

SMART SERVICE WELT

Recommendations for the Strategic Initiative
Web-based Services for Businesses

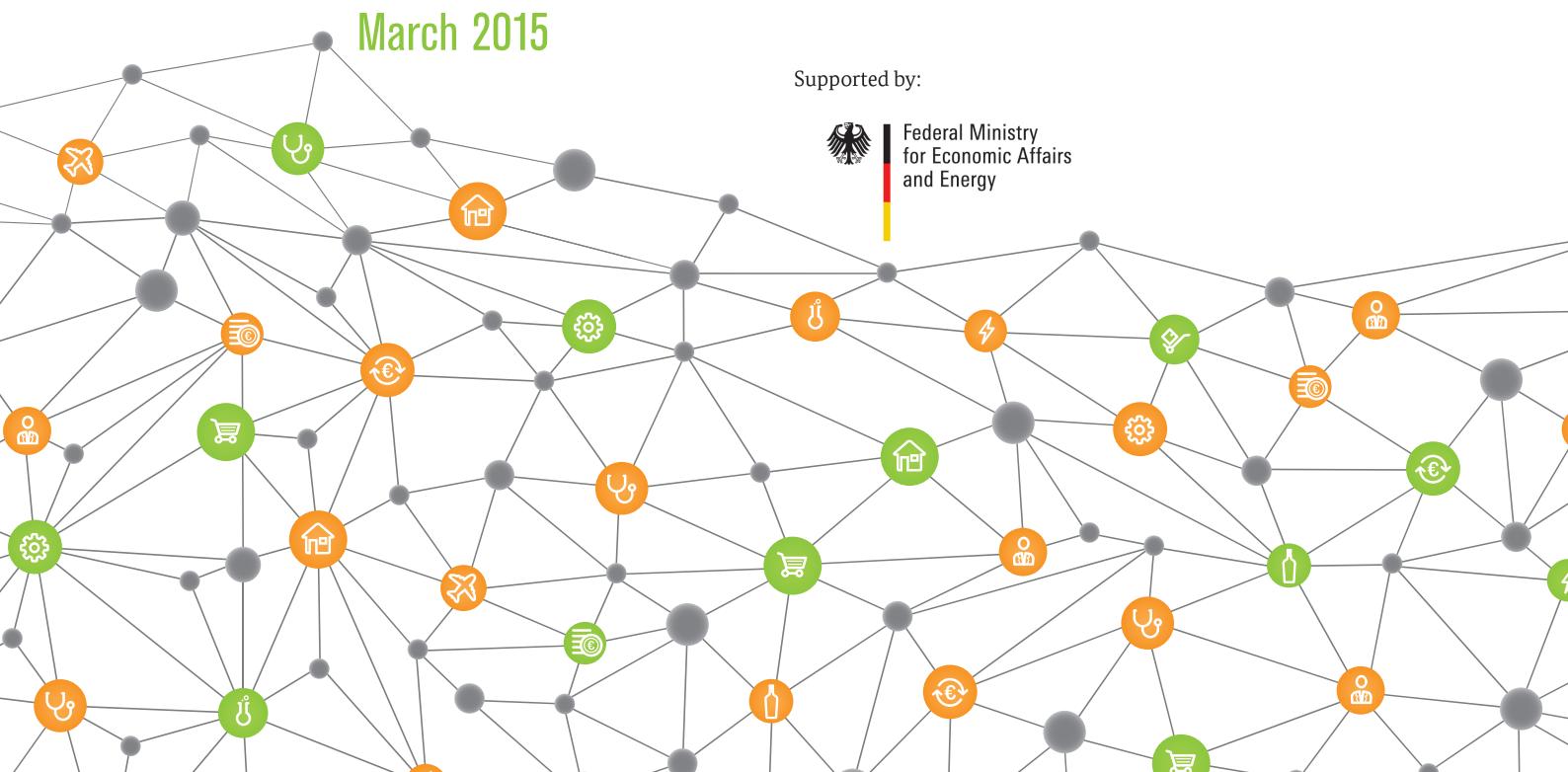
FINAL REPORT
SHORT VERSION

March 2015

Supported by:



Federal Ministry
for Economic Affairs
and Energy



Imprint

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HEILMEYER UND SERNAU ■ GESTALTUNG

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Logo design

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Graphics

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Printing

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Publication date: March 2015

Supported by:



Federal Ministry
for Economic Affairs
and Energy



on the basis of a decision
by the German Bundestag

The Working Group would also like to thank the following organisations for their support:

ABB Ltd.

IG Metall

Accenture GmbH

Merck KGaA

BDI

Nokia GmbH

BITKOM

Robert Bosch GmbH

BTC AG

SAP SE

Boehringer Ingelheim Pharma

secunet Security Networks AG

GmbH & Co. KG

SICK AG

Deutsche Bahn AG

Siemens AG

Deutsche Post AG

Sirrix AG

Deutsche Telekom AG

Trumpf GmbH & Co. KG

EIT ICT Labs

Google Germany GmbH

IBM AG

and Dr. Lars Schatilow

Recommended citation:

Smart Service Welt Working Group/acatech (Eds.): Smart Service Welt – Recommendations for the Strategic Initiative Web-based Services for Businesses. Final Report, Berlin, March 2015.

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Legend of symbols

-  highlight the key messages throughout the whole report.
-  designates a cross-reference to other chapters in the Final Report that contain related or more detailed information.
-  indicates that further information is available online.

Note

All personal attributes in the following report equally apply to women and men regardless of their grammatical form.

Smart Service Welt 2025: A vision for optimising industrial processes

The **Smart Service Welt¹ 2025 vision** focuses on manufacturing, both to provide continuity with the vision of Industrie 4.0 and because Germany is starting from a particularly strong position in this area.

Nevertheless, it can also be directly **carried over to other fields of application**. Automated marketplaces for logistics service providers are already a reality in the private transport sector today and can be expected to become established in heavy goods transport in the future. Data-based optimisation of the value chain – covering everything from seed quantities and fertiliser type to the entire harvest processing and logistics chain – will become increasingly widespread in the agricultural sector. Healthcare will benefit from significant gains in effectiveness and efficiency as a result of both decentralised monitoring of patients' condition through continuous data collection and personalised treatment thanks to the improved diagnoses enabled by intelligent algorithms. In the smart grids sector, new business models are already springing up in areas connected with the energy trade. It is thus apparent that in certain fields of application it will be possible to implement individual aspects of the Smart Service Welt vision even sooner than in the manufacturing sector. Further details are provided in the use cases.

► Chapter 2

The Smart Service Welt 2025 vision follows on from the vision of smart factories in Industrie 4.0. In the **smart factory, individual customer orders determine** manufacturing processes and the associated supply chains. The smart factory produces smart products: intelligent, networked objects, devices and machines that underpin the services provided in the Smart Service Welt. These smart services are put together based on users' needs.

In the Smart Service Welt, all of these **machines**, systems and factories can be easily **connected to the Internet via digital platforms**, using the "plug & use" approach. They are then represented virtually on these platforms. Their integration via the platforms enables the field data level – i.e. the products' operating data – to be accessed from any location.

