Technology evolution through Industry 4.0 in Cooperatives

Saba Sayed [1]

Abstract

Industry 4.0 has received considerable interest globally over the past few years. Industry 4.0 aims to reach higher levels of internal efficiency and sustainability and also a greater degree of automation. Big Data, Cyber-Physical Networks (CPS), the Internet of Things (IoT), the industrial Internet, artificial intelligence, cloud computing, and others are major themes in Industry 4.0. All these elements are specifications that are elements of the visionary framework of Industry 4.0.Cooperatives, as economic institutions founded on the ideals of the society, also have a significant need to enhance human welfare. With time, however, the presence of cooperatives has decreased. There are several reasons that have prompted the number of operational Indian cooperatives to decrease: both internally and externally. Owing to the shortage of funding and other business problems, technology implementation is often a challenging job for cooperatives. Cooperatives' sustainable business efficiency is negatively impacted by many technological problems. The implementation of Industry 4.0 will, however, solve different problems with technology. Aspects of Industry 4.0, such as big data, the Internet of Things, and the smart factory, play a positive role in encouraging the adoption of information technology (IT), which leads to sustainable business efficiency. In addition, the framework and method of the business reinforce the constructive partnership between Industry 4.0 and the application of IT.Researchers carried out an extensive literature review of published research studies, case studies, govt. reports, proceedings of workshops, seminars, etc to analyze the collective action efforts undertaken by Cooperatives in India and in international countries with regard to Industry 4.0. An attempt has been made in this study to analyze various efforts undertaken to understand how features of Industry 4.0 can be effectively used in cooperatives. It explores the logic in Industry 4.0 for the members of cooperatives for their development. This paper also suggests the ways and means of areas in which cooperatives may take up the technology in Industry 4.0.

Keywords: *Digitalization, Cooperatives, Innovations, IoT, Big Data, Digital Technologies*

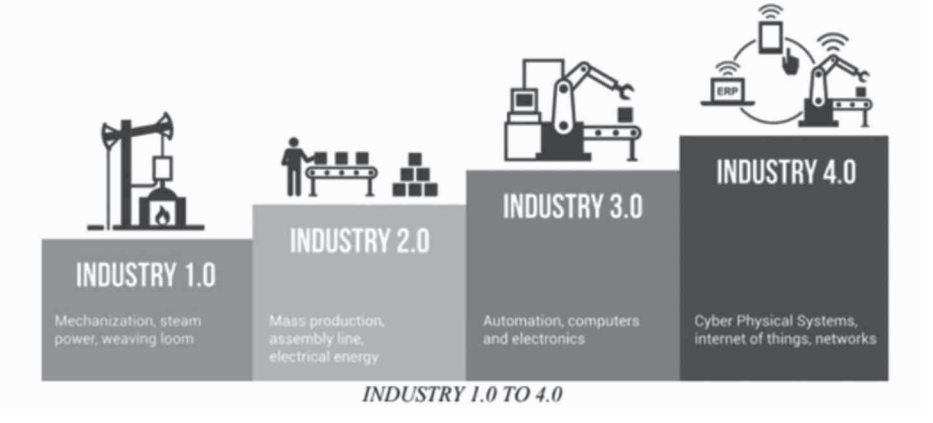
[1] Research Officer, VAMNICOM, Pune

Introduction

The new industry has made great progress since its inception at the start of the industrial revolution in the 18th century. For ages, most objects, including equipment, food, clothing, and shelter, have been manufactured by hand or by working animals. This improved with the implementation of industrial processes at the end of the 18th century. The construction of Industry 1.0 had been a rapid and significant task leading up to the fourth industrial revolution, the future modern age. The term Industry 4.0 refers to the fourth industrial revolution, the next stage in the life cycle of a manufacturing technology in the organization, and the management of the entire value chain. Here is a synopsis of this transition.

1.1 Industry 1.0 to 4.0: The History of the Modern Age

Figure 1:



Evolution of Industrial Revolution.

Industry 1.0

Water- and steam-powered equipment were invented to help workers in the 1800s. As manufacturing capabilities improved, business expanded from individual cottage owners looking after their own — and sometimes their neighbors' — needs to companies with owners, managers, and employees serving clients.

Industry 2.0

Electricity has become the dominant source of power by the middle of the twentieth century. It was easier to utilize than water and steam, and it allowed firms to focus power sources on specific devices. Machines were eventually developed with their own power sources, making them more portable.

During this time, a lot of management methods were developed, allowing manufacturing plants to become more efficient and successful. Division of labor, where each worker does a part of the total job, increased productivity. Mass production of goods using assembly lines became commonplace.

