FUJITSU

White Paper

The Connected Enterprise: Making the Industrial IoT Happen – Right Here, Right Now

A practical guide to digitalizing your business processes with the Internet of Things

Contents

Executive Summary: Thinking Beyond Technology

Like Big Data before it, the Internet of Things (IoT) is entering modern technological language – and is generating its fair share of hype and hyperbole. But despite its focus on sensors, networks and connectivity, the IoT as it is used now is not primarily a "techie" topic. Instead, it is about business processes: how they operate today and how the IoT can help to transform them to make companies stand out. Of course, technical expertise will be fundamental to making this happen – but, increasingly, strong collaboration between business and IT will also be required. For these initiatives to succeed, an overarching, connected way of thinking and planning is just as important as physical networks of sensors and things. Taking a holistic view of the IoT and its growing role in business and industry, this White Paper reflects not only market trends, but also the business requirements and challenges (including crucial factors such as integration and security) facing a host of organizations and industries as they gear up for a connected future.

Connecting the Revolution

Talking up the Industrial IoT

Everyone's talking about the IoT[1], and with good reason. Its likely financial impact is huge: at a projected value of as much as $11 trillion a year by 2025[2], IoT applications will be big business. Moreover, consumers are starting to come to grips with the possibilities the IoT offers: the connected home – which benefits from connectivity between a variety of smart devices such as thermostats and lighting systems – accounted for about a quarter of the IoT market in 2014[3].

But it's in the area of business and industry that the IoT (or the "Industrial Internet") will have the biggest impact in the shorter term. Modern industry is undergoing a digital transformation, and underpinning that change is the IoT. The number of connected "things" continues to grow – estimates vary, but expectations are that, by 2020, 50 billion devices, sensors, pieces of equipment and users will be connected[4]. This year, more than five million new things will be connected every day[5]. Companies across industry sectors are making IoT-related investments – 20% of companies are investing in sensors, for example[6].

Cutting-edge solutions offer a way to connect people and technology in new and transformative ways, boosting industrial efficiency by at least 10%[7] and increasing the productivity of connected companies by as much as 30%[8]. And Industrial Internet projects are already delivering 20 times the efficiencies they were expected to deliver[9]. Of the $11 trillion annual value of the IoT, nearly 70% will be accounted for by business-to-business applications[10].

At the heart of this is data: by accessing and analyzing the vast amounts of data that's now available to them, companies can enhance their operations and even develop new business models. Amid talk of a new industrial revolution, companies in several industry sectors – notably manufacturing and energy – are looking to the IoT to transform the way they do business.

At the moment, however, only tiny fractions of the data being produced in many industrial settings are actually being used, and seldom to optimize operations[11]. The scope for transformation is huge.

A big, complex change

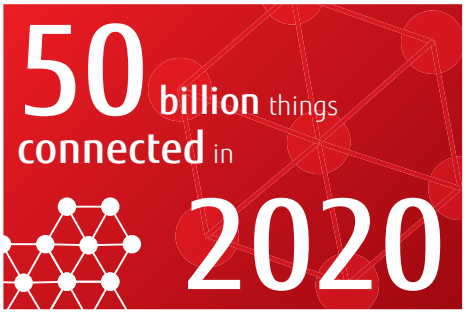
Despite the benefits, however, the road to the Industrial IoT – transforming your business so that people, technology and processes are seamlessly connected – is not an easy one. Once the talk has died down, the reality for many businesses is that the prospect of implementing an Industrial IoT project presents many challenges. For them, uncertainty about the real impact of IoT technologies – on workforce management, value chains, business models and product design – could be confusing the issue. According to one study, for example, most manufacturing companies have little understanding of what the IoT is and how it can help their businesses[12]. James Zhang, Director of Internet of Things at the Fujitsu America SAP® Practice, isn't surprised. "Many customers want to do this," he says. "But they don't know how or where to start."

