

The Innovation of Internet Industries Transformed to Fourth 4th Industrial Revolution: Threats and Challenges of the Cyber-Enabled Industries

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Abstract

Artificial intelligence and machine learning to the advanced automation robotics and autonomous portable smart vehicles (cars & drones), along with genetic advances and biotechnology developments. Technological advancement made possible with the aid of Quantum Supercomputing mobile devices, which archived with extended smart digital ledgers (Blockchain Technology) over the backbone of ultra-fast communication technology (5G). This is not seen from the future; instead, it is the works of the contemporary era of industrial revolution 4.0, and we are at the very beginning of this technological era. However, with such rapid development and advancements, a threat is looming from the darkest technological corner, have made its debut, in the form of persistent cyber threat, which is hunting for preys, across all technological platforms, leveraging any possible technological loophole or misconfiguration to their advantage. Cyber and technological criminals will waste no time, in penetration and breaching any technology that comes across their path, and they have always proven to be superior, where the security experts try to fill the gap as they go. This paper will illustrate some of the threats and challenges associated with the development of industry 4.0.

Keywords

1. Introduction

The fourth industrial revolution has touched many areas of respected domain

The current generation is perceiving the fruits of previous industries and innovations, living the contemporary generation of the 4th industry revolution. A revolution demonstrates a persistent development, in the field of information and communications technology sector. The technological shift towards industry 4.0 has enabled numerous industries to flourish and revolve by transforming to the newfangled wave of technological advancement leveraging the ease of accessibility of the modern technology and smart automated intelligent machinery. That can learn and self-operate such as vehicle trains, drones, and ships — other biotech domains via Human Body enhancements thru wearable devices, biotech implants or even genetic alteration and editing, all that is just a tip of an iceberg of the current possibilities of the modern fourth industrial revolution. The potential of great shift is happening at a rapid speed and still developing and intruding new technologies to enhance further and advance the human life, allowing to connect the nations in a digital platform, improving the means to communicate and exchange information with each other at the human level and machine level. One of the promising evolution of the ICT industry is the introduction of the 5G Network (Fifth Generation of Cellular Mobile Communications) which is a highly sustainable bandwidth that ranges between (10 to 20 GBPS). Unlocking the real potential of the machine to machine communication, expanding the ability to generate, process and analyze gathered data, which would defiantly enhance the research on artificial intelligence and machine learning. This single advancement of the ICT industry impacts a wide range of other disciplines and industries (figure1) such as; the education, healthcare, transportation and improving society by transforming analog cities to productive, smart cities. That relies on clean energy that will reflect on relieving the natural environments and recovering from the introduction of contaminants substance that is harmful and poisonous that may have been affected by the pollution of the past industries.

4th Industrial Revolution is the 3d industrial innovation (Industrial Internet)

The Industrial Internet, or as communally known by tech gurus as the Industrial Internet of Things (IIoT), is a terminology that was first coined by General Electronics GE late 2012, describing the innovation of enabling widespread industrial machines to communicate with each other at a rapid scale, resulting in generating deep insight of internetworks of data. That data has assisted the operators to make critical, and smarter choices, based on the machine gathered intelligence. This is practically a constructive solution specifically when dealing with critical infrastructure, hence the great ability of Supervisory Control and Data Acquisition (SCADA). That enables industrial organizations to control and manage industrial processes locally or remotely via RTUs Remote Terminal Units, that interacts with Programmable Logic Controller's PLCs, which is used mainly for interconnecting with a diverse range of industrial equipment's. Industrial internet is well defined by General Electronics "*Industrial Internet, brings together brilliant machines, advanced analytics, and people at work. It is the network of a multitude of industrial devices connected by communications technologies that result in systems that can monitor, collect,*

exchange, analyze, and deliver valuable new insights like never before. These insights can then help drive smarter, faster business decisions for industrial companies.”