The **platforms are operated by German and European companies**. They are available to machinery manufacturers and users as well as to service providers and form the infrastructure of the new digital ecosystems. The platforms consist of a number of different software components. Critical (software) **modules** and **enablers** are developed and supplied by German and European firms. As a result, the smart manufacturing services provided via these platforms have become a **successful export for Germany and Europe**. A European digital single market ensures efficient market access and rapid scalability for new smart services. This has created numerous opportunities for **startups** and **small and medium-sized enterprises**, which have become pioneers of the Smart Service Welt by providing complete smart services or developing individual modules and enablers. On the shop floor, employees have gone from being no more than machine operators to being creative leaders and decision-makers in the smart factory. Meanwhile, top floor **employees** systematically leverage the opportunities offered by digital technology. Smart services help these smart talents to manage the complexity of the new environment.

In the Smart Service Welt, all kinds of different smart services are realised for users (see Figure 1):

- Potential disruption or goal conflicts in cross-company value networks can be anticipated and prevented thanks to the wide availability of the relevant data. Factories automatically post requests for any services needed to resolve these issues **on fully automated marketplaces**. Conversely, machines and service providers actively seek out work on these marketplaces. Orders for complex smart services continue to be placed by the customer, however.
- Service providers offer fully automated delivery of smart services either remotely or on site. Crucially, this is done predictively, before problems actually occur. This is also made possible by **better-quality knowledge work**. This gain in quality can be achieved thanks to the fact that analyses, diagno-

ses and recommendations in the Smart Service Welt are generated automatically and are thus available at all times. Machines, systems and factories continuously feed back operating – i.e. empirical – data into the platforms. This enables **self-optimisation** of the value-added processes. Moreover, **remote access** ensures that human experience and cognitive abilities also inform processes on site.

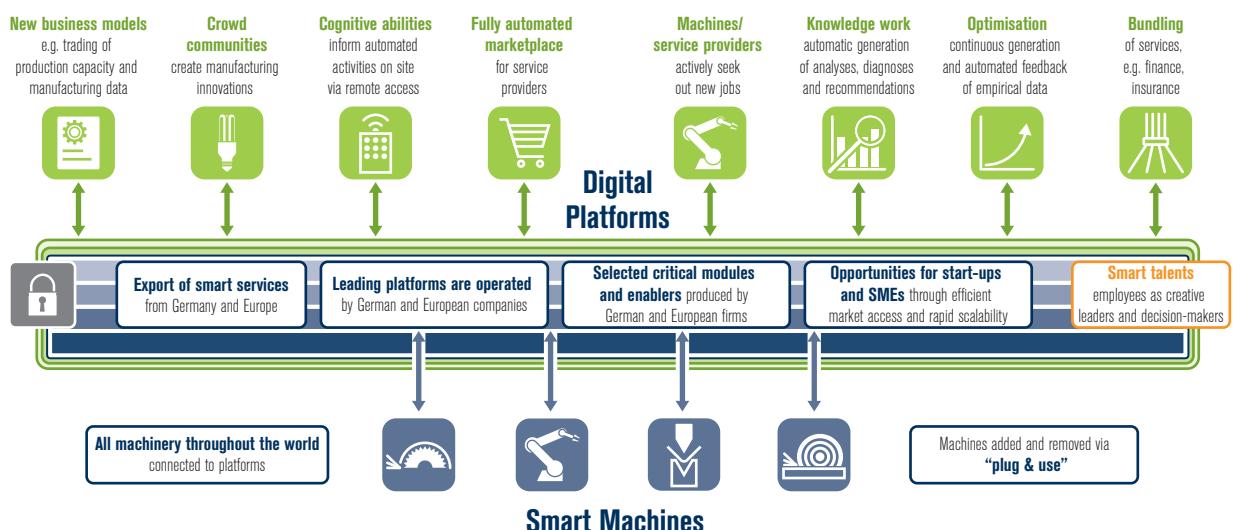
- **New business models** have become established, for example the trading of production capacity or manufacturing data as an alternative service, or performance contracting. Manufacturing **innovations** and data-based product and business model innovations are developed by crowd communities.
- The greater transparency of industrial processes has led to the establishment of **new smart finance and insurance concepts** such as “everything as a service”, “pay-per-use” and customer-/system-specific insurance policies.
- Systematic training and continuous professional development ensure that **employees** have the skills needed to cope with the digitisation of value creation in the Smart Service Welt. Employees’ role in the Smart Service Welt is characterised by responsibility and autonomy.

- At a technical level, it has been possible to establish **comprehensive security management** with proactive protection mechanisms for the Smart Service Welt. These have been systematically built in by design and implemented at an operational level through supporting organisational measures. The security offered by German smart service solutions has increased their appeal and popularity around the world.
- The tension between privacy and IT security has dissipated thanks to the forging of a widespread consensus on this issue throughout society.

As a result, by 2025, the productivity of German manufacturing industry has risen by more than 30 percent. Despite being a high-wage economy, Germany has been able to maintain value creation and employment levels whilst securing its long-term competitiveness.

¹ The German term “Smart Service Welt” is rendered as “Smart Service World” in English. However, for the purposes of this report the authors have chosen to retain the German expression.

Figure 1:
Smart manufacturing services 2025



Source: Siemens 2014

Executive summary of the final report

Smart products are already ubiquitous. The term "smart product" refers to objects, devices and machines that are equipped with sensors, controlled by software and connected to the Internet. They collect all types of data, analyse them and share them with other devices. One in two Germans now owns a smartphone. Moreover, a high proportion of the machines made in Germany already connect to the Internet during operation. These include passenger cars and trucks, construction and agricultural machinery, turbines and engines, solar installations, heating systems and smart meters, fire alarms and other alarm systems, lifts, internal doors, traffic lights, cameras, TVs and music players, kitchen appliances, toothbrushes and increasingly also wearables. No industry and no area of our daily lives have been left untouched. Even public squares, crossroads, exhibition halls, factory buildings, conference rooms and rooms in people's homes are increasingly being digitally connected to create smart spaces.

The global race for data is truly underway

Today, in 2015, around 15 billion products around the world are connected to the Internet. By 2020, this figure is expected to rise to 30 billion.

At present, the consumer and domestic technology sectors account for approximately 50 percent of smart products, while the mobility sector accounts for 25 percent and industry for 20 percent.

The data volume in the Internet of Things, Data and Services will continue to grow rapidly. If German industry wishes to rank among the key players, then it has two to three years to ensure that as many as possible of its smart products installed all over the world are connected to the Internet so that the data generated by them during use can be employed to produce smart services. In other words, Germany must become a global leader in the supply of smart products and smart services and use its position as Europe's leading market to put these products and services to the test.

Smart services enhance smart products

Smart products are the products manufactured by Industrie 4.0, a vision of the fourth industrial age that has been jointly formulated by government, industry, the research community and the social partners. Industrie 4.0 is characterised by the mass manufacture of customised products in batch sizes of as low as one in a highly flexible manufacturing environment, together with the development of processes to enable self-optimisation, self-configuration and self-diagnosis. The factories of the future are run by well-trained employees who are supported in the performance of their complex tasks. The communication and interaction with the machines is facilitated by personalised information tailored to individual machine workstations. The potential of Industrie 4.0 in practice is amply demonstrated by examples such as Siemens' Amberg plant, the manufacturing facility at Wittenstein and the new production system introduced at Festo.

