



# focus

#118

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*future*







#118



# ISO focus

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# Driving the Internet of Things to its

# full potential



From left : **Daeshik Jeh**, Administrator of the Korean Agency for Technology and Standards (KATS), ISO member for the country, and **Dae Seon Yoo**, Administrator of the National Radio Research Agency (NRRA).

To give you an example of how important the Internet of Things has become to Koreans, compare it to the human need to breathe “air”. Not only is it pervasive, it’s vital.

Today, the Internet of Things (IoT) penetrates every aspect of our lives and is integrated into all domains in industry, agriculture and end-user service. As IoT continues to extend and grow, we can no longer imagine life without it.

So how did we get here? In the early 2000s, Korea started an interesting information technology R&D promotion project focusing on radio frequency identification (RFID) and ubiquitous sensor network (USN). You have probably heard about RFID, as its applications are extensive in our day-to-day lives – from badges that open doors to chips that identify animals. USN is perhaps a less well-known technology, but a game-changing one in the development of IoT.

USN refers to a type of conceptual network built over existing physical networks. What’s really extraordinary about USN is that these sensors can extract and communicate data with anyone/anything, anywhere/anytime. In a way, USN has made possible what IoT stands for: connected devices and infrastructures. So when the notion of IoT started getting traction elsewhere in the world, Korea simply switched from thinking in terms of RFID/USN to thinking in terms of IoT – but there were new implications.

Our country is on its way to creating a hyper-connected society and IoT is one of our main driving forces. We are taking several strategic steps to promote this technology. We are increasing international cooperation and globalization. We are encouraging industry to use IoT, and are working on establishing an information and communication technology (ICT) infrastructure based on IoT. We are also promoting the commercialization of IoT services.

For example, in 2014, Korea announced the “IoT R&D Drive Plan”, which aimed to support our goal of a safe and trusted hyper-connected smart society based on an open IoT ecosystem. The plan categorized IoT technologies in terms of service, platform, network, device and security. To move forward, however, we needed to address a few challenges, like the development of a total solution or the foundational technologies needed

for IoT R&D. We also had to work on global IoT-based platforms and service-oriented networks, and promote the development of lightweight devices to support smart technologies. Security and privacy were key considerations. And, of course, so were the standards that we needed to enable all this to work.

To inspire and drive these developments, in 2015 Korea began working on a series of projects that would demonstrate, and thus promote, the use of IoT in industrial domains. We first looked at developing open interworking APIs (application programme interfaces) for smart homes. APIs are used to develop software and basically define how they should interact. Open APIs are key to support interoperability between various types of smart-home products/appliances and services.

Another project was ensuring a secure smart grid to overcome inherent risks and ensure safety and reliability. Yet a third project focused on healthcare, in particular in developing after-care service technologies for discharged patients of serious illnesses (e.g. cancer or heart disease) and for clinical demonstration. Finally, the last project focused on transportation, more specifically the core technology necessary for smart-car services.

We hope these four projects will be a motive force in our goal of developing a hyper-connected society. But we could not do it without standards. Technologies are becoming increasingly complex and interrelated. Just imagine a setting where, for example, Industry 4.0 (such as robotics) is combined with traditional production technologies, which also make use of ICT. International standards are necessary to make this work.

IoT pervades, and can be incorporated into, almost every existing, as well as emerging, technology, but in order to realize its full potential we need standards that enable cross-cutting communication to avoid getting stuck in silos. In our view, ISO has a driving role to play in IoT standardization, bringing together national standards bodies and international experts, as well as other relevant stakeholders in the IoT field, to develop the solutions that are key to this technology’s development. ■

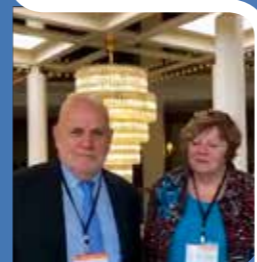
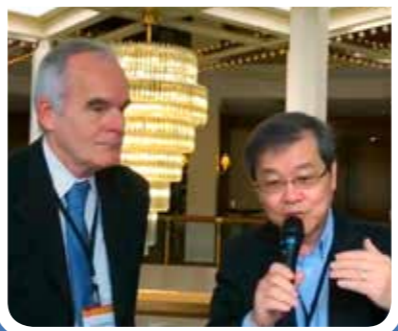
# OUR FIRST EVER facebook LIVE!

As part of a social media campaign coinciding with the ISO workshop on service standards (13-14 June 2016) in Geneva, Switzerland, we organized our first ever Facebook Live broadcast. This new Facebook feature enables users to record live videos with their smartphones. Those watching the event as it unfolds can comment and ask questions that can then be answered directly on the video.

**2** video broadcasts of about 30 minutes



Watch our "ISO Facebook Live" by scanning the QR code:




**+1000** reactions and shares

**+8600** views

**+60** questions and comments

## #servicestandards

Here are some tips and lessons learned:

-  Announce the broadcast in advance.
-  Write a compelling description.
-  Have the right equipment – a good microphone and a stable tripod if you are staying in the same spot.
-  Longer broadcasts are better. It takes at least 10 minutes for people to see you are broadcasting and start asking questions – 30 minutes is a good average.
-  Have at least two people. One holds the phone and monitors questions, the other interacts with participants – a third person to answer comments is a bonus.
-  Don't make it too big – the screen is a small square that fits only 2 to 3 people.
-  Hold the phone vertically from the start.
-  Staying still with a tripod looks neat, but moving around as you interview people is more dynamic. We used a combination of both.
-  Address the commenters by name as you ask the questions or read the comments.
-  Make sure you have space in your phone to download the HD video afterwards.

For us, this was an opportunity to give our Facebook followers a unique access to the people convened in Geneva. We kept it informal, opting for a conversational format with participating service, consumer and developing country experts over coffee. The response was overwhelmingly positive, with over 30 comments and questions asked live during each event, in addition to the post-event feedback.



A person's silhouette is shown in profile, looking towards a city skyline at sunset. The sky is a mix of blue and orange, with the sun low on the horizon. The city buildings are silhouetted against the bright sky. The overall mood is contemplative and forward-looking.

# **How** *the Internet of Things* **will change our lives**

*by Elizabeth Gasiorowski-Denis*

The Internet of Things (IoT) has the power to change our world. And while we are starting to see its incredible impact, we are still very much at the beginning of the transformational journey. Here's a look into the current state of affairs in the race to standardize IoT, along with what people are saying about it.

Soon every device you own – and nearly every object you can imagine – will be connected to the Internet. Whether it's through your phone, wearable tech or everyday household objects, the Internet of Things (IoT) will connect us in ways we can't even imagine yet. Your thermostat, alarm system, smoke detector, doorbell and refrigerator may already be “networked”, but changes are starting to take root in our cities as well. Better management of energy, water, transportation and safety are bringing people in closer touch with their surroundings and capturing our imaginations for urban bliss – a fully integrated, smart, sustainable city. Last but not least, we're seeing dramatic increases in activity and innovation on the factory front, where the potential for cyber-physical systems to improve productivity in the production process is vast.



**Over half of major new business processes and systems will incorporate some element of IoT by 2020.**



As you can imagine, life in ten years will look materially different from how it looks in 2016 as the pace of technology change accelerates, thanks in large part to the coming boom of the Internet of Things. In some ways, IoT still feels like empty tech jargon. It's hard to lump all these different, disparate things together and talk about them in a meaningful way. So, in an attempt to make sense of this emerging technology, let's look at what plans are afoot to build an IoT future.

### **Paradigm shift in technology**

Technology consulting firm Gartner, Inc. projects that 6.4 billion connected things will be in use worldwide this year, up 30% from last year. And this number is expected to grow by more than three times to nearly 21 billion by the year 2020.

Over half of major new business processes and systems will incorporate some element of IoT by 2020, assures Gartner. The impact on consumers' lives and corporate business models is rapidly increasing as the cost of "instrumenting" physical things with sensors and connecting them to other things – devices, systems and people – continues to drop.

Futurist and technologist Chuck Evanhoe, who has spoken extensively about IoT, explains the precipitation of devices connected to the Internet and each other: "IoT will be a tremendous enabler of better information in both the consumer and business environments. I believe that the impact of IoT will be across the board. All of the systems that we don't think about in our day-to-day life will be more effective in keeping humans productive so the impact won't be in just one area."

While flashy applications to consumer technologies understandably generate the most media buzz, there is more to IoT than merely everyday life situations and communications. Networked devices perhaps hold the most promise to cut costs and raise efficiency in production and manufacturing, offering not only to make their management more effective but the work itself smarter. Evanhoe lists the multiple benefits: "From 'Smart Appliances' to the 'Smart Factory', we will have better information, more control and insight into the everyday things that we need to function, both known and unknown. By unknown, I refer to things most people don't think about until they become a problem, such as the power grid. By sensing the things in our world, systems will be better able to keep running without human intervention until something needs or will need, e.g. predictive maintenance, our intervention."



### **Welcome to Industry 4.0**

Around the world, traditional manufacturing industry is also in the midst of a major change, marking the dawn of smart manufacturing or Industry 4.0. Every day, technologies based on IoT make factories smarter, safer and more environmentally sustainable. IoT connects the factory to a whole new range of smart manufacturing solutions, which run around the production. The dramatic improvements to production and cost reduction are projected to generate billions in revenue growth and productivity over the next decade. The transformation that it implies is huge.

IoT gives manufacturers the ability to track objects, to find out how consumers are using a certain product, and to determine which features are the prominent ones. This creates a better understanding of what adjustments should be made to the product(s) to help improve adoption and purchasing rates. Knowing what the users do with the product is something brands want to leverage and IoT makes that readily available.

According to a global survey released by Gartner earlier this year, adoption of IoT is expected to reach 43% of enterprises by the end of this year, with the heaviest users including companies in the oil, gas, utilities and manufacturing industries.

