Industrie 4.0 with focus on economics issues | ICV supports newly created work group

The International Performance Research Institute (IPRI) and the Institute for Technology and Process Management (ITOP) at the University of Ulm have established a new work group that puts Industrie 4.0 into economic focus. The aim is to create a dialogue between companies from the economic region of Stuttgart and Ulm and researchers from the IPRI and the University of Ulm. The work group is supported by the International Controller Association (ICV) and the Ulm Chamber of Industry and Commerce (IHK).

Initial situation

Despite the fact that Industrie 4.0 is considered to be one of the mega trends in production, most companies, especially the small and medium-sized ones, have **problems evaluating the opportunities and risks of the increase in digitalisation and intelligent networking for themselves.** Moreover, the companies are thus far not familiar with the specific steps for the implementation of the Industrie 4.0 concept. Previous Industrie 4.0 work groups predominantly concerned themselves with technology-orientated topics, thereby neglecting these kinds of problems. Specific problem-solving approaches, such as graduated models or roadmaps, have therefore not yet been developed.

Objective of the work group

The work group "Industrie 4.0 – Focus on economic issues" analyses the economic aspects in the context of intelligent networking. The overriding objective is the **development of a method, with which especially medium-sized companies are able to create their specific "Industrie 4.0 roadmap"**. This includes company-specific potentials, the necessary prerequisites, as well as the assessment of costs and benefits of these.

The approach of the work group is divided into four steps (see Figure 1). At first, methods to identify the potentials of digitalisation and intelligent networking are developed. In the second step, the requirements, which are necessary to exhaust the identified potentials, are identified. The emphasis here is on the personnel, technological and organisational requirements. The third step is the assessment of costs and benefits. In this step, the costs and benefits of digitalisation and intelligent networking are determined. The controllers' comprehensive knowledge is in demand at this point at the latest. In the fourth and last step, the results concerning company-specific roadmaps are consolidated. The results are compiled together with the company representatives in the work group, and are subsequently validated in different case studies. The interim findings are presented and discussed at work group meetings.

Public symposium on 30 June 2015 in Ulm

The constituent meeting of the work group took place at the University of Ulm on 12 November 2014. More than 30 participants from the industrial, economic and research sector attended.

The next work group meeting in April 2015 will take place in the offices of a company. **Moreover, a public symposium will be held at the IHK Ulm on 30 June 2015.** In addition to the presentation of the first findings, practical examples are meant to show the implementation possibilities of Industrie 4.0.

For further information, please visit the website of the work group. You can also register on the website:

