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Next Generation IoT Platforms

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Abstract

Industry is one of the pillars of the European economy – the manufacturing sector in the European Union accounts for 2 million enterprises, 33 million jobs and 60% of productivity growth. The new industrial revolution is driven by new-generation information technologies such as the Internet of Things (IoT), cloud computing, big data and data analytics, robotics and 3D printing. These technologies open new horizons for industry to become more adventurous, more efficient, to improve processes and to develop innovative products and services. Recent studies estimate that digitisation of products and services can add more than €110 billions of annual revenues in Europe in the next five years. In this context, Digitizing European Industry (DEI) initiative aims to establish, together with all Member States, and industry and other stakeholders, and building upon existing multi-stakeholder dialogues, a framework for facilitating coordination and cooperation of European, national and regional initiatives on digitising European industry, as well as to mobilise stakeholders across the value chains.

2.1 Introduction

The Communication on DEI was adopted last April 2016. The overall objective of the DEI initiative is to ensure that any industry in Europe, big or small, wherever situated and in any sector, can fully benefit from digital

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innovations to upgrade its products, improve its processes and adapt its business models to the digital change. This required the full integration of digital innovations across all sectors of the economy. In the DEI strategy, the IoT objectives are indicated under the headings "Achieving Partnerships for leadership in digital technologies, value chains and platforms". In this chapter, the results of the related Working Group on "platforms" and more particularly the sub-group on "IoT platforms" will be presented. The activities started with the 1st roundtable in September and ended in May 2017 with a set of recommendations.

The ongoing digitisation of industry and services has a profound effect across all sectors. It is underpinned by research and innovation in relation to several technological trends. The Internet of Things, data analytics, cloud, high-performance computing and artificial intelligence are the most prominent ones. Advances in these technologies are transforming products, processes and business models and ultimately reshuffling global value chains in all sectors (Figure 2.1).

To maintain their competitive edge, companies have to fully embrace digitisation not only by making the best use of the latest digital technologies but also by integrating digital innovations as key elements of their development strategies. Next digital champions can emerge in any sector of the economy from construction and textile to health or energy equipment.
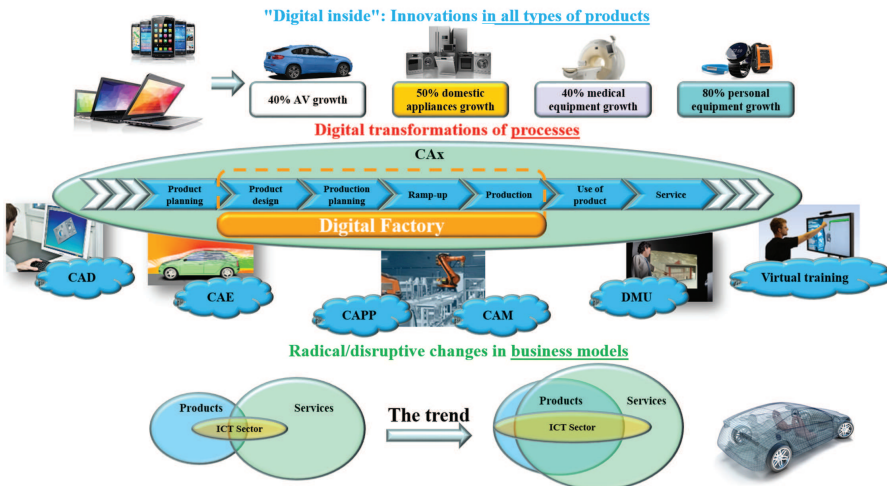

Figure 2.1   Digital technologies transforming products, processes and business models.

In Europe, many companies, especially in the high-tech sector, are already grasping the opportunities of this new industrial revolution, and studies show that digitisation of products and services could increase EU industry revenues by €110 billion a year.

However, many traditional sectors and small and medium-sized enterprises (SMEs) are lagging behind: less than 2% of them use advanced digital technologies to innovate in products and processes. In addition, a large disparity exists between Member States and regions creating a new 'digital divide', which can ultimately hurt all economies in Europe.

To tackle these challenges, the European Commission launched the Digitising European Industry [1] initiative in April 2016. Its overall objective is to put in place the necessary mechanisms to ensure that every industry in Europe, in whichever sector, wherever situated, and no matter of which size can fully benefit from digital innovations.

