



INDUSTRY 4.0



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REVOLUTION OR EVOLUTION?

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2016-06-24

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DEFINITIONS

Revolution

A dramatic and wide-reaching change in the way something works or is organized or in people's ideas about it.

Source: http://www.oxforddictionaries.com/us/definition/american_english/revolution

A **revolution** (from the [Latin](#) *revolutio*, "a turn around") is a fundamental [change](#) in political power or organizational structures that takes place in a relatively short period of time when the population rises up in revolt against the current authorities. [Aristotle](#) described two types of political revolution:

1. Complete change from one constitution to another
2. Modification of an existing constitution.^[1]

Revolutions have occurred through [human history](#) and vary widely in terms of methods, duration, and motivating [ideology](#). Their results include major changes in [culture](#), [economy](#), and [socio-political institutions](#).

Scholarly debates about what does and does not constitute a revolution center on several issues. Early studies of revolutions primarily analyzed events in [European history](#) from a [psychological](#) perspective, but more modern examinations include global events and incorporate perspectives from several [social sciences](#), including [sociology](#) and [political science](#). Several generations of scholarly thought on revolutions have generated many competing theories and contributed much to the current understanding of this complex phenomenon.

Source: <https://en.wikipedia.org/wiki/Revolution>

Evolution

The [gradual](#) development of something, especially from a simple to a more complex form.

Source: http://www.oxforddictionaries.com/us/definition/american_english/evolution

Slow [process](#) of [change](#) from one [form](#) or level to a better or higher one, or that brings into being a superior or new [order](#). Evolution does not occur in a straight, steady progression but is marked by [false](#) starts and dead ends, [random leaps](#) in different directions, and [long periods](#) of no fruitful [activity](#). And, contrary to the popular belief, constant [adaptation](#) (see [natural selection](#)) is not the main [feature](#) of evolution. By far the most dominant evolutionary phenomenon is the preservation of whatever is [working](#) well. The [fundamental](#) natural [principle](#) as borne out by fossil (paleontological) [research](#) is: "If [it works](#), don't mess with it."

Source: <http://www.businessdictionary.com/definition/evolution.html>

Industry 4.0

Industry 4.0, **Industrie 4.0** or the **fourth industrial revolution**,^[1] is the current trend of automation and data exchange in manufacturing technologies. It includes [cyber-physical systems](#), the [Internet of things](#) and [cloud computing](#).^{[2][3][4]}

Industry 4.0 creates what has been called a "smart factory". Within the modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real time, and via the Internet of Services, both internal and cross-organizational services are offered and used by participants of the [value chain](#).^[2]

Source: https://en.wikipedia.org/wiki/Industry_4.0

The marriage of *advanced manufacturing techniques* with *information technology*, data, and analytics is driving another industrial revolution—one that invites manufacturing leaders to combine information technology and operations technology to create value in new and different ways.

Source: <http://dupress.com/articles/industry-4-0-manufacturing-ecosystems-exploring-world-connected-enterprises/>

Industry 4.0 is a term applied to a group of *rapid transformations* in the design, manufacture, operation and service of manufacturing systems and products.

Source: [http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI\(2015\)568337_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf)

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.

Source:

<https://www.gtai.de/GTAI/Navigation/EN/Invest/Industries/Smarter-business/Smart-technologies/smart-factory.html>

Lean Manufacturing

Lean manufacturing or **lean production**, often simply "**lean**", is a systematic method for the elimination of waste ("**Muda**") within a manufacturing system. Lean also takes into account waste created through overburden ("**Muri**") and waste created through unevenness in work loads ("**Mura**"). Working from the perspective of the client who consumes a product or service, "value" is any action or process that a customer would be willing to pay for.

Essentially, lean is centered on *making obvious what adds value by reducing everything else*. Lean manufacturing is a management philosophy derived mostly from the [Toyota Production System](#) (TPS) (hence the term Toyotism is also prevalent) and identified as "lean" only in the 1990s.

Source: https://en.wikipedia.org/wiki/Lean_manufacturing

DESIGN PRINCIPLES

There are four design principles in Industry 4.0. These principles support companies in identifying and implementing Industry 4.0 scenarios.