It is estimated that Industrie 4.0 can deliver annual manufacturing efficiency gains of between six and eight percent.

Once they have left the factory, smart products are connected via the Internet. They exchange ever-larger volumes of data during use. It could be argued that these mountains of data (big data) actually constitute the most important raw material of the 21st century. The big data is analysed, interpreted, correlated and supplemented in order to refine it into smart data. This smart data can then be used to control, maintain and enhance smart products and services. Smart data can generate knowledge that forms the basis of new business models. In other words, big data is refined into smart data, which is then monetised through new, individually combinable smart services. In the industrial context, a smart service might, for example, involve providing compressed gas "as a service" to meet the needs of specific situations, as opposed to simply selling compressors. For private consumers, meanwhile, a smart service might allow them to freely mix and match mobility services online instead of having

to buy their own car. German businesses continue to be too slow to make the switch from suppliers of high-quality products to providers of attractive and flexible smart services.

Smart service providers are able to anticipate customers' wishes more and more accurately. New high-power algorithms that include 1,000 or more parameters for interpreting data from heterogeneous sources are improving the quality of business process forecasts by a factor of 1,000, 10,000 or even 100,000.

The mail order company Otto is a case in point. It uses an intelligent algorithm provided by startup company Blue Yonder to calculate daily updates to its sales forecasts for the coming weeks and months for each and every one of the two million plus items in its range. The algorithm incorporates around 200 variables such as the previous year's sales, current product promotions and even the weather forecast. This provides Otto with a strategic advantage, allowing the company to improve the accuracy of its sales forecasts by between 20 and 40 percent, depending on the product category. As a result, they are able to ensure that

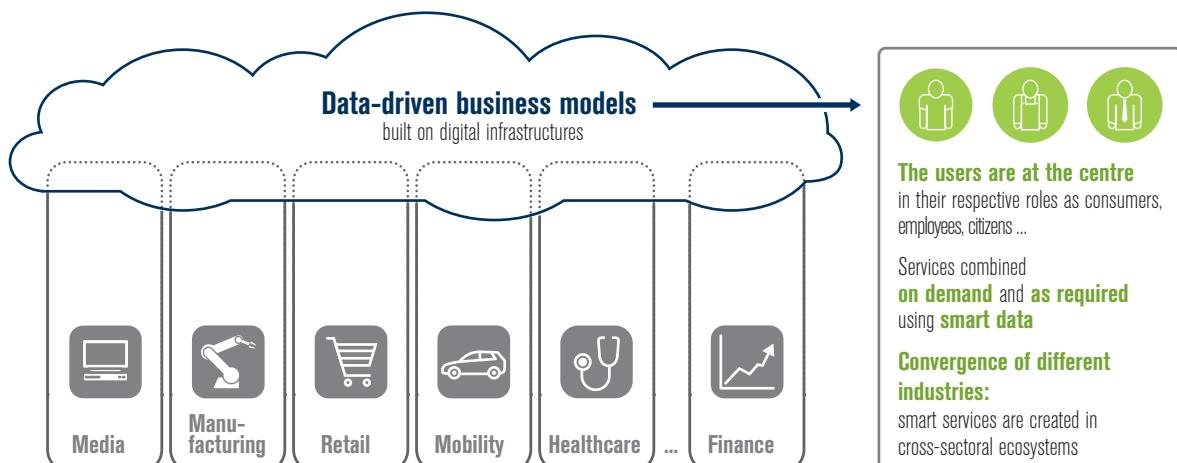
products do not sell out too quickly whilst still reducing stock levels in their warehouses.

The Smart Service Welt is disruptive – it is centred around the user

The Smart Service Welt is centred around the users who employ services in their respective roles as consumers, employees, citizens, patients and tourists. As far as the customer is concerned, smart services mean that they can expect to obtain the right combination of products and services to meet the needs of their current situation, anytime, anywhere (see Figure 2).

Smart service providers therefore require an in-depth understanding of their users' preferences and needs. This calls for them to intelligently correlate huge volumes of data (smart data) and monetise the results (smart services). To do this, they require data-driven business models. In order to develop these business models, providers need to understand the user's ecosystem and situational context. This understanding is based on data and its analysis. All the actors in a network collect data. The ability to correlate huge quanti-

Figure 2:
Smart services: the user is at the centre



Source: Deutsche Post DHL

ties of data obtained through smart products in real time and use this information to provide customers with highly customised smart services is having an enormously disruptive impact on traditional business models throughout the economy. In addition, the marginal costs involved in scaling up smart service business models are much lower. This is because the "as a service" model is often significantly cheaper than the equivalent "ownership" model.

Smart service providers can also use smart data for producing forecasts (real-time predictive analytics) that provide direct input into how the products are controlled, enabling previously unattainable levels of quality and service. For example, a lift manufacturer whose lifts are controlled using software that knows the movements of people on different levels of the building and at its entrances, as well as people arriving from the local public transport network, can increase the lifts' carrying capacity over the course of a day by 50 percent or more. Any competitors who do not have access to this smart service may quickly lose their ability to compete.

These disruptive business models are built on three key components: 1) digital ecosystems and marketplaces, 2) integrated payment functionality and 3) secure user IDs (see Figure 3).

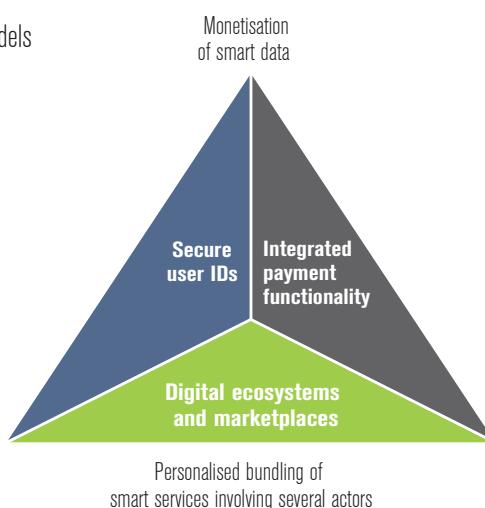
The user has now replaced individual suppliers with their traditional products and services at the centre of these business models. These digitally savvy users expect the right combination of products and services to meet their individual needs to be available "as a service" at all times. Users possess a secure digital ID that is linked to an integrated payment function for smart services.

This shift from product-centric to user-centric business models entails a particularly painful paradigm shift for suppliers of successful products. Since most manufacturers will lack the in-house expertise to execute this switch, smart products will often be combined in real time with third-party services on new digital platforms in order to create smart services.

Digital market leadership will require new digital infrastructures and platforms

At a technical level, these new forms of cooperation and collaboration will be enabled by new digital infrastructures. **Smart spaces** are the smart environments where smart, Internet-enabled objects, devices and machines (smart products) connect to each other (see Figure 4). They are reliant on an underlying high-

Figure 3:
Key components of smart service business models



Source: Accenture 2015

performance **technological infrastructure**. In addition to the much-discussed nationwide upgrading of the broadband network, the ability to guarantee domain-specific latencies (5G) is also key to ensuring real-time data analysis and delivery of the associated smart services. The technological infrastructure will therefore play a system-critical role in the forthcoming transformation of industry and society.