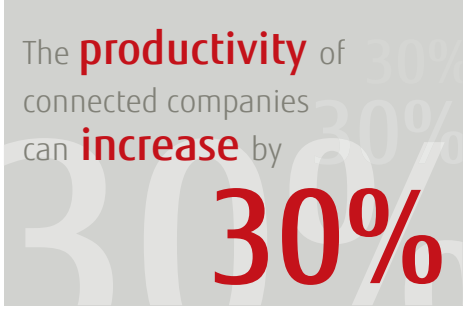
At the root of the problem may be the complexity of the process, and knowing how to use the IoT to transform business and operational models. Developing these systems can take time. Essentially, the IoT means using end-to-end technology to link sensors, networking and platforms to applications and analytics. This level of technology may be just too complicated for many business people to adopt. Companies also face a host of challenges, including interoperability, business silos and security.

Yet it's achievable, now

Ultimately, all business leaders want their companies to be unique, to stand out from their competitors, and to offer better products, better service, more innovation and more customization. Business leaders may want their enterprises connected – because of the benefits that can bring – and the likelihood is that they want it done sooner rather than later.

Smart use of the IoT can help businesses to achieve all these things. Nevertheless, though they may have the core skills in some areas, it's unlikely that they will have the expertise and experience to implement the level of integration that the connected enterprise warrants. Despite the challenges, uncertainty and confusion, however, enterprises can get connected now. Having the right partner on board to assist with implementation can be a useful first step, and the right approach, careful consideration, planning and a few essential steps can lead to successful IoT-driven business transformation.





Time to Get Connected

A connected enterprise uses the IoT to integrate physical and IT processes. All of its lines of business are digitalized: sales and customer service, R&D, supply chain, manufacturing, HR, finance and so on. The power to connect traditional physical processes with cutting-edge IT – to connect people with things – has the potential to change the way companies in a host of industries do business. By using the IoT to enable the seamless integration of IT and operational technology (OT), connected companies can employ smart processes that use the power of data analytics to improve the effectiveness of their operations and cut costs.

Connecting people, things, data and business networks

In essence, a connected enterprise enables humans and technology to work together to create more efficient, cost-effective business processes. In many respects, the IoT is less about the "things" themselves, and more about connecting people and processes in a multitude of ways.

People. Any digital transformation has people at its heart – whether that's employees learning new skills to help them optimize processes, or consumers benefiting from the enhanced experience that IoT technologies can bring. Ideally, the IoT will help to foster an environment of innovation and development by combining cutting-edge technology with traditional people power.

Things. From factory floor to retail outlet, most industries have systems and processes that support the way they operate. These will involve specific equipment and assets – all of which need to be monitored, maintained and optimized. Physical items and processes are governed by OT.

Business networks. Hyperconnectivity is the linking across networks of hundreds – perhaps thousands – of devices, people, sensors and applications. As connectivity grows, so will the opportunities for more sophisticated business solutions. The way to harness this is digitalization, which enables more efficient energy use, reduces production downtime and energy supply, and lubricates supply chains. And the data generated is essential for the optimum running of business processes.

Data. Of all IoT elements, data has the most critical role. The data created by increasing numbers of sensors, smart machines, wireless networks, software and analytics is driving the move toward connected enterprises. Data analytics also plays a crucial role; suppliers of software and analytics are likely to account for most of the technology value in the IoT in the coming years.

Big benefits...

Ultimately, for most companies the power of being connected is about monetizing their new operations – making them work to achieve the long-standing goals of business: improving efficiency, cutting costs and generating new revenue streams.

Linking all of these is the desire to become a best-in-class company and improve customer satisfaction – a crucial differentiator for any business. For most companies, the main drivers of using the IoT to get connected are effectiveness, competitiveness and new business models.

