INDUSTRY 4.0: CHANGING INFORMATION AND COMMUNICATION TECHNOLOGY IN DIGITAL ERA AND ROLE OF LIBRARY AND INFORMATION PROFESSIONALS

Hemant Kumar Sahu
Scientific Officer-C, Inter-University Centre for Astronomy and Astrophysics

Abstract:
The paper gives a brief overview of Industry 4.0, the fourth industrial revolution [Industry Revolution: first -Mechanization through water and steam power/Engine (1784), second-Electrical Evolution, (1870), the third-Electronic and ICT (1970), and fourth-Cyber Physical System (2005)] to the mass cheaper and faster production, higher quality. It helps to early detection of faults on assembly lines using the internet, robotics, ICT, big data, cloud computing with the adoption of automation and digitization to enhance it with smart industry a fully autonomous system in changing ICT era and role of library professional to support Industry-4.0 information needs. The article describes the basics of Industry 4.0, which is the latest industrial revolution denoting a current trend of automation, digitization, data exchange in manufacturing technologies, i.e., communication of proper information to proper users at an appropriate time. It is commonly referred to as the fourth industrial revolution. It includes cyber-physical systems, the Internet, cloud computing, big data, Library and Information and Science (LISc) as well as cognitive computing. The article discusses the roles of various technologies and Library and Library and Information Science (LISc) professionals to support above new industrial revolution and reveals impacts, possibilities, needs as well as adaption. Industry 4.0 is in the initial stage, yet to reach to the masses and more useful in its industrial products, where everything is correlated to our day to day lives. It is already being used and applied in the various industrial device multinational sectors to increases its value, quality, quantity, accuracy, early detection, etc. Hence, more prominent multi-national companies/industries have no option but to adopt tricks, techniques, and technology of Industry 4.0. The main aim of the study is to find out the availability, applicability, various possibilities to use information services using Industry 4.0 technologies in the different sectors like the Internet of Things (IoT), Internet of services (IoS) brings, together technology, devices, and applications that enable personalized industry-specific devices and care programmes. The study is limited to Industry 4.0, information services and the role of library and information science professional and other related subjects. The descriptive method has been used for the study and also supported by studies of the other contributors in the field. Mobile devices that can track chronic and lifestyle associated industries. The findings are also supported with tables, graphs, figure to denote fact and data. The LISc professional should provide Library 4.0 based information services to make use of makerspace, Google Glass, context-aware technology, internet of things, more personalized services, big data, cloud computing, ICT and augmented reality as a symbiosis web, reading, writing, and executing simultaneously, web OS, middleware, and a massive network allowing intelligence interaction just like a human brain. It can be concluded that in the fast-changing, technologies, techniques, tricks as well as high completion it is need of the time to keep pace with digitization and other ICT innovations at different levels to have Industry 4.0.

Keywords: Industry 4.0, Industrial Information Centre And Library, Library And Information Science Professionals, Cloud Computing, Big Data, Production, Cyber-Physical Systems, Internet, Cloud Computing, Big Data, Artificial Intelligence (AI), Information And Library Science, Cognitive Computing, etc.

Introduction

The world has moved from industrial revolution/age to information age and we are witnessing the beginning of transformation knowledge production and its dissemination in the society. We are passing through a constant expeditiously evolving world, where new trends, technologies and techniques in science are developing and obsolete on daily basis. This has impacted not only on many different areas viz. conventional industrial developments but also in our every walk of life, where real world and virtual reality continue to merge as well as allied to this modern information and communication technologies (ICTs), which are being combined with traditional industrial processes. Consequently, it is changing the various production areas leading to fourth generation industrial revolution and traditional companies have now realized that customers are unwilling to pay large amounts for incremental quality improvements. These impacts are important steps to cope with increasing demands for highly customized products as well as services to improve resources efficiently and effectively. Industry 4.0, is a name given to current trend of complete automation and data exchange in the manufacturing technology, the fourth industrial revolution [Industry Revolution: first -Mechanization through water and steam power/Engine (1784), second-Electrical Evolution, (1870), the third-

Electronic and ICT (1970), and fourth-Cyber Physical System (2005)] to the mass cheaper and faster production, higher quality. Consequently, modern smart companies have no option but to adapt the Industry 4.0, where industries are introducing modern ICTs with intelligence devices. It helps to early detection of faults on assembly lines using the internet, robotics, ICT, big data, cloud computing (CC), artificial intelligence (AI) with the adoption of automation and digitization to enhance it with smart industry a fully autonomous system in changing ICT era (26).