Every day, technologies based on IoT make factories smarter.





IoT, for example, promises to bring to the automotive industry changes that we can't predict yet and is already influencing how carmakers build their vehicles and how they think of the future of their products.

Igor Demay, Chair of ISO/TC 22, *Road vehicles*, explains: "IoT in the automotive industry appeared around the beginning of the 21<sup>st</sup> century, with navigation systems changing dramatically the relationship between the driver and the vehicle. We are now in the second period with 'mirror devices' such as mobile phones or portable navigation units known as nomadic devices, whose screens are used by car owners or drivers while driving their vehicles."

That influence is only going to deepen as more connected cars come online and as consumers continue to demand more technology in their

vehicles. "The third step," says Demay, "will consist of all advanced driver-assistance systems and automated driving solutions." So while IoT solutions are part of the industry's future, the challenges that lie ahead are mountainous as the levels of sophistication continue to grow.

### Biggest challenge

As with any new technology, IoT can be confusing and intimidating, especially as debates swirl around standardization. Currently, the biggest problem facing IoT is the lack of consistent standards.

While some layers of the IoT technology stack have no standards, others have numerous competing standards with no obvious winner. Without a "common communication method",

devices will only be able to talk to their own brands and severely limit the helpfulness of connected machines.

To understand how a lack of uniform standards can complicate product development and industry growth, consider connectivity issues. For example, if a company that develops smart clothing is different from a company that develops smart home technology, the chances of their products communicating are minimal. That's because different devices will often use different communications protocols, resulting in a lack of interoperability and an experience that's far from seamless for customers. However, if the two companies used the same standard for connectivity, interoperability would be much more likely.

It's no wonder, therefore, that IoT is a hot topic in the standards community. ISO/IEC joint technical committee JTC 1 formed a working group on the Internet of Things (WG 10) to develop an architectural model for the interoperability of IoT systems. Many of the standards that are needed probably exist, but their relative importance, deployment and application are not yet clear.

To address the situation, ISO established a Strategic Advisory Group (SAG) on Industry 4.0. Its Chair, Kai Rannenberg, believes network connectivity that enables these objects to collect and exchange data is key. "The IoT opens great opportunities and unforeseen applications, but can also create major risks, e.g. when data collection is exaggerated, or when devices connected to the Internet were not designed to handle this challenge."

Rannenberg sees standards leveraging IoT technologies to create more efficient, responsive make-to-order systems. "There will be interfaces, interfaces and more interfaces. Standards are needed to avoid interfaces becoming bottlenecks for bringing products to market. And there is certainly a big role for standards on the architectural design of Industry 4.0/smart manufacturing to coordinate workflows and processes."

For Rannenberg and others, the culmination of the SAG's work is a set of standards ensuring that every device connected to the Internet will be able to seamlessly talk to each other – no matter the chip, operating system or maker of the device.



IoT opens great opportunities and unforeseen applications.



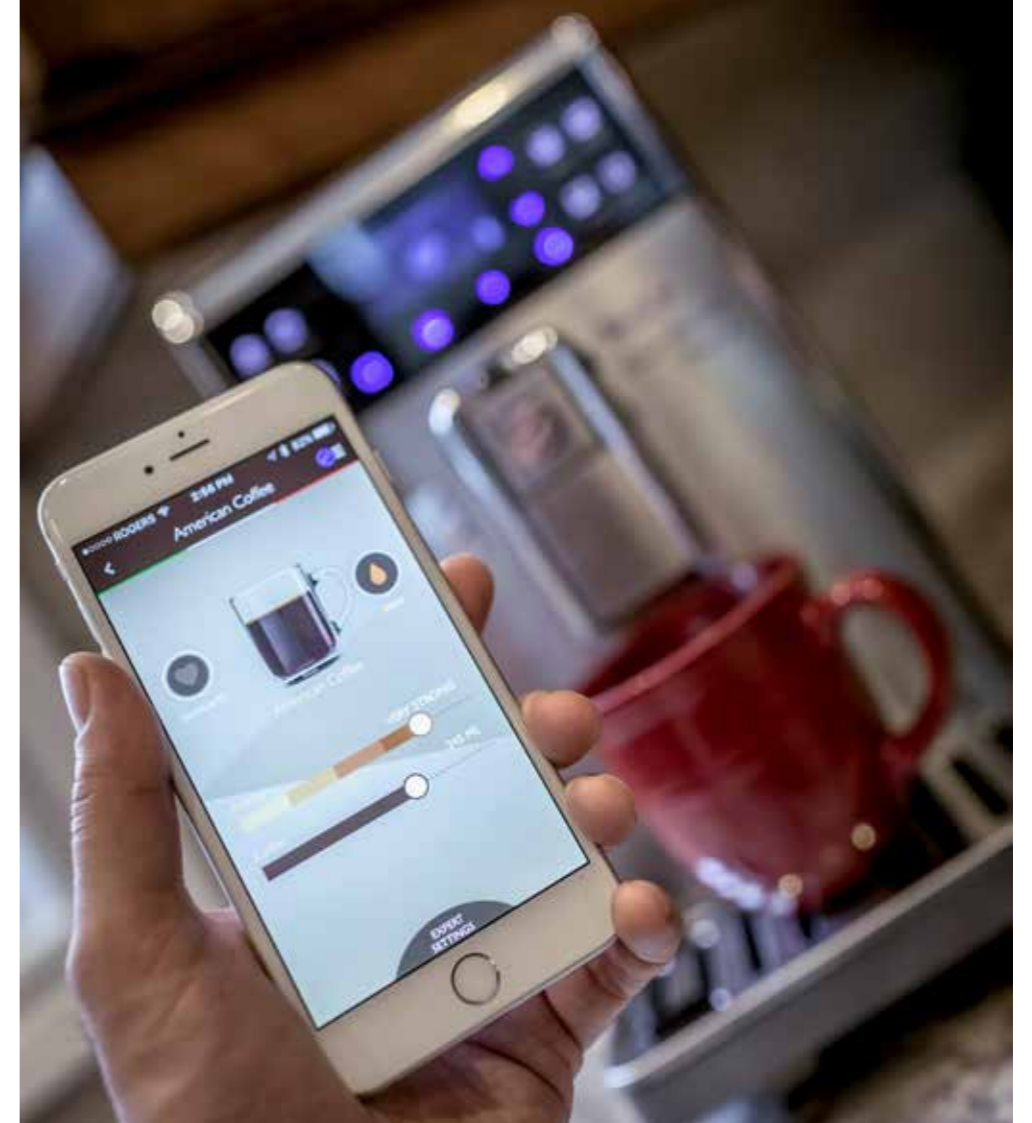


Global challenges were also discussed as concrete examples where IoT can have a significant transformational role.

### Collaborating and sharing

Although multiple organizations, including interest groups and industry consortia, are attempting to establish standards, ISO has its eyes set on collaborative efforts. Earlier this year, ISO, IEC (International Electrotechnical Commission) and ITU (International Telecommunications Union) organized a joint workshop on standards for IoT in Berlin, Germany. The event was hosted by the German Institute for Standardization (DIN), the ISO member for the country, and led by ISO/IEC JTC 1. The aim was to share experience and gain insights on ongoing standardization activities in the area of IoT among the three organizations.

Speakers from various sectors shared their expectations of IoT and how it could impact their area of activity. Several use cases were presented, addressing applications such as smart grids, intelligent manufacturing, supply chain management and wearable smart devices. Global challenges such as energy conservation, smarter cities and improved healthcare were also discussed as concrete examples where IoT can have a significant transformational role. The workshop also examined issues transversal to the different application domains of IoT, such as data privacy and security, and reference architectures. Progress of related standardization is critical for the large-scale adoption of IoT technologies and solutions.



Demonstration of the new Saeco application which controls the bluetooth coffee machine on an Apple iPhone6 Plus.

The workshop concluded that International Standards are of great importance to build a global market for safe, energy-efficient and interoperable IoT devices and systems. Panelists concurred that expanding the existing collaboration between the three international standards organizations is vital for accelerating the successful deployment of IoT. Ultimately, it's likely that more than one collaborative effort will be needed before the state of standards flux settles. No doubt we'll see many more joint efforts to make standards compatible. As a practical matter, though, this pending work will come about in an evolutionary fashion. The experts seem hopeful that we'll start to see a shake-out in 2017 or so – stay tuned.

### Going beyond connectivity

Rapid changes in IoT technology make it challenging for even the most experienced experts to anticipate the future of standardization in the field. What is certain, however, is that the possibilities will be limitless.

Evanhoe, as a futurist, understands the current trends of technology and predicts where they are headed. “The convergence is inevitable,” he says. “IoT goes beyond connected devices, i.e. things with an IP address; all of the automatic identification technologies, including RFID and bar codes, enable IoT by helping to identify the ‘things’ in IoT so it’s all of this working together to enable IoT and its benefits.”

Whether it’s through your phone, wearable tech or everyday household objects, IoT will connect us in ways we can’t even imagine yet. So, if you are looking to hitch your wagon to a rising tide, grab the coat-tails of the coming IoT standards tidal wave and hang on for the ride of your life. ■



# The Internet of Things a very short story

The Internet of Things is the network of physical devices, vehicles, buildings and so on embedded with electronics, software, sensors and network connectivity that enable these objects to collect and transmit data via the Internet.

This year, 2016, we will have **4.9 billion** connected things, so get ready, the Internet of Things is here to stay

Companies like **Google** and **Samsung** are investing in home devices and having a connected kitchen could save the food and beverage industry as much as **15%** annually

The global wearable device market has grown **223% in 2015**

**By 2020,** **250 K** vehicles will be connected to the Internet

According to some estimates, the Internet of Things will add **USD 10-15 trillion** to global GDP in the next **20 years**

Google's self-driving cars average about **10 000 autonomous miles** per week

Based on "17 'Internet of Things' Facts Everyone Should Read" by Bernard Marr.

