Transforming Futuristic Technology Enabled Supply Chain 4.0 – The Next Industrial Revolution

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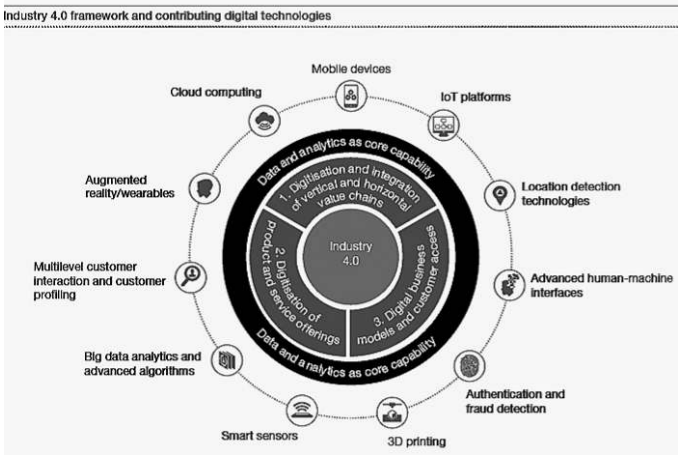
Abstract

Around the world, traditional manufacturing industry is in the throes of a digital transformation that is accelerated by exponentially growing technologies (e.g. ***intelligent robots, autonomous drones, sensors, 3D printing).*** Disruptive ***innovations*** are currently changing the landscape of many industries and their business models. Because of increasingly ***digitalized processes*** and an exponential growth of sensible data, supply chains are also impacted by the ***fourth industrial revolution***. Behind the scenes of the world's leading industrial companies, a profound ***digital transformation*** is now underway. Industrial leaders are digitizing essential functions and processes. They are enhancing their product portfolio with digital functionalities and are investing in data analytics as a foundational capability to drive innovation and significant improvements in efficiency. *In India as well, we see industrial companies planning to dramatically increase their overall level of digitization*. Choosing a path through the ***Futuristic Technology Enabled Supply Chain 4.0*** technologies that Industry 4.0 offers is hard enough, but with uncertainties generated by the ***pandemic COVID-19***, perhaps the universe of viable options has become smaller and more manageable, and the business cases clearer. The term **'Industry 4.0'** stands for the ***fourth industrial revolution***. Other related terms include ***'Industrial Internet'*** or ***'digital factory'***, although neither takes as complete a view. While ***Industry 3.0*** focused on the automation of single machines and processes, Industry 4.0 concentrates on the end-to-end ***digitization*** of all physical assets and their integration into digital ecosystems with value chain partners. Generating, analyzing and communicating data seamlessly underpin the gains promised by Industry 4.0, which networks a wide range of new technologies to create value. The present paper provides a brief overview of exploring ***opportunities and challenges*** encountered by the ***Futuristic Technology Enabled*** Supply Chain 4.0.

Keywords: Industry *4.0, Supply Chain, Organizational Change, Innovation*

Figure 1: Industry 4.0 Framework



Introduction

Technology in Supply Chain : Around the world, traditional manufacturing industry is in the throes of a digital transformation that is accelerated by exponentially growing technologies (e.g. ***Artificial intelligent (AI), Augmented Reality(AR), autonomous drones, Block chain, sensors, 3D printing, Internet of Things (IoT) Internet of Everything (IoE) Vertical Reality (VR), Robots,***

Figure 2: Industry 4.0 framework and contributing digital technologies

Behind the scenes of the world's leading industrial companies, a profound ***digital transformation*** is now underway. Industrial leaders are digitizing essential functions and processes. They are enhancing their product portfolio with digital functionalities and are investing in data analytics as a foundational capability to drive innovation and significant improvements in efficiency. *In India as well, we see industrial companies planning to dramatically increase their overall level of digitization*.

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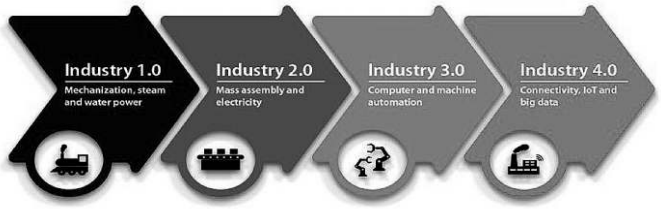
1. What is Industry 4.0?

"The question arises with industry 4.0 of whether it is an evolution or a revolution."