Industry 3.0

In the last few decades of the 20th century, the invention and manufacture of electronic devices, such as the transistor and, later, integrated circuit chips, made it possible to more fully automate individual machines to supplement or replace operators. This period also spawned the development of software systems to capitalize on the electronic hardware. Integrated systems, such as material requirements planning, were superseded by enterprise resources planning tools that enabled humans to plan, schedule and track product flows through the factory. Pressure to reduce costs caused many manufacturers to move component and assembly operations to lowcost countries. The extended geographic dispersion resulted in the formalization of the concept of supply chain management.

Industry 4.0

In the 21st century, Industry 4.0 connects the internet of things (IOT) with manufacturing techniques to enable systems to share information, analyze it and use it to guide intelligent actions. It also incorporates cutting-edge technologies including additive manufacturing, robotics, artificial intelligence and other cognitive technologies, advanced materials, and augmented reality, according to the article ―Industry 4.0 and Manufacturing Ecosystems‖ by Deloitte University Press. The development of new technology has been a primary driver of the movement to Industry 4.0. Some of the programs first developed during the later stages of the 20th century, such as manufacturing execution systems, shop floor control and product life cycle management, were farsighted concepts that lacked the technology needed to make their complete implementation possible. Now, Industry 4.0 can help these programs reach their full potential.

Industry 4.0, at least for the next decade, is here and it is here to remain.

Objectives

This paper reviews various collective action efforts undertaken to understand how features of Industry 4.0 can be effectively used in cooperatives. The specific objectives are as follows:

1. To understand the extent of digitalization through Industry 4.0.

2. To explore the logics in Industry 4.0 for the members of cooperatives for their development.

3. To suggest the ways and means of areas in which cooperatives may utilize technology in Industry 4.0.

Review of Literature

Industry 4.0

This part of literature presents the paper which includes what exactly is Industry 4.0 and how it aims at creating a transparent, smart manufacturing infrastructure for the implementation of technologies. It also focuses on issues and challenges in various sector.

Chaitanya Vijay Bidnur (2020) in his paper "A Study on Industry 4.0 Concept" explored the origin as well as evolution of the Industry 4.0 model. The definition of Industry 4.0 encompasses not only direct production in the sector, but also the whole supply chain from suppliers to consumers, as well as all business operations. Industry 4.0 is a 21st-century technological innovation that allows industries to produce intelligent goods and services while cutting prices and rising performance. The human aspect is critical for the process, and the research is focused on current study in the field. The paper introduces the smart factory concept for automated services, thus increasing the efficiency of operations

Haseeb et al., (2019) in their research paper concluded that the aim of Industry 4.0 is not only to reach a better degree of organisational efficiency and competitiveness, but also greater automation. This study has attempted to address the various issues and challenges pertaining technology advancement in the area of Industry 4.0. Based on the findings the paper reveal that, industry 4.0 aspects such as big data, the Internet of Things, and the smart factory play a constructive role in supporting IT adoption, which leads to long-term market success.

Aulbur and Singh (2014) in their research paper discussed about the reasons by which India is reportedly lagging behind its global counterparts where Industry 4.0 implementation is considered in manufacturing industries. A substantial portion of the manufacturing sector is still in the development process, with technologies restricted to devices that run independently of one

another. The fundamental concept of Industry 4.0 is still in its infancy, with the incorporation of physical networks on a cyber network.

Technology and Industry 4.0

The literature in this section describes the various aspects of Industry 4.0, such as big data, the Internet of Things, and the smart factory and how they play a positive role in encouraging the adoption of information technology (IT), which leads to sustainable business efficiency.

Vaidya, Ambad, Bhosle (2018) explored the nine pillars on Industry 4.0 including Big data and analytics, Industrial of Things, cloud computing, artificial Intelligence, autonomous robots etc. These pillars will change independent and improved operations to a highly integrated, automatic, and optimised method. As a result, conventional manufacturing relationships among suppliers, users, and consumers, as well as between human and computer, become more productive and improve. The nine pillars will help to identify the issues and challenges faced in the implementation of Industry 4.0.

Lee et al. (2014) in his paper 'Service innovation and smart analytics for Industry 4.0 and big data environment' described that in order to boost operating performance and maintenance control, conventional equipment is being turned into self-aware and self- learning devices by Industry 4.0 with the communication around them. The paper examines how big data had changed the services of manufacturing industry.

Bahrin et al.(2016) in their research paper reviewed new inventions in the field of automation technologies. They emphasized that with the introduction of Information and communication Technologies (ICT), the industries have got opportunities to compete in international markets. On the lines of such developments, the automation industries are playing a vital role in introduction of technologies pertaining to industry 4.0.

Industry 4.0 and cooperatives

This part of literature describes the implementation of Industry 4.0 in cooperatives. It discusses how cooperatives' sustainable business efficiency is negatively impacted by many technological problems. The implementation of Industry 4.0 will, however, solve different problems with technology.