Recent years the terminology of **industry 4.0** has gained widespread recognition and adoption due to the infusion of technological advancement within the information and communications technology industry. The terminology “*fourth industrial revolution*” was first introduced and coined by Klaus Schwab in the World Economic Forum, 2016 (Schwab 2016). However, in Klaus Schwab publication at the World Economic Forum 2016 titled, the fourth industrial revolution, did indicate that the term “**Industry 4.0**”, was discussed and coined in Germany, during the Hannover Fair in 2011 (Schwab 2016).

The maturity of the communication industry has unlocked new horizons in enabling physical industries via the automation and the communication ability of smart, intelligent robots, along with the advancement of machinery artificial intelligence, which made them decision smart and proactive. All of this interconnectivity is made possible, due to the backbone of communication technology. The ultra-fast internetworking ability to share data among other machines have resulted in generating big data, that consequently will require more advanced computing ability, to critically analyze and make a smart decision or choice. Hence why the term industry 4.0 has superseded the terminology of the modern internet. Because it perceived as an industry innovation wave rather than a whole new industry, due to the fact that, when the terminology industrial internet was first coined, and it was in its early stage not matured enough. Hence it was considered an innovation, but the fact today clearly can be seen as a whole new industry, which inspires other industries to evolve.

There are an influx new terms and references of technology that leaves once confused thinking they are all the same. However there are distinctive deference’s for the trained ears and eyes or basically a tech specialist, To illustrate the transformation of industry innovation terminology revolution further, and how the industrial internet was the considered as the 3 innovation at a previous stage, but with further maturity it has been recognized as an industry era all together.

It only shows how relative revolutionary terms are as the three industrial Internet innovation waves respectively were figure 2:

- **The Industrial Revolution.** The first revolution of its kind and the starting point of mechanical advancements with the introduction of water and steam operated engines.
- **The Internet Revolution:** the bourn of computing power and the rise of distributed information networks’ due to Advanced Research Projects Agency Network, (ARPANet) a US military funded project to create a reliable and robust communication network that resulted in creating the Internet.
- **The Industrial Internet:** is transforming classic analog industries, to an advance digitalized state, by utilizing the advancement of the ICT sector and transforming to the internetworking industry 4.0.
- **4th industrial revolution:** is an intermix fusion of technologies across multiple domains, come together in harmony to introduce a new breed of advanced machinery that is equipped with artificial intelligence and machine learning capabilities bringing cyber and physical in automation that unlocks new untapped grounds and open new advice potentials.



Figure 1: 5G industries (Explained 2018)

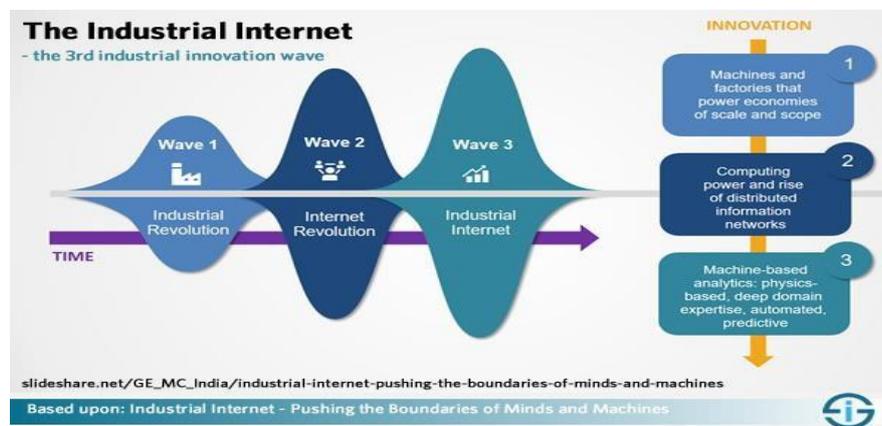


Figure 2: I-scoop industrial wave (i-scoop 2018)

Emerging industries within 4th industrial Revaluation

According to Boston Consulting Group Article “Embracing Industry 4.0 and Rediscovering Growth” by the BCG expert Olivier Scalable, there are nine industries which are transforming the industrial production and representing the shift to smart Industry 4.0.