ATMs were some of the **first** Internet of Things objects as far back as **1974**

The "Internet of Things" is a phrase that **87%** of people haven't heard of

Back in **2008**, there were already more objects connected to the Internet than people





# ARE WE SAFE

*in the Internet of Things ?*

*by Maria Lazarte*

Suppose a criminal were using your nanny cam to keep an eye on your house. Or your refrigerator sent out spam e-mails on your behalf to people you don't even know. Now imagine someone hacked into your toaster and got access to your entire network. As smart products proliferate with the Internet of Things, so do the risks of attack via this new connectivity. ISO standards can help make this emerging industry safer.

As consumers and users of technology, we are often too distracted by the amazing features of the Internet of Things that we don't even take a minute to think about what this means for our privacy and security. Certainly, a connected baby monitor can give parents peace of mind, letting them easily check on their children from their smartphones anytime, anywhere. But when this technology is not protected, we may be inadvertently exposing ourselves and our loved ones. Indeed, spying on random strangers has never been easier. All it takes is a search engine like Shodan – the Google of the Internet of Things (IoT) – which, to highlight the risk of this technology, crawls the net taking pictures of unprotected devices. The inside of our homes, our pets, even our fridges, are only a click away. Some parents realized how vulnerable they were the hard way when the baby monitor they relied on for safety was hacked to

yell obscenities at their sleeping children. It's not surprising that the number of complaints related to IoT technology has risen in the UK alone by 2000% over the last three years.

#### **Brave new world**

The Internet of Things refers to billions of connected smart devices routinely exchanging volumes of data with each other about how we live, work and play. "They purport to make our lives easier, healthier and smarter, and our businesses more productive, but this often comes with a cost," says Prof. Edward Humphreys, Convenor of the ISO/IEC working group on information security management systems. "We want to believe in these technologies because of everything they allow us to do. But we have to be aware of the consequences for the security and privacy of our data."





For example, in your excitement to buy the latest voice-activated smart television, you may fail to consider that this technology needs to be able to “listen” to everything you are saying so it can recognize the right commands. If this stays between you and your TV, then what’s the harm, right? More often than not, however, the communication channels that enable devices to exchange information are not encrypted or otherwise protected from external access. “It’s pretty much like leaving your door open; anyone can walk in any time,” says Humphreys.

The crux of the problem is that most of us expect companies and legislators to have taken these risks on board and done something about them. But if customers don’t understand or demonstrate interest in data privacy, manufacturers won’t either because they know we won’t base our purchasing decisions on those features – we are more likely to buy a webcam because of compatibility, price or even looks! Research by Consumers International shows that the average person spends six seconds looking at the terms and conditions before ticking the consent box, so why should companies bother?

“As far as legislation is concerned, what we do in our homes domestically is rarely protected to

the same extent as organizational data,” says Pete Eisenegger, a consumer expert working on privacy issues at the international and European levels. “Take wearable and portable technology – it tracks and monitors our movements and activities and knows exactly where to find us. If we combine this with all the personal information we provide, photos we post and connections we make, which we often unknowingly give away the rights to, there is room for alarm. Big Data analysis is making it easy to learn about people from their behaviours and preferences.”

In a hyper-connected world, the stakes are high. A recent experiment showed that it was possible to hack a moving car via the entertainment systems and disable the accelerator. “Electronic pacemakers can be life-saving, as long as they are secured from being tampered with. The range of digital technologies that are now emerging and being integrated into the fabric of our lives is overwhelming,” says Humphreys.

“We are seeing the emergence of a brave new world order of Internet technology. This is not just about products but whole systems.” Failure to secure one device can affect others. In 2013, hackers stole millions of credit card numbers from a big US retailer by accessing their systems

through Internet-enabled heating. Vulnerable devices can be used to attack other devices. We need to think of security in IoT like a vaccine. If you are not protected, you risk passing it on to others. The more we protect or “vaccinate” our devices with strong security techniques, the better for all of us.

“This is why I cannot emphasize enough the importance of using information security and privacy standards,” explains Humphreys. “We have a number of solutions to address and minimize many of these risks, and more are on the way – but organizations need to use them.”

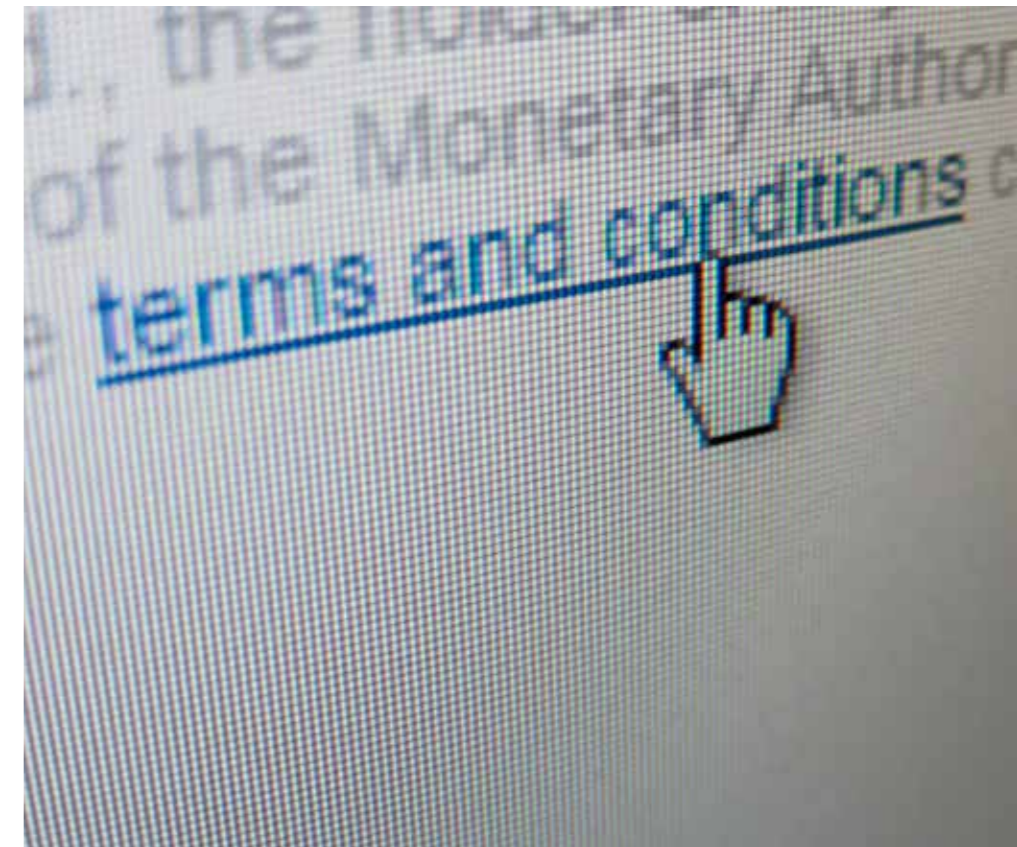
Standards like ISO/IEC 27001 and ISO/IEC 27002 provide a common language to address governance, risk and compliance issues related to information security. ISO/IEC 27031 and ISO/IEC 27035 help organizations to effectively respond, diffuse and recover from cyber-attacks. There are also ISO/IEC standards defining encryption and signature mechanisms that can be integrated into products and applications to protect online transactions, credit card usage and stored data.

For Humphreys, next in line are privacy standards. “We are working to build a solid foundation of standards that safeguard our data in a digitally connected world and reinforce consumer confidence. We hope these can be used to develop solutions that meet the specific challenges of the Internet of Things.”

### Do consumers care?

The problem is further complicated by the fact that many of us have grudgingly, and sometimes willingly, been ready to compromise our privacy and security in exchange for what we regard as more valuable access to state-of-the-art technology. These devices have become must-haves of day-to-day life. Is our data really too high a price to pay for these modern conveniences?

The average person spends six seconds looking at the terms and conditions.





Let's look at consumer behaviour elsewhere online. People regularly upload pictures of themselves and publish videos of their children, they share their political persuasions, their travel destinations and their favourite shopping haunts. The issue is not really whether we should give away so much of our privacy, if we so choose to, but whether we understand the implications of what we are doing and whether we can control what data is collected from us.

As the Internet makes it easier to track and identify people, this information, in the wrong hands, could put us at risk. Awareness of Web security is growing. Research by the National Consumers League in the USA found that 76% of US teens are concerned about privacy and being harmed by their online activity, but people rarely make the connection with IoT.

The ISO committee on consumer policy (ISO/COPOLCO) is pushing these issues into the standardization agenda. Just because consumers don't always understand the consequences of low security doesn't mean they should not

be protected. "Consumer awareness, attitudes and values to security and privacy needs are an important piece of the puzzle that we need to address," says Bill Dee, an ISO/COPOLCO representative. "At COPOLCO we have finalized a report on strategic privacy standards gaps and are now prioritizing the 'privacy by design' of products and services purchased or used by consumers."

### Privacy by design

For Eisenegger, the heart of the problem lies in the fact that, from the start, much of the day-to-day equipment used by consumers in their daily lives is being brought to market with little or no regard for consumer issues like privacy and data protection. "Although there are many international standards that organizations can use to look after our personal information once collected, for IoT to be safer we need to build secure technology with good real-time privacy controls to begin with. Changing our approach

will not only make safety the default, it can also make security features easier to use and update."

Part of the reason why companies fail to protect devices is that the designers developing IoT technologies are rarely security and privacy experts. "Engineers should work with design processes that put a strong focus on these features so that fewer vulnerabilities arise whereas, currently, too many are fixed as an 'after-thought'," says Eisenegger. Hoping to change this, ISO/COPOLCO is proposing to develop a standard on digital design for privacy in goods and services.