Setianingsiha et al. (2020) in his paper emphasized how crucial it is for the cooperatives to catch up with the significant efforts put up by the Industrial Revolution 4.0. The question that cooperatives encounter in this fourth industrial revolution age is to find a way to emerge as a vital player in developing the economic growth of the country. While cooperatives today have experienced setbacks in their progress, in order to strive, it seems important for them to survive and put tremendous efforts.

Griepentrog et al. (2016) in his paper carried out a study on precision farming. In their study they stated that new innovations give agricultural cooperatives the ability to introduce other unique activities, such as precision farming, in addition to opportunities for optimisation. The culture of cooperatives promotes the development of supply chains or the formation of societies through a broadly rich and diverse market ecosystem (members, staff, consumers, vendors, associates, etc.). Hence, this transition influences the cooperative value chain, optimizes some practices and revolutionizes others.

Setyawati (2017) concluded in her paper that, since cooperatives do not have trained human resources, it is normal for cooperatives to become inactive. The failure of cooperative HR to change to technology innovations is another aspect that leads many cooperatives to halt operation. Poor management and HR factors are one of the reasons.

Research Methodology

The author has carried out an extensive literature review of published research studies, case studies, govt. reports, proceedings of workshop, seminars, etc to analyze the collective action efforts undertaken by Cooperatives in India and in international countries with regard to Industry 4.0. Given the research objectives formulated, the methodology of this paper is based on secondary data.

Why Industry 4.0?

Industry 4.0 is transforming conventional equipment into self-aware and self-learning gadgets with communication surrounding them to improve operating performance and maintenance control (Lee et al., 2014). Industry 4.0 intends to build a transparent, smart manufacturing infrastructure that will allow for the adoption of industrial knowledge networks (Bahrin et al., 2016). Industry 4.0's primary criteria are real-time data management, inventory status and location recording, and maintaining guidelines for managing production operations. (2015) (F. Almada-Lobo).

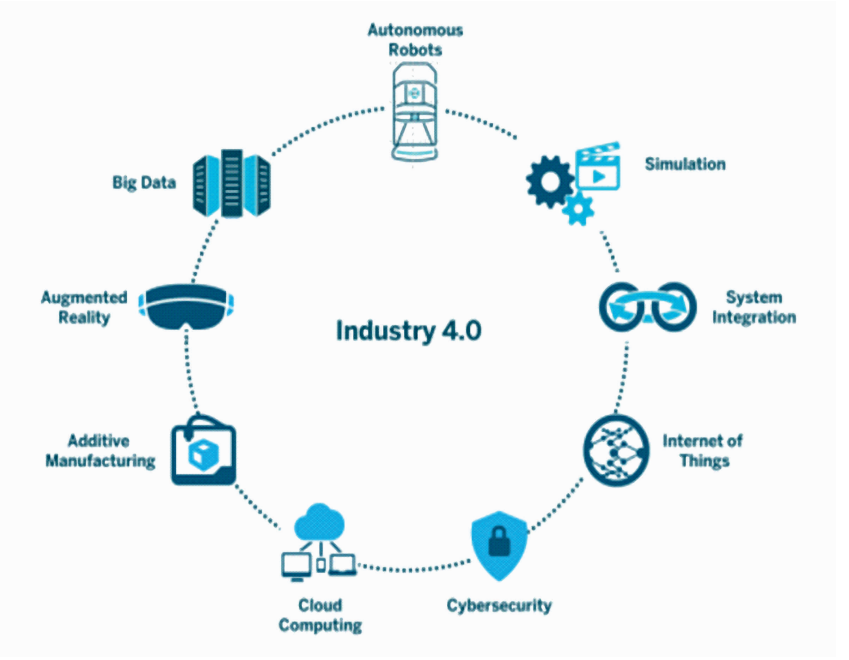


Figure 2: Industry 4.0 technology features and contributions towards digitalization.

Big Data and Analytics

In order to facilitate real-time decision-making, the analysis and systematic examination of information from several multiple sources would become essential for manufacturing equipment and applications, as well as business and consumer management systems (Rüßmann et al., 2015). Big Data consists of four aspects, according to Forrester's definition: amount of data, data variety, the rate at which new data is generated and analysed, as well as the importance of the data (K. Witkowski, 2017). Previous evidence were statistically analysed to classify the threats that occur earlier in the industry in different industrial methods, as well as to identify existing problems and potential solutions to eliminate them from arising in the future.(Bagheri et al.,2015).

