Lean and Industry 4.0

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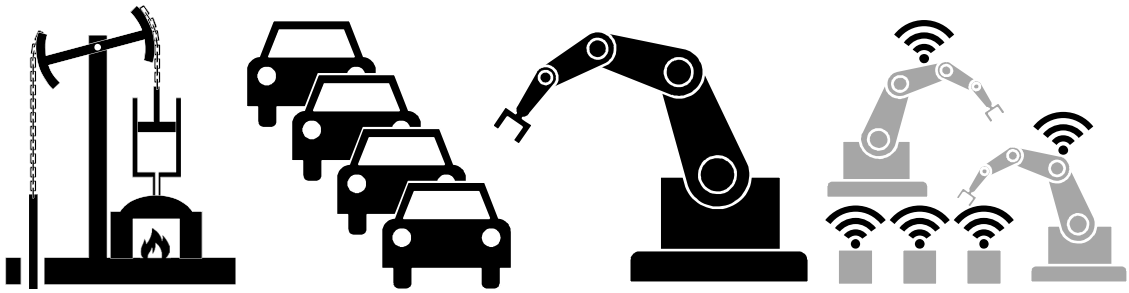
5th Avenue , New York, Easter 1900: Where is the Car?

5th Avenue , New York, Easter 1913: Where is the Horse?

Industry 4.0



1st	2nd	3rd	4th
Mechanization, water power, steam power	Mass production, assembly line, electricity	Computer and automation	Cyber Physical Systems

Why Industry 4.0?

- Representatives of academia and industry met Chancellor Merkel in 2011
- Goal: Major research funds for "Industrial Revolution 4.0" (Industrielle Revolution 4.0) from the German Ministry for Research and Education (BMBF Bundesministerium für Bildung und Forschung)
- Merkel: No Revolution on my watch in Germany!
- Changed: "Industrial ~~Revolution~~ 4.0" → "Industry 4.0"
- Research funds worth 400 Mio. €
- Presented on the Hannover Messe 2011

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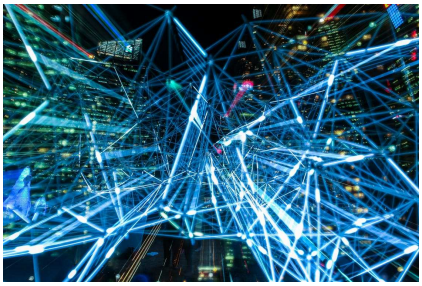
Déjà Vu? – It all sounds familiar

- **Digital Manufacturing** during the 1970s: Something with computers in manufacturing, but not much came out of it
- **Computer Integrated Manufacturing (CIM)** during the 1990s: Also quite a disappointment compared to the promises
- **Digital Factory** from 2000: Results unclear
- **Factory 2.0** from 2005 onward: Initiative of the European Union, pretty much forgotten
- **Smart Factory** from around 2007: Program of the University of Stuttgart, sort of merged with Industry 4.0

A Look at Profitability

Profit = Revenue - Cost

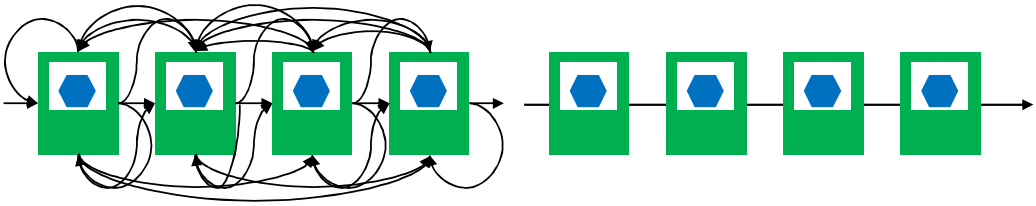
Benefit of Industry 4.0	Benefit often (intentionally) exaggerated. In reality not so much an *Industrial Revolution* as an **Industrial Evolution**
Cost of Industry 4.0	Cost often (**un**intentionally) underestimated. Especially the cost of understanding and analyzing the data is vastly underestimated