While the term “**smart products**” can refer e.g. to actual production machines, it also encompasses their virtual representations. These products are described as “smart” because they know their own manufacturing and usage history and are able to act autonomously. They are connected to each other via the technological infrastructure layer in order to form **networked physical platforms**.

In the next layer, the data generated on the networked physical platforms is consolidated and processed on **software-defined platforms**. Complex algorithms are used to collect, combine and analyse the data. Software-defined platforms then make this refined data available to smart service providers. Virtualisation also means that service platforms are no longer tied to physical objects or to a specific manufacturer’s smart

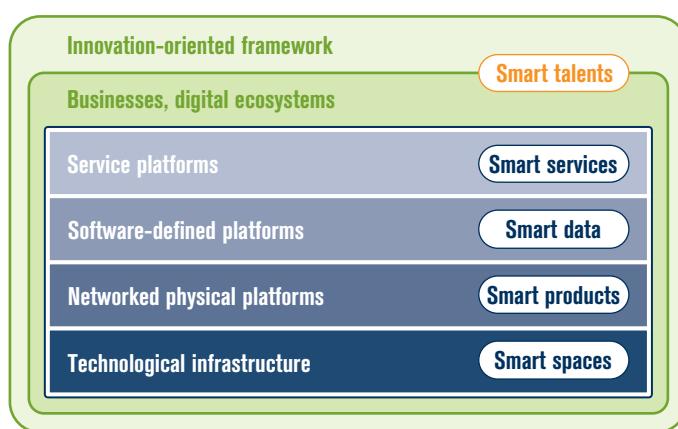
products. Software-defined platforms thus constitute the technology integration layer for heterogeneous physical systems and services.

In conjunction with comprehensive service engineering – i.e. the systematic development of new services – the data are finally refined at the **service platform** level to create smart services. Providers connect to each other via these **service platforms** to form **digital ecosystems**. The service platforms act as the business integration layer, providing the basis for seamless, largely automated and legally compliant collaboration between the different actors so that they can share knowledge and trade information, goods and services.

The establishment of software-defined platforms and service platforms – and the online marketplaces and app stores built upon them –, together with their associated ecosystems, will be key to competing successfully on the global market.

However, successful new business models will only emerge where complex smart products and smart services are combined and orchestrated by well-trained employees, or **smart talents**.

Figure 4:
Layer model
of digital
infrastructures



Source: DFKI/acatech/Accenture

Smart Services are transforming Germany's leading industries

Germany's strength lies in the incremental development of complex, premium-quality intelligent products such as vehicles, machine tools, medical equipment and domestic technology. Increasingly, these products are software-controlled, augmented with supplementary digital functions and able to connect to the Internet. These enhancements are turning them into smart products.

According to two recent Accenture studies¹, Germany's leading suppliers in the mechanical engineering, automotive, logistics, energy and chemical industries compare very favourably with their international competitors in terms of the excellence of their smart products (see Figure 5). Exceptionally well-trained skilled workers, a modern approach to management and first-rate products mean that Germany's industrial enterprises are extremely well placed to succeed in the Smart Service Welt.

Product support-based digital business models are not very profitable at present

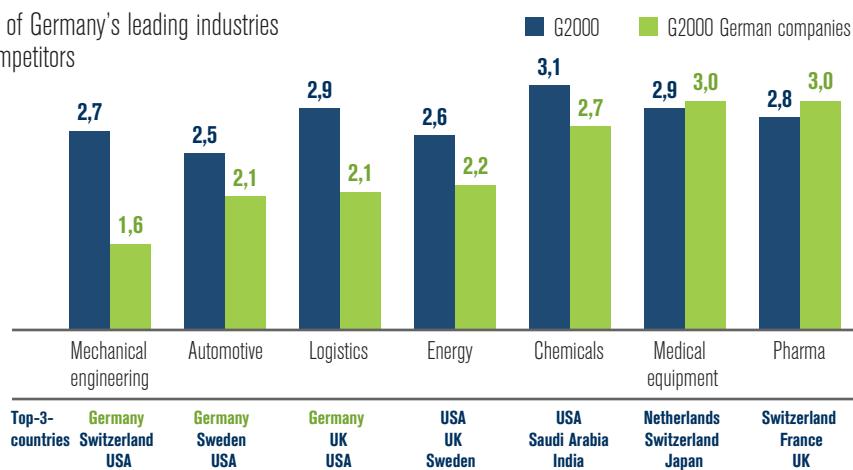
In terms of the maturity of smart services, however, German industry is still largely at the stage where it is using them to optimise and increase the efficiency of

existing processes (see Figure 6). This strategy is already widely employed in practice. Heidelberger Druckmaschinen was one of the early trailblazers, while Trumpf's machine tool business, GEA's milking machine business, Siemens' gas turbine business and Thyssen-Krupp's lift business all use smart services to optimise their equipment's operation. However, it is often difficult for manufacturers to bill customers for the smart services that support their products, meaning that they struggle to recoup their investment in digitisation. As far as the customer is concerned, they expect the equipment to function correctly one hundred percent of the time. If that means that the manufacturer has to invest heavily in digitisation, then it is certainly something the customer wants, but rarely something for which they are prepared to pay a premium.

Many German manufacturers of premium products appear to be prisoners of their product support-based business models.

However, continuing to focus narrowly on product-centric niche market leadership is no longer a viable option. Smart services are unleashing a wave of disruptive business model innovations that has already swept through many industries and will be coming to the rest before long. Critical system knowledge about

Figure 5:
Digital competitiveness of Germany's leading industries compared to global competitors



Digital competitiveness of G2000 companies by industry (n=227); Ratings: 1 = highly digitised, 2 = digitised to some extent, 3 = digitised to a very limited extent, 4 = not digitised at all; based on Accenture G2000 company rankings and Accenture's Digital Index.

Source: Accenture 2015

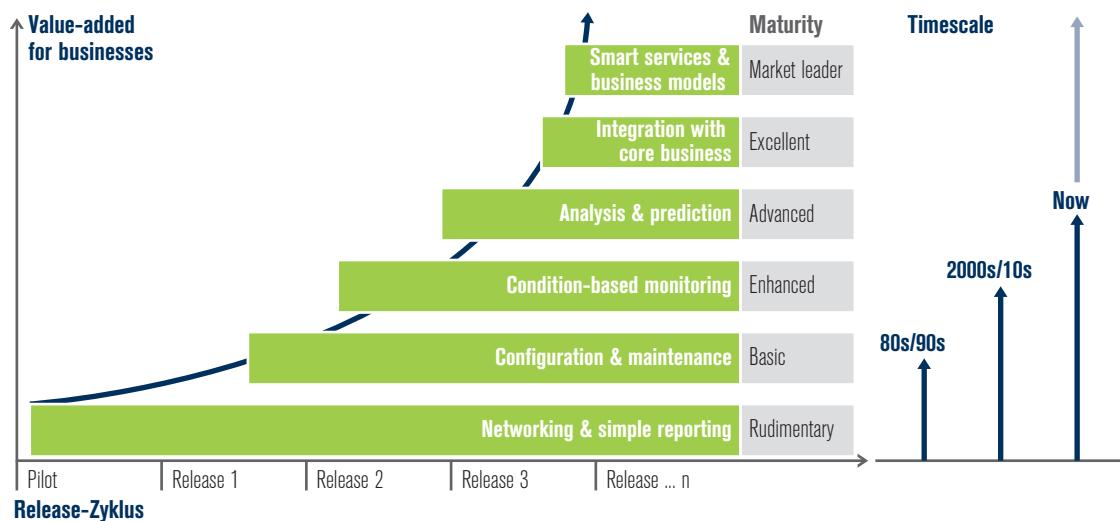
digital value networks and combined smart services is therefore key to the survival of German and European industry. In the final analysis, whoever controls the service platforms will also gain control of the entire value chain. Trustworthy, neutral intermediaries are in a position to balance the interests of providers and customers. However, intermediaries can also attempt to supplant manufacturers and service providers by gaining sovereignty over the data and seizing control of value-added control points so that it is they who ultimately write the new ground rules. The global race for control of the data and platforms is already truly underway.