Drones and Robots

Because of their advantages and capacity to adapt to varied jobs in industrial domains such as maintenance, inspection, and transportation, drones and robotics are having a significant impact on Industry 4.0. As a result, firms have begun to invest in the features of drones and robotics that can be connected into (IoT) to perfect Industry 4.0. Robots and drones are both

mechatronic systems capable of autonomously completing tasks in a physical environment. The primary distinction between the two is that the term "robots" is more generic and encompasses both stationary and mobile robots. Drones, on the other hand, can move about. Another distinction is that robots have greater autonomy and rely less on human input. Finally, using Robotics 4.0 and drones in the fourth-generation sector will allow for the advanced implementation of complex jobs. Another important feature is the ability of Robotics 4.0/drones to engage cooperatively. The advantages of Robotics 4.0, drones, and integrated Robotics 4.0/drones in Industry 4.0 include improved task conditions, increased productivity, safety, and innovative solutions to complicated processes.

The Internet of Things

Industry 4.0 integrates the Internet of Things (IoT) with industrial strategies in the 21st century to allow devices to exchange, interpret and use knowledge to direct human intelligence. The Internet of Things (IoT) is a new concept that is getting momentum in the emerging wireless communication scenario. The central principle of this theory is the ubiquitous existence of a number of items or artifacts around us, such as Radio-Frequency IDentification (RFID) tags, sensors, actuators, smart phones, etc., which are able to communicate with special addressing schemes (E. Hozdić , 2015).

The Cloud

The cloud-based IT interface acts as the technological pillar for linking and communicating the various components of the Industry 4.0 Technology Centre (M. Landherr, 2016). Organizations require improved information sharing for business 4.0 i.e. attainment of response times in milliseconds or much faster across platforms and businesses (Rüßmann et al., 2015).

Application of Industry 4.0 in Cooperatives

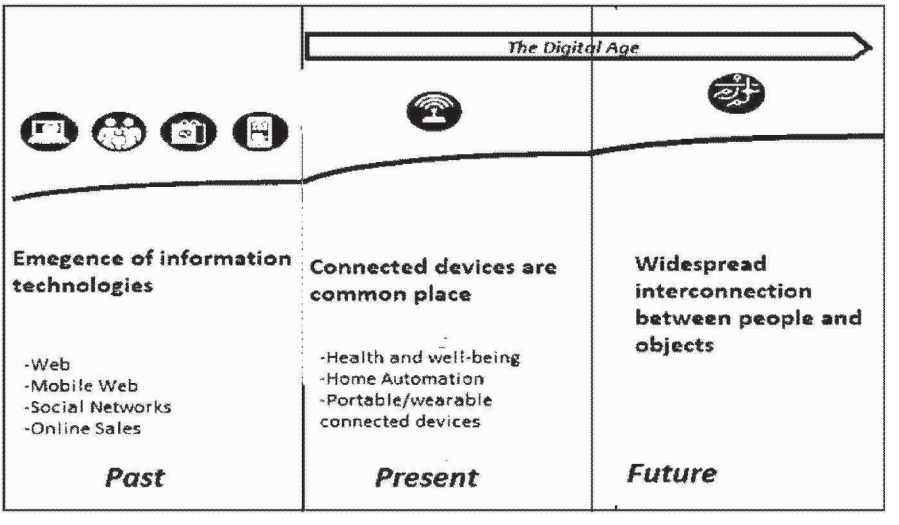
Cooperatives, as economic institutions founded on the ideals of the society, also have a significant need to enhance human welfare. With time, however, cooperatives are becoming less common. The number of functioning Indian cooperatives has decreased for a variety of reasons, both internally and externally. Parallel to this, action must be taken to investigate cooperatives that, until recently, were still deeply involved in society, in order to recognize trends and methods helping the cooperatives to increase their operations so

that they can be used to enhance the sustainability of other cooperative enterprises.

The question that cooperatives encounter in this fourth industrial revolution age is find a way to emerge as a vital player in developing the economic growth of the country. The technological changes in the developing markets have put a pressure on the cooperatives to react to the fast moving changed environment. While cooperatives today have experienced setbacks in their progress, in order to strive, it seems crucial for cooperatives to catch up with the significant efforts put about by the Industrial Revolution 4.0 (Setianingsiha et al, 2020).

We reached a modern digital phase in 2008, with transition growing due to improvements in digital technologies and directly influencing society. As a result, new smart devices are becoming popular and in the future, users will be gradually connected, between each other and with their devices, with the automation of the connectivity between people and objects.

Figure 3: Industry 4.0 – Building the digital enterpris



Source: PwC Report

Digital technology is enabled by developments that allow these tools to operate, such as the Internet of Things, the cloud, and systems for storing data.

The pervasive use of information and communication technology (ICT) by the industrial sector and conventional production practices is rapidly redrawing the borders between the real world and the virtual world through

what are defined as cyber-physical production systems (CPPSs). CPPSs are a virtual network of social machines structured in a fashion close to that of social networks. To put it plainly, they connect IT to mechanical and electronic components that then interact through a network with each other. A very early version of this technology was the Radio Frequency Identification (RFID) technology that had been in since around 1999 (Deloitte AG, 2015).

