organizations across different industries co-create new value-enhancing experience for individual customers by orienting around the delivery of outcomes. We call these ecosystems Digital Arenas. Shared platforms play a critical role to connect and host ecosystem partners.

Again it is important to ask what your value is and how you position your service in a Digital Arena. It is also critical to examine if you could make your product or service a customer-experience platform for attracting new partners and users.

Transformation toward Digital Arenas

The forces of Digital, characterized by intelligence, connectivity and customer-orientation, are transforming industries into Digital Arenas. Let's look at transformational impacts to manufacturing, financial services and retail industries as examples.

Manufacturing

How will digital transform manufacturing industry?

*Shanghai Instruments and Electronics Associates (Shanghai INESA), a provider and operator of Smart City integrated solutions chose Fujitsu as their co-creation partner. We are jointly setting up a smart factory. The company uses Fujitsu's Intelligent Dashboard to visualize and analyze all the data related to production and the consumption of resources in the factory. This produced significant outcomes including 25% increase in productivity and 50% decrease in production running time.*¹²*

Connectivity and intelligence are transforming factories into smart factories. IoT enables us to connect machines, facilities and processes, and collect real-time data. Data analytics allows factory managers to understand the status of their entire operations in real time, for improving productivity. Furthermore, we can create 'digital twins', virtual representations of machines and processes the factory floor, enabling in-depth insights and simulation. AI will generate insights such as forecasting demand, predicting machine failures, and optimizing production plans.

Products are increasingly digitalized and software controlled. For example, some shoes and shirts already have sensors, connected to networks for monitoring vital data. In the near future, intelligent algorithms will be embedded into products – even tiny ones. What manufacturing industries deliver is dramatically changing from the value of products to the value of using products. In other words, outcomes delivered from using products matter most. As a result, the border between manufacturing and service is being blurred. Companies which manufacture products for business use can be transformed into innovative service providers. They will be paid for how much outcomes their products have delivered, for instance, reducing their customer's operational costs. Consumer goods manufacturers will engage with each customer, design personalized products digitally, and produce them rapidly at a smart factory. Leveraging IoT, they will be able to continue to provide smart services after delivery.

Manufacturing companies will increasingly partner with companies in adjacent industries to co-create greater user experience and more valuable outcomes. A product could be transformed into a platform for many ecosystem partner services. For example, a car is becoming an intelligent software based mobility platform. It will provide users with all sorts of features, even taking care of their health conditions.

Financial Services

Financial services are probably one of the most advanced industries when it comes to digitalization. However they may even yet have the most potential. In capital markets, sophisticated algorithm trading is already commonplace. Data-driven intelligence is being applied to a broad range of tasks in finance. Intelligent robots advise on investment portfolios, recommend insurance policies, and evaluate credit applications. Voice recognition enables fraud detection. People will enjoy naturally spoken voice interfaces for financial transactions.