1. Interoperability:

The ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things (IoT) or the Internet of People (IoP).

2. Information transparency:

The ability of information systems to create a virtual copy of the physical world by enriching digital plant models with sensor data. This requires the aggregation of raw sensor data to higher-value context information.

3. Technical assistance:

First, the ability of assistance systems to support humans by aggregating and visualizing information comprehensibly for making informed decisions and solving urgent problems on short notice.

Second, the ability of cyber physical systems (CPS) to physically support humans by conducting a range of tasks that are unpleasant, too exhausting, or unsafe for their human co-workers.

4. Decentralized decisions:

The ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomous as possible. Only in case of exceptions, interferences, or conflicting goals, tasks are delegated to a higher level.

MEANING OF INDUSTRY 4.0

Characteristic for industrial production in an Industry 4.0 environment are the *strong customization of products under the conditions of highly flexible (mass-) production*. The required automation technology is improved by the introduction of methods of self-optimization, self-configuration, Self-diagnosis, cognition and intelligent support of workers in their increasingly complex work.

Source: https://en.wikipedia.org/wiki/Industry_4.0

BASICS FOR INDUSTRY 4.0

1. Internet and cyber-physical systems

Internet of Things (IoT) and cyber-physical systems (CPS) such as sensors having the ability to collect data that can be used by manufacturers and producers.

2. Data

Advancements in big data and powerful analytics means that systems can trawl through the huge sets of data and produce insights that can be acted upon quickly.

3. Information Security

Communications infrastructure backing Industry 4.0 up is secure enough to be used by heavy industries.

4. Standards

Information needs to be interchangeable between the devices in the systems and the data in the whole supply chain.

5. Optimized Processes

Business and manufacturing processes need to be optimized to gain the full advantage of the promised value gain.

6. Skilled employees

The change from manual work to automated work requires employees, who are able to use IoT and CPS as well independently execute work with the support of the provided information and data.

BENEFITS

According to a survey from PwC Management Consulting in Munich (January 2015) the companies are expecting following benefits from Industry 4.0

- Increase in turnover attributable to Industry 4.0 cumulated, incremental growth in 5 years of 12.5% (2.5% per year)
 - European companies expect more than €110 billion additional revenue per year attributable to Industry 4.0
- Improved satisfaction of customer requirements, by Horizontal co-operation.
- Reduction of the time from idea to final product on the market
- Enhanced flexibility
- Increased efficiency

REVOLUTION OR EVOLUTION?

Industry 4.0 will drastically change the way we are working and make decisions, and therefore has to be considered as a revolution in the industry.

On the other hand the term Industry 4.0 was created after the actual driving technology already existed and is continuously developing. We could argue, that the IoT was a direct result of the development of computer technology, which is said to have started in 1927 with the differential analyzer, built by H. L. Hazen and Vannevar Bush at MIT. (Source: <https://en.wikipedia.org/wiki/Computer>) This would indicate Industry 4.0 is part of an evolution.

Also it could be argued that Industry 4.0 is an evolution of data collection and analyze of Lean Manufacturing (KPI). One important part of Lean is the availability of information and best in real time, to be able to react fast and better to customer requirements. Also Industry 4.0 and Lean claim to improve the whole value stream. Even the goals or benefits are very similar. In the table below you find just a few samples.

Goals/Targets	
Industry 4.0	Lean Management
Reduction of the time from idea to final product on the market	Reduce Time by eliminating waste in form of transportation, movement, waiting etc.
Improved satisfaction of customer requirements	Customer Satisfaction
	Improve Quality
Increase in turnover	Add Value
	Capitalize on opportunities
	Reduce Total Costs
	Eliminate Waste

Maybe even some advocator of Lean will say, Industry 4.0 is a new tool added to the Lean toolbox and therefor it must be part of the evolution of Lean.

CONCLUSION

My personal conclusion is, that Industry 4.0 is revolution and evolution at the same time. Industry 4.0 is and even will much more change the way of working and even living as well it will help to achieve more benefits and easier problem solution capabilities in Lean, Lean SixSigma and other areas.

We all should focus on, how could we use the new technologies in our area of expertise to develop a work and living environment in which hopefully everybody will find her/his place.

Best regards,



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