Industrie 4.0 or The Industrial Big Change

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New information technologies led by the Internet of Things are impacting all significant functions of industrial companies and are leading to new business models with new products, services and business processes.

The author's Y-model (see graphic) shows the significant productive process types of an industrial company where the effects of Industry 4.0 on them are explained in the sections that follow. Graphic symbols in the Y-Model show functions and the bars contain the operational driving forces from I4.0. Significant technologies associated with I4.0 are shown outside these.

- The left side branch of the Y-Model shows order driven business processes in an industrial company (sales, procurement and production orders), designated in following sections as Logistics.
- The right side branch of the Y-Model shows product (development) led processes.
- The lower section of the Y-Model (the factory) shows logistical and product related processes together: the assignment of parts to be produced to resources, along with the prompt control and execution of the manufacturing process follows here.

The three process areas of factory, product development and logistics will be examined in more detail in further sections.

Process area Factory

Significant new I4.0 technologies in the factory are the so-called Cyber Physical Systems (CPS). These are software intensive production systems connected to the internet and able to communicate with each other as well as with intelligent materials. Materials are described as intelligent if they carry their properties such as quality and manufacturing steps with them in a data storage system (chip). Via RFID technologies these materials can navigate their way through the manufacturing process practically independently. Should a CPS suddenly fail then another system can automatically take over the function.

The high flexibility of CPS makes possible the strong individualisation of the manufacturing process as the process changeover of the system takes place with no loss of time and therefore also with no costs. For this reason the manufacture of quantities with batch size 1 is possible at the cost of mass production. A further significant technology is the cost effective storability of mass data in the production process (big data), made possible by price reductions in storage media and new "in memory" database technologies. Sensors measure the condition of machines, materials and production peripherals in real time. Analytical evaluation processes should not only explain past performance, rather they should use actual conditions to trigger immediate action and beyond this give indications of expected future system behaviour. The best known example is that of predictive maintenance in which the current behaviour of the system points towards abnormalities leading, for example, to the advice that a particular component may need to be replaced in the near future. Collectively, the combination of these technologies leads to the vision of a real time self-directing, extremely decentralised factory (smart factory).

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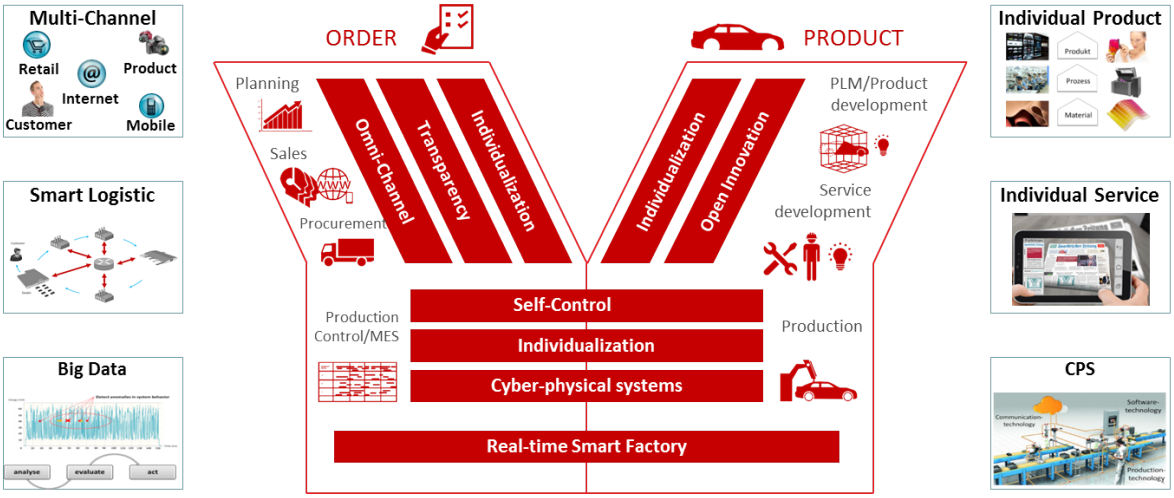

Industry 4.0 – The Big Change: Das Y-Modell von Prof. Dr. August-Wilhelm Scheer

Process area Product Development

The upper right side section of the Y-Model illustrates the development of products as well as closely product associated services. Stronger transition to more flexible manufacturing supports the stronger individualisation of products. This means that the number of variations of finished goods can be increased right up to the purely individual manufacturing process for a specific customer.

New technologies such as 3-D printing increase the development speed of new products through the faster development of prototypes (rapid prototyping). Concepts such as the speed factory at Adidas enable the customer specific manufacture of a running shoe following a scan for the fit. In an I4.0 environment with intelligent materials and processing equipment, all activities undertaken over the lifetime of a product, such as repairs, maintenance, adjustments etc. as well as the application and application conditions of the product can be automatically recorded and stored. This leads to the concept of transparent product lifecycle management (PLM). Evaluation of PLM data by the manufacturer brings new possibilities in product related services. Predictive maintenance has already been referred to with the capture of machine data in the factory.

An extreme further development in maintenance services is the takeover of operating responsibility for machines by the manufacturer itself. This concept is known as BOO – build, own, operate. The manufacturer knows its machines and production facilities best and is able, via PLM data, to analyse their performance and optimise their operation dependent on all operating conditions. It is therefore likely that the manufacturer will operate systems itself at clients or in production facilities it has set up itself. The client is no longer buying plant or machinery, it is receiving and paying for a service.

Process area Logictics

The upper left hand side of the Y-Model – Logistics – is also being significantly changed by I4.0. In the first instance a customer can issue orders, change them or cancel them, through many different channels (omni-channel) such as standard computers, laptops or smart phones. All channels must be usable by each other. A client's ease of access to its supplier leads, together with individualisation, to an increase in change requests and therefore to higher demands on flexibility during manufacture and product development. The client can wish a change in its original product definition practically just moments before the start of the manufacturing process.

The individualisation of products through increased variations of type and customer individual manufacture increases the number of suppliers and diminishes the manufacturing depth of a company. This means that the company's logistics network must be able to react faster. The information relationships now available in orders between supplier and buyer are rendered inadequate. More than this, the entire supply chain network must become transparent.

The description of the three starting points for I4.0, factory, product and logistics shows clearly how deep the changes in the drivers of business management for industrial companies will be in individualisation, decentralisation, self-directing, service orientation and transparency. The Industry 4.0 age has begun!

About Scheer

Scheer GmbH was created out of the merger between Scheer Management GmbH and IDS Scheer Consulting GmbH. Particular focus in the development of products and services is placed on the sector specific support and accompaniment of companies in their digital transformations. Scheer GmbH offers clients overarching support for all company processes critical to their success, from the strategy, over the implementation and up to operation. For these companies the Scheer GmbH has committed itself to new partnerships such as with SAP in the area of Hybris and SAP S/4HANA. With the innovative software architecture Scheer BPaaS (Business Process as a service) and current developments in the ARIS solution Scheer GmbH companies offer support to companies working towards digital business models. Customers profit from the in-depth expertise gained from our many consultancy projects which include implementations with SAP and the management of the applications in our own data centre.

August-Wilhelm Scheer, Professor for Business Informatics, inventor of the ARIS concept and entrepreneur is shareholder and chairman of the advisory board of Scheer GmbH and supports it through his many years of experience in the IT sector. He is committed to the close cooperation between science and research that ensures the innovative strength of this strongly growing business.

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