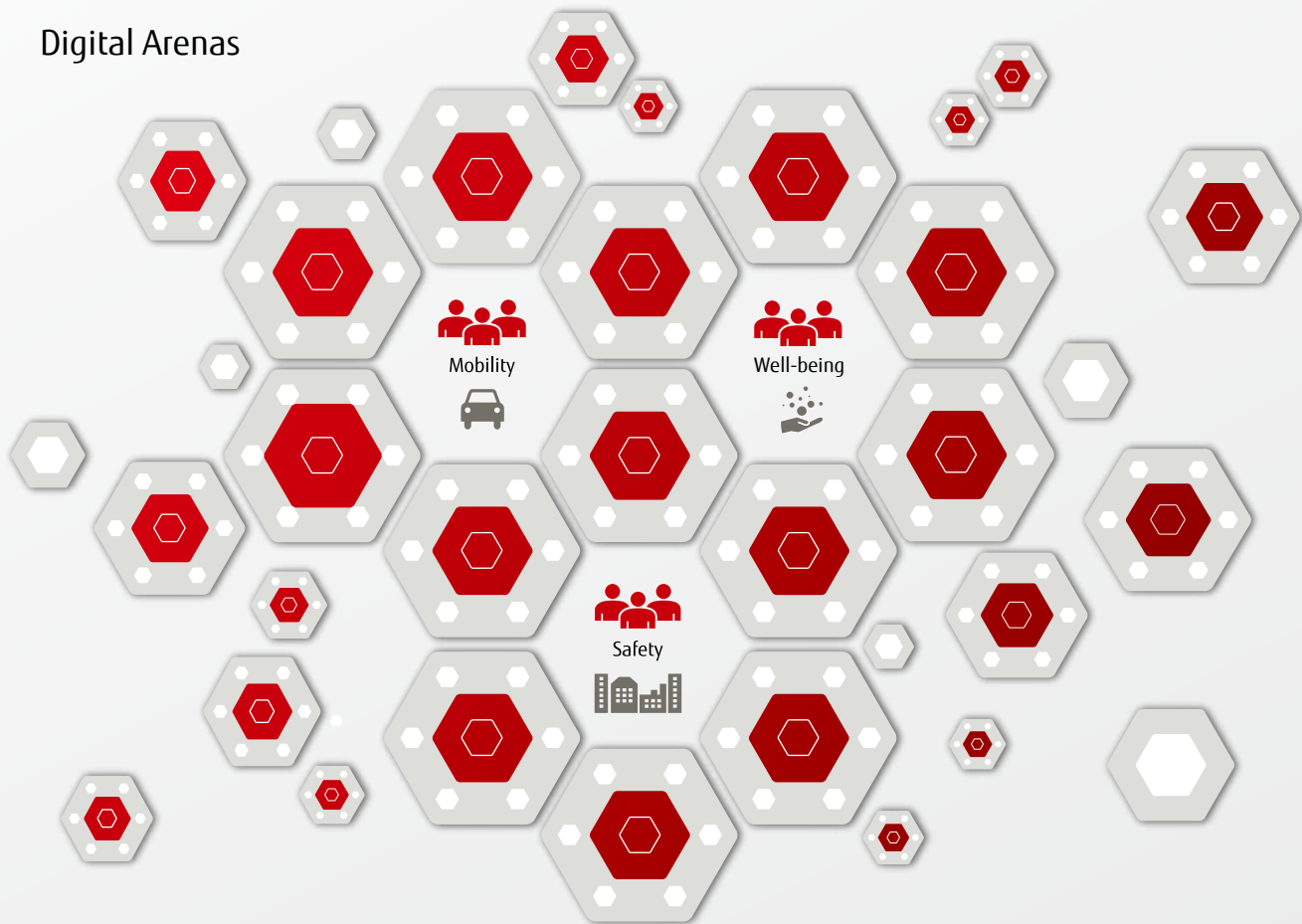
But it also means financial industries really need a new type of digital workforce, who can create new ideas, agilely develop digital services and leverage open innovation. Digital connectivity is changing the structure of retail finance. New Fintech entrants offer innovative services such as mobile payment, peer to peer financing, or Blockchain transactions. These new services certainly pose disruptive challenges. But many banks have already been proactively connecting and embracing them through APIs, offering alternative services to their users.

Digital will accelerate a shift toward realizing more personalized financial services. We believe Digital Arenas for providing trust and assurance will be organically shaped around people's needs.

*Fukuoka Financial Group is a regional bank located in Kyushu, Japan. The Group is establishing a service platform it calls 'iBank' to deliver a personalized mobile banking user experience. It has chosen Fujitsu as a co-creation partner to build a cloud platform to enable mobile services and connect various Fintech services. Furthermore, the group is shaping ecosystems to share data and energize regional businesses and communities.*¹³*

Digital forces will connect financial industry and other industries for creating innovation. For instance connected cars and connected healthcare will enable more personalized insurance.