"If we could develop a privacy design process inspired by the ISO 9001 continual improvement cycle, as ISO 10377 has already done for product safety, we would be taking a great step forward," adds Eisenegger. "Such a standard could focus on making it easier to trace and protect our data, ensure confidentiality of Big Data analytics and assess product privacy."

"Instead of wondering whether consumers should accept the default security and privacy options currently offered by technologies, products and services, we should be asking what developers can do to build confidence and trust in consumers," says Eisenegger. "It's the new frontier for international security and privacy standards. One that 'vaccinates' products and services, that adequately protects our information and provides real-time consent control over how it can be used. One that minimizes the amount of data collected by devices. One that keeps us informed about any third-party processing, and reinforces traceability and accountability."

If this is successful, then a similar approach could address cross-cutting digital issues like accessibility and vulnerability as well as privacy, while taking into account affordability, fairness and non-discrimination.

So although there is a wide set of cyber security standards currently available, there is still work for ISO in the Internet of Things. "The ISO/IEC 27001 family of standards are really good at helping organizations keep our information secure once it has been collected. But we need to develop solutions specifically targeting the risks raised by IoT," says Eisenegger. Standards are a powerful way of bringing these issues to the international agenda.

We can't wait any longer to take action. Our homes, activities and personal information are now irreversibly intertwined and connected with those of billions of other people through everyday devices. The Internet of Things is taking privacy and security implications to a whole new level by effectively making who we are and what we do accessible online. To keep our lives safe from prying eyes, we need to close the door and put a lock on it. ■



**76% of US teens are concerned about privacy and being harmed by their online activity.**





# Powering up the Web



With the rapid rise in “things” connected to the Internet – from cars to watches to robots – there has never been a better time for standards to truly allow us to realize its potential. ISO’s member for Germany, DIN, tells us how.

**Christoph Winterhalter, Chairman of the Executive Board at DIN, the ISO member for Germany.**

## New Chairman of the Executive Board at DIN

Christoph Winterhalter was elected as new Chairman of the Executive Board at DIN, the ISO member for Germany, effective 1 July 2016. Before joining DIN, he held various global management positions within the ABB Group, where he worked successively in robotics, corporate research and control technologies.

Winterhalter has also been engaged for many years in the German “Plattform Industrie 4.0”, and has been a member of the executive board of the German society of measurement and automatic control. His competence and experience will be invaluable in helping DIN strengthen its position as a competent partner of German industry in all matters of digital communication and technology.

## MEMBER VIEW

Today, there are more things “online” than people. By 2020, more than 20 billion devices will be submitting and receiving data via the Internet to connect with other “things”, without any intervention from us. Of their own accord, these “things” convey information on everything from vital parameters, temperatures, traffic or operating conditions, maintenance requirements and instructions for industrial robots to the steps you have walked and the calories you have burned.

This is known as the Internet of Things (IoT), and with it come the risks related to security and incompatibility and the opportunity for it to work even better. Germany is one of the world leaders in the advancement of Web potential, and managing the risks, with its Industrie 4.0 project to establish Germany as a leading provider and market for cyber-physical systems and avant-garde manufacturing solutions<sup>1)</sup>. Christoph Winterhalter, Chairman of the Executive Board at DIN, tells us how standards can play a major role.

## Growing in value

IoT is the fundamental technology and methodology for all “smart” solutions, be it cities, logistics, health or other. By “smart” we mean making use of the latest technologies to work sustainably

<sup>1)</sup> Germany Trade and Invest, <https://www.gtai.de/GTAI/Navigation/EN/Invest/Industries/Smarter-business/smart-products-industrie-4.0,t=the-internet-of-things,did=384720.html>

and effectively. A smart city, for example, is one that creates sustainable development and a high quality of life in all areas, including economics and infrastructure. Being highly connected to the latest technology is a key foundation for that.

A current report by consulting firm McKinsey concludes that IoT will generate an annual value of up to USD 11 trillion by the year 2025, corresponding to some 11% of global GDP<sup>2)</sup>. By far the main portion of IoT value will be generated by smart manufacturing (known as Industry 4.0), followed by smart cities and smart health.

While IoT is becoming a reality today, it was already predicted some 25 years ago when Mark Weiser published his essay “The Computer for the 21<sup>st</sup> Century” in 1991. He described the connection of individual physical objects (things) through a virtual representation in a structure analogous to the Internet. But it is only now, with the availability of broadband networks, and smart sensors and actuators controlled by highly miniaturized embedded computers, that we can actually see the realization of his ground-breaking vision: the Internet of Things.

## Interoperability is the key

The potential and opportunities for improvement and innovation in a vast number of areas offered by IoT solutions are endless, but there are some key challenges that need to be addressed if it is to develop successfully. The most essential of these are to ensure interoperability and information security as well as an appropriate level of protection of personally identifiable information.

The main value proposition of IoT is the overwhelming amount and ubiquitous availability of data of different kinds, which can be combined, analysed and turned into action. Interoperability is an essential prerequisite to achieve this. Without interoperability there will just be an archipelago of singular solutions. Implementing business models on top of IoT exposes business data to the Internet in far greater measure than was the case in the past. Protecting such data from being stolen or manipulated is therefore of vital importance for any business, which can only exploit the opportunities of IoT if a high level of information security is provided. What’s more, much of the data collected is of a highly personal nature. Techniques like anonymization or pseudonymization, as well as other approaches to ensure suitable privacy, help to create trust in the use of IoT solutions.

<sup>2)</sup> McKinsey Global Institute, “The Internet of Things: Mapping the Value Beyond the Hype”, June 2015.

## The standards opportunity

From a standardization point of view, the biggest challenge is to join the existing standards developed for various vertical industries, such as medicine or transport, with new standards to exploit the potential of IoT. Vertical standards must be amended to reflect IoT aspects, and IoT standards must support the requirements of vertical industries. For example, the “digital twin”, i.e. the virtual representation of a physical object, can only be useful if it represents a valid model of its real-world counterpart in a standardized language format that everybody can understand. To achieve this, a joint effort of vertical and horizontal industry sectors is required.

Today, there is a vast variety of standards development organizations working on standards for IoT, but still there is no widely accepted set of foundational standards. Moreover, some vertical sectors are slow to recognize the work being done in information and communication technology (ICT), one of the founding pillars of IoT. In other words, much of this joint effort is yet to be performed. ISO, along with its sister organization the International Electrotechnical Commission (IEC), can play an important role here. They are where most vertical industries develop their global standards – ISO and IEC standards – which are accepted worldwide. The ISO/IEC joint technical committee ISO/IEC JTC 1 on information technology has published a large number of important standards in ICT – for example on information security or protection of personally identifiable information – and will continue to do so in the future. These are significant assets that the two standards organizations could contribute to make IoT a reality.

## Addressing the challenges

On the other hand, there are a number of challenges that organizations have to address. Firstly, virtually all “smart” technologies are technology-convergent, i.e. they employ technologies from several sectors. Therefore, standardization must have appropriate mechanisms to cope with such sector-overspanning problems. In addition, speed is king in information technology. This means ISO and IEC must have processes and working methods suitable to keep pace with IT developers, where necessary. Finally, they must create an attractive value proposition for other standards development organizations, enticing them to integrate relevant work with the world of ISO and IEC standards.

Addressing these challenges could make ISO and IEC a centre of gravity for IoT-related standardization, which will be key to attracting new players who are not fully engaged in such standardization today. This will help to significantly reduce the risk of market fragmentation and will allow us to fully exploit the huge potential of the Internet of Things. ■





# On the road to transport connectivity

The Internet of Things (IoT) revolution will bring numerous improvements to all industrial sectors, but an area that will realize many of the advantages of IoT in the years ahead is transport. Here, two experts discuss the most important issues as more connected cars come online and explain why they back ISO standards to meet the IoT transport challenge.

IoT is already  
influencing  
how carmakers  
think of the  
future of their  
products.

The Internet of Things (IoT) is dramatically accelerating the pace of innovation in the transportation industry – especially the cars and trucks we drive every day. Today, many vehicles include numerous connected systems that provide drivers with the ability to listen to satellite radio, view streaming video, display and use smartphone apps, navigate roadways, request roadside assistance, unlock doors remotely, and find open parking spaces. Naturally, IoT will also bring to the automotive industry changes that we can't predict yet.

But IoT is already influencing how carmakers build their vehicles and how they think of the future of their products. By 2020, consultancy Gartner estimates that nearly 250 million cars will be connected to the Internet, and PricewaterhouseCoopers forecasts that the connected car market will be worth USD 149 billion by that year. It's clear that IoT will soon be a buzzing business for standards, with ISO/TC 204, *Intelligent transport systems*, leading the pack.

To see where we stand on developments in these areas, *ISOfocus* spoke to Knut Evensen, Chief Technologist at Q-Free, and Dr Young-Jun Moon, Senior Research Fellow and Chief Director at the National Transport Technology R&D Center of the Korea Transport Institute. Here, the two experts from ISO/TC 204 discuss some of today's challenges with IoT, the opportunities that lie ahead, and how standards will shape our increasingly connected and integrated lives.





**ISOfocus:** From your point of view, where do you see the greatest progress of IoT today in the Intelligent Transport Systems (ITS) industry? Is it still too early to tell?

**Knut Evensen:** The greatest progress today is probably that many actors are increasingly aware of the opportunities and challenges that IoT represents. Carmakers, road authorities, infrastructure operators, city authorities and telcos are coming to realize that ITS is one of the major growth areas for IoT.