The concept of industry 4.0 is widely used across Europe, particularly in Germany's manufacturing sector. In the United States and the English-speaking world more generally, some commentators also use the terms the 'internet of things', the 'internet of everything' or the ***'industrial internet'.***

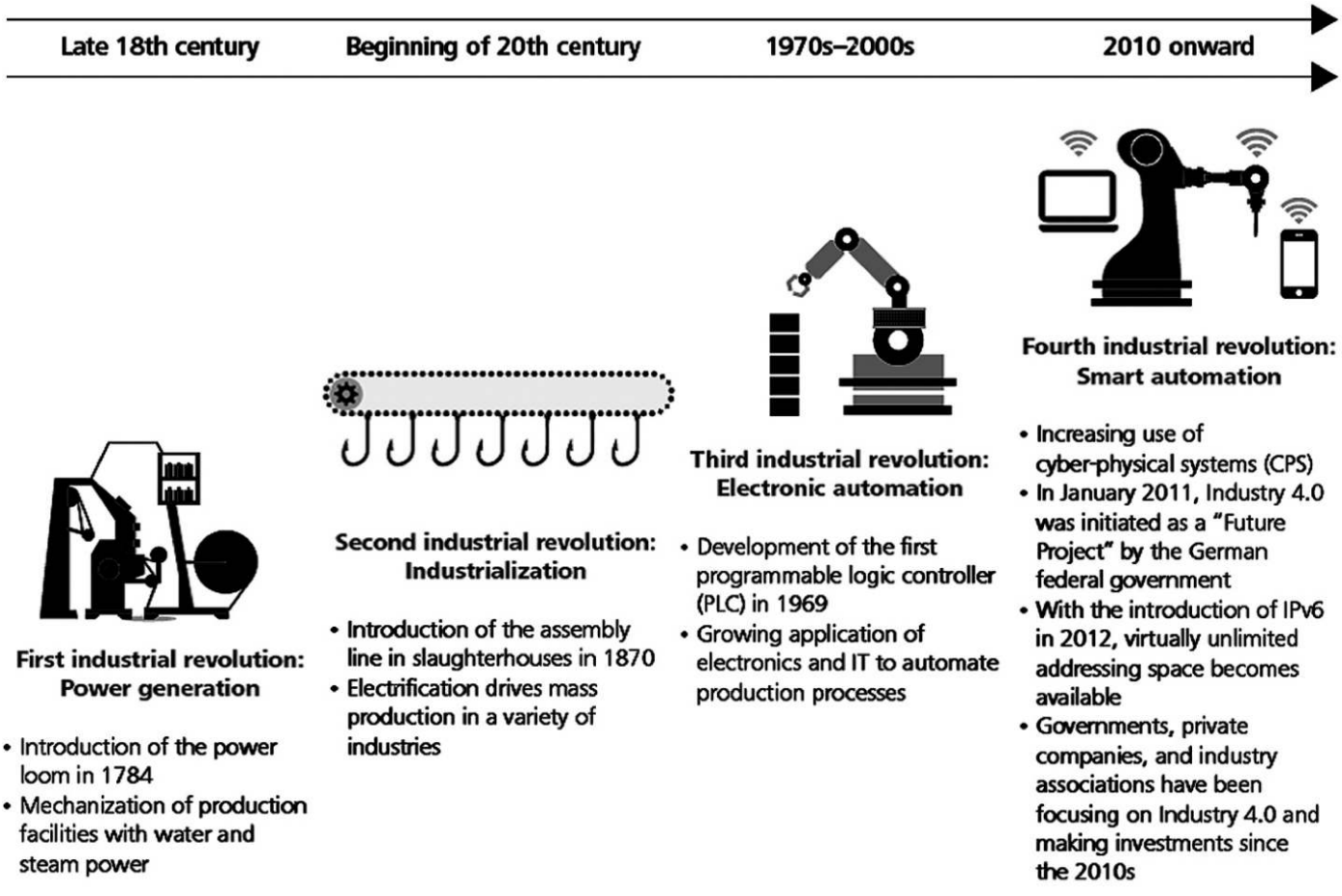


What all these terms and concepts have in common is the recognition that traditional manufacturing and production methods are in the throes of a digital transformation. For some time now, industrial processes have increasingly embraced modern information technology (IT), but the most recent trends go beyond simply the automation of production that has, since the early 1970s, been driven by developments in electronics and IT (Chart 1).

2. Industry 4.0

Industry 4.0 is the current trend of ***automation*** and data exchange in manufacturing technologies. It includes ***cyber-physical systems,*** the ***Internet of things*** and ***cloud computing.*** 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***

Figure 3. A histtory of industrial revolutions: Industry evolution with key developments.



Sources: Germany Trade & Invest, "INDUSTRIE 4.0—Smart manufacturing for the future," July 1, 2014; National Academy of Science and Engineering, "Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative Industry 4.0," April 2013; Deloitte analysis.

Graphic: Deloitte University Press | DUPress.com

While terms like industrial ***Internet and digital factory*** are also used to describe these changes, here, we use ***Industry 4.0*** to describe the *journey industrial companies taking towards a complete value chain transformation*. At the end of this transformation process, successful industrial companies will become true digital enterprises, with physical products at the core, *augmented by digital interfaces and data-based, innovative services*. These digital enterprises will work together with customers and suppliers in industrial digital ecosystems. These developments will fundamentally change individual companies as well as transform market dynamics across a whole range of industries. And that is true in countries all around the world—in both developed and emerging markets.