Industrial Revolution

The industry is the production of goods or related services within an economy. The major source of revenue of a group or company is the indicator of its relevant industry. When a large group has multiple sources of revenue generation, it is considered to be working in different industries. Manufacturing industry became a key sector of production and labour in many countries during the Industrial Revolution, upsetting previous mercantile and feudal economies. This came through many successive rapid advances in technology, such as the production of agricultural goods, textile, steel glass, mining, coal, invention of machine tools, etc. "The Industrial Revolution marks a major turning point in history; almost every aspect of our daily life was influenced in some way mainly standard of living of the general mass population, which began to increase consistently to meaningfully improvements until the late 19th and 20th centuries. However, the Industrial Revolution was the transition to new manufacturing processes in the period from about 1760 to sometime between 1820 and 1840. This transition included going from hand production methods to machines, new chemical manufacturing and iron production processes, the increasing use of steam power, the development of machine tools and the rise of the factory system. Textiles were the dominant industry of the Industrial Revolution in terms of employment, value of output and capital invested. The textile industry was also the first to use modern production methods. The Industrial Revolution began in Great Britain, and many of the technological innovations were of British origin. By the mid-18th century, Britain was the world's leading commercial nation, controlling a global trading empire with colonies in North America and the Caribbean, and with some political influence on the Indian subcontinent, through the activities of the East India Company. The development of trade and the rise of business were major causes of the Industrial Revolution".

Need of Study

Firstly, industry 4.0 is in the initial stage, yet to be known and reach to the masses and more useful in its industrial products, where everything is correlated to our day to day lives. It is already being used and applied in the various industrial devices in multinational sectors to increases its value, quality, quantity, accuracy, early detection, optimized the processes, add value, etc. in the entire supply chain, almost in real time. Hence, more prominent multi-national companies/industries have no option but to adapt tricks, techniques, and technology of Industry 4.0. In this process very huge data/ information is required. The data/information collection, storage and communication plays an important role in process of Industry 4.0, where Information Centres and Libraries (ICLs) and LISc professionals play a key role in collection, collation, organisation, storage and communication of above resources and services for use by public as well as private industries and individuals to support Industry 4.0. Hence, the present study is need of time.

Secondly, "Industry 4.0 embraces a number of automation, data exchange and manufacturing technologies that are changing the landscape of how we make products and expanding the boundaries of innovative, new manufacturing opportunities. It is modelled on a Value Chain Organisation that merges real and virtual worlds using the Internet of Things (IoT) and the Internet of Services (IoS). It provides factories with real-time intelligence allowing them to efficiently produce products of higher quality that can be completely customized. Five years ago the industrial device connectivity market was largely insignificant but it is now expected to grow at a 38 percent over the next five years by adopting the capabilities of the IoT (Lobo. 2018). There is no systematic scientific descriptive study on the above interdisciplinary subject especially in developing countries like India, hence the present study."

Thirdly, today, in an Industry 4.0 factory, machines are connected as a collaborative community. Such evolution requires the utilization of advance- prediction tools, so that data can be systematically processed into information to explain uncertainties, and thereby make more "informed" decisions. Cyber-Physical System-based manufacturing and service innovations are two inevitable trends and challenges for manufacturing industries. Lee et al. (2018) in a paper addresses the trends of manufacturing service transformation in big data environment, as well as the readiness of smart predictive informatics tools to manage big data, thereby achieving transparency and productivity (20-22).

