



Automated Manufacturing | © iStock.com/Baran Äzdemir

INDUSTRIE 4.0

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One of 10 "Future Projects" identified by the German government as part of its High-Tech Strategy 2020, the "INDUSTRIE 4.0" project represents a major opportunity for Germany to establish itself as an integrated industry lead market and provider.

So-called because it will usher in a fourth industrial age, INDUSTRIE 4.0 is set to revolutionize manufacturing and production. INDUSTRIE 4.0 represents a paradigm shift from "centralized" to "decentralized" smart manufacturing and production.

"Smart production" becomes the norm in a world where intelligent ICT-based machines, systems and networks are capable of independently exchanging and responding to information to manage industrial production processes.

This brave new world of decentralized, autonomous real-time production being pioneered in Germany has its basis in two things:

Germany's continued role as one of the world's most competitive and innovative manufacturing industry sectors.

Germany's technological leadership in industrial production research and development.

Germany has the ideal conditions to become a global leader in innovative, internet-based production technology and service provision. Technological leadership and vision in the fields of manufacturing, automation and software-based embedded systems, as well as historically strong industrial networks, lay the cornerstone for the long-term success of the INDUSTRIE 4.0 project.

INDUSTRIE 4.0 – WHAT IS IT?

Today we stand on the cusp of a fourth industrial revolution. A revolution which promises to marry the worlds of production and network connectivity in an "Internet of Things" making "INDUSTRIE 4.0" a reality.

The world as we know and experience it today has been shaped by three major technological revolutions. The first Industrial Revolution, beginning in the UK at the tail end of the 18th century and ending in the mid-19th century, represented a radical shift away from an agrarian economy to one defined by the introduction of mechanical production methods.

The second period of radical transformation with the advent of industrial production and the birth of the factory at the start of the 20th century was no less precipitous; ushering in as it did an age of affordable consumer products for mass consumption.

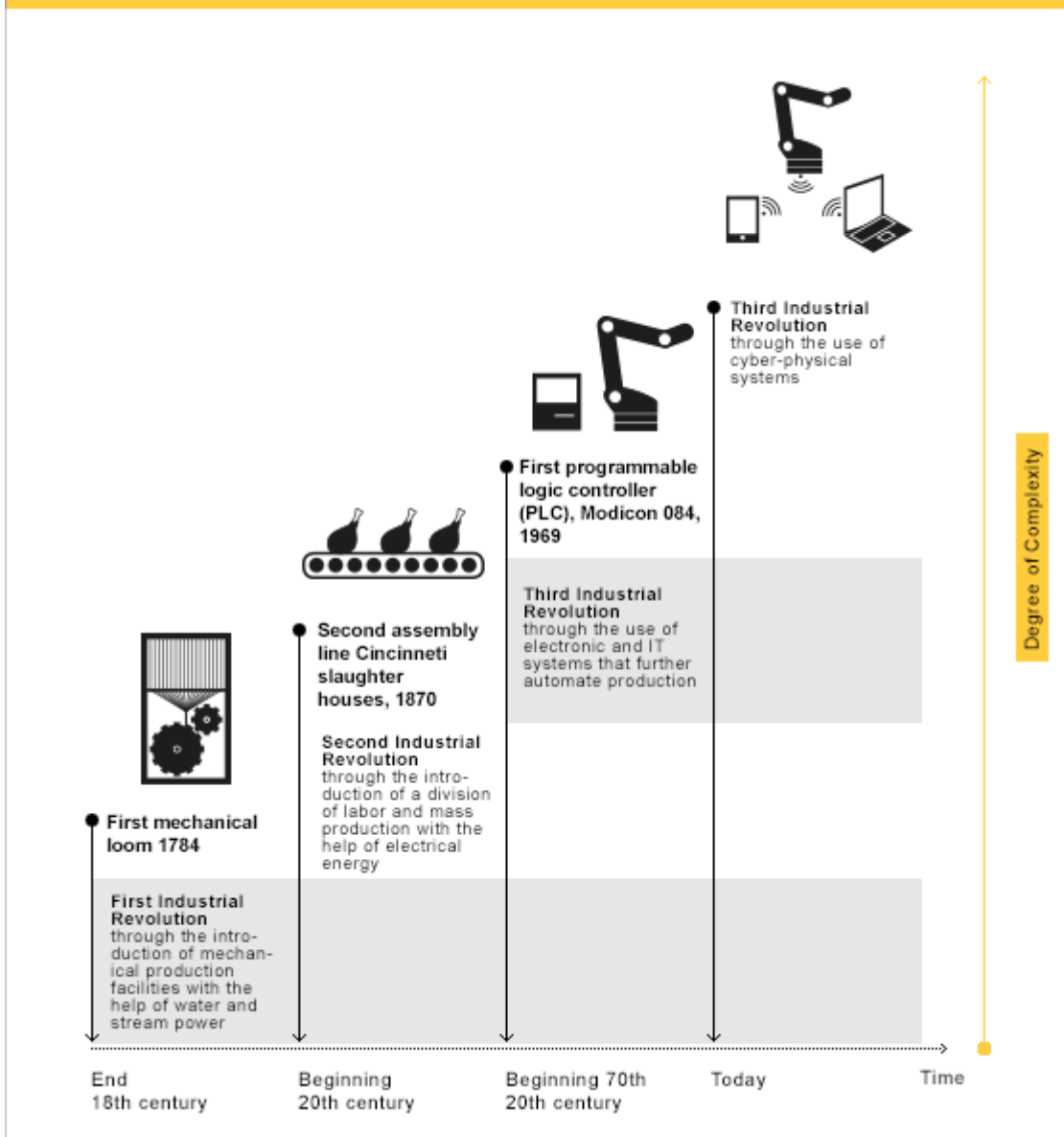
In the late 1960s the use of electronics and IT in industrial processes opened the door to a new age of optimized and automated production.