And it works:

- After deploying an integrated manufacturing and quality-management solution, one of the world's largest food processing companies not only improved its operational efficiency and the quality of its food, but it is also expected to potentially save tens of millions of dollars in product recalls and refunds[13].
- By combining IT and OT to increase productivity, improve the reliability of its assets and gain visibility into its operations, one of North America's largest utilities saved several million dollars by being aware of and avoiding risks[14].

Effectiveness

Two of the main goals of an IoT implementation are boosting effectiveness and accelerating time to market. In Germany alone, companies expect productivity to increase by 18% by 2020 as a result of the application of the IoT[15]. Automating business and operational processes makes them more effective, efficient and cost-effective (one estimate puts potential savings in some industries at $30–$90 billion[16]).

Increasing automation will bring benefits in terms of efficiency and cost, but also challenges in terms of workforce and workplace management. The growing use of robotic technology, for example, will create opportunities and challenges around human/machine interaction.

Competitive advantage

More efficient processes make a company more agile; improve safety, reliability and compliance; and enhance the experience of customers, employees and partners. By "democratizing" data, companies can make all kinds of information readily available to many different users, improving their awareness of data and their decision-making capabilities.

While improving operational effectiveness will enhance competitiveness, it does not in itself create competitive advantage. But new connectivity and data processing capabilities will allow companies to develop new business models based around services. For many companies, moving from a production to a service model will be a natural progression. Being able to offer services improves customer satisfaction, brings in new revenue and helps to keep down ongoing operating costs.

One engine manufacturer, for example, uses data from sensors in its engines to offer replacement parts where and when they are needed[17]. Another large manufacturer and provider of industrial solutions allows third parties to exploit the data coming from its products and offers infrastructure services to enable those third parties to run their applications[18].

Connecting with industry

The IoT can have a big impact on industry, and there are already some interesting developments in sectors such as retail, transportation, logistics and construction. Here we consider two industry sectors where the notion of the connected enterprise is already having measurable success: manufacturing and energy. These sectors rely heavily on information – whether updates on the performance of factory equipment or information about consumers' energy use. And they already rely on technology – almost all companies in these sectors are on the road to being fully digitally mature. What's more, about two-thirds of manufacturing executives are confident that their IoT initiatives can boost their profitability by 2020[19].

Manufacturing

Of the challenges faced by manufacturers today – which include bridging the skills gap and looking after the health of their workers – two of the main ones are regulatory compliance and balancing asset maintenance with production[20]. Demands from customers and partners to innovate and change mean that creating and developing new processes and services is vital to their ongoing success. They also have to cope with vast amounts of data produced by their operations – in some cases, millions of measurements and data inputs in a single day. IoT solutions are tailor-made to address these challenges.

Manufacturing and energy companies have a strong desire to adopt digital technology[21]. The reason for this is clear: automated routines, asset optimization and operating efficiencies – central manufacturing concerns – are all key aspects of being connected. Indeed, the factory is where the IoT and connected technologies will have the biggest economic impact: up to $3.7 trillion by 2025[22].

The desire to adopt digital technologies is also high in manufacturing. As is confidence in the results: 95% of IT decision-makers are confident that they can help their companies make the right technology-based decisions[23]. Perhaps this isn't surprising, given the inherent need in this sector to keep abreast of technological developments. Manufacturing organizations have already made considerable investments in sensor technology and analytics capabilities, and are poised to see the return on those investments.

Applications are already getting results. From products that relay information back to the plant after they've left, and those that provide ongoing maintenance information, to manufacturers that now offer service deals[24], the IoT is making its presence felt in this sector.

Energy

Energy companies face an ever-growing threat to their traditional business models, and deregulation means that for many it's a struggle to stay competitive[25]. The need to conserve energy, reduce greenhouse gas emissions and develop more efficient ways of managing and distributing energy means that the use of connected and smart appliances, meters and grids is becoming ever more central to the day-to-day operations of many companies.