Fourthly, today our lives are full of competitions and industries are no exception to it. To remain competitive, various industrial device manufacturers, as well as, consumers need the ability to innovate and respond quickly to the changing industrial systems, ways and means in which the industries can now be treated the best. It can

be assumed that in very near future innovations and agility (quick move) of I- 4.0 is clearly going to be vital, part and parcel for industrial devices manufactures, the best care worldwide through above innovations. It includes numerous devices, hardware, software, techniques and technologies. It is a fact that in the present fast growing industrial society there are various recent developments in its various sectors resulted in higher availability, affordability, technologies, techniques and tricks. Consequently, any delay, missing link in the process of adaption and/or any stage in the product release and delivery will lead/result to press the various challenges, opportunities/ loss of market. Industry 4.0, is now-a-days buzzword and internationally accepted concept leveraging (way of applying) individualizing and virtualization across the international domain and the latest a new arrival in the industrial revolution but very fast growing industry, which involves from manufacturers/ producers to consumers/users via service providers. (1, 4, 9-11, 21, 28).

Fifthly, now I- 4.0 has already arrived and ready to change not only trade and business but also social as well as personal and organisational factors. In I- 4.0 man and comprehensive machine interact with each other as real virtual world of production. Automation/digitization are continued their development. Human workforce is slowly/gradually being replaced by machines and software in almost all the areas of industries. The healthcare/ medical industries are going to shift from manufacturing/ production industry to a service industry by adopting Health 4.0 with new roles and responsibilities beyond traditional manufacturing products (9-11).

Sixthly, customization of product-specific devices will require high quality, high mix production that particularly lends itself to the greater automation and higher levels of intelligence provided by the I-4.0 model. Physical objects passing through production processes will incorporate their own embedded Software and Computing Power (CPS) to interact with more intelligent machines, Cyber-Physical Production Systems (CPPS) on the plant floor. The products (CPS) will be the service consumers and the machines (CPPS) the service providers. Intelligent exchanges of information within this completely networked environment will enable production to be self-managing and self-optimizing. Consequently, it is essential and mandatory as well as compulsion for industries to move from physical traditional production system to modern I- 4.0. Hence, it is essential to have present descriptive study before adapting I- 4.0 (3, 5-8, 12, 14, 20).

Seventhly, in general sense industry is a place to produce goods at the mass level and/or related services within a budgetary provision. The major source of revenue of any country comes from these groups of industries as the growth of industry determines pace of economic development of any nation. Healthcare/medical industry is same as other industries in regard to value chain to cope with the changing demands highly sophisticated of higher quality. To have a competitive advantages effectively and efficiently, it is essential to have a strong industrial information system (IIS) due to information revolution, scattering and seepage to provide pinpointed information to proper users at proper time and also to support I- 4.0. It is more useful in healthcare than other industrial sectors and its products. It is a new concept and in the initial stage of development and yet to be reached to the masses for its uses and applications. These digital devices are emerging and facilitating the mass quality based manufacture/ production. Hence, the present study (3-5, 9-11, 24, 26, 28).

Eighthly, the I- 4.0 device manufacturers are experiencing with the increasing updation, opportunities i.e. pricing, quality, quantity, profit margin and speed as well as more challenges too i.e. 4Ms (Money-(prices and benefits), materials (quality and quantity), Machines (infrastructure, hardware, software, speed, etc.), as well as manpower (workforce), 4Ws and 2Hs (i.e. what, why, where, when and how and how much) of Industry 4.0. Hence, there is need of the time to adapt I- 4.0 cope up with the modern fast changing needs of the society as well as also to overcome above competitive challenges as new emerging technology both at manufacturing and distribution levels. It is also essential here to define, clarify, overview its availability, affordability, and adoptability of I-4.0 along with applications (9-11, 28).

Ninthly, recent advances in manufacturing have proved ways and means for the systematic and scientific development of CPS, in form of I-4.0 with pinpointed and proper communication of information and exchange of data. It is also well known fact that utilizing various components of I- 4.0 in very near future will not only improve the quality of products but also perform more efficiently, and effectively, collaboratively, realistically, to transform it into next generation including industrial sectors, which are also changing very fast in their ways and means for their value based industrial models (1, 3, 13-17, 26, 28).

