



Do you remember 2011? No? You should. It has been the year of a real revolution if you believe the promoters of Industrie 4.0. But to be honest, it has been a revolution not to come to an end; it has been a revolution, just announced at Hanover Fair 2011, the so-called 4th Industrial Revolution. Since this time, some controversial discussions are on-going reaching from real enthusiasm until heavy criticism. Let us take the opportunity here to clarify some basic questions: What is Industry 4.0? What are its challenges and its opportunities, what are the critics and the risks not to deal with Industrie 4.0 as it is called in Germany? In this series, join us to get a pragmatic introduction and overview including an outlook about this important topic which is not only relevant for Germany and also impacting our industrial and even social environment – and probably you, too!

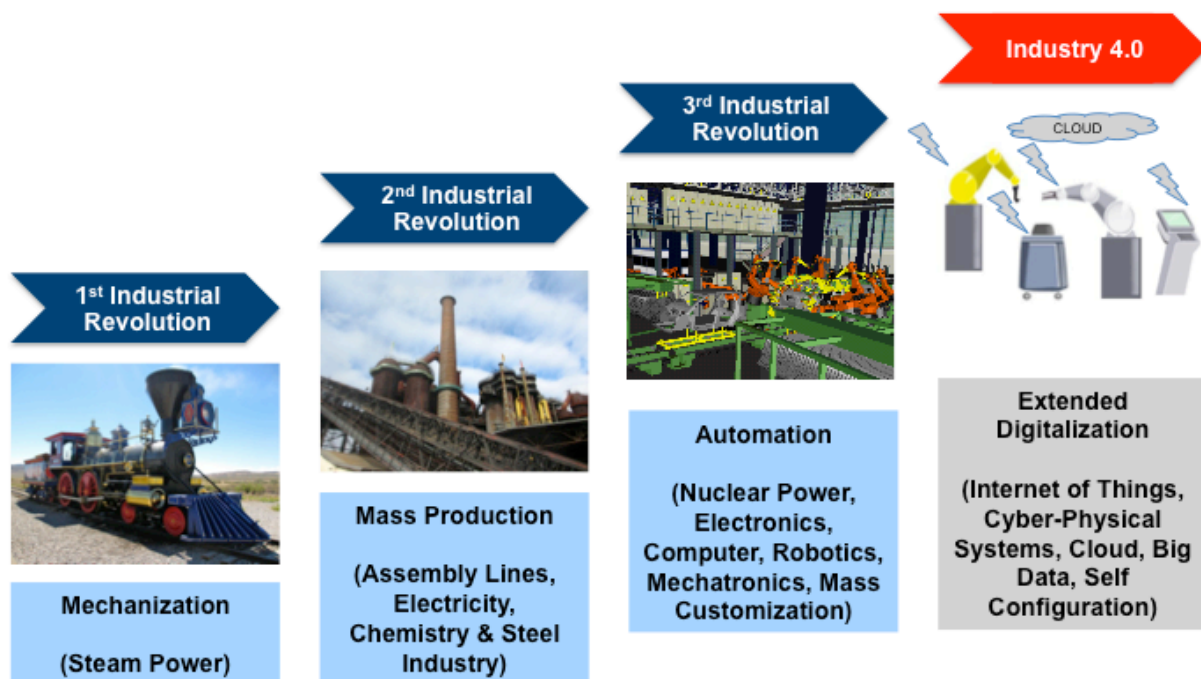
In contrast to evolution, a revolution is mostly a dramatic, often disruptive change. This is obviously the case for the first industrial revolution when James Watt and his contemporaries invented the steam engine. Until this invention, work has been based mainly on working animals, manpower and to some extent on wind power and waterpower like on sailing boats or wind and water mills. But the basic principles have not changed or rather slowly improved for centuries. But when invented, the steam engine conquered quite a lot of areas of mechanisation reaching from driving pumps in coalmines, railroads, shipping and factory mechanisation. The industrial revolution is a terminology on which historians can agree to have a common understanding and it is not only limited to technology or production. It is also a terminology referring to a change in agriculture and linked to a dramatic social change what we call the social question as it has had a big impact on modern society: the need for workers and new ways of organisation of work, the movement from rural population to growing cities, and a big shift in societies in general.

If you take this into account, the next revolutions what we call the second and third, seem to be not so obvious or you could argue to classify them in another way, more then evolutions. Interesting to know that the so-called second industrial revolution would be described in America and Europe differently. For the Americans, the second Industrial revolution is the area of big business, the area of the steel and railroad barons and of mass production, starting with the new production principles in the slaughterhouses of Chicago, which have been the inspiration for Henry Ford when introducing the conveyor belt in the automotive industry later. The Tin Lizzie, the model T, became the first car, which could be afforded by average people to fair prices. In Europe, especially in France and Germany, we would speak about the new age of electricity and chemistry, when people like Werner von Siemens build the first electrical tram or companies like BASF and Bayer started their global success story. Almost one century after the age of Watt, Stephenson and their followers, surprising things have been invented: the airplane, the Zeppelin, the automobile or the telephone – only to mention some. It has become an age when people where thinking we can achieve almost everything by technology. Remember the famous books of Jules Verne like “From the Earth to the Moon”. Two terrible world wars followed and technology made some additional progress: the first computers have been used for decoding military secrets or have been used for mathematic calculations. Experiences have been made with ballistic rockets like Wernher von Braun’s V-2 and jet planes like Messerschmitt Me-262 and the age of nuclear power began. Probably, you would agree that it is difficult to give this age an unambiguous name: the atomic age, the age of automation or computers? If we speak now about a third industrial revolution we could maybe align on the fact that the first major digitalization wave started: The semiconductor based computers, the first numeric control systems and robots have been introduced and Computer Integrated Manufacturing (CIM) propagated the area of production without humans: Hall 58 at Volkswagen or robot test fields at Fanuc robotic



company and the in usage of Automated Guided Vehicles in factories, e.g. in paper mills. For consumers like you and me, the world changed, too: The transistor radio has getting popular, Sony's Walkman has been the ultimate mobile device – who can remember? – the first personal computers like Mac, Commodore etc. have been installed at home and it was the time when Bill Gates has pointed out that 64 K RAM would be sufficient for a PC. Think about it. Furthermore, electrical typewriters have still been in usage and the first CAD tools have been introduced. Since this time, the digitalization speeded-up and our way of working changed. Today, CIM is assessed differently: The human-less factory has still not become reality. For different reasons, of course! At the beginning of digitalization, CIM has had to face real challenges like heterogeneity of systems, unavailability of the right software solutions, no or insufficient standards for exchange or only proprietary solutions in place reaching from computer hardware, automation systems, software to machinery. However, the direction has been still followed, as we will discuss in our next articles.

And do not forget: the pressure on product development, production and the supply chain increased heavily: global competition, cost pressure, turbulent markets and shorter product life cycles, shorter development times, increasing number of variants etc. Please follow us on our journey to Industrie 4.0. In our next article, we will start to speak about the different approaches in Engineering and Digitalization.



Sources (pictures): Arno Ritter and Fraunhofer IPA