Chapter 1

This is illustrated by the example of Uber, a company that provides a taxi hiring service without actually having physical assets of its own. Uber uses platforms to scale its business model. This allows it to add new online customers or drivers – i.e. people who use their own cars to provide the service – at virtually no cost to the company.

There is nothing new about platform markets. Indeed, the success of platform markets is a big part of the history of e-commerce. Auction portals and online marketplaces have revolutionised the retail trade, while hotel and travel portals have had a similar impact on the tourist industry. As the Internet of Things,

Figure 6:
Maturity of digital business models



Features of smart services

- User-centric, cross-company and cross-sector
- Very often data-driven
- Extremely agile – short release cycles
- Data and algorithms increase value-added – economies of scale are key
- Lateral business benefits often come about as a side-effect
- Market leaders employ the following elements:
 - Algorithms
 - Platforms
 - Marketplaces and digital ecosystems

Source: Accenture 2015

Data and Services continues to grow, these platform models are now also finding their way into traditional industries.

Nevertheless, the vast majority of smart product manufacturers have yet to join the race. Even though they do have expertise in connecting smart products, collecting and analysing big data and providing specific smart services, this is still not enough for them to become players in cross-company smart service ecosystems. These ecosystems are characterised by the erosion of boundaries between companies and a readiness to work with different partners, all supported by underlying digital platforms. This requires suppliers of smart products and services to develop new cross-sectoral cooperation models.

There is already fierce global competition to control both the platforms and smart products' operating data. However, only a handful of smart product manufacturers have entered the fray – companies with specific smart data and smart service expertise currently dominate the market.

Despite this, there is no reason why a machine tool manufacturer like Trumpf, for example, should not become a smart service provider, e.g. by establishing a marketplace for their products and the associated data. This would enable tens of thousands of users to share information, allowing them to optimise set-up times, material usage, machine parameters and power consumption, as well as minimise fault sources and downtime, etc. The practical experience built up by thousands of users adds value to the machines, since this store of operational expertise is now available to everyone. The machine manufacturers can either ask people to pay a service charge for using the marketplace or charge users for downloading apps.

Some of the other use cases outlined in this report also highlight a fundamental trend towards vertical industrial solutions. This strategy involves suppliers trying to cover several of the layers within the digital ecosystem by starting with their own product portfolio and supplementing it with smart services and smart talents. There is no real difference in this respect between companies

from Europe and the US such as Bosch, General Electric, Philips and Siemens.

Nonetheless, many German product manufacturers remain wedded to their traditional product-centric business models. The rate at which they move is determined by their products' relatively slow innovation cycles. Furthermore, many of them lack both in-depth expertise in the field of digital business and the ability to develop new, data-driven services and business models. They are thus a long way off being able to engage in flexible and open cooperation in digital value networks.

This means that it is (far too) easy for new market players originating from digital niche markets to gain a foothold. These players' innovation cycles are significantly shorter than the development cycles of product manufacturers. Moreover, visionary smart service entrepreneurs tend to be willing to live with lower quality if this means that they can get the service out onto the market more quickly so people can start benefitting from it. First generation satnavs are a case in point.

Technological sovereignty is key to future profitability and job protection

The success of the German automotive industry demonstrates that not all the basic technologies and components for digital business models necessarily need to come from Germany or Europe. It will, however, be crucial to be the leading supplier of the elements that are strategically important for adding value, especially the engineering and systems integration services for the platforms. Germany was one of the early pioneers and market leaders in the fields of business software and big data platforms. Software companies such as SAP and Software AG as well as research organisations such as the German Research Center for Artificial Intelligence (DFKI) and the Hasso Plattner Institute (HPI) have given Germany a competitive advantage in this market. Europe must maintain or attain technological leadership in the system-critical components that are key to success. These include the principal building blocks of the platforms such as security technologies, semantic technologies, real-time algorithms, predictive analytics and cloud computing.

► Chapter 3

Software-defined platforms and service platforms provide an open run-time environment for smart services. In other words, they provide the general basic functions for systems integration, data analysis and collaboration in digital ecosystems. These platforms run in highly automated cloud centres.

In the Smart Service Welt, cloud centres play the same role as factories in the product-centric world – they are the manufacturing facilities of smart services.

The control points for the digital value chains reside in the software-defined and service platforms. Failure to steal a march on the competition in terms of access to these platforms and the associated data will mean that the race for digital leadership is lost. If this happens, it will be others who skim off the profits from smart services.

Now that platforms are the new control points in terms of profitability, the development of system knowledge has become a critical success factor. German businesses and research institutions therefore need to develop and implement platform architectures, integrating the individual components to create commercially viable platforms. Furthermore, the suitability for everyday use of the individual platform solutions must be tested in use in order to assess their cost-effectiveness, user acceptance and reliability. This will be key to enabling rapid scaling up of German platform solutions.

The Industrial Internet Consortium (IIC) launched in the US is indicative of the widespread interest that exists with regard to cross-company cooperation to test smart services in use. The IIC was established in March 2014 by GE, Cisco, Intel, AT&T and IBM. As an open consortium, it now counts more than 130 organisations from around the world among its membership. The participating companies provide the technology environments for developing Innovative Industrial Internet² prototypes that can be rapidly realised in testbeds for certain priority areas. The initiative has thus created an ecosystem of companies from different industries that work together and share ideas, best practices and thought leadership in connection with the Industrial Internet.

German industry need to establish an agile strategy similar to the Industrial Internet Consortium to enable pre-competitive, cross-company test bed piloting of use cases and its own leading platforms. This strategy should be organised and paid for primarily by the industrial sector.

Security and trust are the Achilles' heel

The Smart Service Welt requires complex networking of a wide range of decentralised components via the Internet. This often involves the exchange of large volumes of sensitive data where each component is accompanied by its own security risks. In conjunction with the rapidly rising proportion of software in all areas, the fact that several components are connected to each other across different companies means that there is a much bigger target for potential attacks. As a result, the number of targets for cybercrime and cyberterrorism is rising. IT security and data protection are therefore key to the success of the Smart Service Welt.