Tenthly, industrial system as whole is going to be highly benefited from the implementation of I- 4.0, device, as well as concept. The CPS has also been arrived and also been adopted in various industrial sectors mainly to multinational industries, however yet to be introduced and reach to the masses at grassroot level. Few steps have been initiated in this direction but miles to go. Hence, it is essential to have knowledge about I- 4.0 and to carry out the present study.

Eleventhly, industries especially pharmaceutical industries/factories are working on smart pharmaceutical models to enable, and support link between the traditional physical and modern virtual world. The present study is going to cover above aspects of health 4.0 (14, 21).

Twelvethly, the Big Data, CPS, Robot, AI, CC, ICT, LISc tools are being used and tested in various industrial sectors, systems and services to cater the needs of individualized/personalized products and services. Now above technologies have been arrived based on automation, digitization, and virtualization. Consequently, it will lead to individual as well as cross country/ organizational healthcare services/ systems, highly dependents on real time data/ information. This development is going simultaneously responding aforesaid 5Ws + 2Hs and 7Cs, as new healthcare model will be under factory budget (1-7, 15-17, 20-26).

Objectives:

The main objectives of the study are:

- To give an overview and to find out the availability, applicability, affordability, scalability various possibilities to use information services using Industry 4.0 technologies in the different sectors like the Internet of Things (IoT), Internet of Services (IoS), CC, AI, ICT, BB, CPS, biosensor, LISc, etc. bring together technology, devices, and applications that enable personalized industry-specific devices and care programmes to make these devices more effective, efficient, affordable, and useful that enable personalized specific devices and care programmes.
- To reveal the fundamentals to find out the various new opportunities and more challenges arise out of i.e. Industry 4.0 in term of increasing competitiveness, accelerating innovations, bringing new products to the market more quickly and also suggest solutions.
- To present higher, standard quality, enough quantity (i.e. maximize the products), cheaper (i.e. minimum cast/resources) and faster industrial products using Industry 4.0 above tools and devices for more accuracy and expeditious fault findings/ diagnosis and solutions/ treatments.

Scope and Limitations:

This study is descriptive in nature and limited to industry as well as mass production. The study is also limited to Industry 4.0, information services and the role of library and information science professional, Information centres and libraries (ICLs) and other related subjects.

Industry 4.0:

The term "Industry 4.0", shortened to I-4.0 or simply I-4, originates from a project in the high-tech strategy of the German government (Marr, Bernard)., which promotes the computerization of manufacturing but was revived in 2011 at the Hannover Fair In October 2012 the Working Group on Industry 4.0 presented a set of Industry 4.0 implementation recommendations to the German Federal Government. The Industry 4.0 workgroup members are recognized as the founding fathers and driving force behind Industry 4.0. On 8 April 2013 at the Hannover Fair, the final report of the Working Group Industry 4.0 was presented. This working group was headed by Siegfried Dais (Robert Bosch GmbH) and Henning Kagermann (German Academy of Science and Engineering). As Industry 4.0 principles have been applied by companies they have sometimes been re-branded, for example the aerospace parts manufacturer Meggitt PLC has branded its own Industry 4.0 research project M4." (14).

Table 1: Summary of Industrial Revolution

Generation	Year	Revolution
1st	(1784)	Mechanization through water and steam power/ Engine
2nd	(1870)	Electrical Evolution,
3rd	(1970)	Electronic and ICT, and
4th	(2005)	Cyber Physical System, i.e., Industry 4.0)

Figure 1: Industry 4.0

(Source -https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/)

Table 1reveals a summary of industrial revolution from 1st generation to 4th generation whereas Figure-1 summarizes various components of Industry 4.0, a transformation i.e. fueled by nine fundamental technological advancements, mainly based on Internet of Things (IoT), Cyber Physical System (CPS), Big Data (BD), Cloud Computing (CC), Collaboration Systems, Artificial Intelligence (AI), Robotics, ICT, which has been described as following as component of Industry 4.0. The Industry 4.0 (I-4.0) is commonly referred to as fourth generation of industrial revolution is already re-defining how we manufacture 'things' today. It sets out the concepts for how companies can achieve faster innovation and increase efficiencies across the value chain. But, in the world of medical device manufacturing, which is burdened with regulatory compliance and is still largely dependent on paper-based processes, what does Industry 4.0 really mean?