The initiative focuses on actions with a clear European value-added. It builds on the momentum and it complements and connects different national initiatives. Of particular importance are four action lines: the European platform of national initiatives including Digital Innovation Hubs, Digital Industrial Platforms, Digital Skills and Smart Regulation.

2.2 DEI Implementation – Working Groups

The implementation of the DEI initiative is supported by a Roundtable of high-level representatives of Member States' initiatives, industry leaders and social partners. To support the work of the Roundtable, two Working Groups (WG) have been set-up in order to make progress on aspects of the implementation of the DEI Action Plan:

- WG1: Mainstreaming digital innovations across all sectors;
- WG2: Strengthening leadership in digital technologies and in digital industrial platforms across value chains in all sectors of the economy.

The WGs performed fact finding, collected best practices and formulated recommendations, addressed to the High-Level Representatives attending the Roundtables. On industrial platforms, the challenge is to seize the opportunities arising from digitisation to establish European leadership in the next generation digital platforms and re-build the necessary, underlying digital supply chain on which all economic sectors are increasingly dependent. We addressed this challenge in the WG2 by pursuing the objectives to provide a

view on the current landscape of platform activities, to develop a vison for the future European platforms, to analyse the gaps, to identify the key players and key initiatives and develop an action plan with recommendations to the roundtable. The WGs produced several reports available on Futurium [2].
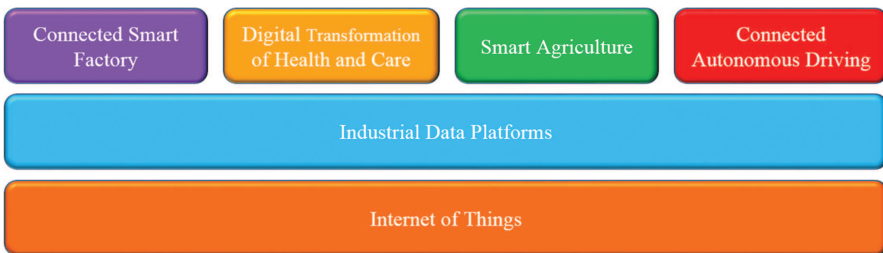
To allow in depth analysis the Working Group 2 was further broken down into specific vertical areas (Smart Agriculture, Connected Smart Factory and Digital Transformation of Health and Care) and on horizontal issues (Industrial Data Platforms and Internet of Things) as depicted in Figure 2.2.

From now on we will focus on the results of the sub-working group on "IoT platforms".

2.3 IoT Platforms – State of Play

The term 'platform' has several different meanings. The DEI Communication defines it, rather narrowly, as "multi-sided market gateways creating value by enabling interactions between several groups of economic actors" [3]. A broader, and more useful, interpretation would be "agreements on functions and interfaces between industry players that create markets and market opportunities leading to ecosystems and standards." This definition could be instantiated for IoT with the following meaning. IoT platforms supported by dynamic ecosystems should cover the complete value chain from sensors and actuators, connectivity, cloud infrastructure, applications and services.

Digitising European Industry - Working group on: Strengthening leadership in digital technologies and in digital industrial platforms across value chains in all sectors of the economy

Connected Smart Factory	Digital Transformation of Health and Care	Smart Agriculture	Connected Autonomous Driving

Industrial Data Platforms

Internet of Things

Structure of the IoT Subgroup discussions:

❖ Current landscape

❖ Vision: where to go

❖ Bridging the gap

❖ Main stakeholders to be involved

Figure 2.2   Digitising European Industry – working group 2 subgroups.