► Chapter 3.3

100 percent safety and security can only be achieved in closed systems. However, open systems are a fundamental requirement in the Smart Service Welt paradigm. Safety and security can therefore only be relative. Industries such as the automotive industry and the manufacturing sector have already been living with the “relative” safety paradigm for many years. Today, if an automotive manufacturer tried to convince its customers that its vehicles could offer them 100 percent safety, their promise would not be considered credible. However, manufacturers have learned to provide “relative safety”, offering very high safety standards as a product feature that can be certified by third parties such as the TÜV. Smart service providers need to adopt a similar approach by defining verifiable quality indicators so that they can establish quantifiable relative security standards. It will be essential for these security solutions to be both transparent and user-friendly. It should be easy for users to tell whether the service they are using is sufficiently secure to meet their needs. This will instantly enable them to take better precautions themselves.

"Resilience by design": the new security paradigm of the Smart Service Welt

It is not that there is a shortage of security solutions. The problem is that they are not being used systematically and cost-effectively.

IT security comes at a cost. Truly effective security solutions for the Smart Service Welt need to be implemented right from the planning and development phase (security by design). This involves substantial planning and investment which is nonetheless indispensable. In order for our society to continue its journey towards the Smart Service Welt, the underlying technological infrastructure will need to be largely fail-safe, reliable in use and protected against all forms of tampering. Since 100 percent security is not a realistic proposition, the infrastructure will need to be capable of responding flexibly to unexpected attacks and preserving or rapidly recovering its functionality – in other words, it will need to be resilient.

Many industries – for example the aviation and rail industries and electronic stock exchange and payment systems – already have established IT security solutions that guarantee a high level of security and resil-

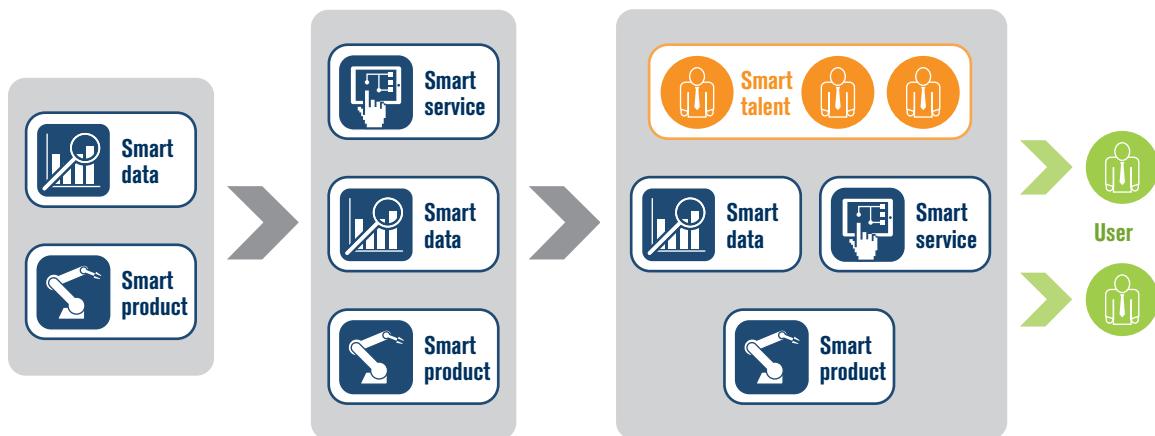
ience for their services. These solutions can be carried over to the other fields of application in the Smart Service Welt. Resilience by design thus constitutes the security paradigm of the Smart Service Welt.³

The formula for becoming a leading digital supplier

Successful new business models will emerge where complex smart products and smart services are combined and orchestrated by well-trained employees, or smart talents. These digitally trained smart talents will deliver combined physical and digital services that are increasingly provided "as a service" (see Figure 7).

These value chains extend far beyond the boundaries of any individual company. They require highly-scaled platforms where all the players are organised into an ecosystem and knowledge that increases the smart services' value-added is traded on marketplaces. "Smart talents" are the architects of these digital business models. Well-trained human resources who are capable of working with integrated physical and digital services will be absolutely indispensable in order to achieve leadership in the digital economy. Smart services should therefore be shaped in a way that pro-

Figure 7:
Smart talents as a key success factor



Source: acatech

vides a better proposition for users, contributes to social welfare and permits workers to enjoy decent working conditions.

It is by combining smart products, smart services and smart talents that it will be possible to become a leading supplier in the Smart Service Welt. Germany is well placed to do just this.

The following example from the field of healthcare illustrates the point. An X-ray machine (smart product) manufacturer creates a service platform that provides access to an image database containing millions of X-rays of specific cases. In addition to supplying the actual X-ray machine, this allows the manufacturer to provide diagnosis support "as a service" (smart service), giving them a valuable competitive advantage. As the ecosystem grows, so does the reservoir of expertise for providing the service, i.e. the knowledge of the radiologists (smart talents) who use the platform.

Global competition requires a paradigm shift in companies and the workplace

Another important requirement for the journey towards the Smart Service Welt is to ensure that business leaders fully understand the new challenges. In the Smart Service Welt, management will have to collaborate with other companies in value networks as and when the need arises. Competitors will cooperate with each other and employees will engage in automated interactions with platform operators, meaning that they will no longer be managed by the traditional in-house management structures of the company that employs them. The changes in management, culture, collaboration and business models could be so profound as to require corporate rethinking rather than mere optimisation of the existing organisation. In view of the high competitive pressures, teams of "accelerators" should drive the rethinking process both in-house and across several different companies. Connected digital pilot groups provide an effective means of rapidly and successfully managing the transformation of businesses in the Smart Service Welt.

Chapter 4

Working in dynamic digital networks requires a high degree of integrative knowledge.

Communication skills and competencies such as being a team player, having the ability to organise one's own work, having an understanding of the overall system and lifelong learning will all be essential. The new skill sets will also include a basic knowledge of data processing, working in virtual environments and using digital assistants. The teaching and learning process itself will also be transformed. In the Smart Service Welt, training and continued professional development together with the need for a far more agile training system will all be of fundamental importance.

New jobs such as data scientist and user interaction designer are becoming increasingly important.

The Smart Service Welt entails both threats and opportunities for workers. On the one hand, it is causing some employee groups to become replaceable. This applies equally to certain functions in manufacturing industry and to knowledge work and frontline roles in the service sector. At the same time, however, new job profiles and areas of employment are emerging, for example in fields such as development, administration, design, consultancy and support. Since these new employment opportunities will not automatically compensate for all of the jobs lost as a result of smart services, the challenge will be to ensure that the transformation process creates good-quality jobs with decent working conditions. There is an opportunity to afford employees greater autonomy and make many aspects of their work more interesting. Nevertheless, there is also a danger that jobs could become increasingly precarious, as well as of higher workloads and the polarisation of employees into highly skilled knowledge workers on the one hand and people who perform purely administrative or functional work on the other. The rise in mobile ways of working thanks to the virtualisation of work processes will provide an opportunity to achieve a better work-life balance. However, it could also have harmful consequences for employees' health by eroding the boundaries between their

work and their private lives. The use of crowdsourcing to farm work out via the Internet could also have a negative impact if it results in permanent employees with guaranteed social rights being increasingly replaced by freelancers with precarious employment conditions.