Companies are already introducing smart devices into consumers' homes, and the prediction is that utilities in particular will be responsible for the bulk of the connected devices in homes and companies by 2020[26]. In plants and grids, meanwhile, converging IT and OT – as well as innovations in asset maintenance, monitoring and performance – could help to push global IoT-related spending in this sector to about $200 billion by 2018[27]. (One particularly interesting application is the use of IoT technology to deliver solar power to remote locations in Africa[28].) How quickly connected energy companies can grow depends on how effectively they can develop streamlined, secure and efficient processes.

...And big challenges

But for most companies, becoming a connected enterprise will involve big changes and significant challenges. Many companies – particularly in heavy industry – have complex legacy systems that are expensive to replace. And justifying significant expenditure on technology projects that may not have immediately obvious ROI can be difficult. Despite the undoubted value they see in the industrial IoT and the connected enterprise, practical considerations around costs and implementation will weigh heavily on their decisions.

The challenges facing industry can be divided into four broad categories:

- Interoperability and compatibility
- Security
- Cultural acceptance, education and training
- Tackling the silo mentality

Interoperability and compatibility

Communication is at the heart of the IoT: systems and sensors interacting and sharing data. Interoperability between these systems and sensors, and the software that drives them, is essential. Interoperability is already recognized as a broad issue with IoT implementations – in some settings, it will be essential to unlock as much as 60% of the value of IoT applications, and more than $4 trillion per year by 2025[29]. Crucially, the ability to integrate new systems with existing infrastructure is seen as a major stumbling block – a third of companies say it affects their digital decision-making. Being able to combine new technologies with existing solutions is now a key goal for half of IT decision-makers.

In industrial settings, interoperability brings its own problems – not least ensuring that new solutions work with legacy systems. Alongside interoperability, companies have to define a reference architecture and build a digital platform, and ensure that their network is strong and efficient enough to handle hyperconnectivity. For many organizations, the problem comes with implementing complete integration between IT and OT. For many, this – and understanding how to incorporate data effectively into their processes – will be a major issue.

Security

Amid the hype and excitement generated by the IoT, it's worth remembering that ever-increasing dependence on machines and sensors brings with it a whole new set of risks. The threat of cyber attack darkens the drive to digital for most organizations – in manufacturing, for example, security is one of the top three concerns for many companies[30]. The economic impact of cyber attacks could be as much as $3 trillion, while the effect on labor could be equally significant[31]. At the practical level the problems become more apparent: the collection of sensitive data via a multitude of sensors can expose this data to risk; and the size and – in some cases – disposability of sensors make them particularly vulnerable to attack[32].

Kozo Otsuka, Principal Architect in the Fujitsu EMEIA CTO office, highlights the issue in manufacturing: "In Europe – especially in Germany – security is one inhibitor to cloud service adoption for manufacturing companies, for example. They are really, really keen on protecting their internal data."

This all adds up to a headache for those embarking on digital transformations. Many CIOs maintain that tackling security could account for as much as 30% of their overall activity[33]. And as the technology continues to evolve rapidly, questions about how well IT staff will be able to keep up with change will hang over much of the initial work in this area.

Cultural acceptance, education and training

Becoming connected means big change, and not all companies are ready for it. They may have a battle on their hands trying to persuade key individuals – managers, employees, decision-makers – to accept that such fundamental change is valuable or even necessary.

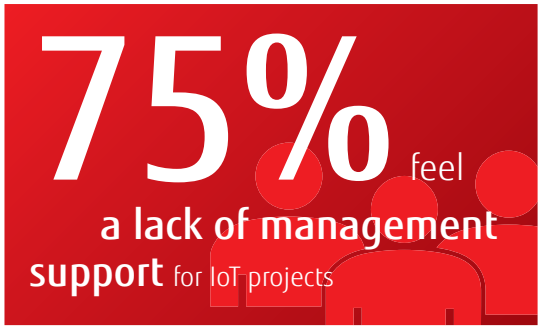
Business models will need to change, regulations will have to be followed and workers will have to be trained and empowered to operate in the new environment – and managers to make the key decisions to move any initiatives forward. All of this takes time and energy, and will have to confront often endemic cultural barriers and resistance. Establishing change management and governance models can be complex, but is vital.