Connected manufacturing as Industry 4.0, several other commonly known terms may point to the same phenomenon. These include:

- *Industrial Internet*
- *Connected Enterprise*
- *SMART Manufacturing*
- *Smart Factory*
- *Manufacturing 4.0*
- *Internet of Everything*
- *Internet of Things for Manufacturing*

The term "Industry 4.0" originates from a project in the high-tech strategy of the ***German government,*** which promotes the ***computerization*** of manufacturing.

Design principles

There are 4 design principles in Industry 4.0. These principles support companies in identifying and implementing Industry 4.0 scenarios.

i. **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).*

ii. **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.*

iii. **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 to physically support humans by conducting a range of tasks those are unpleasant, too exhausting, or unsafe for their human co-workers.

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

3. Challenges

Table 1 : Industry 4.0 Key business objectives, organizes

 BUSINESS OPERATIONS	Productivity improvements	• Maximizing asset utilization and minimizing downtime • Driving direct and indirect labor efficiency • Managing supply network costs and synchronization • Ensuring schedule and plan stability and accuracy
	Risk reduction	• Ensuring raw material price and availability • Managing warranty and recalls effectively • Mitigating geographic risks
 BUSINESS GROWTH	Incremental revenue	• Finding sources of growth for the core business • Growing aftermarket revenue streams • Deepening customer understanding and insights • Strengthening customer integration and channels
	New revenue	• Creating new products and service offerings • Expanding internationally and in emerging markets • Indentifying attractive M&A opportunities

Challenges which have been identified include

i. IT security issues, which are greatly aggravated by the inherent need to open up those previously closed production shops
ii. Reliability and stability needed for critical machine-to-machine communication (M2M), including very short and stable latency times
iii. Need to maintain the integrity of production processes
iv. Need to avoid any IT snags, as those would cause expensive production outages
v. Need to protect industrial knowhow (contained also in the control files for the industrial automation gear)
vi. Lack of adequate skill-sets to expedite the march towards fourth industrial revolution
vii. Threat of redundancy of the corporate IT department
viii. General reluctance to change by stakeholders
ix. loss of many jobs to automatic processes and IT-controlled processes, especially for lower educated parts of society

4. Impact of Industry 4.0

Proponents of the term claim Industry 4.0 will affect many areas, most notably:

i. Services and business models
ii. Reliability and continuous productivity
iii. IT security
iv. Machine safety
v. Product lifecycles
vi. Industry value chain
vii. Workers' education and skills
viii. Socio-economic factors

1. Industry Demonstration: To help industry understand the impact of Industry 4.0, Cincinnati Mayor John Cranley, signed a proclamation to state "Cincinnati to be Industry 4.0 Demonstration City".
2. An article published in February 2016 suggests that Industry 4.0 may have beneficial effects for emerging economies such as India.

5. Addressing today's challenges

i. **Go beyond just data, generate insights –** Use data analytics to understand customers, market trends, track usage patterns, predict failures etc.

ii. Improve, standardize, and automate: processes to reduce internal cost to serve

iii. Contract effectively to get best value and manage risk in the changing digital landscape

iv. Embrace technology to support business e.g. application of sensors, drones, machine learning, 3D printing etc.

v. Develop right skills internally and explore partnerships to meet new digital needs

6. What can you do to prepare for the future?

Behind the great potential of the ***digital supply chain (DSC) lays Industry 4.0,*** the fourth industrial revolution. A transformation in production and automation was brought on first by steam and water power (Industry 1.0), then by electrification (2.0), and more recently by the digital computer (3.0). Industry 4.0, digitization, is about companies orienting themselves to the customer through e-commerce, digital marketing, social media, and the customer experience.

Digital ubiquity is also causing companies to completely rethink how they go about operations. Operations are often mistakenly viewed as "manufacturing," but operations are what gives a company its ability to act. As with every other aspect of a company, digital technology is enabling completely new operating models.

7. Conclusion

In this work on Industry 4.0 two methodological approaches have been used to explore the impact on the procurement function. A scope of study was used to better understand Industry 4.0 while in-depth explorative interviews with seven procurement managers should reveal insights from practice. Of course this study is limited with regards to the number of participants in the explorative survey. However, the conceptual findings and empirical insights support the conceptual differentiation of "Procurement 4.0" from previous maturity levels of technology use in procurement. The observations have been collected in form of six fundamental observations. *Obviously, Procurement 4.0* must support superior Industry 4.0 strategies of the company. In this role it shall assure the dynamic cooperation across organizations borders

and the achievement of a collaboration productivity rent, while safeguarding the companies risk exposure within the Industry 4.0 supply chain. However, research on the topic is still in its infancy, while practice signaled a high demand for explanative knowledge. More conceptual and empirical work is needed to better understand the effects of Industry 4.0 on procurement in detail. With these considerations in mind, this work is an initial exploration of the phenomenon and further observations need to be taken.

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