Digital Arenas



Retail

For the retail industry there are enormous opportunities to use digitalization to transform customer experience.

S Group is a Finnish network of companies operating in the retail and service sectors. One of its subsidiaries is ABC Petrol, which provides fuel and retail outlets in over 400 locations in Finland. Fujitsu collaborated with ABC to integrate its mobile application with Fujitsu's POS system. The solution enabled seamless customer experience. When customers drive up to the station, the app shows the available pumps, customers select the number they want to use, step out to fuel the vehicle, put the pump back and are free to drive away. Over 600,000 customers have downloaded the ABC app and transactions have increased five-fold in eight months. "Our clientele loves it and the feedback has been fantastic," commented Antti Erikivi, Supply Chain Director of ABC.^{*14}

Digital connectivity can enable unified experience between

physical stores and digital spaces. Analysis of customers' in-store location data allows retailers to optimize staffing allocation and store layout. Fujitsu offers a solution that enables this. Furthermore, real-time location data would enable context-aware personalized services, delivering most relevant information at the right location and timing. Data-driven intelligence could allow retailers to understand individual customers better, and use insights to tailor services. When are they likely to come next time? What might they want? What might they want that they don't know they want? In addition, virtual reality and augmented reality technology will take customer experience to a different dimension.

Retail industries are connecting with other industries to shape Digital Arenas for consumer value. Retail, mobile payment, public transportation and others have already created Digital Arenas for delivering better personalized customer experiences. For instance, digital technology such as palm-vein biometrics enables ubiquitous cash/card-less payment for retailers.

^{*14} For details please see Book2 page 38

Digital Co-creation

Digital Co-creation

Organizations must see co-creation as extending value-creation out beyond their traditional boundaries. Digital Co-creation is a journey. But it is easy to get lost. It requires leadership and organizational commitment.

The first step is to think about the disruptive vision for your organization. It is necessary to revisit what value your organizations will deliver for your customers. It is also crucial to evaluate what disruptive impacts the forces of digital will give to your industries and your business. How could data-driven intelligence change the rules of the game? How could connectivity disintegrate and reshape your business structure?

The next step is to think about how you want your business model to change. Which adjacent industries could be involved for realizing joint value and customer experience? How could you position your products or services in a Digital Arena? Do you play the role of platform or an ecosystem partner? Which key enabling digital technologies can you leverage?

The third step is to implement your digital business architecture thinking about 5 layers: customers, ecosystem, workforce, processes and technology. It is important to view these layers from the flows of data and connectivity.

Customer layer:

How could digital help connect your customers? How could you leverage customer's data, such as transactional records, social media and others, while protecting their data security and privacy?

Ecosystem layer:

Which ecosystem partners could provide data or data-driven intelligence, relevant to the customer experience value you want to realize? How could your organization interface with these partners?

Workforce layer:

How could your organization empower your people with data-driven intelligence? How could your people co-work with external partners or participate in communities? What kind of co-creation workplaces could your organizations provide?

Process layer:

How could your organization digitally connect your operations, collect and accumulate data for generating insights? What kind of data governance and security rules are necessary?

Technology layer:

How could your organization build an IT platform (we call it a digital business platform) to connect processes, people, ecosystems and customers, to create intelligence from data, and empower your workforce? It is crucial to provide security for all layers. It is also important to align and connect your existing IT system to reduce complexity and generate value. To this end, modernization of your existing IT systems may be necessary to meet your digital requirements.

A design approach is useful for guiding each step. Organizations could start small with a PoC and move to a fully-fledged digital business, expanding into shaping ecosystems in Digital Arenas.