It is still too early to see the full impact of IoT on our industry, but some pilot sectors are starting to deploy services based on Big Data collected from the transport sector, and many if not most service providers and authorities are taking advantage of this influx of information. This is not true IoT yet, but the business cases are building up and creating a marketplace that will be essential to drive the real transfer to IoT.

**Dr Young-Jun Moon:** IoT might be able to replace one of the major parts of ITS, i.e. data collection and surveillance, with highly reliable sensors for providing not only device-to-device (D2D) connectivity in each ITS station but also Big Data sources in ITS services.

But, I agree, the technology is still too young to be deployed fully in the ITS industry, as the business case for IoT is still lacking due to both technical and economic problems in the marketplace – it’s not cost-effective enough yet.

**What are some of the challenges you see to further developing IoT for ITS, knowing all the complexities?**

**Evensen:** ITS has a number of built-in challenges. Some of these are institutional, where different organizations like carmakers and road authorities are used to having full control over their respective environments. Now, all of a sudden, they have to cooperate on a very detailed level.

Other challenges are proprietary interfaces that have resulted in vendor lock-in over large parts of the traditional ITS industry, as well as issues with data ownership and the question of where data access should be possible in the value chain.

I believe the biggest challenge for an “open future” IoT, however, may turn out to be some early IoT movers with clear business cases and strong financial muscles who manage to corner the market and build a “closed garden” for “their” ITS devices. This is an area where formal standards and regulatory pressure may play an important role to enable a more open market going forward.

**Moon:** For me, I see the challenges for developing IoT best summed up as follows: How can unconventional ITS be introduced with ease, cheaply and simply? How can we get connectivity and interfaces between devices? And how are we going to manage Big Data collected from IoT?

**What role, if any, can standards development play to address these challenges? What specific areas in ITS might require standards in the short term, and does ISO/TC 204 have certain related priorities?**

**Evensen:** Standardization obviously plays a big role in enabling IoT in the ITS domain. Many of the challenges mentioned above can be directly solved by proper technical standards with their related conformance test regimes, whilst other challenges will need regulations to be effective, and then again with standards as the technical underpinning.

This is recognized by the technical committee and we are looking at the various challenges both from a short-term and long-term perspective. In the short term, the current working groups are studying their area of work to see what can be done. Over the long haul, however, there will be a

need to change operations to enable closer cooperation with other working groups and technical committees. Some of the obvious standards needs include creating open data ports in vehicles and roadside equipment, for instance. These data parts are an absolute necessity to avoid the lock-in situation we know now, and to enable the rich local data access that will be needed in most future IoT/Big Data concepts. ISO/TC 204 has started standardization of such data ports, but it will be up to the authorities around the world to determine if these data ports will be mandatory or not.

**Moon:** Such challenges for developing IoT in transportation have to be addressed through standardization, and for ITS, it would be in a committee like ISO/TC 204. The four ITS stations recently defined in ISO/TC 204 as Cooperative ITS – Vehicle ITS Station, Personal ITS Station, Roadside ITS Station and Central ITS Station – should be incorporated with IoT in the short term. This means almost all the working groups directly and indirectly involved with IoT development. But in the long run, ISO/TC 204 may have to be reorganized to further address these challenges.

## Smart mobility

What are Intelligent Transport Systems (ITS)? ITS describe technology applied to transport and infrastructure to transfer information between systems for improved safety, productivity and environmental performance. This includes stand-alone applications such as traffic management systems, information and warning systems installed in individual vehicles, as well as cooperative ITS (C-ITS) applications involving vehicle-to-infrastructure and vehicle-to-vehicle communications.

## The potential of IoT-connected cars

The combination of Wi-Fi and IoT technology paves the way for a bevy of rich services for drivers and passengers alike, such as enhanced navigation, real-time traffic and parking information, streaming infotainment and integration between dashboards, smartphones and wearable devices such as health trackers and smart watches.



**Knut Evensen**, Chief Technologist at Q-Free.



**Dr Young-Jun Moon**, Senior Research Fellow and Chief Director at the National Transport Technology R&D Center of the Korea Transport Institute.



**Looking into the future, how do you see IoT evolving in ITS and smart transportation? What do you envision transportation will be like as IoT evolves?**

**Evensen :** IoT and Big Data can be seen as one of the three main pillars of the ITS future. The other two are connected automated vehicles (CAVs – self-driving cars) and smart cities. These three are interwoven to such a degree that one cannot exist without the other in the future.

The current challenge in the ITS standardization community is twofold. Firstly, this evolution overlaps with the work of several committees that so far have been naturally separate, and that also includes other standards developing organizations. Coordinating all these to avoid an unruly proliferation of standards and potentially harmful overlaps can be a real challenge.

Secondly, we have the same situation inside each committee. The ISO/TC 204 working groups are traditionally set up according to vertical application areas: parking, public transport and tolling/payment systems, for example. These are becoming increasingly interwoven services that consumers expect to find in the same application on their smartphones, and that requires a new level of coordination. ISO/TC 204 has been looking into the need to reorganize its working structure and has several ad hoc groups studying the practical ways to achieve this.



**Moon :** As mobile and nomadic devices such as smartphones have changed transport systems and services in a big way to make people's transport behaviour and trip patterns more "intelligent", IoT might change transport systems and services to make them even more connected, automated and integrated.

People may be able to use transport more efficiently, safely, and "green", taking advantage of information based on Big Data from IoT. New mobility systems including means, infrastructure and facilities should be connected and integrated to provide people with smarter mobility services. IoT will also accelerate evolving vehicle technology with even more connectivity and automated functions.

**How will the work of ISO/TC 204 contribute to achieving greater integration of ITS for the success of IoT? How do you see ISO/TC 204 laying the groundwork with the standards under development today?**

**Evensen :** The changes that CAV, IoT and smart cities bring together already have a big impact on ISO/TC 204. In the short term, all the relevant working groups will be looking into their portfolio of standards to see if changes are needed. For instance, we are creating a common ITS Data Catalogue that will be needed for IoT.

Other examples are the working groups on Cooperative ITS and Communication that have, for several years, been advocating an IoT paradigm with Internet Protocol version 6, and new work around Green ITS and Intelligent Mobility are all aligning with the same new paradigm.

**Moon :** For the past two decades, ITS technology and standardization have focused on two measures of effectiveness (MoE) – safety and mobility. But as information and communication technology (ICT) and mobile devices are introduced into transport, another MoE (i.e. sustainability) is being taken on board in terms of changing travel behaviour and/or trip patterns under the concept of shared economy.

For the future transport society, enabled with IoT and Big Data, those three MoEs are to be combined and harmonized to prepare a new paradigm of ITS involving automation, electrification and mobility integration to provide services that are safe, smart and green. ■

People may be able to use transport more efficiently, safely and "green".







People stop to look at the evening movie show in the world's largest and longest LCD screen in Beijing.

# China connects the world *with standards*

China is unarguably the world's leader in machine-to-machine connectivity, a network solution frequently heralded as the next industrial revolution. Seizing on the promise of this new digital age, the country is banking on standards to turn the Internet of Things into a major pillar of the Chinese economy.

The Internet of Things (IoT) ecosystem is expected to be vast, with some 50 billion devices to be connected by 2020, predicts Cisco Systems Inc., an IT company specializing in networking solutions. Although it is a global phenomenon, China leads the world in the delivery of IoT with 74 million connections at the end of 2014 – almost one-third of the global market – according to GSMA, an organization representing the interests of mobile operators worldwide. The reason is simple. China's extraordinary economic growth has resulted in a newly affluent

middle class that is driving demand for key cellular IoT applications and connected consumer goods. The country's enormous population has also spurred the construction of new cities requiring transport networks and infrastructure, which provide a fertile substrate for IoT development to flourish. For China, a breakthrough growth in the digital age could also be the key to maintaining stable productivity growth, but without the right enabling conditions that opportunity could be lost.



To realize its full potential, IoT must enable a plethora of machines, devices and vehicles to exchange information; and the key to enabling communication between all these diverse “things” is standardization. To find out more, *ISOfocus* asked Jie Shen, Jianhui Li, Mingjuan Wu, Tao Xing and Shuyi Chen, five experts from the Wuxi SensingNet Industrialization Research Institute in Wuxi, Eastern China, how the country is tackling this incredibly complex issue.

### The Great Enabler

From ancient times to the present, human society has evolved constantly to reach the information era in which we now live, a knowledge-based society surrounded by a high-tech global economy that originated in the digital revolution of the latter half of the 20<sup>th</sup> century. Yet, despite spectacular technological advances, we are still faced with a number of challenges, especially in populous developing countries like China.

As a new world superpower increasingly focused on socio-economic welfare, China pays close attention to issues affecting its people’s everyday lives such as food safety, traffic congestion and environmental pollution. In essence, most of these intractable issues occur because the information resources in the physical world have not been fully explored and efficient connections between the human world and a variety of information resources have not yet been established. IoT is considered the major “enabler” for future developments in information and communications technology, to create seamless and harmonious connections around the world, boost economies and improve people’s daily lives.

### Early bird

Since early 2009, IoT has become the key technology underpinning China’s strategic industrial development. The Chinese government set its focus firmly on IoT, heavily promoting its use in the development of a number of industry applications following the policies for enterprise digitalization and cloud-based sharing solutions enshrined in the country’s 12<sup>th</sup> Five-Year Plan (2011-2015) and 13<sup>th</sup> Five-Year Plan (2016-2020). This resulted in a myriad of IoT application pilot programmes being launched, developed and popularized in areas such as public safety, intelligent transportation, environmental protection, food traceability, healthcare, industrial manufacturing, agriculture and electrical energy.