Tackling the silo mentality

When it comes to IoT projects, there is a clash between corporate departments, namely IT and lines of business. The basic purpose of most current IoT implementations is to integrate OT and IT, which highlights the heart of the problem: these are two parts of businesses that seldom talk to each other.

The issue is one of silos: while business teams make the decision to implement IoT projects, IT teams understand the technology required. The need for "joined-up" thinking and planning is clear – if nothing else to avoid expensive project mistakes. Aside from witnessing a possible shift in the dynamic back to IT, it's possible that the schisms created between departments in recent years – as business units wrest ever more control away from IT – will only serve to make the situation worse.

Management support for IoT projects is vital, but 75% of businesses feel that they don't have it yet – something that will increase the likelihood of silos forming[34]. Tackling this will require an approach that fosters collaboration, and enhances the end-to-end, company-wide involvement of truly connected deployments. In addition, one key aspect of industrial IoT implementations is the growing need for customizable solutions – simply because every company's needs, systems and processes will be different.



Start the Transformation Today

The benefits of connecting your enterprise are clear; the challenges seem daunting. So where do you go from here?

With the right approach, you can go beyond talking about your solution to making it happen. What's more, it can happen sooner than you think.

The key to ensuring success is to make the best possible start. Before you begin, though, it's worth knowing that there's no "one-size-fits-all" IoT solution, and that "bottom-up" approaches (building on and optimizing your existing processes) are not mutually exclusive from "top-down" ones (revamping your systems). A lot of what you decide will depend on your position in your organization, and the support you receive – both internally from management, and from external partners.

At the heart of this transformation is managing change – your systems were designed largely with human beings, not devices, in mind. But whatever your approach, and with the right support, there are some crucial steps to follow from the outset. Remember also that there's nothing wrong with thinking small at first. Often, the most effective IoT programs can start with a series of smaller steps.

1. Put IoT and digital on the board's agenda
For too long, technology adoption has rested just with the IT department. But this is no longer the best approach when you are talking about transforming your service offering. IoT must be a board-level initiative, driven not just by the CIO but also by the CEO and business leaders. After all, the benefits it can bring – new revenue streams, improved service and increased effectiveness – are business-level results.

2. Define a reference architecture
First, develop a strong reference architecture and a strategic roadmap for your implementation. This should involve an assessment of your own capabilities – where your strengths are and where you may need help. Companies usually have a mixture of technical skills: most have "traditional" IT expertise (servers, networking and so on), some have expertise in OT, and some have specific device expertise, including experience of "bring your own device" (BYOD) schemes. The issue comes with filling the gaps: not only does the IoT require experience across different technology areas, but this also has to be carefully coordinated to achieve the right results – something that few companies can do.

3. Make security your top priority
Security is a big concern for IoT leaders at global enterprises. In most business IoT settings, using data effectively but safely requires several layers of encryption, and even additional layers of authentication, such as biometrics. First, identify any vulnerabilities you may have in your IoT setup, and start to address these. Issue security certificates directly to your devices, and use certificate management software to automate security alerting, reporting and management. Alternatively, work with a partner that can manage your environment for you.

4. Set the standards
One issue with the IoT is standards – and the relative lack of them. Even reference architectures for these kinds of projects have yet to be clearly defined. Inevitably, the big step of transforming your business with the IoT will mean that some level of connection will have to take place between devices and your core enterprise systems. So it's vital that you build on your existing IT and OT investments – be creative with what you have, rather than attempting to develop concepts beyond your basic core competencies. You will have developed effective architectural practices for your core technology systems, so capitalize on these. And anything you can't do in house? Outsource.