How will it help manufacturers meet demand for increasingly sophisticated, higher quality and rigorously regulated medical devices, and beyond those highly personalized custom devices? New trends in how medical devices are made and how they deliver value are fundamentally changing, devices are moving more and more into the world of the Internet of Things, utilizing highly sophisticated chipsets, processing capabilities and sensors. They are mobile and connected like never before, delivering solutions in innovative new areas such as patient-specific devices and 'Lab on a Chip' electronic diagnostic testing. What does the future of manufacturing medical devices, efficiently and profitably, look large like? Or, should we say manufacturing the 'Internet of Medical Things' (IoMT) (4, 10, 24, 28).

Role of the Industrial Information Centres and Library and LISc Professionals: Information is power and necessary keep the decision makers abreast of the technical data/ information available, accessible worldwide. Generally, large volume of industrial information data/ information is lost due to lack of suitable industrial information system/ICL. However, an effective flow of information inside/outside industry is an important component to minimize the resources (4Ms= money, manpower, machine and materials) and avoid duplications. Many private businesses and public organizations, including hospitals, museums, research laboratories, law firms, and many government departments, industries and agencies, maintain their libraries/ ICLs for the use of their employees in doing specialized research related to their work. Industrial ICLs/ libraries belong to this special library category and a large extent an outgrowth of the efforts on the part of businessmen.

Role of the Industrial Information Centres and Library: The library or information center (ICL) is also known as store house an important place for various information/data resource, which contributes to the accomplishment of objectives by the organization. The primary aims and objectives of any industrial ICLs are identified closely with those of the organization so that the ICLs can meet the real pinpointed, accurate, appropriate information needs of its clientele on real time basis to provide timely, information to the organization to succeed in its technical and business operations at different levels for decision making (25). The role of the ICLs in any field is changing and developing and has touched every aspect of its functions and services viz. form, format, acquisition /collection, classification, cataloging, reference, SDI/CAS, inter library loan, document delivery circulation as well as training and research support. The impact for change must come from the library and information science (LISc) professional rather than the employer, whose view of change may be rather narrow. Increasingly the industrial ICLs/ library's role will be close involvement in the organization's business activities, identifying information needs and giving the advice to meet those needs even to support I-4.0. This will include exploitation of external resources, acquisition of special collections and an active role in the development of the "corporate memory" and integrated information systems. In the present study the role of the ICLs/ library and LISc professional within its organization is reviewed, and its place within the information network.

Role of the Industrial LISc Professionals: "The world today boast of a knowledge based society. This quest for knowledge knows no bounds and limits and is never satisfied. According to Issa (2003), there has come to be in today's world, a full realization of the fact that information remains the prime commodity of the present age. It has continued since the dawn of civilization to the modern age. Indeed, the availability and free flow of information bring about knowledge, which has great potentials to provide impetus for the social, cultural, spiritual, political, economic, scientific and technological advancement of a nation (1)." The growth of industries determines the pace of economic development of a nation. Industrial libraries play an important role in providing relevant information for the development of industries. To keep pace with the advancements in technology and management, the information needs in the industry are also becoming more and more sophisticated. To cope up with this emerging need industrial ICLs/ libraries are also equipped with recent information and advanced technology. Industrial library professionals act as an important channel for information transmission with a variety of information services to support industrial information management. Hence job satisfaction of industrial library professionals is very important for increasing the performance level of libraries, which in turn enhances the productivity of industries (25). Hence, to cope up the industrial sophisticated developments LISc professionals should have skill and knowledge of recent advanced ICTs to support I-4.0. They can also support in planning, organization, staffing, coordination, reporting and budgeting I-4.0.

