Industrial Revolution 4.0: Dresden Leads the Way

After the manufacturing industry's mechanization, electrification and digitalization, the use of the Internet rings in the fourth industrial revolution. Within the global competition, 'Industry 4.0' holds enormous potential for Germany as a business location, and Dresden's highly automated semiconductor industry functions as a blueprint for tomorrow's industrial production.

We are at the beginning of a new industrial revolution and alternative methods in industrial production: the so-called 'Industry 4.0'. Considering an increase in global competition and worldwide trends that include the shortage of resources, demographic changes and urbanization, how well we adjust to these challenges will determine Germany's future as a viable business epicenter. The manufacturing process of the future should be flexible, efficient and sustainable. In the factory of tomorrow, the vision of Industry 4.0 is that everything is connected to everything, machines communicate with each other, and building parts, materials and shipping containers exchange necessary information via chips and wireless systems. This complete automation will enable cars, chairs and cell phones to organize their own production. The result: The future 'intelligent' factories – or 'Smart Fabs' – will be smaller, faster and more efficient. Using modern technology Smart Fabs will distribute production processes across different factories, and with 'intelligent' chips and central monitoring tools, Smart Fabs will be optimized to capacity.

Chips for the World produced in Dresden's Smart-Fabs

The region around Dresden is Europe's largest site for microelectronics. The high-volume production of 300-mm thin wafers at Globalfoundries and the high-volume production of power electronics at Infineon in Dresden are unique in Europe. Today, every second chip produced in Europe is made in Dresden. The city's competence in microelectronics is traditional: in the 1970s, the GDR computer producer Robotron placed Dresden at the front lines; the IT-pioneers delivered across borders to West Germany and to the United States. Today, Dresden workshops produce 200 different types of chips.

One of the larger microelectronics giants, Infineon, is considered the blueprint for intelligent networking of the entire production in the Smart-Fab. The chip expert's Dresden site is one of the most highly automated chip factories worldwide. All moving parts including the boxes that transport wafers from process to process are equipped with RFID-chips (radio-frequency identification-chips) and deliver information that is important for the control of the manufacturing process: updating as the process progresses, shortages and malfunctions. Simple monotonous tasks like the loading and unloading of wafer boxes at process machines are disappearing more and more until intelligent systems will be completing standard contracts automatically, while more demanding tasks like planning and quality control are increasing in significance at the Smart-Fab.

Robot 'Co-Worker' Made in Dresden

The Dresden location for microelectronics employs a staff of expert automation specialists. Four leading companies have formed a network for innovation called the Automation Network Dresden (AND). One of the technological front-runners for the equipment for Smart Fabs is the Dresden enterprise Roth & Rau – Ortner. The automation specialist developed 'Scout', a self-navigating robot for flexible use in chip factories. Void of any guide systems on the floor or ceiling, Scout takes care of transportation and handling. Innovative 3-D sensor technology ensures that the robotic colleague can safely be employed even where men and machines share a narrow space. Scout checks its environment, avoids obstacles

and plans its own routes to its destinations. Dresden technology assists chip manufacturers worldwide in automated manual transportation and handling that makes production more efficient and intelligent.

Artificial Intelligence for the Smart-Fab: Software Sector is Booming in Dresden

Hardware can only 'think' by means of appropriate software. The machines in traditional sectors are becoming 'intelligent', and manufacturing sites are developing into ultramodern Smart-Fabs through software which collects enormous amounts of data, evaluates it, and derives action recommendation from the analysis. The new production software, for instance, recognizes when certain parameters are changing, when the pressure in a chamber decreases, or a gear is no longer running smoothly. In addition, the software alarms the system and independently initiates appropriate countermeasures.

Like no other, the 4.0 industry in Dresden combines the proficiency of modern chips and automation solutions with intelligent software. For example, since 2013 the e-commerce giant Amazon has relied on Dresden IT-expertise for its new development center. At Dresden's Amazon Development Center Germany, software specialists are working on plans for next generation 'cloud' services. IT experts are developing new technical solutions for Amazon's cloud platform Amazon Web Services through which Amazon supplies millions of customers with data and services directly from the Internet. In addition, these IT specialists are developing artificial intelligence, training machines to predict developments – a quality that will have enormous impact on the Smart Fab.

In Dresden, hardware and software specialists are actively collaborating. In the workshop 'Cyber-Physical Systems' of the industry association 'Silicon Saxony', representatives of Dresden's microelectronics and software sectors meet regularly to discuss questions regarding Industry 4.0. The forum gives its members, among them T-Systems Multimedia Solutions, Technical University Dresden, Institute for Microelectronics and Mechatronics-Systems, and Infineon, opportunities to exchange experiences from industry and research, which proves that intelligent solutions for the future of Industry 4.0 are forming beyond branch borders.