VC investment

IoT platforms

IoT developers

$1.9B in 2014	
$768M in 2010	
221 deals in 2014	
91 deals in 2010	

360+
IoT platform offerings

200 Startups	50+ Multinational	< 20 Open Source
200 US based	100 European	30+ IoT platforms acquired

4.5Mio
IoT developers

91%
IoT developers use open source

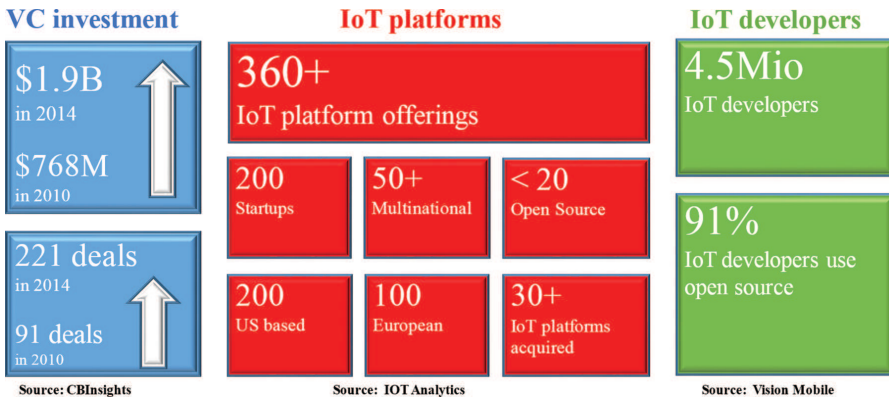Source: CBInsights   Source: IOT Analytics   Source: Vision Mobile

Figure 2.3   IoT platform landscape.

The current landscape of IoT platforms highlights that the European offer is very fragmented. The coordination and support action, UNIFY-IoT has identified that around 360 known platforms exist, with the vast majority of these being developed from 2013 onwards (Figure 2.3).

Across the 360 platforms identified world-wide there is a mix of cloud companies, some open source platforms, some industrial sector driven platforms, e.g. by Bosch, Siemens or GE, and some standards based solutions.

This burst of new platforms is mainly dominated by US suppliers. The initial explosion of new platforms supported by SMEs in the area is, however, slowing down which is a sign of a new immature market. There will thus be a natural selection within the market over the next few years where competition is fierce.

Internet giants like Google, Amazon or Apple have invested in traditional markets like transport (the Google car), smart home (the NEST thermostat) or big data for energy (Google Energyworx) – and this could cause a seismic shift in traditional sectors and it value chain from product design, development and service provision.

The risk of US dominance in future industrial platforms is also quite high and the above-mentioned large companies have significant resources to acquire a dominant position and impose de-facto standards.

It may be worth making a distinction between IoT for consumers and Industrial IoT with the first covering smart phones, fitness tracking tools etc. and the second being exploited in areas such as smart factories, smart health care, etc. However, the borderline between consumer and industry is blurred as machine data allow to extract personal information. Fast advances

are being made in the consumer world and a question is how this can drive innovation in the industrial space.

The industrial IoT domain summarizes everything what is outside the classical consumer domain with a strong emphasis on B2B business. In general, there is a convergence of consumer and industrial Internet. We see signs of 'consumerization', for instance, in the home market through the appearance of voice control appliances like Amazon's Alexa or Apple's Homepad. Also, this is typically the case in the automotive industry in which consumer and industrial platforms are merging in the concept of connected and automated driving.

2.4 Needs and Priorities for the Next Generation IoT Platforms

As highlighted in 2.2 the current fragmentation of IoT platforms creates challenges for business and consumers. With the proliferation of platform offerings there is considerable fragmentation and at present there is no clear convergence towards a limited number of platforms. Although we may expect some form of consolidation in the future, there is a clear need for interoperability and a need for open platforms to foster up-scaling and to avoid vendor lock-in. This issue may require collaboration on the definition of common interfaces and data format. The emphasis should be on developing a convergence on existing standards rather than in generating new platforms and new IoT standards. A starting point of this collaboration could happen at different levels with different communities:

- IoT European Platforms Initiative (IoT-EPI) as part of the Cluster of Research and Innovation projects in which about 34 different platforms are demonstrated and used in different use cases;
- Use cases supported by the EU funded IoT European Large-Scale Pilots Programme. These actions should be complemented with the support to standardisation activities and the help of the AIOTI which has a major role to play in forging consensus in industry. A European approach to standards would eventually influence standards at an international level such as oneM2M or W3C in the case of defining semantic interoperability.

Besides a diversity of standards, European industry is confronted with increasing security risks. Cybersecurity continues to be a serious issue in the IoT space, especially with recent high-profile breaches, essentially through

botnet attacks. Security and privacy need to be addressed at different levels. Privacy needs to be protected within each sector. Privacy and end-to-end security solutions should be addressed based on local reasoning and trust, validating novel business models when data is aggregated and shared across the value chains.