Impact of ICT on Industry: The I-4.0 revolution considers important factors from technological, industrial as well as social point of view. The ICT is the applications of computer and telecommunications equipment to stores, retrieves, transmitted and manipulate data, often in the context of a business or other enterprises. The terms are commonly used as a synonym for computers and computer network, but it also encompasses other information distribution technologies

such as television and telephones. Several industries are associated with information technology, such as computer hardware, software, electronics, semiconductors, internet, telecom equipment, e-commerce, and computer services. The responsibilities of those working in the field include network administrations, software development and installations, and the planning and management of an organization technology life cycle, by which hardware and software are maintained, upgraded, and replace. Librarians and support staff working in the industry and corporate libraries provide a variety of services for people of all ages. Special libraries provide specialized information services to trade organizations, research laboratories, businesses, government agencies, art museums, hospitals, newspapers, publishers, and others.

Major Historical Developments: The earliest recorded use of the term "Industrial Revolution" seems to have been in a letter from 6 July 1799 written by French envoy Louis-Guillaume Otto, announcing that France had entered the race to industrialize. In his 1976 book. Keywords: A Vocabulary of Culture and Society, Raymond Williams states in the entry for "Industry": "The idea of a new social order based on major industrial change was clear in Southey and Owen, between 1811 and 1818, and was implicit as early as Blake in the early 1790s and Wordsworth at the turn of the [19th] century." The term Industrial Revolution applied to technological change was becoming more common by the late 1830s, as in Jérôme-Adolphe Blanqui's description in 1837 of la révolution industrielle. Friedrich Engels in The Condition of the Working Class in England in 1844 spoke of "an industrial revolution, a revolution which at the same time changed the whole of civil society". However, although Engels wrote in the 1840s, his book was not translated into English until the late 1800s, and his expression did not enter everyday language until then. Credit for popularizing the term may be given to Arnold Toynbee, whose 1881 lectures gave a detailed account of the term. Some historians, such as John Clapham and Nicholas Crafts, have argued that the economic and social changes occurred gradually and the term revolution is a misnomer. This is still a subject of debate among some historians.

Research Method

The descriptive method has been used for the study and also supported by studies of the other contributors in the field.

Components of Industry 4.0.: Herman, et al (2015) suggested to use Industry 4.0 components and proposed four components viz. CPS, IoT, IoS, and Smart Factories (4-11, 15-21, 24, 26, 28).

Modern Sensors: In I-4.0 the fourth industrial revolution transformation, sensors, machines, part and ICTs are inter connected popularly known as CPS can interact with each other as well as can collect, analyse the data to forecast failure, auto configuration and adaptability the changes for quicker, more flexible, and better efficient process tor qualitative and quantitative productions at reasonable and/or reduced costs.

The Computer Networking: Horizontal and Vertical Integration: It is an undisputed fact that even today's fourth generation industrial revolution the most of ICTs are yet to be connected fully. Consequently, causing a big gap among raw material, engineering plant production process, business, services, supply as well as function, capabilities and use due to lack of complete automation/integration and access of data from any machine, anytime (24x7), anywhere.

Cyber Physical Systems (CPS) and Cyber Security: The I-4.0 revolution is not only accounts for technological and industrial revolution but also covers social aspects and popularly known as CPS. The CPS, is "A transformative technology for managing interconnected systems between its physical assets and computational capacities (20)". According to Lee, CPS is, "Integrations of computation, and physical processes embodied computers, networks, monitor and controlled physical processes usually with feedback loops, where physical processes affects computation and vis-à-vis." In such an environment, CPS can be further developed for managing information/data to reach the goal of intelligent, resilient as well as self adoptable machines by integrating CPS with production, logistics, and services in the current industrial processes. Consequently, today it is possible to transfer factories into an Industry 4.0/ factory with significant economical potentials (2, 20-31).