## China’s IoT market is predicted to reach USD 325 billion by 2020.



China’s IoT market has grown in leaps and bounds since 2009 and is predicted to reach USD 325 billion by 2020. What’s more, the country accounts for 56% of the Asia-Pacific market (excluding Japan). A large number of these initial IoT applications have laid a sound foundation for the rapid development of IoT in China. Many well-known enterprises – big names such as mobile vendors Huawei, Xiaomi and ZTE, and white goods manufacturer Haier – are optimistic about the prospects of IoT and have invested considerable amounts of money in its development. In the not-so-distant future, IoT business and manufacturing models are expected to evolve further until they are successfully adopted.

### The pivotal role of government

As it has done in other IT sectors, China’s central government is leading developments. Faced with the diversity and complexity of IoT, Chinese government and industry are acutely

aware of the importance of standardization to enable the development of IoT from real-life experiences. But standardizing IoT for the country’s diverse industry is a complicated and arduous task. Many questions must be answered, such as how to accurately define the boundaries of IoT, how to coordinate the development of its different application domains, how to establish a top-level business/technology planning framework, how to develop a coordination mechanism between a great number of start-up businesses, how to break down the existing “information isolated islands” to achieve big data fusion, and so on. After a long and in-depth study combined with practical applications, Chinese experts and organizations involved in IoT standardization have made great progress in organizational structure, working mechanism, top-level reference architectures and standardized systems, generating an IoT roadmap for future development.



The business world has become a powerful driving force for IoT standardization.



In 2011, a National Working Group on Basic Standards for IoT (IoT BS) was established under the stewardship of the National Development and Reform Commission of China, which is responsible for the overall planning for the country, and the Standardization Administration of the People's Republic of China (SAC), the ISO member for the country. The IoT BS is to focus on developing foundation standards for IoT and coordinating the work of relevant technical standards bodies in China, such as the standards organizations on radio-frequency identification (RFID), sensor networks, instruments and equipment, network communications, and others.

In collaboration with the Ministry of Industry and Information Technology, government agencies for public security, transport, agriculture and the environment, among many, as well as other industrial associations, the IoT BS set about forming the sub-working groups that would be devoted to IoT application-specific standards. A formal standardization framework thus emerged for basic and common profiles, as well as application-specific profiles, and standards development organizations for the different ramifications of IoT were duly established.

### Architecture is key

Standardization is easy in a research environment but difficult to achieve in the real world. Reference architectures are of great help for standardization as they define guidelines that can be used when planning the implementation of an IoT system. By analysing the commonalities of a multitude of IoT applications and systems, an IoT Reference Architecture (IoT RA) was hence developed based on a six-domain model. It provides a top-level framework for IoT design, development and industrial cooperation in the diverse and complex ecosystem of IoT applications. Furthermore, the IoT RA guides the creation of new IoT-based business models.

With the standardization framework and Reference Architecture for guidance, IoT standards organizations, and other relevant industrial associations in China, were able to develop a large

number of standards, including Chinese national standards, industry standards and association standards – a trend that is accelerating as many enterprises join in standards development programmes. In fact, the business world has become a powerful driving force for IoT standardization, moving from low-value-added product manufacturing to an innovative high-tech manufacturing industry, which now leads China's economic development.

China has also been actively involved in international endeavours for IoT standardization through its participation in study groups on sensor networks, such as the ISO/IEC JTC 1 SGSN in 2008 (later superseded by ISO/IEC JTC 1/WG 7) and other working groups, including ISO/IEC JTC 1/WG 10 on IoT Reference Architecture in 2014, responsible for the future ISO/IEC 30141, and, more recently, ISO/IEC JTC 1/WG 11 on smart cities.

China has played an important role in these international working groups by proposing and promoting new projects and leading the IoT standardization efforts. It also takes the organizational lead on a number of international IoT standards, with many Chinese experts assuming convenor or secretary roles in ISO technical committees.

### A leap of faith

We are looking forward to an exciting and promising future, transformed by the social and economic benefits that will surely emerge from the adoption of IoT technologies. At the forefront of this technology, China is working hard to establish an extensive cooperation mechanism involving global experts, institutes and private enterprises in many countries across the globe, to share experiences and lessons learned from IoT worldwide.

The advent of IoT could be a game-changer for China, ushering in a new era of global competitiveness for our industries. By harnessing the potential of continuous connectivity, this marvellous technology promises to bring about another industrial revolution, enabling a “disruptive leap” in productivity, driving economic growth and enriching our lives. ■







# ***The next frontier for business***

The Internet of Things is already changing lives today. Businesses are responding to the new promises offered and the challenges raised. Standards, meanwhile, help resolve some of the related complexities.

Standards are  
critical for ensuring  
interoperability.

The Internet of Things (IoT) has been labelled as “the next industrial revolution” because of the way it will change the industrial landscape, working life and production systems, as well as how governments and businesses interact with the world. In fact, the revolution is already starting.

So what are the changes taking place and how are business models evolving? *ISOfocus* consulted David Welsh from Corporate Standards at Microsoft, to discuss standards and the Internet of Things. Here, he reviews the opportunities and challenges of IoT adoption, the role of standards and the ways in which business could contribute to the rise of Industry 4.0.

***ISOfocus*** : Everyone’s excited about the arrival of the Internet of Things, but are there potential obstacles to its adoption?

**David Welsh** : The Internet of Things brings the promise of new services, innovative business models and the harnessing of data to facilitate everything from improved predictive maintenance to a better consumer shopping experience. However, according to a recent report by the World Economic Forum, one of the greatest barriers keeping businesses from adopting IoT is the lack of interoperability, or standards, which can significantly increase complexity and cost.

At Microsoft, we are committed to standards and interoperability in IoT, and belong to several IoT-specific standards organizations and consortia on a national and international level. Standards are critical for ensuring interoperability between a broad set of processes and equipment that are worth decades of investment for many companies.

**What are the other challenges faced by businesses when moving forward in IoT?**

Interoperability is one piece of the puzzle, but when it comes to what’s on the mind of global enterprises, and as more businesses connect the devices and assets they already own to unlock new business value, security will also come to the foreground. At Microsoft, we believe that IoT standards should address a number of critical issues, including cyber-physical security, “notice and consent”, globally relevant IoT standards and alignment with other countries’ IoT strategies and international trade commitments.

In the foreseeable future, the scale of connected “things” will reach new heights. According to Gartner, 6.4 billion connected things will be in use this year and more than 20 billion by 2020. The tremendous growth of connected devices and assets has increased concerns about security challenges in IoT. Unlike traditional IT security, where the focus is on securing software and data, IoT requires extending security for both software and hardware, often referred to as cyber-physical security. Protecting IoT solutions requires ensuring secure provisioning of devices, secure connectivity between these devices and the cloud, and secure data protection in the cloud during processing and storage.



### What is the relationship between standardization and IoT? How should new standards for IoT be developed?

The development of open, voluntary, consensus-based and globally relevant standards is a major driver for a robust and competitive IoT marketplace. Standards are particularly crucial for IoT because they provide the basis for interoperability, which is needed to ensure that new IoT systems and legacy technology systems can work together.

Collaboration with industry is key to the development of any new IoT standards. Openness and interoperability between hardware, software and services will help both enterprises and government transform how they operate. Standards for IoT must reflect the fact that IoT relies on functions that are both traditionally information technology (IT) as well as customarily operational technology (OT).

Standards organizations should therefore be developing, when necessary, and adopting, when available, OT- and IT-aligned reference models, architectures and open interfaces for IoT. For example, in the case of smart manufacturing, existing standards need to be amended to fully enable advanced industrial technologies to develop, especially in cyber-physical security, cloud-based manufacturing services, supply chain integration and data analytics.

Today, there are a number of standards available that must be considered together, in an integrated fashion, to facilitate the transformative business opportunities of smart manufacturing: ISO/IEC 27000 on information security, ISO/IEC 28000 on supply chain security, and IEC 62443 on industrial control systems and automation.

### What are the challenges that need to be addressed in the immediate future to get manufacturers, particularly the big manufacturers that use different approaches, on board?

Manufacturers today face a number of unique challenges as they struggle to stay competitive and deliver greater value to customers. These companies need to be able to connect a broad range of equipment and software that often spans decades of investment. Many manufacturers see the potential of IoT to solve these challenges but, in order to execute the vision, they need a platform that is open and secure and provides all the required services to deliver complete solutions.



David Welsh from Corporate Standards at Microsoft.

### How is IoT changing lives in the USA?

Many people currently associate IoT with purchasing wearables, such as a fitness monitor, or connected home products, such as a thermostat. That said, for every person who personally touches IoT through a wearable or connected home, there are many other average Americans who don't think they've experienced IoT. This is where many businesses are often putting the power of IoT to work to improve consumer experiences – even if they are not actively aware of it.

This is, in some ways, the real “Internet of Things”, where the brands you trust have a massive opportunity to make your life better. Microsoft works with many of them, including Gojo Industries, inventor of the Purell hand sanitizer, by tracking hand hygiene compliance through the Microsoft Azure IoT service to make patients in hospitals safer from germs, and Rockwell Automation, which uses Azure IoT and data

This IoT movement has the potential to improve the way we work and live.

technology (including Power BI business intelligence) to automate the collection and analysis of data from remote installations across the petroleum supply chain.

### How do you see IoT evolving over the next ten years? Where do you see the role of standards in untangling some of the tricky issues?

In the near term, IoT is providing the connective tissue making the transformation of both industrial and consumer markets possible. The flow of data from the network edge back to central IT is creating a new era where machine intelligence, with live telemetry from the real world, is disrupting conventional industrial practices around the globe, changing how we use transportation, for example, and allowing us to build safer vehicles with increasing productivity on the factory floor for a more competitive industry.

Fuelled by digital connectivity, cloud computing and powerful new machine analytics, this IoT movement has the potential to improve the way we work and live as significantly in the next ten years as mainstream IT and the Internet did over the past 60 years.