The Internet of Things and Services can now be added to the historical list of forces (mechanization, electricity, and information technology) powering industrial change. The changes being wrought by INDUSTRIE 4.0 will see it become the global language of production. INDUSTRIE 4.0 promises to increase manufacturing productivity levels by up to 50 percent – and halve the amount of resources required.

Germany's position as an embedded systems technology leader gives birth to enabling cyber-physical system (CPS) technologies which ingeniously marry the digital virtual world with the real world. Cyber-physical production systems (CPPS) made up of smart machines, logistics systems and production facilities allow peerless ICT-based integration for vertically integrated and networked manufacturing.

Germany has set itself the goal of being an integrated industry lead market and provider by 2020.

Industry 1.0 to Industry 4.0



From Industry 1.0 to Industry 4.0 | © DFKI 2011

SMART INDUSTRY

INDUSTRIE 4.0 opens the door to an age of "smart industry" in which people, devices, objects, and systems combine to form dynamic, self-organizing networks of production.

Decentralized intelligence helps create intelligent object networking and independent process management, with the interaction of the real and virtual worlds representing a crucial new aspect of the manufacturing and production process.

INDUSTRIE 4.0 represents a paradigm shift from "centralized" to "decentralized" production - made possible by technological advances which constitute a reversal of conventional production process logic. Simply put, this means that industrial production machinery no longer simply "processes" the product, but that the product communicates with the machinery to tell it exactly what to do.

Highly individualized, low-volume, real-time production becomes the norm as new industrial assistant systems allow new forms of machine-human production in a changing industry landscape.

INDUSTRIE 4.0 connects innovative embedded system production technologies and smart production processes to pave the way to a new industrial age which will radically transform industry and production value chains and business models in tomorrow's smart factories.

SMART FACTORY

The merging of the virtual and the physical worlds through cyber-physical systems and the resulting fusion of technical processes and business processes are leading the way to a new industrial age best defined by the "smart factory" concept.

The deployment of cyber-physical systems in production systems gives birth to the "smart factory." Smart factory products, resources and processes are characterized by cyber-physical systems; providing significant real-time quality, time, resource, and cost advantages in comparison with classic production systems.

The smart factory is designed according to sustainable and service-oriented business practices. These insist upon adaptability, flexibility, self-adaptability and learning characteristics, fault tolerance, and risk management.