www.ak40.ipri-institute.com

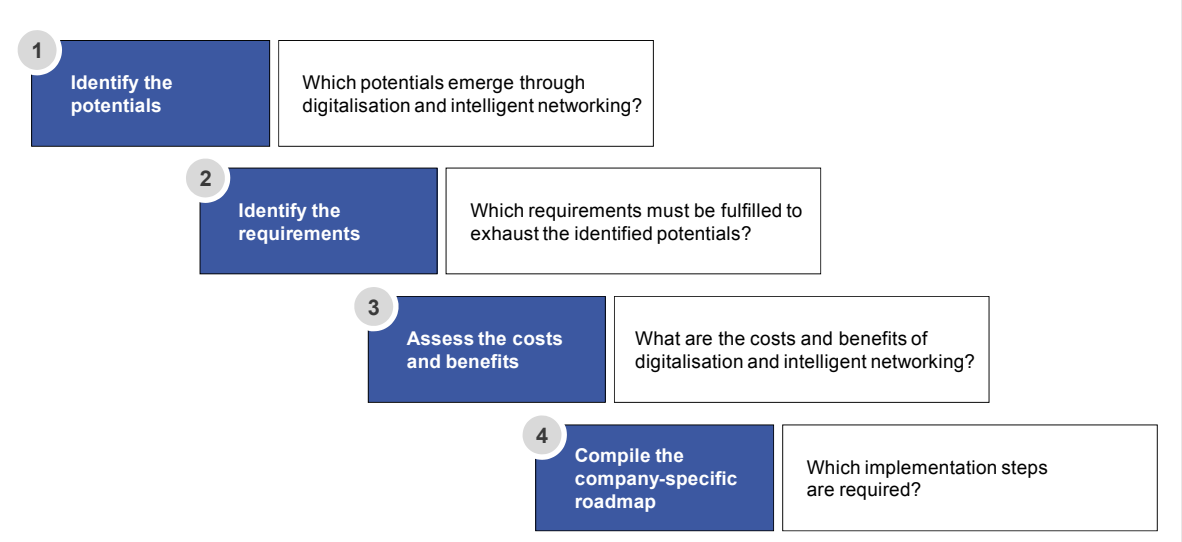

Figure 1: The approach of the work group

Smart products | Increased customer value through intelligent networking

In addition to the optimisation of production processes, Industrie 4.0 impacts the range of services as well. One speaks of smart products when intelligent networked products are used by customers. This new type of product can be found in all areas of life. In comparison to "conventional" products, they offer a significantly higher range of functions by means of data based services. From the controlling standpoint, questions such as how such business models should be evaluated for one's own company and to what extent new data sources can be processed beneficially in this connection arise.

Characteristics of smart products

Smart products are complex systems in which hardware, software, sensors, data storage, microprocessors and networking components are interconnected. They are distinguished by four characteristics (see Figure 2):

- **Aware –** smart products are aware through integrated sensors. Through them, they collect information concerning their operating status and their environment.
- **Intelligent –** smart products are intelligent because they are equipped with processors, software and data storage. This allows them to make autonomous decisions, and enables independent self-learning processes.
- **Connected –** smart products are connected both with one another as well as with their environment. The connection happens by means of communication elements. These make it possible for them to interact with other smart products.
- **Responsive –** smart products become reactive through a built-in control technology. It makes environmental adaptation through their own impetus or due to external commands possible. Smart products influence their environment through actuators.

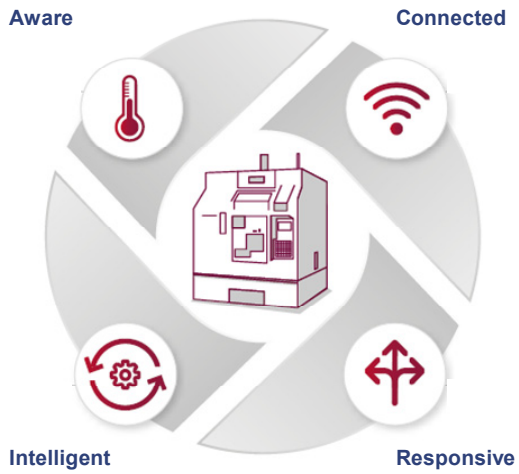

Figure 2: Characteristics of smart products
(cf. Capgemini 2014, p. 7)

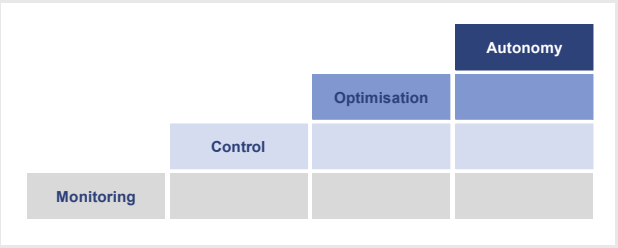

Figure 3: Functional levels of smart products
(cf. Porter and Heppelmann 2014, p. 70)

The four functional levels of smart products

Smart products can be divided into four steps in regard to their range of functions: monitoring, control, optimisation and autonomy (see Figure 3):

- **Monitoring** is made possible by sensors that register operations, the surroundings or the status of the product. This way, users are informed if there are critical changes to the product or the surroundings. If this is the case, the product emits warnings or gives notifications.
- **Control functions** make it possible for products to be controlled remotely or via algorithms (exemplary reaction rule: "If the sensor recognises rain, then the windscreen wipers should switch on."). A versatile and personalised operation is hereby possible. An intelligent door opening system for instance shows the surveillance camera's image on the smart phone and lets the door be opened via the smart phone.
- **Optimisation** is made possible through the monitoring and control functions. By means of data analysis in combination with algorithms, the product's performance can be continually improved. For example, intelligently networked wind turbines adapt to one another and to the weather conditions, in order to generate optimal energy production.
- **Autonomy** is achieved through the combination of the three previously described functions. Adaptive products thereby adjust themselves automatically to the circumstances. The only task humans assume is the monitoring of their performance. As an example, a system of mining machines can be pointed out. They operate completely autonomously below ground, and are attuned to one another.