Summary

- Begin with a disruptive vision of your organization.
 - Design your business model, factoring in intelligence, connectivity and customer orientation.
 - Implement your digital business architecture thinking about 5 layers: customers, ecosystem, workforce, processes and technology.
-

5 layers to design digital business



Digital Society

We are facing serious challenges everywhere in the world. Digital technology has a critical role to play in solving them. To realize a sustainable world, we need to design greater alignment of business with the shared goals of society.



What will our future society look like?

How will our society change over the next couple of decades? What are fundamental forces behind the change? What are our common challenges?

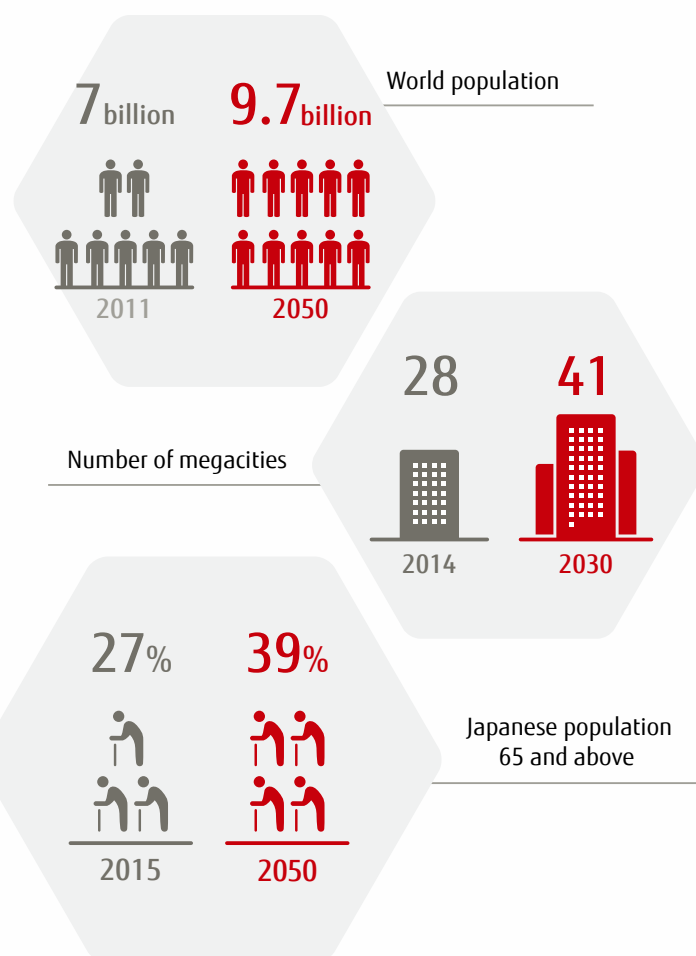
The world population surpassed 7 billion in 2011 and is expected to reach 9.7 billion in 2050.^{*15} At the same time, massive numbers of people are moving to cities to work and for a better quality of life. The number of megacities with 10 million or more population is estimated to rise from twenty-eight in 2014 to forty-one in 2030.^{*16}

Many of these new, big cities will be in Asia, South America and Africa. Globally, the gravity of economic activity is shifting from the North to the South. This is good news for the global economy because new demand will be generated as a result. But these cities also face difficult challenges of urbanization, including congestion, increasing pollution, energy constraints, security of food and water supply, and resilience to natural disasters.

Contrast this with what is happening in developed countries. Many cities in Japan and Europe are experiencing a decrease in population, which is posing serious challenges of sustainability. In addition, people are living longer, as we saw in Chapter 1. 39% of the Japanese population is forecast to be over 65 by 2050.^{*6}

This also means an increasing burden of pension provision and healthcare insurance. This issue of an aging population is not limited to developed countries, either, but to many countries in the world.