New innovations give agricultural cooperatives the ability to introduce other unique activities, such as precision farming, in addition to opportunities for optimization (Griepentrog et al., 2016). The culture of cooperatives promotes the development of supply chains or the formation of societies through a broadly rich and diverse market ecosystem (members, staff, consumers, vendors, associates, etc.). Hence, this transition influences the cooperative value chain, optimizes some practices and revolutionizes others.

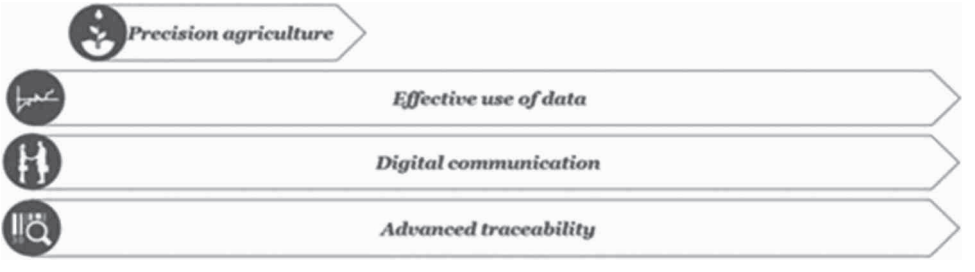


Figure 4: Use of Industry 4.0 in Precision Agriculture

Source: Gartner, IBM

Precision farming innovations (GPS, drones, sensors and connected devices) are now very popular, and several cooperatives and their members have embraced them. Their acceptance, though, is largely in the form of a "catalogue of services" and the prospects of global convergence seem minimal for the time being. When innovations develop, cooperatives apply to the catalogue.

Cooperatives offer drone tracking and surveillance facilities for their members. To remotely assist and educate farmers on farm management, cooperatives use information from milking machines and automation systems.

Cooperatives are backbone of the economy, so that the welfare of their families and groups is the way for the society to strengthen. With respect to the role of cooperatives for the interests of their members, the advantages of cooperatives have been reported in many researches (Goel, 2019). The

presence of cooperatives not only gives services to cooperative members, but also to individuals who are not cooperative members. However, the presence of cooperatives is rare in the Industrial Revolution Age 4.0 that cannot be distinguished from the growing number of market rivals. There is no denying that the concept of cooperative cooperation, founded on the sense of independence and recognition of its members, does not appear in a changing environment of complex and competitive economic systems.

The failure of cooperative HR to change to technology innovations is another aspect that leads many cooperatives to halt operation. Poor management and HR factors are one of the reasons. Setyawati (2017) concluded that, since cooperatives do not have trained human resources, it is normal for cooperatives to become inactive.

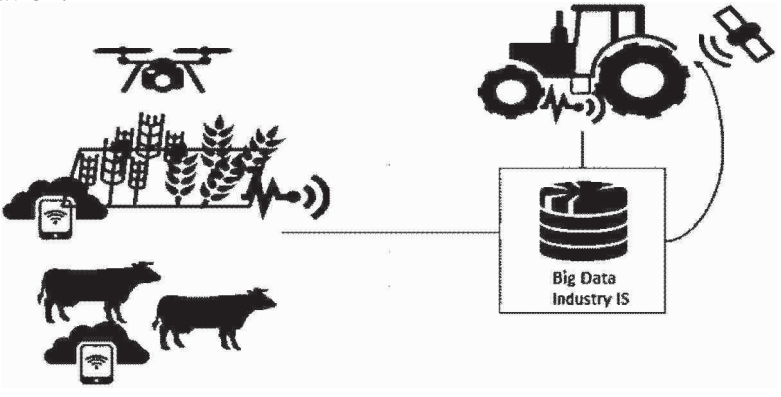
Cooperative limitations are also observed in areas of financial management and information systems, along with HR aspects. There have been researches in this respect that explicitly explore ways to improve sustainability and build cooperative enterprises. The technique for sustaining and establishing cooperatives can be based on the collaboration between cooperatives and small businesses that have proved this interaction to offer benefits to both (Mazzarol, 2013). Loubere and Zhang (2015) clarify that attempts in China to retain cooperatives are performed by the role of the government in developing new cooperative measures. The introduction of new models and management skill and HR was part of each of these findings.

Industry 4.0 in Agriculture Cooperatives

With many of the cooperatives examined, the advancement of digital technology was seen as a core concern amongst these five big developments influencing the modern age (demographics, emerging countries, urbanisation, the environment and technology) (Figure 5) Generally speaking, the agriculture sector is more linked than normal and has traditionally lead the way in the introduction of emerging technology such as GPS. In order to pursue new practices and facilities, the sector has initiated several digital transformation projects.