Industrie 4.0 and Controlling | First results of the ICV survey

We are currently conducting an online survey in order to find out in what way the controller community deals with Industrie 4.0 and what changes they can expect in regard to controlling. So far, a total of approx. 200 controllers have partaken in this survey. At this point, we would like to present the first results to you, and thereby reveal what intrinsic potential benefits from the controlling standpoint can be expected through Industrie 4.0 (cf. Figure 4). A detailed evaluation of the survey will be published in the next Dream Car report.

Improved control of operative processes

Trends and future developments can be derived using "predictive analytics" tools (cf. BITKOM 2014, p. 61). This will enable controllers to have more efficient, faster and more direct control. Integrated systems make more customised interventions into the processes possible. For example, this would enable changes to the production programme and ongoing production processes at short notice. Moreover, the impact of activities can be simulated and their cost-benefit relationship can be made transparent.

Detection of new interdependencies

The amount of generated data increases enormously through digitalisation. "Data mining" applications aim to detect new patterns and regularities with a large database, and to make these useable. By disclosing previously unknown cause-effect correlations, a variety of opportunities for improved decision-making emerge.

Analysis of real time data

The analysis of real time data refers to the detection and evaluation of data at the time they arise. Changes and deviations are thereby detected faster. The constant monitoring of ongoing processes will take over from the retroactive control of completed processes. For the controller this means, among other things, that reports can be created more effectively due to the up-to-dateness. When using such speed advantages, however, the quality of the data should not be neglected.

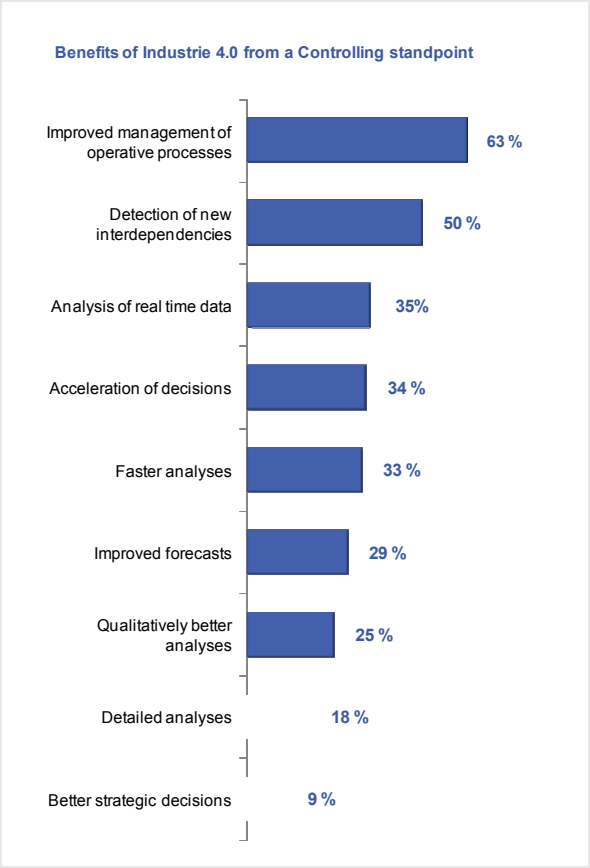

Figure 4: Potential benefits from the controlling standpoint

References

Bundesverband Informationswirtschaft, Telekommunikation und neue Medien (BITKOM), Big-Data-Technologien – Wissen für Entscheider, Berlin 2014.

Capgemini, Industry 4.0 – The Capgemini Consulting View, Berlin 2014.

Porter, M.E./Heppelmann, J.E., How Smart, Connected Products are Transforming Competition, in: Harvard Business Review,11/2014, p. 64-88, 2014.