

acatech STUDY

Industrie 4.0 in a Global Context

Strategies for Cooperating
with International Partners

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Foreword

Industrie 4.0 denotes the transformation of “traditional” industries by the Internet of Things, Data and Services. The term has been used to encapsulate a paradigm shift in the economy ever since the report of the Industry-Science Research Alliance Working Group was presented to the German Chancellor and the Plattform Industrie 4.0 was launched at the 2013 Hannover Messe. The real-time networking of products, processes and infrastructure is ushering in the fourth industrial revolution where supply, manufacturing, maintenance, delivery and customer service are all connected via the Internet. Rigid value chains are being transformed into highly flexible value networks.

The Plattform Industrie 4.0 steering committee and the Industry-Science Research Alliance/acatech have made a major contribution to developing a common understanding of “Industrie 4.0” in Germany.¹ The term describes a new stage in the organisation and management of the entire value chain throughout a product’s lifecycle. The product lifecycle is geared towards customers’ increasing desire for customisation and encompasses everything from the original concept to ordering, development, manufacture, delivery to the end customer and recycling, as well as all the associated services.

What makes this possible is the availability of all the relevant information in real time thanks to the networking of all the entities involved in the value creation process, together with the ability to use this data to determine the optimal value stream at any given point in time. Connecting people, objects and systems leads to the emergence of dynamic, real-time optimised and self-organising cross-company value networks that can be optimised on the basis of different criteria such as cost, availability and resource consumption.²

Germany’s innovative and successful manufacturing industry, its strengths in the field of business IT and its know-how in the

relevant key technologies mean that it is well placed to build a leading market and position itself as a leading supplier of innovative Industrie 4.0 solutions. Accordingly, Industrie 4.0 promises to deliver high-quality jobs and stable economic growth. It also offers new opportunities with regard to demographic change and sustainable, resource-efficient business.

Nevertheless, it also poses a number of major challenges for businesses. Existing manufacturing systems need to be horizontally integrated into value networks and vertically connected with companies’ internal business processes. It is therefore necessary to engineer the end-to-end digitalisation of the entire value chain.

Government, business and the general public have yet to fully appreciate the dramatic extent of the digital transformation sweeping through our economy and society. Germany is in danger of falling behind its global competitors with regard to the development of the necessary infrastructure, the integration of digital technologies, the race to establish norms and standards and the creation and development of business models. However, this threat is going almost unnoticed due to current strength of the German economy.

This is the background to the present study which was funded by the Federal Ministry for Economic Affairs and Energy (BMWi). Based on the findings of an empirical survey of experts from six industrialised nations, it analyses both the opportunities and challenges for international cooperation in the field of Industrie 4.0 and the issues relating to the development of common norms and standards. The study thus provides businesses, organisations and policymakers with a sound basis for the numerous decisions that will have to be taken if the digital transformation of our economy and society is to be completed successfully.

Prof. Dr. Dr.-Ing. E. h. Henning Kagermann
President acatech

1 | See Forschungsunion/acatech 2013.

2 | See Plattform Industrie 4.0 2016.

1 Introduction

A radical transformation is occurring in our economy. Following on from industrialisation, mass production and automation, the fourth industrial revolution is now underway. Known in Germany as Industrie 4.0, this phenomenon involves the real-time networking of products, processes and infrastructure. Just like the previous technological milestones in our economic history, Industrie 4.0 will have profound global impacts on manufacturing processes, business models, technologies, the workplace and people's everyday lives. It is too early to predict exactly what the factories of the future will look like. What we do know, however, is that networking and cooperation will play a key role in them.

At its core, Industrie 4.0 involves the technical integration of Cyber-Physical Systems (CPS) in the realms of production and logistics. Supply, manufacturing, maintenance, delivery and customer service are all connected via the Internet. Smart machines, warehousing systems and production resources are capable of independently exchanging information, triggering actions and autonomously controlling each other. This makes it possible to achieve a fundamental improvement in industrial processes: rigid value chains are being transformed into highly flexible value networks.⁹

With its innovative and internationally successful manufacturing industry, modern software solutions for corporate customers and established know-how in the relevant key technologies, Germany is well placed to become a leading market and leading supplier of innovative Industrie 4.0 solutions. This in turn has the potential to deliver high-quality jobs and stable economic growth. Industrie 4.0 also opens up new opportunities in the areas of demographic change and sustainable, resource-efficient business.

At present, German companies are concentrating on their strengths in the development and production of high-quality manufacturing technologies for industrial (B2B) customers. They are also globally renowned for their expertise in the field of data analysis and for their highly-skilled workforce. On the other hand, Germany's weaknesses include the slow rate at which innovations are developed into products and the fact that German entrepreneurs tend to be less adventurous than in other

countries. These problems are accompanied by serious shortcomings in Germany's digital infrastructure which is far less developed than in South Korea and the US, for example. In order for Germany to play its part in actively shaping the future of Industrie 4.0, these obstacles will need to be proactively addressed.¹⁰

Based on the findings of the *INBENZHAP* project, another important requirement is the development of international standards.¹¹ A series of standard protocols will be required to allow factories, machines and products all over the world to communicate and interact with each other and to make sure that solutions can be used in any country. Indeed, these standards are necessary for international technical cooperation to be possible in the first place. The full integration of digitalisation, networking and new ways of collaborating in manufacturing industry is therefore a global challenge. The Plattform Industrie 4.0 is leading the way on this issue in Germany. Similar initiatives exist in many leading industrialised nations, for instance Smart Industry in the Netherlands, *Produktion 2030* in Sweden, *Nouvelle France Industrielle* in France, *Industria Conectada* in Spain, *Průmysl 4.0* in the Czech Republic and *Fabbrica Intelligente* in Italy.¹² In order to ensure a strong voice internationally, cooperation should be strengthened at national, European and global level between businesses and the institutions that coordinate these government and private sector initiatives.¹³

This is an extremely challenging area, since norms and standards must be applied not only across different countries but also across different systems. Moreover, the highly dynamic nature of the technology requires them to be highly flexible and adaptable. Ideally, standards or norms should be established for national or corporate solutions in order to create a secure investment environment and build trust.¹⁴

Standards are especially important to companies that are currently adopting a wait-and-see approach towards Industrie 4.0. One of this study's main aims was to investigate the developments and expectations in different industrialised nations. In order to carry out this international evaluation of the importance of cooperation in the field of Industrie 4.0, representatives of businesses and organisations from the largest industrialised nations were asked about what Industrie 4.0 means to them, where they think cooperation is needed and how this cooperation should be approached.

9 | See Forschungsunion/acatech 2013.

10 | See Gausemeier/Klocke 2016.

11 | Ibid.

12 | See Europäische Kommission 2015.

13 | See Scheer 2013.

14 | See DIN e.V./DKE 2015.