Figure 5: Developments influencing modern world

The cooperatives demonstrated how difficult it is to truly understand the implications of new technologies when it extends through all operations and changes all operations. Although digital technology is seen as a possible advancement in some areas, such as precision agriculture, it is rather widely shown as a driving force for quality improvement and agricultural growth. They have been motivated by the vast market community of agricultural cooperatives (owners, clients, vendors, other cooperatives, etc.) to be among the first to support the digitalization of information transfers with their numerous members. Most of the cooperatives either have adopted or are proposing mutual work projects. Digital technology is often used by cooperatives to optimize the methods of manufacturing, distribution network, management and quality control, mostly by the efficient usage of information.



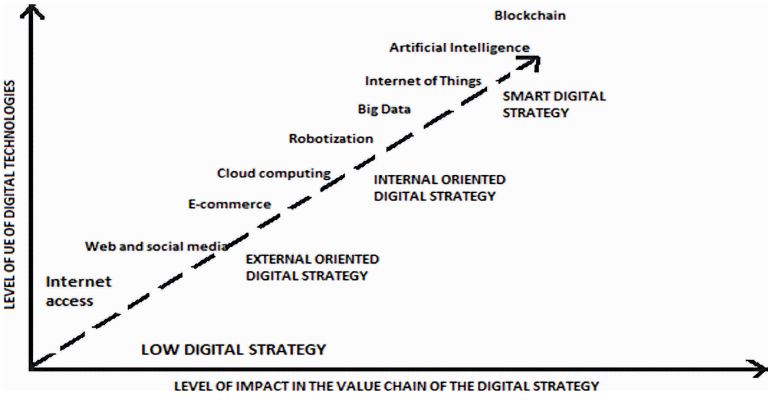
Source: PwC global report on the commercial application of drone technology

GPS and drones allow farmers to increase production and minimize their impact on climate change. Precision farming innovations (GPS, drones, sensors and connected devices) are now very popular, and several cooperatives and their members have embraced them. Agricultural data helps farms to be scrutinized, while data analysis will help farmers keep one step ahead of them.

Digital technology is a core concern for farmers and cooperatives across all technical breakthroughs; they have already embraced. In adopting emerging technology such as GPS, which they have used on their tractors since the 1990s, farmers have led the way. Today, the number of farmers with tablets and smartphones has been growing since 2013. Technology transformation has quickly accelerated and puts the user at the core of the technology. Digital transition refers to how, with the advent of IT technology, culture has changed:

- 1960: the first machine.
- 1992: creation of the Internet.
- 1994: advent of internet purchases.
- 1995: development of social networks.
- 1999: creation of the mobile Network.

Sensors offer valuable farm-related information to farmers and integrated devices ease everyday tasks. These includes land sensors, to monitor markers of the soil (rainfall, humidity, etc.), Onboard sensors on tractors or drones for crop health tracking, plant identification, sensors on livestock for geolocation and surveillance. To ease everyday operations, farmers often use a range of connected devices like milking and feeding robots that allow tracking of livestock, linked devices that require the sowing of multiple hybrid seeds in the same row based on the soil conditions and smart farming, with automated solutions. In combination with external data, the efficient need for sensor-generated data ensures that farms can be tracked in real time. Farmers will plan for a variety of circumstances and maximize performance by reviewing the information, allowing them to remain a way ahead in making smart choices.



As shown in figure 7, an incremental digital transformation of the agri-cooperatives is usually followed. The y axis shows the digital extend of new technology adoption and its effect upon the supply chains of cooperatives (Production, distribution, packaging, advertising, and promotions in the field (x axis).

Digitalization in IFFCO through Industry 4.0

Agriculture is being recognised as the key part of the 2019-2020 Union budget. In order supply guaranteed income for small and marginal farmers, the Government of India has decided to spend extensively in agriculture sector. It has made Niti Aayog, a national research centre for the design and conduct of programs and research on future technology, including machine learning and artificial intelligence to promote our country's economic growth (Srivastav et al., 2019).

Uzhavan app, Ag mobile, CCMobile app, IFFCO Kisan are a few of the built applications that take into account the need for hourly farming requirements. Several significant projects, such as e-choupal, Agri sector, Kisan Suvidha and the more recent e-NAM, have long attempted to position agriculture as the catalyst. There was a lack of coordination of accurate knowledge to the farmers as more focus was put on hardware than software. This has led to the formation of an agricultural information cloud with IoT and RFID (radio frequency identification) technology convergence. The farming industry too has recently visualized the incorporation of IoT and agricultural activities in the production and conceptualization of innovation for plant factories. A lighting sensor and a video sensor, for instance, will display the light intensity distribution in real time and track the size of the plant. This will aid in deciding the stages of growth and development of plants.