5. Work with the right partner
No business can be expected to have all the knowledge and expertise required to make the industrial IoT work. Filling the gaps and coordinating technology skills are a lot easier with the right partner working alongside. In fact, having the right partner is one of the fundamental elements of the success of any large-scale IoT initiative. Once you have decided to investigate the possibilities and opportunities inherent in an IoT project, and have engaged your technology team to explore the possibilities, the input of an external partner can be invaluable.

Action, not words

Talking about the transformative effect of the IoT is all very well, but it's important to talk to clients, not at them. A consultative and business-oriented approach is vital, and companies are more likely to trust – and work effectively with – those partners with the right experience. As a manufacturer itself, with expertise in both OT and IT, Fujitsu is well aware of the challenges many companies will face as they get connected.

From talking to companies in several industry sectors, we've learned that they expect their IoT projects to meet a few key criteria: they should be effective, compatible with their existing systems, secure, and fast to deploy. We've been examining the potential of the industrial IoT for some time and believe that an end-to-end approach is the right one – from initial consultation on reference architecture and strategy to full implementation and integration, followed by ongoing managed services.

Most companies want to get the most out of the IoT sooner rather than later. A lot of this will depend on the systems they already have, and whether any solutions they implement – either stepped solutions or full implementations – can complement and enhance their existing IT and OT systems. We've developed a dedicated connected enterprise solution that covers both IT and OT software layers. And because it's based on and tightly integrated with SAP applications and the SAP HANA® platform, developed from our experience and customized according to what companies want, it's relatively easy and fast to deploy – in a matter of weeks in some cases.

Our dedicated solution comprises two main elements:

Fujitsu Connected Manufacturing. This uses internet connectivity to improve delivery, visibility and quality. The Connected Manufacturing element works with existing SAP and shop-floor automation systems to heighten visibility into the value chain, streamline processes, optimize operations and ensure compliance. This interoperability can often mean very rapid implementation times.

Fujitsu Connected Assets. This element analyzes data from assets equipped with sensors to optimize their use, performance and maintenance. Connected Assets help maintenance teams to track the performance of their assets, automate their processes and mobilize their workers, moving companies from reactive to predictive maintenance.

In short, our broad experience and knowledge can help companies to approach the IoT in a realistic and pragmatic way:

1. We take a business-oriented, consultative approach.
2. Our understanding of both the IT and the OT layers means we can develop innovative, end-to-end solutions that are based on an in-depth knowledge of relevant technologies and SAP applications, as well as the SAP HANA database.
3. Our pre-packaged solutions enhance our expertise in flexible and customer-oriented delivery.

Everyone is talking about Industrial IoT solutions. We can make them happen.

Conclusion: Some More Steps to Success

The value of the IoT is clear – as are the challenges it presents, and the complexity of its deployment. But success is within the grasp of most companies – and you can learn from their experience. Those with successful implementations have taken several essential steps. Before embarking on your own digital transformation, ensure that you have strong change management processes in place. Next, find a suitable partner with a strong ecosystem to help you innovate and develop your connected enterprise solution, and start with a pilot implementation.

During the pilot, spot where the quick wins are and aim to achieve them. Then quickly develop prototypes of your new products and services and, to maintain the momentum of your transformation, scale up those initiatives and projects that produce measurable success, using robust, scalable technology platforms. And remember that it's essential to get management support early on in the process.

The IoT is powering the transformation of industry; in manufacturing and energy, for example, companies are becoming digitalized and the benefits are being realized. This is a journey that is not without its challenges, but it's one that will become increasingly important and complex, taking us into the territory of edge processing, robotics and artificial intelligence. And into other industry sectors, as Kozo Otsuka highlights: "Companies in sectors such as transportation, shipping and logistics are thinking about how they can be a part of production besides delivering the goods."

Sooner or later, this is a journey that most companies will have to take. By adopting these steps and working closely with a partner well versed in operational processes – one that can help them understand the implications of the IoT for their business, provide the necessary technology, and ensure that implementation and integration are smart and seamless – they can become intuitive, agile and connected enterprises.