Images: pixabay.com and pexels.com

Benefit at Semiconductor Fabs

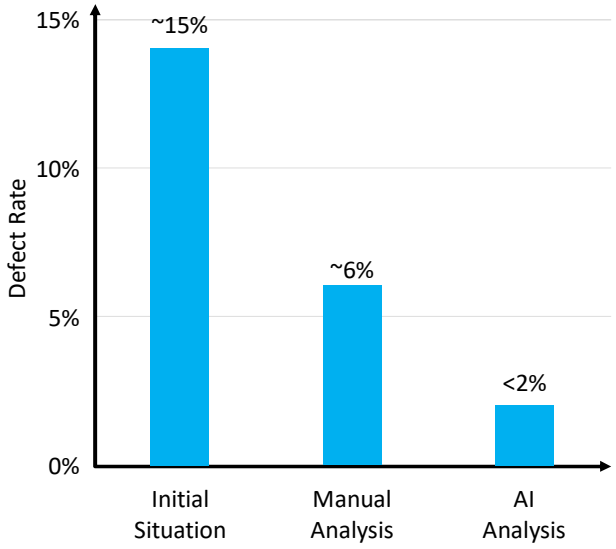
	Semiconductor Fab	Automotive Factory
Asset Costs	Ca. $20 Billion for factory, $200M for one Lithography machine	Ca. $1 Billion, few machines over $1M
Inventory Cost	1 Waver over $1 Million Retail Value	1 Car Retail Value $20-100 000
Material Flow	Complex Job Shop, modern chip 30+ layers, lead time 3 months, up to 100 visits at one process	Easy to optimize Flow Shop, lead time 1-2 weeks, usually only one visit at one process
Defect Rates	30% and more, halving defect rates would be $150 000 per waver	A few parts per million (ppm)



Vastly more improvement potential at a Semiconductor Fab!

Benefit in Improving Quality

Foundry Quality Rates



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Industry 4.0: Caution!

- Do not underestimate the cost!
- Understand the risk if you bet the company on Industry 4.0! (except Startups)
- Understand the need for Skills
- Select sensible, realistic Industry 4.0 projects

Industry 4.0 can really help, but also could make you bankrupt!

The Origin of the Term "Lean"

Triumph of the Lean Production System

John F. Krafcik — *MIT International Motor Vehicle Program*

THE RESEARCH FINDINGS REPORTED in this article will help to overturn a common myth about the auto industry: that productivity and quality levels are determined by an assembly plant's location. In reality there exists a wide range of performance levels among Japanese, North American, and European plants. Corporate parentage and culture do appear to be correlated with plant performance; the level of technology does not. Plants operating with a "lean" production policy are able to manufacture a wide range of models, yet maintain high levels of quality and productivity. *Ed.*

Sloan Management Review
41
Fall 1988

ON ONE SIDE OF THE WORLD there is an automotive assembly plant that is truly remarkable. Assembly line workers perform not only production line tasks, but also quality

firms these negative impressions. Unlike the first plant, this plant utilizes numerous robotic applications for actual assembly tasks such as installing seats, bumpers, and lights. Apparently all the bugs

Krafcik, John.F., 1988. Triumph of the lean production system. Sloan Management Review 41–52.

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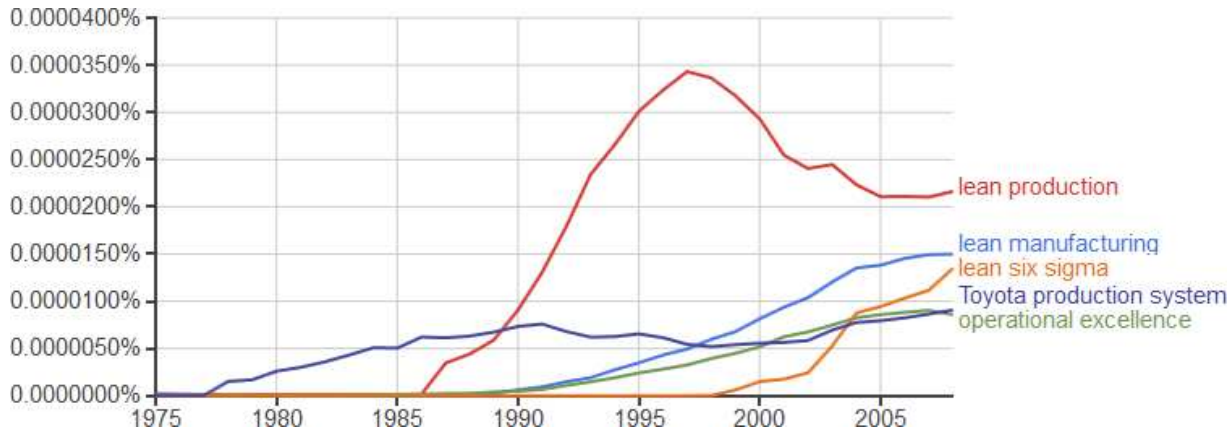
Different Terms used in Literature



- % of occurrences in books and papers Google Ngram viewer, data only until 2008

What is Lean?

Lean manufacturing or lean production, often simply "lean," is a systemic method for the elimination of **waste** within a manufacturing process. (*English Wikipedia*)

Lean is the permanent struggle to **flow** value to one customer. (*Mike Rother*)

Lean Production refers to the both **economical and time-efficient** use of factors of production resources, personnel, materials, planning, and organization in the context of all company activities. (*Gabler Wirtschaftslexikon*)

The core idea is to maximize **customer value** while minimizing waste. (*LEI Institute*)

"Lean" is the set of management practices based on the **Toyota Production System**. (*Mark Graban Lean Blog*)

A lot of different definitions

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Blind Men describing an Elephant

Lean is a Culture!