Global positioning systems (GPS) data and wireless sensor nodes (WSN) have also acted as important tracking resources to track and compare parameters. It has been found that geo- referencing approaches using unmanned aerial vehicles (UAV) and drones have a beneficial influence on crop production and pesticide monitoring. The information stored in such sensors and agriculture equipment and tools was regularly exchanged with farmers via a GPRS-connected cell phone. On-field sensors such as flipping on/off a pump/valve when water level in the field exceeds a certain specified threshold can be tracked and managed remotely by farmers to making crucial decisions using deep learning techniques concerning crop management.

IFFCO Kisan, a joint venture between IFFCO, the fertilizer major, and Bharti Airtel, the telecoms giant, is all set to ramp up its national high-tech farm project. IFFCO Kisan would rely on a single range of roughly half a dozen crops as part of the scaling up plan.

IFCCO uses sophisticated technologies such as the Internet of Things (IoT), Artificial Intelligence (AI) and precision farming to set up high-tech farms, as

reported by Morup Namgail, Head (Agtech), IFFCO Kisan. IFFCO currently has around 10 big projects underway in various locations around the nation, affecting about 15,000 farmers. The organization is enthusiastic about the early outcomes of certain big ventures and has developed a crop-specific approach to extend the activities of high-tech farms. These ventures have been launched by IFFCO Kisan in cooperation with major product and agro - based entities.

Another big initiative is to manufacture pure organic Ashwagandha in Madhya Pradesh's Ratlam district in collaboration with The Himalaya Drug Company. As part of this mission, IFFCO Kisan agtech has encouraged the usage of IoT soil monitoring equipment, vegetation index satellite imagery analysis, and soil moisture stress reverse image mapping to automatically identify pests and diseases, and to prepare for optimum irrigation.

According to a latest Nasscom survey, the agritech sector received close to $248 million in funding during June 2019, up from about $73 million in 2018. This represents a 300 percent increase in less than a year. The industry seems to have been expanding rapidly, but the business still has a good time to go before it reaches the last mile farmers.

Figure 8: An IOT FARM MEETING by IFFCO-Kisan

Automated Milk System in Amul

Most of praise for the increase in milk demand belongs to the start of Operation Flood, the world's largest dairy growth initiative, in the 1970s, termed as the 'white revolution', the first of its kind. Presently, India has $1.2 trillion of dairy sector, which has emerged as huge market compared to the European Union and the United States. Over the recent years, it is rising gradually and India contributes more than 18 percent of the overall supply of milk across the globe.

Unlike the West, India's dairy farmers remain poorly organized, resulting in uneven milk content and composition. To optimize their processes, they lack precise, meaningful information. Milk producers, who own only two cattle maximum, have failed to increase their productivity in the world's largest dairy market. According to IFCN Dairy Research Network., the yield is upto 1,249 kg per cow annually, as against in US, where the size of the farm on an average is almost eight times more per cow (Bazmi, 2018).

There are start-ups moving ahead. To increase the dairy yield, the start-ups are transforming the poorly organised dairy market through techniques of automation, which uses advanced analytical tools and Internet of Things (IoT). In the dairy market, IoT innovations span the whole value chain, from milk processing to transactions. Farm workers can monitor the health and yield of a cow through a wearable sensor and calculate essential elements such as milk volume and production, somewhat similar to a Fitbit for cows. Farmers can gain direct feedback using this information, which they will then correlate with their counterparts to enhance efficiency and raise the sales.

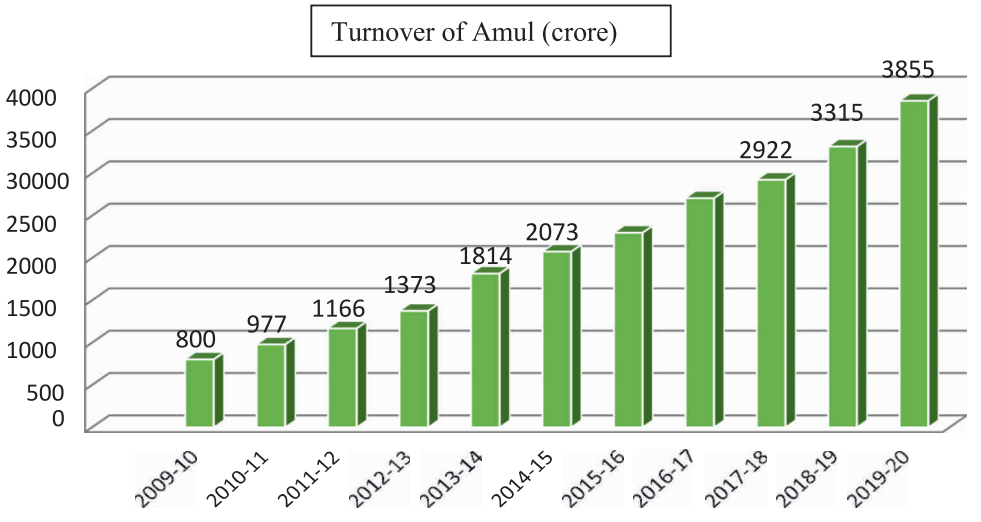
This innovation also serves the consumers of farmers. Milk consumers, such as major dairy cooperatives, are capable of controlling the environments within which they store, transit and sell milk. This enable them to have detailed details on the quality and consistency of milk, each farmer's record of production and fees owing to them, leading to better resource management.