Other things are changing. The world is becoming hyper-connected. Global flows of people, goods and capital continue to increase. Take a simple product like a cup of coffee. It has come on a long and complex journey from its origins



in an equatorial plantation, traveling through multiple intermediaries to its point of consumption. Smart phones, consumer electronics and cars have even more complex supply chain histories. The internet and smart mobile devices are connecting billions of people and processes. Today, IoT is connecting sensors, any kind of devices and physical infrastructure, producing massive amounts of data. What is coming next? Blockchain, an emerging new technology, has the potential to realize peer to peer trusted transactions instantly at a near-zero marginal cost anywhere in the world. But there are big challenges. Society is threatened by intensifying cyber-attacks. The number of security incidents continue to rise. Our privacy is at the risk of extensive commercial use and censorship for national security reasons. The opportunity exists to create a world where everybody can access and transact with anybody, anything and any information at their fingertips. But we may equally end up in the gloomy scenario of a world that is disconnected under the pressure of cyber terrorism.

*15 United Nations "World population projected to reach 9.7 billion by 2050" 2015

*16 United Nations "2014 Revision of World Urbanization Prospects" 2014

Responsible Business

Aligning business and society

What would it mean if we all could live healthy and fuller lives? What if we could continuously generate innovation? What would it be like eliminating congestion in fast growing cities? What if we could make cities more resilient to disasters? Or reverse climate change? What would it mean if we could greatly improve agricultural productivity?

If we want a better future, the starting point has to be to ask ourselves what kind of future we want. If we want to transform society, we must center our vision around people. This is an undertaking that should not be left only to governments and the public sector. The business world is a major part of society. Companies, especially global ones, have a responsibility to the widespread communities they and their ecosystem partners belong to. Global companies increasingly can have as much influence as individual governments. Therefore, it is becoming increasingly important to align business goals and shared goals of society.

To help address the world's difficult social challenges, the United Nations set out 17 Sustainable Development Goals (SDGs) and 169 targets in 2015. These are shared goals to be achieved by 2030. As well as governments many enterprises have also embraced these goals and already started to work toward them. For example, well-known companies like Shell, Unilever, Coca-Cola and IKEA are committed to supporting the initiative. According to PWC, 71% of enterprises are already planning how they will engage with the SDGs. 41% of them

say they will embed SDGs into their strategy and the way they do business within five years.*¹⁷

Fujitsu is also supporting the initiative, working together with partners. In March 2017, for instance, Fujitsu made an agreement to collaborate with the Global Centre for Disaster Statistics (GCDS), which the United Nations Development Programme (UNDP) and Tohoku University jointly established. Under this scheme, Fujitsu will voluntarily contribute to developing and managing a Global Database for disaster statistics for four years. It is estimated that the aggregated annual loss resulted from natural disasters could amount to 520 billion dollars globally.*¹⁸ However, as there are no globally consistent statistics available, it has been difficult to use data for planning and executing actions. Having a globally consistent statistics database around disasters will help visualize the data, apply the acquired insights for developing actions, and monitor effectiveness. In this field, Fujitsu is collaborating with many institutions to mitigate damages from natural disasters. For example, we developed a solution to fast simulate estimated impacts of Tsunami, and a disaster information management system leveraging smart phones.

A Human Centric Intelligent Society

Digital technology has a foundational role to play in solving difficult global challenges. Data-driven intelligence could help us to find better ways to take effective measures to minimize the impact of disasters, as well as to conserve energy, avoid congestion, reduce greenhouse gas, and reduce food waste.

SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



The digital era is seeing the explosion of global data. How could we exploit these vast amounts of data? Digital connectivity will change the way our society works. For instance, we will be able to digitally connect cars, roads, bridges, railways, and even ships. What this means is we can not only make things more efficient, but target all sorts of other values too, like minimizing harm to the environment or enabling greater convenience. Digital will change our viewpoint from the supply-side to the people-side. As we saw in Chapter 2, these high value services will be co-created by ecosystem partners and by people themselves across a variety of Digital Arenas.