High levels of automation come as standard in the smart factory - this being made possible by a flexible network of cyber-physical system-based production systems which, to a large extent, automatically oversee production processes.

Flexible production systems which are able to respond in almost real-time conditions allow in-house production processes to be radically optimized. Production advantages are not limited solely to one-off production conditions, but can also be optimized according to a global network of adaptive and self-organizing production units belonging to more than one operator.

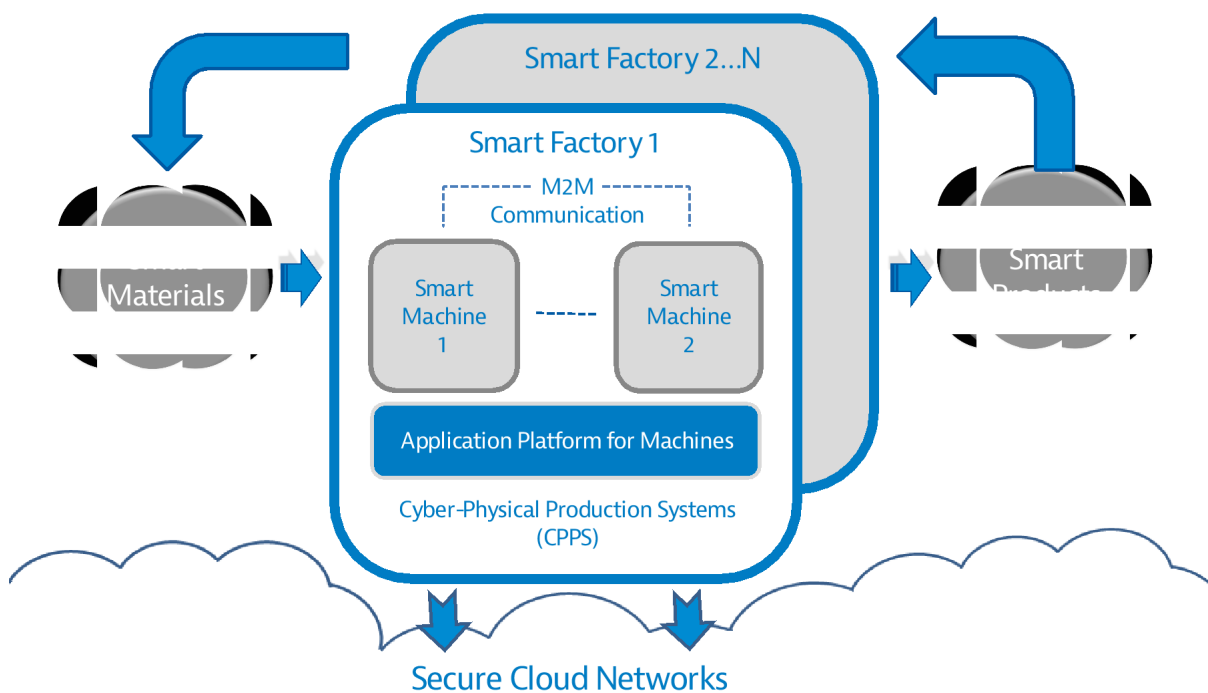
This represents a production revolution in terms of both innovation and cost and time savings and the creation of a "bottom-up" production value creation model whose networking capacity creates new and more market opportunities.

Smart factory production brings with it numerous advantages over conventional manufacture and production. These include:

- CPS-optimized production processes: smart factory "units" are able to determine and identify their field(s) of activity, configuration options and production conditions as well as communicate independently and wirelessly with other units;
- Optimized individual customer product manufacturing via intelligent compilation of ideal production system which factors account product properties, costs, logistics, security, reliability, time, and sustainability considerations;
- Resource efficient production;
- Tailored adjustments to the human workforce so that the machine adapts to the human work cycle.

Smart factories, with their interfaces to smart mobility, smart logistics, and smart grids concepts, are an integral component of tomorrow's intelligent infrastructures.

Industry 4.0 Smart Factory Pipeline (Cloud-based secure networks)



Industry 4.0 smart factory pipeline (cloud-based secure networks) | © GTAI



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