

Industry 4.0: A Brief Overview

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The conventional supply chains are linear. The material flow is unidirectional. The flow is downwards from raw materials to finished goods/service. This approach believed in maximizing profits by extracting more and more output from given resources. This was achieved by gigantic factories using economies of scale. These factories were not only inefficient by present-day standards but not safe for workers.

Very few countries like England, the United States, Germany and communist USSR etc. were industrialized. This system always used Push strategy. They produced in large quantities and exported to their colonies or other less developed countries. Later, as many countries were decolonized and technology became available the so-called industrialized countries lost much of their global markets. As a result, many national markets emerged with huge trade barriers. The protectionist approach brought further inefficiencies. The industrialized countries realized the loss and wanted to further

explore the foreign markets with the same old philosophy of "Economies of Scale". The resulted in many trade blocks and World organizations like WTO.

The redressal mechanisms put forth by WTO and similar organizations-built confidence among trading nations and the World economy grew. But in the process, humans destroyed the delicate balance of nature. The average temperature of the Earth started going up with many undesired consequences. The term 'Global Warming' was coined to explain this phenomenon.

Global warming is changing the course of many nations, governments, corporates and civic bodies. Now, efficiency and profit are not as important as sustainability. Every, the organization is trying to bring in the sustainable processes even at the cost of its profit margins.

The sustainable practices use 10R framework (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover). Unlike conventional supply chains, this framework

is circular. The end product finds its way back to its origin just like a drop of rainwater finds its way back to the ocean. This is the reason why such supply chain is called a closed-loop supply chain. Such supply chains have given birth to the concept of "Circular Economy".

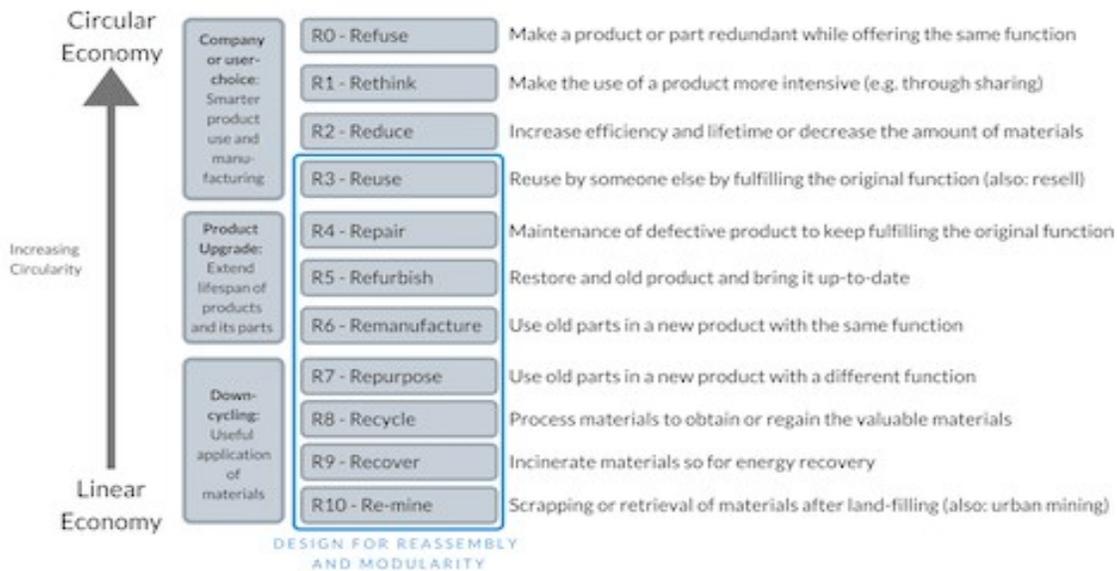


Figure 1. 10R role in Economy (Kirchherr et al.; 2017, Potting et al.; 2017 and Reike et al.; 2018)

Achieving the circularity in the economy as desired is not easy. It requires a lot of planning, coordination and execution among all the stakeholders including the end customer. To achieve this all the modern-day

technologies are used. From improved excavation methods to delivery of the order by drones. The use of all these technologies along the supply chain is called "Industry 4.0". The term was first coined in Germany.

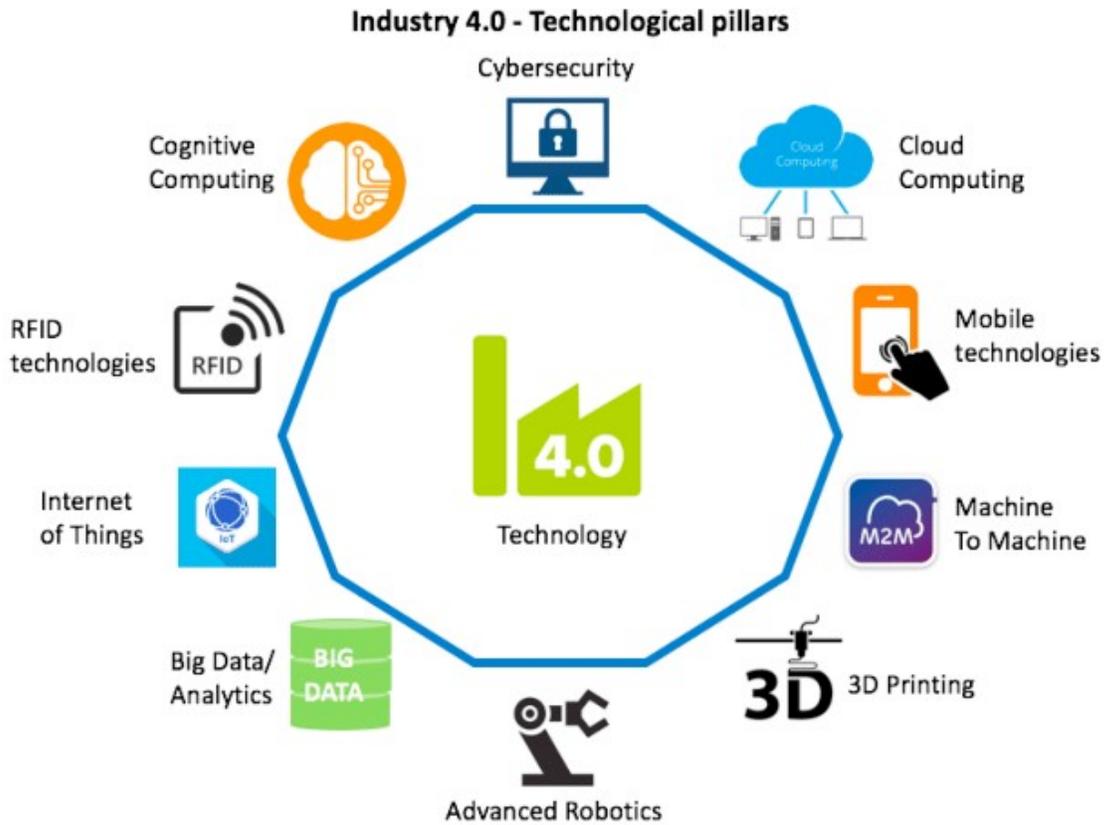


Figure I Industry 4.0 Technologies. (Maicon Saturno et al 2017)

It is a cyber-physical system. Where both software and hardware give a synergic effect. The advancement of Machine learning, Artificial Intelligence, Blockchain technologies are used to optimize these systems. There are many challenges to overcome. The basic challenges include good network like 5G, availability of trained manpower and social acceptance. Many researchers and practitioners are working in the area to explore great opportunities.

The time will answer whether it becomes a "Fourth Industrial Revolution" or bursts like a "Dot-com Bubble"

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