Internet of Things (IoT) and Internet of Services (IoS): The IoT is a new paradigm especially related to smart factory aspect, which includes Radio Frequency Identification (RFID), sensor, actuators, mobiles, etc. with provision of unique address system interact/cooperate with each other to achieve the common goals. The IoT brings together physical objects with embedded electronics, software, sensors and network connectivity that means they are able to collect and exchange data with each other. These devices will have more and more for product tracking, inter and intra factory interaction, automated control with real time basis to follow steps, machines, for end production. In the manufacturing environment this becomes the Industrial Inter to achieve the net of Things (IIoT) physical objects with embedded and added machine learning, machine-to-machine communication and integration of existing automation technologies. This

not only increases productivity but also identifies any inefficiency, increases quality consistency, and reduces waste both in terms of better utilization of machines and reduced scrap. Alongside making existing manufacturing processes more efficient, Health 4.0 offers new opportunities in terms of increasing competitiveness; accelerating innovation; bringing new products to market more quickly; adding capability to easily customize individual orders, and enabling faster response to customer demands (1-9, 14-21, 28-31).

Autonomous Robot: Now robots are widely used in almost all the sectors of our life and industries are no exception to it for handling complex processes with greater utility and safety. Robotic technology is being used in almost all the scientific and industrial sectors now-a-days. Other areas of innovation in I- 4.0 include robotic-assisted production; early fault finding/ diagnosis, next generation of advanced equipments and other industrial products, and biometric stamps that act as a 'lab on a chip' (LOC) alternative to reagents and chemicals. A LOC is an automated, miniaturized laboratory system that can be used inside and outside of a hospital for a wide range of patient measurements such as blood gases, glucose and cholesterol levels. This technology enables fast diagnostics with only small amounts of samples and materials required (3, 10-15, 19-21, 26-28).

Big Data: Big data term is now used to manage the vast data worldwide. industry is full of data ranging from start of product to arrival and use of it. Big data analytics consists of 7Cs in the integrated Health 4.0/ Industry 4.0 and cyber physical systems environment.

7Cs: Connection-sensor networks, Computer, Cyber-model and Memory, Communication, Community/ customization- personalization and value, Cloud computing, and Cognitive computing. Hence, the role of big data in Health 4.0 adoption of Health 4.0 is much more than others.

Cloud Computing (CC): Now CC is being used in majority of advanced data storage and retrieval system due to various reasons and I-4.0 is not exception to it. It is supposed to facilitate business process with virtual access despite geographical distances (cloud). There is huge amount of data/ information generated in I-4.0., which harbours a lot of data/information that can, amongst other things, be used for quality assurance measures. The CC, which can provide 'anytime, anywhere' and has ability and storage for the huge amounts of data generated. Its service are used to store the voluminous data hence, are also used in Health 4.0 and allows healthcare industries/companies to scale their IT resources much more easily and cost-effectively. However, it also entails potential data security issues and need to be addressed before adopting. The main obstacles cited included high investment requirements and companies' low level of automation (10, 19-21).

Cognitive Computing:

Modern ICT and LISc Tools: Information is power and its needs in our every walk of life is well known globally so as to Health 4.0 industry. The ICTs are now an integral part of the our lives/environment. The so-called IoT with its intelligent sensors makes life easier in many areas. Examples include tracking parcel deliveries and wearable (portable computer systems), which provide assistance in everyday life. Health/Hospital Information Services/Systems (HIS) play an important role to support Health 4.0 and to cope up with changing needs of multinational health/medicine industries. On the other hand biomedical/health Information centres and libraries (ICLs) are known as store house of knowledge/information resources with huge collection of information/ data resources with its pinpointed and prompt services to the proper users at proper time. Now-a-days integration of HIS constitutes a real and growing needs; especially large multinational healthcare/medical industries using multiple hardware and software even to support Health 4.0. Last three decades it is experienced that information integration has attracted much attention by using ICTs. However, now health industries are adopting and/or on the verge of adaptation its fourth generation revolution i.e. Health 4.0. The automation/ digitalisation of industry affect the entire value chain. From individual products to digitising workflows in companies and connecting companies with clients and service providers via the IoT– Health 4.0/Industry 4.0 makes completely new manufacturing processes possible and requires new and specific business models (6, 18-21).

Artificial Intelligence (AI): The AI is playing a significant role in the processes of Health 4.0 for the man machine interaction. The so-called IoT with its intelligent sensors makes life easier in many areas. Examples include tracking parcel, location deliveries of raw materials, parts, and wearable (portable computer systems), which provide assistance in everyday life. A change is also taking place in the industry (9, 15, 19-21).