Over the next decade, as manufacturers move beyond the infrastructure and connectivity challenges, they will begin experimenting with new capabilities enabled by the IoT improvements and sophisticated data analysis. As they expand beyond the manufacturing floor to integrate with external business partners, smart buildings and cities, and consumers, standardization activities will shift to semantic integration, interoperability across different ecosystems and vertical business domains, and secure data management. Looking forward, industry-led initiatives hold the most promise for overcoming such complexity. ■





**EURO 2016 WINS SUSTAINABLE DEVELOPMENT**

EURO 2016, the European Football Championship, earned certification to ISO 20121 for its sustainable operations management at the tournament in France.

Both UEFA, the governing body of European football, and its organizational partner EURO 2016 SAS, implemented a committed and innovative strategy for EURO 2016, which built on previous initiatives put in place at the final tournaments in 2008 and 2012.

A comprehensive strategy, embedded at the heart of tournament operations and featuring numerous measures, contributed to the ISO 20121 certification. For example, spectators were not only encouraged to use public transport to stadiums but they were also provided with an “eco-calculator” enabling them to offset their emissions, as did UEFA officials and all 24 participating national associations.

New initiatives were developed, such as carpooling and taxi-sharing options, to optimize mobility. Other actions included various programmes promoting respect on and off the field through the “Celebrate Football” campaign, the monitoring and recording of incidents of discrimination at matches, and ensuring total accessibility to games for disabled spectators.

**SUPPORTING STANDARDS PROMOTION IN SOUTH AMERICA**



*Marketing and communication staff from ISO members in the South and Central American region meet in Buenos Aires, Argentina.*

Growing national awareness about standardization and increasing the promotion of standards were the topics of a recent workshop held in Buenos Aires, Argentina. The event, hosted by IRAM, the ISO member for Argentina, brought together marketing and communication staff from ISO members in the South and Central American region.

The three-day workshop provided an opportunity to discuss some of the challenges national standards bodies face when communicating about and promoting standards. Topics included adapting to the changing needs of today’s standards user, market segmentation, new products and how to get the most out of digital communication tools on an often limited budget.

Challenges and opportunities specific to the region were also discussed in a session led by Kory Eguino, Executive Secretary of COPANT (Pan American Standards Commission). The event was part of the ISO Academy programme implemented under the ISO Action Plan for developing countries.

**THE SOLUTION FOR GLOBAL SERVICES**

The power and potential of standards in the services sector was the theme of the global ISO #servicestandards social media campaign that took place recently to raise awareness of the importance of standards for driving economic growth and improving the quality of services.

Services are the largest component of most economies, according to the World Trade Organization (WTO), and the demand for standards to ensure a high level of service is increasing proportionately. How to meet this demand and where the future lies were therefore key themes of the campaign. They were also the focus at ISO’s international workshop, “Global services: ISO standards as solutions”, held in Geneva at the same time.

The event brought together experts from standardization bodies, consumer organizations, international trade organizations and representatives in the services sector to share best practices, expectations and experiences.



**Read more about service standards at [www.iso.org/servicestandards](http://www.iso.org/servicestandards).**



**Watch the video on the impacts of ISO 50001:**



**ISO 50001 IN THE LIMELIGHT**

An international conference to highlight the value of ISO 50001 on energy management systems was held in June 2016 in Stockholm, Sweden.

The event, organized by the Swedish Standards Institute (SIS), ISO member for the country, and the Swedish Energy Agency, in cooperation with ISO, served to commemorate the fifth anniversary of ISO 50001, which boasts nearly 7 000 organizations certified to the standard at the end of 2014.

ISO 50001, *Energy management systems – Requirements with guidance for use*, specifies requirements for establishing, implementing, maintaining and improving an energy management system. The aim is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, use and consumption.

After five years of existence, time has come to revise ISO 50001 to ensure it remains a useful tool for all types of businesses and organizations around the world. Experts from nearly 30 countries also met in the Swedish capital the same week to discuss and advance the revision work.

**BRAZILIAN CITY OF PINHAIS ADOPTS ISO 18091**

Pinhais, in Paraná State, Brazil, recently signed its City Action Plan thanks to the use of an ISO standard for quality management in local government.



*Participants receiving their attendance certificates issued by ABNT/CB-25, the Brazilian Quality Committee (mirror committee for ISO/TC176).*

Using the Brazilian version of ISO 18091 (which provides guidelines for the application of ISO 9001 in local government), and guidance developed by SEBRAE (Brazilian Support service for SMEs), Pinhais was able to develop and formally adopt its 2016-2017 Action Plan by assessing its current situation and identifying actions for improvement in sustainability and administration.

It is the first time in Brazil that an international management standard such as ISO 18091 has been formally applied through a legal provision.

*ISO correspondent and subscriber members participate in a week-long training to maximize their involvement in ISO standards work.*



**NEW RIGHTS PILOT PROGRAMME**

The New Rights Pilot Programme (2014-2019) is an ISO Council initiative that opens up the possibility for correspondent and subscriber members to take an active part in ISO standards development work.

Some 30 ISO members are taking part in the pilot, which acts as an extended training environment for members looking to eventually upgrade to full membership and demonstrates to their stakeholders the advantages of engaging more fully in international standardization. It also helps alert decision

makers to the need to expand participation into other ISO topics relevant to national economic, social and environmental priorities.

As part of the programme, 25 participants recently attended a week-long training course at the ISO Central Secretariat in Geneva, Switzerland, to learn more about their rights and obligations and how to maximize their involvement.

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# How **standards** meet GLOBAL ECONOMIES

by Sandrine Tranchard

It's no secret that voluntary standards play a vital role in supporting economic growth by boosting productivity and innovation. However, the impacts of standards within businesses and their supply chains are less well understood. Three comprehensive studies by ISO members seek to shed light on the often invisible benefits of standards.

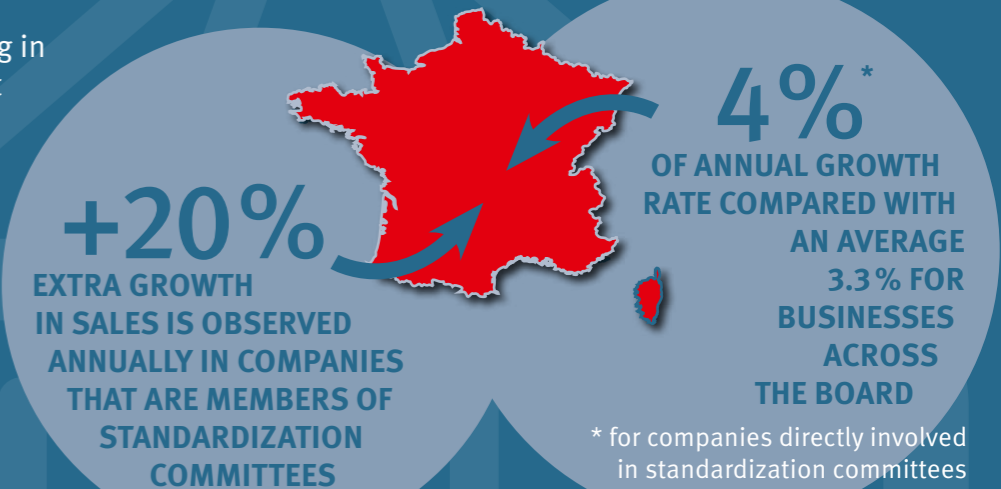


# FROM SALES TO PRODUCTIVITY

Recent studies conducted in 2015 by ISO members, such as the British Standards Institution (BSI), the Standards Council of Canada (SCC) and France's national standards body (AFNOR), demonstrated the impacts of standards on sales, export and productivity in their respective economies.

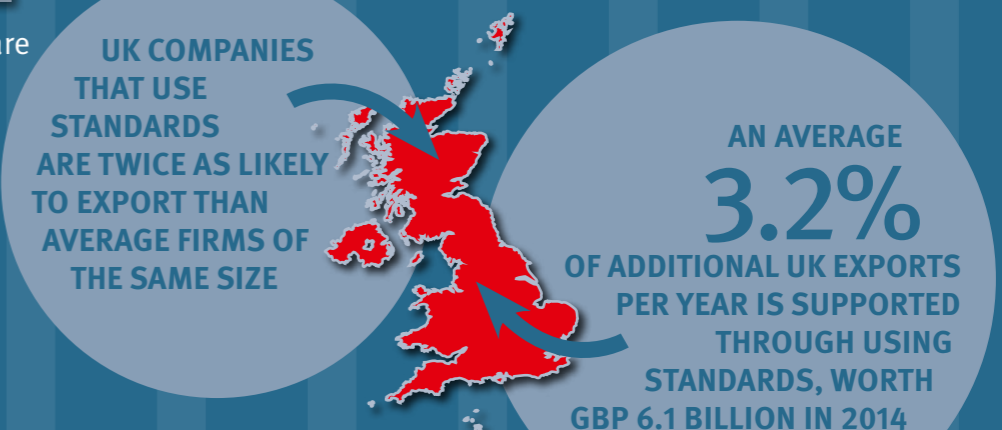
## IN FRANCE

Companies participating in standards development measurably increased their economic performance.