In order to make the most of the Smart Service Welt's opportunities and minimise the threats, it will be necessary to ensure that all the relevant actors participate in shaping the changes right from the outset – including government, businesses, the social partners and company-level worker participation bodies. Employees should also be directly involved. Widespread training will be required to prevent polarisation of the workforce. Measures to mitigate the dissolution of mobile and digital work protect employment and social standards will also need to be taken. It will furthermore be necessary to protect the co-determination and participation rights of individual employees in cross-company value networks.

Europe must complete its digital single market as quickly as possible

Innovative companies in the US have a significant head start over their European counterparts in that they are able to scale up their smart services in a large, homogeneous domestic market before expanding internationally. The digital market in Europe, on the other hand, is highly fragmented. The complex array of different regulations in Europe is particularly challenging for SMEs and acts as an obstacle to them scaling up their business models.

In order to provide a level playing field for growth, the European Union must create a single regulatory framework for a European digital single market, so that smart service providers can reach all of the EU's 500 million citizens. It will also be necessary to introduce a single data protection regulation for the whole of Europe in order to harmonise the rules on privacy, data storage and copyright.

► Chapter 5

There is a particular need for an EU-wide approach in the field of copyright and patent protection. This is because the growing trend for completely different companies to come together to form user-oriented partnerships could in some cases infringe third-party (intellectual) property rights. Reliable solutions will need to be found to address this issue.

In order to ensure future competitiveness, it will be necessary to create a European digital single market accompanied by a single data protection regulation for the whole of Europe and harmonised copyright and patent protection rules.

Building a consensus on informational self-determination in Europe

The Smart Service Welt is built on data-driven business models that configure customised services for individual users using a wide array of data sources. To make this possible, big data applications often collect, store and correlate data in countless different combinations over lengthy periods of time. As such, the collected data is not only important for the current application but also provides the basis of analysis techniques that have yet to be developed.

Personal data protection standards in Germany are among the highest in the world and the relevant legislation is correspondingly strict. A growing data protection movement is highly critical of the trend to collect and store increasing quantities of data, expressing concern about flagrant abuses of individual privacy and data sovereignty. According to the critics, we need to heed the warning signs and ensure that the principles of data minimisation, anonymisation and informational self-determination are upheld. Data that has not been collected cannot be analysed, while anonymised data cannot be used to harm the interests of the individual.

These views are perfectly understandable and justified. However, the Smart Service Welt is fundamentally driven by data and most of this data is inevitably going to be personal in nature. The concept of autonomous driving, for example, will never be feasible if

some road users refuse to share details of their vehicles' movements with everyone else. It is already clear that many solutions in the Smart Service Welt will be fiercely debated. It is therefore necessary to establish a broad consensus throughout Europe regarding which data can and should be publicly available and which should remain private. Users should have the right to decide how their own personal data is used.

In Germany, and across Europe as a whole, people's occasionally rather cavalier attitude to how they handle their own personal data is directly at odds with their concerns about the powers that be snooping on employees, patients and members of the general public. We have yet to develop either a culture of privacy and trust with regard to how data are used or the technical, regulatory and societal framework needed to make this possible.⁴

One problem is that the rate at which society and government are able to arrive at a consensus is much slower than the pace of the digital revolution – not least because of the strongly opposing views regarding the content of the new Data Protection Regulation.

While data protection requirements in Germany are high, so are the needs of data-driven smart services. Moreover, in some cases people have a rather cavalier attitude towards how they handle their own personal data. It is therefore necessary to establish a broad consensus throughout Europe regarding which data can and should be publicly available and which should remain private.

Germany's key role in shaping the European Data Protection Regulation

Europe needs to find a balance between trust and data protection on the one hand and the economic and social benefits of digital technology on the other.

A European digital single market is needed that provides a Europe-wide regulatory framework with as few national access barriers as possible. This will be par-

ticularly crucial to small and medium-sized enterprises. Germany must therefore play a key role in shaping the European Data Protection Regulation and must work towards a solution that enjoys widespread support throughout Europe. The European Data Protection Regulation will need to be adopted by 2016 at the latest if Europe is to avoid jeopardising its technological leadership. If adopted, this Europe-wide data protection solution will have a huge impact and influence throughout the rest of the world. It will be necessary to reach a sensible compromise so that we do not pass up this opportunity and lose our position as market leaders.

Stepping up the pace and solving the digital dilemma

The digital dilemma facing European industry arises from a lack of speed and agility. The life cycle rate of smart services is constrained by slow product development times.

In one recent survey⁵, only one in five German businesses said that they were strongly focused on both smart products and smart services. Moreover, four out of every ten companies are not doing anything at all in this area. Almost 80 percent of the firms that took part in the survey said they had little if any cooperation with other companies in the field of digitisation.

The journey towards the Smart Service Welt is effectively a race to use smart data in order to gain access to customers. The race will be won by whoever has the best understanding of customers and their needs and preferences. It is this understanding that is the key to the new business models. Consequently, the leading providers of digital business models will endeavour to gain control of the software-defined and service platforms in every part of the economy so that they can monopolise the control points for smart services. If an intermediary is able to control the customer and data interfaces, they will be in possession of a key service control point. From

this position, they will be able to relegate the manufacturers and providers of smart products and services from the role of leading providers to nothing more than interchangeable suppliers. On the other hand, if Germany's particularly strong leading suppliers succeed in upgrading their products and services into smart services, they will be in a position to unlock new potential for growth, profitability and employment.

The outcome of the race remains uncertain. Germany and Europe must therefore act swiftly to drive the establishment of smart service business models and promote and develop the platforms, infrastructure and talents needed to make them possible.

¹ Accenture: International Benchmarking of Digital Performance in 2014, 2014 (unpublished); Accenture: Digitization Index 2014/15, continued (unpublished).

² Terms such as "Industrial Internet", "Internet of Things" and the German "Industrie 4.0" concept all describe the same evolutionary trend – the arrival of the Internet of Things, Data and Services in the manufacturing environment and the comprehensive value chain integration enabling it.

³ acatech (Ed.): Resilien-Tech, „Resilience-by-Design“: Strategie für die technologischen Zukunftsthemen (in German) (acatech POSITION PAPER), April 2014; Thoma, K. (Ed.): Resilien-Tech, "Resilience by Design": a strategy for the technology issues of the future (acatech STUDY), Heidelberg, April 2014.

⁴ acatech (Ed.): Internet Privacy. Taking opportunities, assessing risks, building trust (acatech POSITION PAPER), Heidelberg, 2013; Buchmann, J. (Ed.): Internet Privacy. Eine multidisziplinäre Bestandsaufnahme / A multidisciplinary analysis (acatech STUDY), Heidelberg, 2012.

⁵ Accenture/Die Welt (Eds.): Mut, anders zu denken: Digitalisierungsstrategien der deutschen Top500, 2015, available online at: accenture.com/de-de/Pages/service-deutschlands-top-500.aspx (accessed 4.2.2015).

General recommendations

The user is at the centre of the **Smart Service Welt's data-driven business models**.

Digital platforms refine data originating from smart products and a variety of other sources in order to build up a precise picture of individual users' preferences and needs. They also provide the technological infrastructure for marketplaces and ecosystems. Based on the user's needs, products and services from different providers are bundled together on the digital platforms to create individual smart services.