Results:

Discussion and Interpretation: The main objectives of the study is to give an overview to achieve higher quality, cheaper and faster production of Industry 4.0 devices viz. communication devices mainly internet, smart Mobile devices, CC, AI, CPS, Big Data, IoT, IoS, IoP, cognitive computing, ICT, LISc tools .The findings are also supported with tables, figures to denote fact and figures with various variables based on literature review. The major findings are:

- It has been observed based on review of literature that efforts have been made to adopt recent development of I- 4.0

devices, however it is restricted to developed countries and multinational industries and yet to be reach to developing and underdeveloped countries as well as small scale industries.

- The overview of the literature also indicates that various major opportunities viz applications of industrial device manufacturing, value based care, information, the IIS, LISc tools, etc. are not up to the mark and needs advertisements at global level.
- The study also reveals that there is lack of suitable standard IIS to cope with the I-4.0 and also to organize, and establish more authenticate accurate, IIS. The existing IIS is not up to the mark to make the industrial devices more effective, efficient, innovative and useful. Hence, it is affecting adoption of I-4.0.
- The other studies have indicated that the uses of I- 4.0 is increasing but with a very slow speed hence investment and management, international and cross industrial collaboration, is also not there.
- "Although strict regulations mean that changes may happen more slowly in the medical markets compared with some other industries, I-4.0 offers medical device manufacturers such incredible benefits that it will happen. It provides a pathway for efficient production of increasingly complex products while capturing and analysing data flows to assist with regulatory compliance and process improvement (18)". Regulatory compliance does not guarantee high quality but the end to end traceability and complete visibility of production processes within the I-4.0 model means compliance can be less painful while product quality, and so customer satisfaction, is increased indicated by Lobo (24).
- Findings point out that since I- 4.0 is in its initial stage the concept of data ownership and security (agreements, MOU, data encryption, etc. are considered only very few cases). Some steps have been considered but much more to be done related to legal issues, IPR, specification, agreement.
- Furthermore, it reveals that provision of maintenance, monitoring, of various processes are there but differ from factory to factory in various aspects of I-4.0.
- The study also concludes that there is no uniformity in standardization, and employment procedure while adopting I-4.0.

Suggestions:

- The concept of I- 4.0 is new and very initial stage of development need to be promoted through appropriate policies and programmes. Hence, it is suggested to adopt and use I-4.0 and its various technologies and techniques, it is essential and suggested to clear skill and knowledge about it before adopting and implementing (18).
- The ICLs should provide Library 4.0 based information services support I-4.0. Hence it is suggested to use of makerspace, Google Glass, context aware technology, internet of things, more personalized services, big data, cloud computing, and augmented reality as a symbiosis web, reading, writing, and executing simultaneously, web OS, middleware, and a massive web allowing intelligence interaction just like a human brain.
- To keep pace with automation, digitization and technological innovations, LISc professional must have to reshape his/her role from production, service deliver to business execution to support his/her organisation.
- Privacy and data security is paramount, hence needs to be protected for quality of services. The basic concept of security and safety as well as up-datedness, resilience, have to be accepted as a mandatory variable.

Conclusion

It can be concluded that I-4.0 is not only going to address challenges faced globally viz. population based problems, resources of energy and efficiency, production, etc to the mass cheaper and faster production, higher quality. It helps to early detection of faults on assembly lines using the internet, (IoT, IoS), robotics, ICT, big data, cloud computing (CC), AI, data exchange in manufacturing technologies, communication of proper information/data to proper users at an appropriate time, with the adoption of automation and digitization to enhance it with smart industry in changing ICT era and role of LISc professional to support Industry-4.0 information needs, as well as cognitive computing. It also reveals that in the fast-changing, technologies, techniques, tricks as well as high completion it is need of the time to keep pace with digitization and other ICT innovations at different levels to have Industry 4.0. The LISc professionals, as well as, ICLs have to play a vital role to support I-4.0 and there is need to train LISc professional with new skills, knowledge with more global vision as this is an open new field.

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