- Cultures are hard to define
- Cultures are hard to measure
- Cultures are hard to learn

Lean and Industry 4.0 Similarities

A good implementation requires your full attention and support as well as a lot of time of both you and your people

This can **not** be outsourced

PDCA: Plan Do **CHECK** and **ACT** – Did it actually work?

Most implementations fail due to lack of PDCA

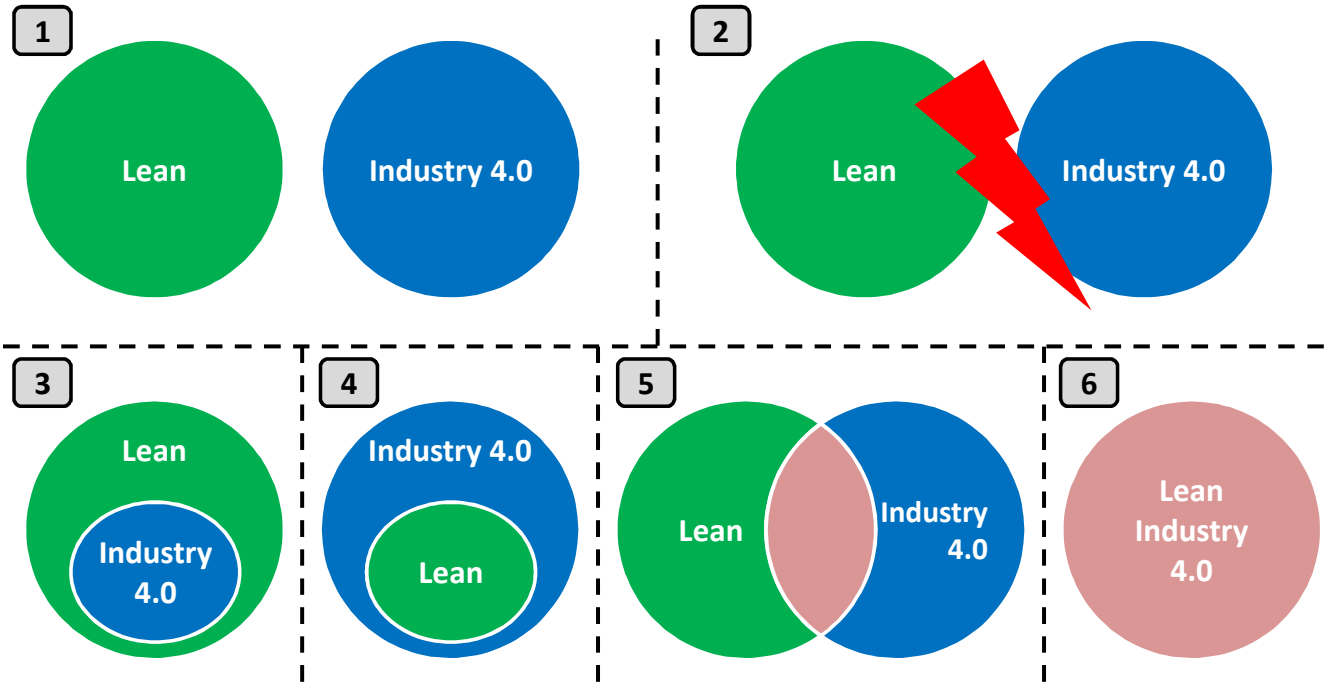
Successful implementations can make a huge difference for the business

Lean and Industry 4.0 Differences

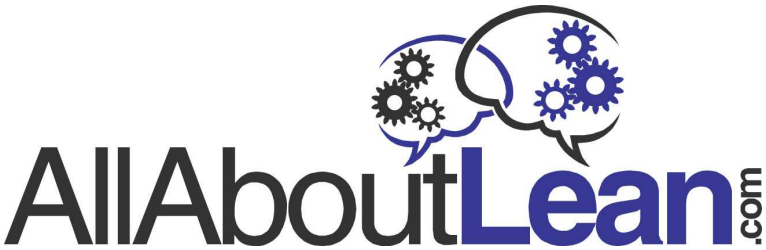
Lean	Industry 4.0
Focus on people, their needs and how they interact	Focus on computer, automation, and robotics, vision is to get rid of people (Lights out factories)
Often easy and quick fix solutions	Hardware and Software-heavy
Flexibility in changing the production system	Reduces flexibility, difficult to change Production System
Continuous improvement involving the workers	One-Stop implementation that is hard to improve
Can include computers	Must include computers

Go to www.menti.com and use the code 35 52 49 0

Lean and Industry 4.0? Mentimeter



Thank you ☺



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