End-to-end security and security by design needs to be provided at all levels, considering devices, platforms and the connecting network. Beyond this, risk assessment and security up-dates should be continuously managed over time during the entire product lifecycle within a framework that involves all actors of the value chain. The next generation IoT platforms will have to be much more secured and support agile concepts to respond to dynamic security risks, whilst also ensuring the privacy of the users. Hopefully a starting point will be the results of the IoT-3 Call with a set of resulting projects that shall integrate sophisticated security concepts with emerging IoT architectures for ensuring end-to-end security in highly distributed, heterogeneous and dynamic IoT environments.

As more critical applications are connected via networks, e.g. autonomous driving or energy grids, there will be a need for higher quality network connections. If availability and timeliness in networks cannot be guaranteed there will be a need to keep processing local. Indeed, there is a growing trend towards data processing close to the point of action, i.e. edge computing, to address real-time availability in platforms and also limit liability and risk that would otherwise be incurred from performing processing in central clouds. New high potential areas using the recent advances in Artificial Intelligence could be explored to filter, analyse and process the data at the sensors/actuators level, with increasing computational power close to the network edge.

Much of the potential value from IoT will come from moving beyond proprietary technologies and sectoral siloes that largely exist today. New revenues may come from product and service innovations that enable economic growth and up-scaling of existing platforms across different sectors. The rise of the IoT will change the 'vertically integrated' economic models, and open up new horizons for industry to become more adventurous, more efficient, and to develop innovative products and services.

A firm strategy on digital transformation involving a strategy for leadership on IoT platforms needs to be supported by national programmes and policies. There are a number of national activities on platforms and it would be beneficial to share information between these. However, there are some challenges. Useful information on the impact of platforms is not yet

available and platform development is being driven by different sectors, still in isolation. For instance, in France platform development is being driven by the micro-electronics industry and in the UK it is driven by smart city or manufacturing applications. This leads to differences in national IoT strategies. Actions that foster more explicit activities between member states are needed that spread best practice and also increase the awareness of IoT. A horizontal approach is needed to support convergence of IoT platforms and the benefits can be maximised through coordination at a European level via connection of regional and national innovation hubs.

To promote acceptance and prove the reliability of platforms there is also a need for large experimental facilities for testing and demonstration of novel standards, architectures and platforms driven by selected verticals. Here there is a key need to avoid silos and vendor lock-in. Open standards and open APIs are important elements to allow SMEs to access and exploit an IoT platform. A vibrant developer community is an essential element of an ecosystem supporting a platform. To ensure this it is important that small SMEs and start-up players get involved in these activities to address new business opportunities and business models.

2.5 Conclusion

Future platforms should bridge the current interoperability gap between the vertically-oriented IoT platforms and mobilise third party contributions by creating marketplaces for IoT services and applications. A harmonised European market for IoT interoperability standards and open APIs are a prerequisite for a free marketplace which reduces dependencies and barrier for new business and SMEs.

Security and privacy have to be addressed in priority in the next generation IoT platforms. This will require actions not only in research and development, in large scale deployment but also at policy level with the possibility to introduce IoT trusted labels.

Although there are significant investments in national IoT strategies, initiatives addressing platform building will not be able to compete at an international level as there is insufficient local user base. In order to compete there is a pressing need for Europe to co-ordinate activities to create critical mass and avoid fragmentation and silos.

Last but not least, there is a need to promote a dialogue across a critical mass of stakeholders, including large companies across the value chain but also across vertical sectors, and promote consensus on platform up-scaling.

As mentioned above, an open platform approach would be sought of, allowing start-ups and entrepreneurs to create new services, giving SMEs access to new technologies and emerging standards. This stakeholder dialogue can be supported by the alliance AIOTI with the aim of bringing different communities together. Here there is a need to discuss legal issues, technical bottlenecks and market barriers. The aim would be to drive the convergence of standards across different sectors and accelerate adoption of IoT platforms in relevant sectors (sector-specific) whilst promoting spill-over effects to other sectors.

The European Commission encourage industry to drive standards and platform building that enable cross-sector fertilisation and up-scaling. For this to happen, the Commission is prepared to support leadership in platforms through its WP2018-20 under Horizon 2020 by large testbeds allowing companies to collaborate on connected objects and test new business models across different sectors.

References

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[2] Futurium: https://ec.europa.eu/futurium/en/dei-implementation/library

[3] COM (2016) 180 final, 19 April 2016

[4] IoT European Large-Scale Pilots Programme, online at https://european-iot-pilots.eu/