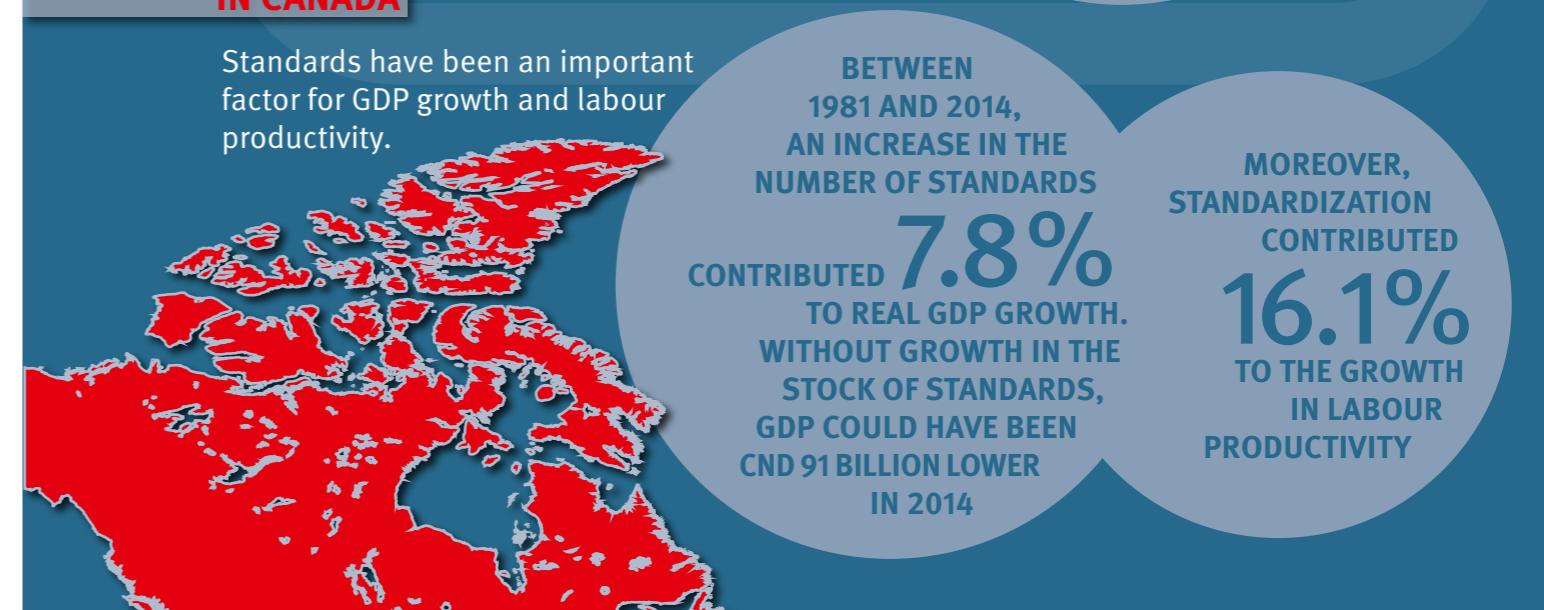
## IN THE UK

Standards are a passport to export.



## IN CANADA

Standards have been an important factor for GDP growth and labour productivity.



The state of the global economy, with all its ups and downs, has proved to be a topic of growing concern in recent years. In a world still suffering the aftermath of the 2008 financial crisis, considered by many economists to have been one of the most severe depressions since the 1930s, economic policy makers, business leaders and politicians are called upon to find solutions to overcome prevailing crises, reduce uncertainty, stimulate investment, revive growth... in short, restore confidence.

The truth is, the global economy is in a rut. "Growth is flat in the advanced economies and has slowed in many of the emerging economies that have been the global locomotive since the crisis." Such was the stark observation made by Ángel Gurría, the Secretary-General of the Organisation for Economic Co-operation and Development (OECD), as he unveiled the OECD Economic Outlook, a twice-yearly analysis of major economic trends, during the organization's annual Ministerial Council Meeting and Forum in Paris in the second quarter of 2016.

"Slower productivity growth and rising inequality pose further challenges," he added. "Comprehensive policy action is urgently needed to ensure that we get off this disappointing growth path and propel our economies to levels that will safeguard living standards for all." That is where voluntary standards can help.

Over the years, many studies and surveys have clearly demonstrated the economic benefits of standardization on national economies and recognized their potential for facilitating international commerce by helping to break down barriers to trade. As a matter of fact, a series of recent studies<sup>1)</sup> conducted by ISO members in Canada, France and the UK points to a direct link between the use of standards and economic growth, labour productivity, the ability to export, and more.

1) These studies were carried out by independent market research companies for ISO members, respectively, the Centre for Economics and Business Research for BSI, the BIPE for AFNOR, and the Conference Board of Canada for SCC.

Titles of the studies are:

- *Getting aligned. How adopting standards affects Canada's productivity and growth* (SCC)
- *The economic contribution of standards to the UK economy* (BSI)
- *Study of the economic impact of standardization* (AFNOR)

Over the years, many studies and surveys have clearly demonstrated the economic benefits of standardization on national economies.





The empirical analysis showed that standards were associated with an increase of nearly 3 billion Canadian dollars (CND) in Canada's real gross domestic product (GDP) in 2014 and contributed around 28.4% of annual GDP growth in the UK, which translates to 8.2 billion pounds sterling (GBP) as measured in 2014 prices. Similarly, the French survey revealed that the direct contribution of standards to France's GDP amounted to EUR 3 billion in 2013.

### The causal effect

For John Walter, Chief Executive Officer of the Standards Council of Canada (SCC), "The tangible benefits of standards are all around us. They keep

our society running efficiently and safely; they protect us by ensuring the safety of the food we eat and the products we use; they reduce costs to consumers and give us greater choice by providing access to global products."

That being said, the economic benefits of standards are not always as obvious, he concedes, which is why it was important to undertake the study in order to clarify and confirm the essential role that standards play in fuelling a more competitive and innovative Canadian economy. "Because the Standards Council of Canada relies on evidence to deliver standardization solutions that provide value to Canada, research like this is an important part of our work," he asserts.

Companies and governments  
need to understand and  
embrace standards.

For its part, France's national standards body, AFNOR, had already conducted a study in 2009 demonstrating, at the national level, the strong correlation, over two decades, between economic growth ratios and the stock of standards. The conclusive results motivated AFNOR to carry out a second round of analysis.

AFNOR's General Director, Olivier Peyrat, summarizes it thus: "We felt last year that it would be ideal to step up a gear and to investigate, at the French level again, the causality link, if any, between the development and actual use of standards on the one hand and the growth/export rate on the other hand."

This new study is amongst the first, if not the first, to illustrate this causality link and not just the strong correlation, Peyrat explains. This is very good news indeed, both from the micro- and macroeconomic point of view, and reveals just how standards help remove barriers to world trade by providing the technical basis on which political trade agreements can be put into practice, be it at the regional or international level.

### Enabling the economy

For Scott Steedman, Director, Standards, at the British Standards Institution (BSI), the reason behind the UK study on economic benefits of standards was to get an updated – and impartial – estimate of the impact of standards on productivity at the national level. "Together with the UK Government's Department for Business, Innovation & Skills, we decided to commission a new study on the economic benefits of standards as it had been ten years since the previous study. It was important to us to engage an external research agency so that the study could be independent."





## Getting the word out

The results are unequivocal. Investing in standards pays dividends for organizations that use them and standards generate more benefits than they cost to implement. But these conclusions serve no purpose if they are kept under wraps. So how did our ISO members spread the good news?

### AFNOR (FRANCE)

AFNOR launched its promotional campaign by sharing the study results with the media and all its stakeholders, be they private or public. Naturally, it then wanted to disseminate the findings to the international community. Moreover, each of AFNOR's employees continues to use the data to promote the value of standardization among its business partners – any executive should pay attention to such strong arguments.

### BSI (UNITED KINGDOM)

To disseminate the good word, BSI arranged a coordinated press and social media strategy to match the study's launch date in June 2015. It produced support materials (a summary brochure, two infographics and display materials) as well as a video explaining the findings, which it published on a dedicated Web page for BSI customers and committee members. Copies of the report were also sent to senior contacts in business and government. Moreover, BSI has spoken about the study, which is also available in Chinese, at stakeholder meetings hosted by ISO members in several countries.

### SCC (CANADA)

As a Crown Corporation of the Government of Canada, SCC openly shares important research data by making it freely available on its Website ([www.scc.ca](http://www.scc.ca)) and promoting it when meeting with stakeholders, both in Canada and internationally. Given the technical nature of the research, SCC also developed an infographic to highlight key results in an easy-to-understand manner.

The core message is that standardization affords a genuine advantage for the economic activity of companies that get involved in it.

Echoing these thoughts, Olivier Peyrat hopes that the French study will convince national governments to rely more significantly on voluntary standards as a lever of economic growth, whether in conjunction with smart regulation or as a means to support R&D policies.

The core message is that standardization affords a genuine advantage for the economic activity of companies that get involved in it. As Peyrat says, “Voluntary standards are a key factor for the acceleration of growth; thanks to them, companies can break into export markets with technologies, services or an organization that are benefitting from all the value contained in standards.”

International studies continue to provide evidence of the link between standardization, productivity, return on investment and economic growth. In an unstable global economy, standards help companies unlock their potential in terms of products, processes and management and contribute to supporting domestic and international trade. They should therefore be seen not as a constraint but as a tool that helps businesses thrive and compete, ensure safety and support economic growth. What is more, standards are the blueprint that help governments and regulators build effective policies for an innovative and sustainable world – for the benefit of future generations. ■

One thing that hadn't been included in the previous study was a sector-based analysis in seven key sectors, says BSI's Director of standards, which involved interviewing 527 companies about their use of standards. This gave some microeconomic context to the overall macroeconomic study.

Steedman also highlights that the main thing companies and governments should take away from the study is that, whether you represent a company, a sector or a government department, you must have a standards strategy in place, for the study clearly shows that the highest-performing sectors are those that make the best use of standards. “The most important thing that companies and governments need to know about standardization is that standards are an enabler for the economy,” he emphasizes. “Standards improve productivity, increase trade and accelerate innovation.”

## Why standards matter

In simple terms, for Canada's John Walter, standards are fundamental. “Companies and governments need to understand and embrace standards,” he says. “Investing in their development, implementation and conformity assessment pays dividends for those who do so.”