Indication of Sources

[1] The IoT was one of the five most-hyped technologies of 2015, according to Gartner (and reported on the VentureBeat website)

[2] "Unlocking the potential of the Internet of Things", McKinsey Global Institute, June 2015

[3] Business Insider Intelligence data, cited in "The Impact of the Internet of Things: The Connected Home", GSMA, March 2015

[4] Fujitsu Technology and Service Vision, 2015

[5] "Gartner Says 6.4 Billion Connected 'Things' Will Be in Use in 2016, Up 30 Percent From 2015", Gartner press release, November 2015

[6] "Digital IQ Snapshot", PwC, 2014

[7] "Defining and Sizing the Industrial Internet", by David Floyer, cited on Wikibon.com

[8] Projection by acatech, cited in a post on the Deutsche Bank Research website

[9] "Embrace The Quietly Advancing Industrial Internet", Forbes Tech, November 2015

[10] "An executive's guide to the Internet of Things", McKinsey Quarterly, August 2015

[11] "Unlocking the potential of the Internet of Things", McKinsey Global Institute, June 2015

[12] "The Internet of Things Has Finally Arrived (Unfortunately, Most Manufacturers Aren't Ready)", Executive Summary, MPI Internet of Things Study, The MPI Group, January 2016

[13] "The Connected Enterprise: Hype or Reality [video]", Fujitsu, November 2015

[14] "The Connected Enterprise: Hype or Reality [video]", Fujitsu, November 2015

[15] "Opportunities and challenges of the industrial internet", PwC/strategy&, 2014

[16] "Use industrial Internet of things to propel automation investments, higher productivity", Plant Engineering, 2014

[17] "As cheap as chips: turning the 'internet of things' into business benefits", ComputerWeekly.com, 2012

[18] "GE Adds Infrastructure Services To Internet Of Things Platform", TechCrunch, August 2015

[19] "The Internet of Things Has Finally Arrived (Unfortunately, Most Manufacturers Aren't Ready)", Executive Summary, MPI Internet of Things Study, The MPI Group, January 2016

[20] "Six Challenges Facing Modern Manufacturing Companies", Manufacturing Net, October 2014

[21] "Walking the digital tightrope", Fujitsu, January 2016

[22] "Unlocking the potential of the Internet of Things", McKinsey Global Institute, June 2015

[23] "Walking the digital tightrope", Fujitsu, January 2016

[24] "Manufacturing shifts up a gear with internet of things", The Irish Times, June 2015

[25] "The Internet of Things is revolutionizing utilities", IoT For Utilities, Energy Conference Network, December 2015

[26] "The internet of things", Utility Week, July 2014

[27] "CEO Perspective: The Internet of Things for Utilities: Top Priorities to Build a Successful Strategy", SAP, 2014

[28] "Case Study: Smart solar energy delivered to Africa's 'off grid' population with a helping hand from the Internet of Things", IMC, January 2015

[29] "Unlocking the potential of the Internet of Things", McKinsey Global Institute, June 2015

[30] "The Fujitsu KISS Report – Manufacturing Sector: Keeping IT Simplified and Streamlined to maximize the business value of SAP® Applications and SAP HANA®", Fujitsu, November 2015

[31] "Risk and responsibility in a hyperconnected world: Implications for enterprises", McKinsey, January 2014

[32] "Are We Creating An Insecure Internet of Things (IoT)? Security Challenges and Concerns", Toptal, 2015

[33] "Risk and responsibility in a hyperconnected world: Implications for enterprises", McKinsey, January 2014

[34] "The Internet Of Things Has The Potential To Connect And Transform Businesses, But Early Adopters Have Focused Mostly On Efficiency Plays", Forrester Consulting, August 2015

Contact
Fujitsu Technology Solutions GmbH
Mies-van-der-Rohe-Straße 8
80807 Munich

Website: www.fujitsu.com/sap
Contact: www.fujitsu.com/fts/contact