Figure 3: Boston Consulting Group (Group 2015)

Challenges and threats of the 4th industrial revolution

Schwab has expressed few fundamental apprehensions: In regard to organizations failing to embrace the technological shift and fall behind, along with governments who are unable to engage and regulate the new technologies to their benefits. Therefore, it will produce critical security concerns; as the gap of industry, advancement will grow in some societies, where the rest will fall behind.

According to white research paper conducted and published by “Siemens Financial Services” in quarter one 2018, in attempted to uncover what are the key challenges to achieving digital transformation, the research has captured the opinions of 40 manufacturers and expert consultants in management across 11 countries and they have identified six key challenges facing manufacturer (Swadlo 2018).

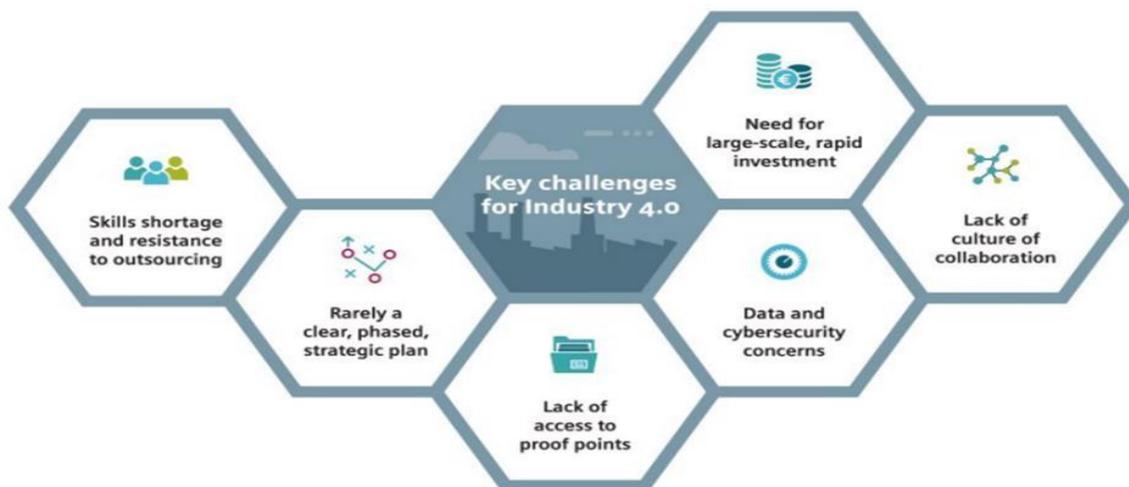


Figure 4: Key challenges for Industry 4.0 (Swadlo 2018)

- 1- Digital skills:** according to the Siemens Financial Services research survey, respondents have indicated three key areas of shortage, within digital skills domain: digital production expertise, digital maintenance capabilities and operating and strategic analytics. STEM Foundation is an innovation-driven charity that supports improvements in STEM (Science, Technology, Engineering, and Mathematics). It has illustrated in a study titled, “Shaping the Future of STEM Skills,” that the influence of technology is shaping the needs of innovative skills sets, that are highly adaptable and scalable, to keep up with the rapid change of technology advancements and fulfill the demand of the marketplace (Skills 2017).
- 2- Access to finance for the scale of investment:** according to SFS interviewees contemplate that without appropriate funds to support the ever-increasing demand on implementing latest technological gear, the manufacturer will elude from conducting effective digital transformation.
- 3- creating a culture of collaboration:** A survey to assess executives readiness for Industry 4.0 by Deloitte Global published on Deloitte and Forbes Insights titled “.The Fourth Industrial Revolution is here—are you ready?”. Stated that executives pointed out that what makes the shift difficult is the implement digitization on 4.0 industry is the “lack of internal alignment (43 percent), a lack of collaboration with external partners (38 percent) and a focus on the short term (37 percent)” (Deloitte 2018).
- 4- Data and cyber security:** information security concerns have overgrown as fast as the technology itself, the more interworking we allow the more vulnerabilities we encounter because simply we expose data to a varies types of abuse. The cyber threats landscape is constantly evolving, alongside the technological advancements, which in many cases it may supersede the current technology, as cybercriminals actively on the pursuit for methods to breach the technology to discover Loopholes and misconfiguration to leverage the technology in use. The type of cyber-attacks on the 1980s, where generic and basic such as password

