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# Industry 4.0: Role of Cyber Security and Blockchain

– Vinod Kumar Mishra

Blockchain Consultant with Natanedu & VegoilChain

 <https://orcid.org/0000-0002-8416-9156>  [vkumar201415@gmail.com](mailto:vkumar201415@gmail.com)

Industry 4.0 is seen as the next industrial revolution driven by technology with interconnected systems which would be capable of making own decisions. The industry will be driven by automation and smart manufacturing in factories with solutions build using technologies such as Internet of Things (IoT), cloud computing, artificial intelligence and Blockchain to name a few. The lives of almost all the human beings will be affected by the rapid transformation of change.

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## Introduction:

The principles which the industries identify the use cases for industry 4.0 are based on:

- Interconnected devices: Multiple machines will be interconnected to each other and data would be transferred using sensors, systems and transferring protocols.
- Transparency of information: The information will be based on the data which will be transparently available to all the parties involved in the process. The security and availability of data is the key.
- Visualization of information: The information which flows

from various interconnected devices needs to be converted to meaningful visual representations for human decision making. The visualization can be based on automated analysis using technologies like data analytics and artificial analysis.

- Decentralized democratic decision making: The machines will be able to make smart decisions based on the predefined rules. The automated decisions will not be controlled by one authority in the process but will rather be based on the rules agreed by all the parties in the process. However, the exceptions can be well defined into the system and agreed upon by all the parties in the system.

## Cyber security in Industry 4.0:

The data in industry 4.0 involves three stages in which firstly the data

is collected from different devices imitating the human emotions, secondly the data is processed using different data analytics techniques with meaningful insights derived from it and finally the insights are transformed into automated actions into the inter connected systems.

The data will play the most critical role in the entire forth revolution of the industry. The secure transfer of data between all the parties involved in the process should be the key for all subsequent automated data processing and automatic decision making by the interconnected machines into the system. The entire system should ensure secure transfer of data throughout the process with utmost priority. The number of interconnected devices into the system increases the risk of cyber security attack which can result in manipulating the data which can result in adverse automated decision making and further actions by organizations.

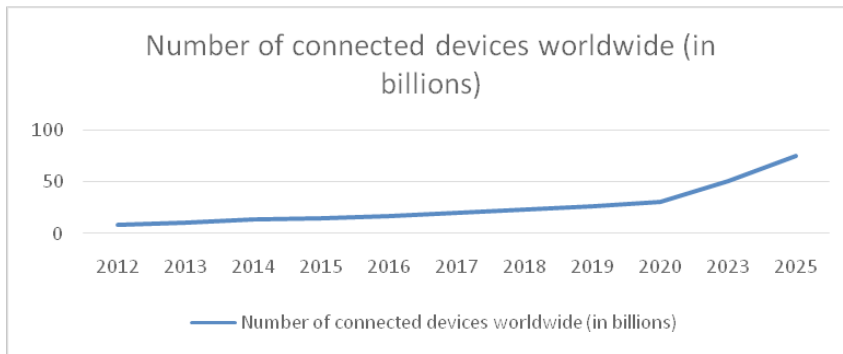


Fig. Estimated number of connected IoT devices  
 (Source: <https://www2.deloitte.com/us/en/insights/focus/industry-4-0/cybersecurity-managing-risk-in-age-of-connected-production.html>)

The risks for the Industry 4.0 era need to be considered differently to create a secure and resilient cyber strategy. The risks increase when all the parties such as customers, participants in supply chain, factories and operations are connected to one system and huge amount of data is transferred from multiple interconnected systems.

The traditional cyber security mechanisms adopted to protect unauthorized entry into the system are use of firewall, malware protection software and intrusion detection systems. The entry points of data are connected to multiple WIFI networks, Internet of Things (IoT) devices. All the devices will be connected to public cloud-based systems. The Information technology (IT), Operational technology (OT) and intellectual property (IP) assets are being utilized in industry 4.0.

According to a report from ENISA, which is European union agency for cybersecurity the following cyber security challenges and recommendations were highlighted for industry 4.0:

- The organisation needs to increase awareness related to the information technology and operational technology security. The lack of knowledge of the people specifically the people within the organization related to

the security aspects are one of the major concerns. The knowledge will help the employees monitor, prevent and detect any issues into the interconnected automated systems.

- Well defined organizational cyber security policy is needed for planning the next stage implementations for industry 4.0. The entire governance and adoption of the industry 4.0 technologies will be determined by the cyber security policies already in place and functional within the organization.
- Most of the emerging technologies are perceived as liability into the already complex processes.
- The security standards need to be well defined so that all the parties can trust and collaborate to one common system. The processes involve parties from multiple countries working on different standards. The mapping between different standards will ensure flow of data and its interpretation by different other technologies in industry 4.0.
- The interoperability between different devices, platforms and frameworks into the industry 4.0 ecosystem is needed for automated decision making and efficient smart manufacturing.