Fujitsu believes technology will empower people to build a safer, more prosperous and sustainable world. The forces of digital, including intelligence, connectivity and people-orientation, will transform our society, with interconnected Digital Arenas, delivering the needs of people more efficiently than we could imagine. We call this a Human Centric Intelligent Society. It is a new and emerging digital society, where people, enterprises and public services co-create innovative value to achieve the common good of society.



Individual aspiration drives business and society toward a shared goal

Tatsuya Honda, a 'super creator' awarded by the Information-technology Promotion Agency of Japan for 2014, was inspired by his unique personal goal. He said, "Meeting people with impaired hearing in my freshman year opened my eyes to a soundless world. It drove me to create a technology to help them, allowing them to feel the shapes of sounds." Honda developed "Ontenna", an innovative device which enables the hearing-impaired to sense characteristics of sounds through light and vibrations in their hair. The device borrows the same concept as cat's whiskers, which can sense delicate flows of air. He joined Fujitsu's design team, and is focused on making this innovation a success. Honda's aspiration, Fujitsu's business and society's need are aligned. This is a small example of working toward a world where "no one is left behind", that SDGs are aiming at.



*17 PwC "Making it your business: Engaging with the Sustainable Development Goals" 2015

*18 The World Bank 2016

Working on shared goals

How could we co-create a better world leveraging the transformational power of digital? Let us have a look at some transformational scenarios, where emerging Digital Arenas are driving social value and better experiences for people. Here are three areas where Fujitsu is aligning to UN SDGs.

Everyone living fuller lives

SDG3 Well-being (Ensure healthy lives and promote well-being for all at all ages)

It is good news people are living longer on average, but we must ensure *everyone* lives a healthy life. Every year in the world, 6 million children die before their fifth birthday. How can digital innovation promote dignity and wellbeing?



Data-driven intelligence has a great potential for delivering transformational outcomes. As we saw in the case of San Carlos Clinical Hospital in Chapter 1, an AI-based system was able to learn from a huge volume of clinical records and other research data, and use this to generate insights to help doctors to make clinical decisions tailored for individual patients. AI and supercomputer simulation are enabling much

faster discoveries of chemical compounds effective for treating cancers and other difficult diseases. It is also possible to analyze genomes and other data such as lifestyle activities to enable preventive and individualized medicine. We can also use computing simulation for creating digital twins of our own bodies. For instance, the University of Tokyo and Fujitsu jointly developed a heart simulator, which can visualize the motions of 640,000 muscle cells.

Digital connectivity could transform how healthcare and other care services are delivered. It could realize truly human centric care for the wellbeing of individuals. Cloud and IoT can help us connect people, clinics, hospitals, drug stores, advanced medical institutions and others for sharing data and providing personalized services. And security services are critical for ensuring that value comes out of the data without compromising people's privacy. For example, Fujitsu has already provided regional healthcare networks linking about 7,000 hospitals, clinics, elderly care and other related facilities in Japan.

Sustainable city

SDG11 Sustainable City (Make cities and human settlements inclusive, safe, resilient and sustainable)



A city is a living thing. It comprises many different kinds of activities and functions, which are all interconnected. It is in a continual state of dynamic transformations in response to environmental changes. Today, more than half of the world's population lives in cities, and this ratio is ever increasing. Cities are facing difficult challenges everywhere. How can we use the forces of digital to make a positive impact?

We believe the answer is to co-create human centric services among stakeholders, in both the public and the private sectors. In Singapore, Fujitsu has been collaborating with the Agency for Science Technology and Research, and Singapore Management University. We are developing a unique solution to deliver convenient and stress-free urban mobility, leveraging data-driven intelligence and digital connectivity. This context-aware solution is designed to predict congestion of public spaces and public transport, and make intelligent interventions at precise moments to ease it. For instance, it can send targeted mobile coupons to motivate people into different behaviors – shopping in a nearby shopping mall. The system





can ease congestion in real time. A field trial achieved good results at optimizing the flow of people right after a major sports event.

