

Industry 4.0 and the digital transformation: pursuing a competitive position in the new technological revolution



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When Europe's policy makers and industry leaders were alerted to the essence of speed in their pursuit of competitiveness and much needed economic growth and jobs, the call for immediate and bold action to accelerate the digital transformation and seize business opportunities could not have been clearer: act now or risk being left behind.

The recently published ARTEMIS Industry Association Strategic Research Agenda (2016) echoes this sentiment. It highlights the need, in creating a pathway to digital transformation, to enable a more agile and shorter development cycle of smart products, i.e. those products embedding software. This Research Agenda highlights the need to adopt new design methods, particularly those related to design-by-composition and correct-by-construction principles. Key to this is a focus on providing strong technological capability over the whole value chain, removing barriers between application contexts to yield multi-domain, reusable components (building blocks) for such systems that have embedded intelligence. Extending the use of digital platforms to build the stronger eco-systems, with the participation of end-users and suppliers, is essential to accelerate innovation and create new innovative business models for jobs and value creation.

New unprecedented opportunities

The digital transformation provides great prospects to open new markets to every

business in Europe and beyond, bringing a new and wider variety of smarter products and services that will reshape the future and create new unprecedented opportunities. European companies will be able to generate international market opportunities with new products and services empowered by digital investments, disruptive business models and improved production processes. From engineering and automotive to healthcare, pharmaceuticals and farming, all industrial sectors are impacted.

Europe must use its leadership in the now so-called 'Cyber Physical Systems'. These are products that link the physical world to the cyber one by embedded intelligent ICT systems to make products smarter, more interconnected, interdependent, collaborative and autonomous. By harnessing these capabilities in time and across space, applications will emerge that have enormous and disruptive new qualities (features) and functionalities with unprecedented societal impact and economic benefit for citizens and societies. In the future, Cyber-Physical Systems will manage complex systems like smart grids, transport or water management systems, and will make everyday objects such as homes, offices, cars, trains, cities or clothes intelligent, connected to the Internet ... the Internet of Things.

The fourth industrial revolution is here. Its major power lies in combining digital technologies with other advanced and leading-edge technologies. Creating suitable solutions and services as well as related innovation strategies and new business models is helping to modernise Europe's manufacturing capabilities; in the near future, traditional factories will increasingly be transformed into smart digital manufacturing environments.

Collaborative automation

Collaborative automation, as embraced in the ARTEMIS Innovation Pilot Project Arrowhead, will be driven by software (systems) and connected through the Internet of Things, and will know no borders. The significant gains in productivity (higher efficiency, lower costs) of this approach have already been demonstrated, especially in production, smart buildings and infrastructures, electromobility and the virtual market of energy.

The collaborative and cross-domain approach has shown its effectiveness, but

now it will be complemented by the development of common building blocks to make significant advances in design-by-composition. This will also accelerate the development cycle, maximise the reuse and the time to market, be more cost-efficient in the adoption and deployment of technological solutions, master their growing complexity, ensure safety, security and privacy, allow flexibility and facilitate interoperability between the various systems. And, in the end, bring innovative products faster to the market.

Cyber-Physical Systems of Systems and the Digital Transformation

An analogy to the whole evolutionary process from the mechanical to the digitised eco-system can be found in the development of photography. The first products existed in a mechanical or analogue (physical) form. They were then transformed into a digital form in the evolution from integrated electronic components to embedded software. The next step was integration into the digital mobile phone, as photography and music converged into one device, the internet-connected smart phone, and consequently a system in a large system with cloud storage and computing. In a shift from a product to a smart product integrated in a system possibilities are created for completely new types of application that have not been possible to date. Thus, as Cyber-Physical Systems of Systems emerge, characterised by a large number of physical devices and computing elements that are interconnected in both physical and informational terms, the vastly increased amount of information and the new level of connectivity offer unprecedented potential for more efficient operation, higher flexibility and adaptability, improved levels of reliability and better quality of products and services. They pave the way for new markets such as Big Data, which is considered now as the new 'oil', as data have to be extracted, processed and used to fuel various types of applications.

The time is ripe to seize the tremendous opportunity we have to make the digital transformation happen. Greater pan-European collaboration and open innovation can accelerate the process, bring new thinking into organisations and ensure that the best ideas are implemented and successfully brought to market. And keep Europe at the forefront.