Huge milk firms, too, are driven largely by automation. The nation's biggest dairy union, Amul, headquartered in Gujarat, has embraced digital technology to minimize milk wastes and help its significant expansion. 'By 2014, the federation's modern automation and control technologies had enabled the consistent handling of million litres of milk. Amul's turnover in FY20 grew 17% to reach Rs. 38,550cr as shown in figure 9.

The AmulDMS (Distributor Management Software) has been introduced at 3,300 distributor's points. More than 3,700 salesmen of such dealers uses cellphones for booking puchases by Sales Force Automation (SFA). For 350 wholesale dealers, the Federation has also launched a mobile-based DMS solution to capture secondary sales data from remote areas and small wholesalers.

The Amul union has made significant progress in implementing the Amul Automatic Milk Collection System (AMCS) system at Village Dairy Cooperative Societies (VDCS). Until now, the initiative has reached a

maximum of 13 village communities. The application has assisted in the convergence of the IT Supply Chain from Cow to Customer (C2C). Over 15 lakhs (1.5 million) messages are sent every day.



The increasing production of Amul products made it convenient for the four million milk producers of the cooperative to boost their own production and satisfy the needs for milk products. In such market, collaborations between start-ups and existing firms are necessary to drive technology. Empowering accurate statistics and quicker pathways to income for India's dairy producers would also enable India to retain its status as the largest dairy industry in the world.

Farms are gradually being computerized. Producers are assisted in the management of their automatic milking systems, which produce data continuously. It is also possible to control farms remotely, to track changes in milk temperature, livestock health, quantity of feed consumed, output volumes, milk flows, etc. Farmers can now handle certain facets of farming using smartphones.

Conclusion & the Way Forward

In a number of ways, the innovation movement built on intelligent technology is changing cooperatives and fostering development. From the standpoint of achieving growth, technological advancements will aid in increasing efficiency in operations and opening exciting opportunities for consistent engagement of customers. Owing to the shortage of funding and other business problems, technology implementation is often a challenging

job for cooperatives. Cooperatives' sustainable business efficiency is negatively impacted by many technological problems. The implementation of Industry 4.0 will, however, solve different problems with technology.

Aspects of Industry 4.0, such as big data, the Internet of Things, and the smart factory, play a positive role in encouraging the adoption of information technology (IT), which leads to sustainable business efficiency. Diversifying the practise, innovating and collaborating with others and using emerging technology are all essential to perform more effectively and sustainably.

Industry 4.0 in cooperatives cannot succeed on a stand-alone basis and need to be supplemented by members' active participation. In the progress of adopting and handling of digital tools, the members of cooperatives must feature with certain competencies such as technical knowledge and skills, desire to contribute and/or accept and capability of collaborating effectively. Thus, features of Industry 4.0 can improve the quality, quantity and access to services of cooperatives and its members at large. It goes without saying that if the cooperatives have a ubiquitous platform, every member shall be able to avail benefits accrued out of such activities.

While demand for technology has increased, majority of cooperatives face challenges in adopting and successfully using it. Cooperatives, on the other hand, see technological change as a challenge. They are attempting to set simple goals and following a flexible strategy, progressing step by step, in order to effectively go digital. Cooperatives must satisfy the demands of different stakeholders in their market community, and the stakeholders are encouraging them to go digital:

- Members expect that their relationships with cooperatives be monitored in almost real-time using emerging technology, as well as to have meaningful insights to new tools. They want advice and assistance in incorporating technologies like precision agriculture.
- Members are criticising the new paradigm internally. They need more user-friendly yet adaptable techniques, mostly to promote enterprise growth.
- Consumers and third-party providers are moving in order to keep pace through a greater automation of workflows.
- Certain cooperatives are part of distribution network, where operations are aided by the use of digital technologies that enable for easier communication.

To respond to and help cooperatives' transformational change, IT structure must progress as:

- Conversion of IT models into data aggregation platforms for all data sources (resources, processes, mobile devices, etc.) – usage of information systems.
- Execution of Big Data platforms as required satisfying the needs of high information flow and real-time computing.
- Existing operations (advisory systems, distribution networks, etc.) where emerging media provides new tools and approaches.
- Innovative offerings (data usage, for example), at the possibility of the outsider exploring majority of the value chain.

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