cracking and password guessing. However, on the late 90s and early 20s, the systems started to be semi-complex deploying more technological enhancements on legacy systems, which allowed them to communicate more. Consequently, cybercriminals stepped-up their skills on e-discovery by conducting networking port scanning and basic packet analysis to apply packet spoofing technique. Today, cyber-attacks take place with advanced penetration testing technique with the aid off a combination of smart and advanced malware code that partake multiple ability such as advanced network scanning and in-depth packet analysis, along with keylogger capabilities to steal credentials, and finally the distractive ability of denial of service attack to compromise the availability of services. Figure 5 is an illustration of cyber-attack evolution by frost & Sullivan white paper titled “Cyber Security in the Era of Industrial IoT:” (Sullivan 2017).

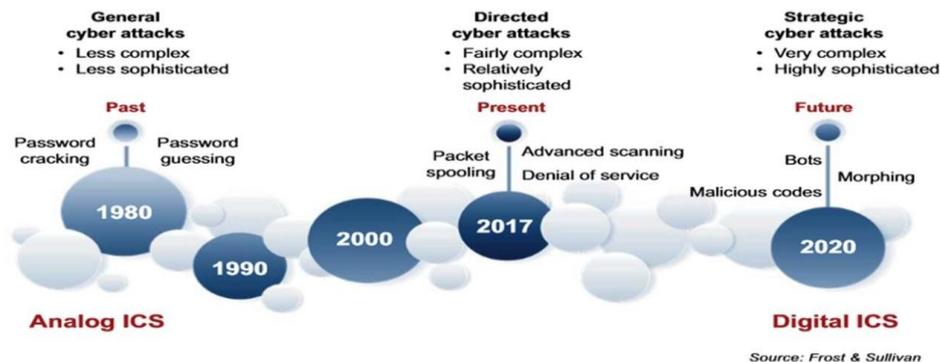


Figure 5: Evolution of Cyber-Attacks (Sullivan 2017)

5- Comprehensive access to proof points: The lack of proper and comprehensive studies of the industrial shift of technology may lead in talking wrong un-calculated decisions. Those decisions will impact the return on investment, and it will impact the ability to transform and digitizing services, and that is a critical challenge to overcome, and Proof points are defined as case studies about manufacturers’ investment in Industry 4.0 technology, which clearly illustrates the level and period of return-on-investment.

6- Specialized strategic management and planning capabilities: Siemens Financial Services research survey, respondents have emphasized on the importance of adopting a clear strategic plan that can be measured in phases in order to calculate the return of investment in each phases so later it can be modified or changed to meet the organization's goal.

Others 4.0 related challenges

- Lack of clear industry 4.0 strategy and road map
- Lack of existing working pilots
- The challenges regarding the integration of People, IT and OT.
- Risk control and defining uncertainty
- Lack of clearly defined roadmap of e.transformation □
- Data compliance and regularity.
- Technological complexity of connected devices and parties.
- Lack of clear standards of 4.0 industry discipline.
- Human capacity building and talent development challenge

3. Conclusion

The fourth industrial revolution has been progressing at a rapid pace, and every day we come closer to unlocking new areas of research, solving more complicated predicaments, all in pursuit to enhance the way human race live and communicate. The advancements of the 4th industrial revolution have touched multiple domains, allowing them evolving and advance. Rapidly, the technological advancement and knowledge that the human race will pose and consequently will enable them to travel across the galaxy and explore the potential of leveraging other plants resources. As the development progress in developing more and more deeper into the artificial intelligence and machine learning will create the opportunity to witness a fifth industrial revolution, which can be advancing the technological and scientific research of aerospace and astrological domain, countenancing the human race to infinite possibilities of resources.

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