The Smart Service Welt's **user-centric business models** are replacing the product-centric business models found in manufacturing industry. This disruptive change will have a direct impact on Germany's industrial core and will also shape the future of work. It is therefore important to ensure that businesses, government, research institutions, the social partners and civil society in Germany all pull in the same direction when it comes to building cross-company digital platforms and their components and **establishing smart services made in Germany**.

The Smart Service Welt Working group recommends:

1) A Smart Service Welt Implementation Platform

A **Smart Service Welt Implementation Platform** would allow businesses and research institutions to carry out pre-competitive cross-company piloting of digital platforms and their components.

- The implementation platform should be **business-driven**. It should be led by Germany's leading companies, but should be open to businesses of all sizes and from any industry, as well as incorporating selected international companies.
- The primary goal should be to **establish and operate** digital pilot platforms to be run as **living labs** for key fields of application.
- This will require the development of innovative, rapidly realisable prototypes in testbeds provided by the participating companies. Doing so will lead to the creation of an ecosystem where players from different industries and sectors work together and share best practices and thought leadership in connection with the Smart Service Welt.
- The platform should address **as many smart service fields of application as possible**, with a particular focus on mobility, machinery and plant (Industrie 4.0), trade and logistics, health and medical care, energy and consumers.

▷ Chapter 2 and Appendix

- The **priority areas** identified through the digital pilot platforms should be studied in depth in **four working groups**:
 - Regulations and Standards
 - Security and Privacy
 - Work Organisation and Training
 - Global Framework
- An **interdisciplinary research advisory board** should be established, comprising representatives of the business and research communities. In addition to providing advice for the implementation platform, the

board should be tasked with formulating integrated research roadmaps on the following themes:

- Digital platform technologies
- Transforming organisations and the workplace
- The implementation platform's work should draw on **experts from a wide variety of fields** such as business development, product management, service development, law, psychology, industrial sociology, etc.
- In addition to the findings of the Smart Service Welt Working Group presented in this report, the implementation platform should also **build on other existing initiatives**:
 - the national IT security competence centres,
 - the software clusters, which can provide a starting point for creating a smart service competence centre,
 - Siemens' Automation and Digitalization Campus.
- The people involved should ensure **coordination with related initiatives** such as the Industrie 4.0 dialogue platform.

2) A Smart Service Welt Innovation Platform

A **Smart Service Welt Innovation Platform** initiated by the German government and anchored in the IT Summit process should act as a multiplier of conditions that support innovation, promoting a dialogue with the public on the economic implications of the Smart Service Welt transformation, as well as knowledge transfer and the establishment of consortiums, especially for SMEs.

- The innovation platform should be **policy-driven** and include as many as possible of the Smart Service Welt's stakeholders.
- The innovation platform should pursue the following goals:
 - It should facilitate a **dialogue between government, business, the research community, the social partners and civil society**. A broad dialogue with the public should address the opportunities and threats of data-driven smart service business models and create the basis for their widespread acceptance.
 - **Priority areas** should be identified through this ongoing dialogue, in consultation with the implementation platform. The innovation platform should use these to drive the creation of the conditions needed to establish the Smart Service Welt.
 - The innovation platform should **establish transfer centres** that act as multipliers for SMEs.
- The innovation platform should be **anchored in the IT Summit process** and should coordinate closely with the implementation platform through shared experts and joint actions.
- The innovation platform should address the following **key work organisation issues**:
 - Strengthening company-level worker participation so that it also includes cross-company networks, workers' right to be unavailable when contacted outside of agreed on-call hours, guaranteeing employees' right to informational self-determination, updating occupational health and safety regulations for mobile and digital work and changes to the social security system in order to counter the threat of precarious digital employment.

- In addition, the social partners and company-level actors should shape the way work is organised to provide employees with greater autonomy and create good jobs that involve a wide range of different tasks. The employees themselves should also be involved in this process. The way work is organised should furthermore comply with the relevant occupational health and safety requirements. The greater flexibility that now exists should be used to improve employees' work-life balance. Comprehensive training initiatives should be implemented in order to prevent polarisation of the workforce and help employees to retain their employability.

3) Key research areas

In order for Germany to create internationally groundbreaking platform solutions, it will be necessary for researchers and businesses to work together to address a variety of urgent research issues connected with the Smart Service Welt and to develop the **appropriate measures**. The key areas are as follows:

- end-to-end semantic modelling, personalised interaction and high-scale real-time data analytics for smart services;
 - ▷ Chapter 3.1
- the development of reusable, open and interoperable software modules for digital platforms;
 - ▷ Chapter 3.2
- the development and testing of business models for the operation of digital platforms and providing the services traded on them;
 - ▷ Chapter 3.3, Chapter 5
- the urgent development and demonstration of proactive security systems and data security and protection strategies, together with targeted measures for disseminating knowledge about IT security and raising awareness of security threats;
 - ▷ Chapter 4.1
- investigation of training requirements in the Smart Service Welt and the development of targeted training models;
 - ▷ Chapter 4.2
- analysis of the opportunities, threats and requirements of the Smart Service Welt in terms of how work and businesses are organised. The German government's "Future of Work" labour research programme provides a basis for this, but will need to be expanded and developed in a targeted manner;
- analysis of employment trends, changes in employment structures and work organisation challenges, together with formulation of the relevant labour policy strategies.
 - ▷ Chapter 5

4) Conditions for supporting innovation

Alongside the technological infrastructure, the key condition for growing digital value creation in the Smart Service Welt is the **establishment of a European digital single market**. Germany must act decisively to drive existing strategies and initiatives at European level and integrate them into its own initiatives.

- ▷ Chapter 5

Preview of the long version of the final report

1 The goal: global digital leadership

2 The Smart Service Welt: use cases

Smart Production Services I – productivity gains in digital ecosystems

Smart Production Services II – a technology data marketplace

Smart Logistics Services – (sea) ports and heavy goods transport

Smart Energy Services – providing a glimpse into the energy transition app store

Smart Farming Services – boosting productivity through networking

Smart Healthcare Services – patient-centred care

3 Digital Platforms: open, connected and secure

3.1 Software-defined platforms: the technology integration layer

3.2 Service platforms: the business integration layer

3.3 Security strategies for the Smart Service Welt

Detailed recommendations for digital platforms

4 The organisational dimension: cultural change in businesses and the workplace

4.1 Training and continuing professional development

4.2 Work organisation

Detailed recommendations for organisation and work

5 An innovation-oriented framework – creating a level playing field for Germany and Europe

Detailed recommendations for an innovation-oriented framework

About the Smart Service Welt Working Group

Only available in German:

Appendix

1 Detailed description of use cases

2 Technological enabler components of software-defined platforms



The full English version of the report

is available at:

acatech.de/smart-service-welt-recommendations



Die Langversion des Abschlussbericht

finden Sie unter:

acatech.de/smart-service-welt-umsetzungsempfehlungen

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The Working Group would like to thank all the external participants in the workshop “Security, Safety and Privacy in the Smart Service Welt” held on 27 November 2014 in Berlin for their thoughtful input:

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