This small example shows how a Digital Arena can come together to create value for citizens at scale. Digital technology enables us to see multi-layers of urban activities in real-time at a glance. How are people moving? How are businesses running? How is traffic on roads and railways changing? How and where is energy demanded and supplied? Where are crimes happening? How are environmental pressures developing? Where are we facing risks of natural disasters? We have an opportunity to combine some of these data and generate insights. Data-driven intelligence will empower us to predict how the things could develop and make better decisions.

High-productivity agriculture

SDG2 Food and agriculture (End hunger, achieve food security and improved nutrition and promote sustainable agriculture)

Food and agriculture is one of the big untapped fields which technology could improve. In many countries, people are still growing food in the same way they have been doing for generations. In spite of food shortages in many places, incredibly, 1.3 billion tons of food, roughly one third of global food production is lost or wasted every year. How could we supply food securely? How could we transform agricultural productivity significantly? How could we reduce food waste?



Data-driven intelligence and digital connectivity could completely transform the way that food is grown and distributed. Fujitsu is providing an agriculture cloud service, we call Akisai, to over 350 organizations in Japan, and expanding it in Korea, Vietnam and other countries. This solution effectively digitalizes agricultural knowledge allowing even inexperienced farmers to grow food efficiently. Fujitsu is also operating a precision agriculture factory, powered by IoT, in Japan as well as in Finland.

A big opportunity comes from enlarging this Digital Arena. Fujitsu is working to connect farms, seedling companies and other ecosystem partners to co-create agricultural innovation. Furthermore, by digitally connecting farms, logistics, food companies, retailers as well as individual consumers, we could have an opportunity to optimize demand and supply, leading to reductions of wastes at each stage.

In addition to these, Fujitsu is also working to provide better education, respond to climate change, and promoting industrial innovation.

Summary

- Align your business goals with a shared goal of society.
- SDGs provide good directions. Creatively apply digital technology to solve a big social issue.
- Work with partners in a Digital Arena toward a shared vision.

Your co-creation partner

A trusted partner

How can you choose a co-creation technology partner? In our survey, business leaders told that they want to work with partners that have “digital technology capability”. But they also named “understanding of their industry and business requirements”, “alignment with their vision and strategy”, and “trust for collaboration” as similarly important expectations of their partners.

Throughout our 81-year history, Fujitsu has been working alongside countless numbers of customers, delivering innovation. We developed a wide range of telecommunications and computing products, including the fastest supercomputer in the world and other cutting-edge technologies. Leveraging these, Fujitsu has successfully delivered solutions and service to solve the challenges of our customers. Particularly, we have been supporting mission-critical social infrastructure for customers across the world, such as banking systems, stock exchange trading systems and public network systems. To do so, we relentlessly pursue the highest quality so that our customers can have total confidence in everything we do.

Fujitsu values trusted relationships with our customers, understanding their goals as well as their challenges. This is how we have responded to their expectations. Our 156,000 people in the world are working for our customers in the spirit of “shaping tomorrow with you”.

Technology for the future

What technology do we need to realize digital transformation for society? What technology do you need to embed into your business core?

To realize growth in a digital society, we need a different style of technology. It is a style of technology that connects everything. It learns data and generates intelligence. And it empowers people to make better decisions. To enable all of these things, Fujitsu is committed to strengthening four critical technology areas: AI, IoT, Cloud and Security. Bringing these technologies together, we provide unique digital services to allow our customers to gain insights from data, achieve tangible business outcomes, and realize better experience for their customers. We call this **Connected Service**. And it is enabled by our digital business platform MetaArc. You can find more details about our technologies and services in Book 2.

Digital is leading all of us to a different future. Fujitsu will leverage our digital technology architecture and our long experience in working with organizations in a wide spectrum of industries, to provide the very best value for our customers. Fujitsu wants to be your digital co-creation partner, together delivering unique human centric value to help you thrive in a digital society.



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