- Secure integration with the legacy systems is required for including all systems existing in silos into the common industry 4.0 platform.

**Role of Blockchain:**

Blockchain technology is one of the emerging technologies which is looked forward for used to ensure transparency and decentralization. The encryption and peer to peer replication of systems in the distributed ledger technology will ensure the trust and transparency into the system. Blockchain will be the technology on the storage level which will ensure integrity of data. The authenticity of the data which is entering into the process will be protected by asymmetric cryptography for each member roles tagged to a device. Only data from the specific systems can enter the distributed network with automated secured verification and validation. The data analytics layer will query the blockchain ledger at real time and processes the data to derive meaningful insights. The insights can be stored into the ledger as transaction on the data in coming from multiple sources.

The functionality of smart contract in Blockchain will help in automating the entire process in decentralized distributed network. The computer program to process the raw data, derive meaningful insights and trigger actions based on the insights can be pipelined in the smart contract. The smart contract is a software program which runs automatically in the decentralized blockchain network. The logics and workflow related to the course of actions can be deployed into the Blockchain network which will autonomously execute the decisions making the entire process transparent and automated.

The large amount of data which will be entering onto the system needs to be from the credible sources. The

authenticity of the data is required since the entire automatic workflow of transactions will be dependent on the quality of data. The security breaches into the data entry of the system can be secured by cryptography. The data cannot be easily tampered once the entry is secured by the inherent properties of Blockchain such as peer to peer replication, distributed nodes and consensus.

Industry 4.0 relies greatly on the credibility of the data. The data is the primary source for further automated and manual decision making. The data will trigger a smart contract conditions into the network along with helping in derivation of insights from data analytics and artificial intelligence operations.

Blockchain technology will mitigate the issue of single point of failure. The availability factor of the data is exponentially increased while securing the reliability of the data. Blockchain

technology fulfills the decentralization of information and its tamperproof nature for critical industrial infrastructure. The latest reports from National Institute of Standards and Technology (NIST) or the ECIP i.e. European Critical Infrastructure Protection the data needs to be secured to track back the sources in case of any adverse situations.

**Conclusion:**

The industry 4.0 wave is already paving, and several organizations have started exploring the different technologies to reduce manual labour and increase efficiency. The different emerging technologies such as Internet of things (IoT), Artificial intelligence, data analysis are few technologies which promises to be driving the revolution. The cyber security standards and strategy needs to be very carefully designed while creating industry 4.0 frameworks for industries. Blockchain technology can also be instrumental in creating trust,

transparency and democratization into the distributed common platform.

The reliability of the data is one of the key factors which will lead to high scale adoption and automation using the technologies in Industry 4.0. Proper use of cyber security technologies and data security technologies will ensure that the data is credible which will help in scaling up the operations.

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**Vinod Kumar Mishra** has more than 3 years experience as a Freelancer Consultant in Blockchain and Cyber Security. He is presently working as Blockchain Consultant with Upgrad. His qualifications include B. Tech in Computer Science and Engineering (C.S.E) and Bachelor of Laws (L.L.B). He has Completed multiple certifications in Blockchain including ' Introduction to Digital Currencies' from University of Nicosia, 'Blockchain for Business - An Introduction to Hyperledger Technologies' from Linux Foundation, ' IBM Blockchain Foundation Developer' and ' IBM Blockchain Essentials' from IBM , Certified Blockchain Expert (CBE) from Blockchain Council and ConsenSys. He has also completed multiple certifications in Cyber Security from Asian School of Cyber Laws.

vkumar201415@gmail.com

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### Reviewers Comment

**Reviewer Comment 1:** As the Industry 4.0 wave is already paving, the title of the study is contemporary in nature and it is the need of the hour. The article clearly explains the role of cyber security and Blockchain in the industry 4.0.

**Reviewer Comment 2:** The Industry 4.0 is related with the society's current trend of data exchange and automation. Any addition such emerging theme is highly commendable.

**Reviewer Comment 3:** The author has very well touched on the current theme of industry 4.0 by linking it with the cybersecurity. As cybersecurity plays a very important role in every kind of decision making.



### Editorial Excerpt

The article has 5% plagiarism which is accepted as per the norms and standards of publication for the magazine. The authors have modified the paper as per reviewers' comments and editorial boards suggestions. The comments related to this manuscript are noticeable related to the theme "**Role of Cyber Security and Blockchain**" both subject-wise and research-wise. The combination of Internet and other future-oriented technology has resulted in paradigm shift in industrial production leading to what today is known as Industry 4.0. With the industry 4.0 factories these days are driven by automation and smart manufacturing. After the editorial boards observations and blind reviewers remarks the article has been decided to categorise and publish under the "**Experiential Research Papers (ERP)**" category.

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