

Achieving sustainable development goals through Fourth Industrial Revolution: An Indian perspective

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ABSTRACT

Purpose: Today's world is technology driven. With the emergence of Fourth Industrial Revolution, it is of utmost importance to harness the power of technology for the collective good of more than a billion people living in India. The paper aims to explore the status of the United Nations Sustainable Development Goals (UN SDG) in India and how Fourth Industrial Revolution technologies can be utilized for fulfillment of these goals. **Methodology:** A detailed systematic review of research papers, articles, reports, and book has been done to explore the aspects of Fourth Industrial Revolution and Sustainable Development at global and India level. **Findings:** The Fourth Industrial Revolution has offered countries opportunity to build a more inclusive and sustainable society through technology. Moreover, for a country like India, where still domains defined in UN SDGs are not digitized fully, Fourth Industrial Revolution may provide solution to the problems. Poverty, hunger, inequality, and digital exclusion can be redressed, lead to sustainable development, and provided prompt digitization is preceded. **Implications:** The paper provides a deep insight into Fourth Industrial Revolution and sustainable development in context of India and how bringing both aspects together can revolutionize the Indian economy. The paper also discusses challenges which further lay for country. The paper points out the various modern technology solutions which can facilitate in achieving UN SDGs. **Originality:** The paper is first to explore the potential of the Fourth Industrial Revolution technology in achievement of UN SDG, hence facilitating India's aim to achieve UN SDGs by 2030.

Key words: Fourth Industrial Revolution, Sustainable Development, Technology, United Nations SDGs

FOURTH INDUSTRIAL REVOLUTION: MEANING AND SCOPE

According to Professor Klaus Schwab (2016), we are living in a world where technology will alter the way we live, work, and communicate. With the growth of artificial intelligence (AI), robotics, internet of things (IoT), information and communication technology (ICT), nanotechnology, 3D Printing, genome editing, storage and quantum computing, the world has already entered the "Fourth Industrial Revolution (4th IR)" Era. Professor Klaus Schwab, who has coined the

term, believes that exponential pace, unprecedented processing power, storage capacity, swiftness, possibility, and systems impact of 4th IR makes it different from others (Schwab, 2016). While third Industrial Revolution was simply digitization of the processes and procedures, Fourth Industrial Revolution is an innovation based on the combination of varied technologies.

However, with opportunities comes challenges and it holds true for Fourth Industrial Revolution as well. On the one side, the Fourth Industrial Revolution will raise worldwide income, improve the quality of life with increased production

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and supply and improve productivity and system's efficiency. Looking at the supply side, new technologies will be emerged for the efficient production of goods while new patterns of consumerism, more transparency, and customer engagement will gain relevance on supply side. It will also enable government to monitor and pursue pervasive surveillance systems to ensure a more secured and strengthened economy. On the another side, with internet being the enabler of the Fourth Industrial Revolution and 52% of the world population is still offline (World Economic Forum, 2018), this endeavor seems to be a distant dream. The fear of job loss due to automation is another challenge expected. The subsequent section discusses the UN's Sustainable Development Goals (SDGs) and role of 4th IR in achieving them.

SUSTAINABLE DEVELOPMENT AND FOURTH INDUSTRIAL REVOLUTION

United Nations SDGs

A total of 17 comprehensive goals were set by United Nations General Assembly in 2015. These are (United Nations, 2018):

- Goal 1: No Poverty
- Goal 2: Zero Hunger
- Goal 3: Good Health and Well-Being
- Goal 4: Quality Education
- Goal 5: Gender Equality
- Goal 6: Clean Water and Sanitation
- Goal 7: Affordable and Clean Energy
- Goal 8: Decent Work and Economic Growth
- Goal 9: Industry, Innovation, and Infrastructure
- Goal 10: Reduced Inequality
- Goal 11: Sustainable Cities and Communities
- Goal 12: Responsible Consumption and Production
- Goal 13: Climate Action
- Goal 14: Life Below Water
- Goal 15: Life on Land
- Goal 16: Peace and Justice Strong Institutions
- Goal 17: Partnerships to Achieve the Goal

All these goals are aligned with the Fourth Industrial Revolution either directly or indirectly. Innovative and technologically backup solutions may lead to more inclusive, inequality free, and sustainable society (United Nations, 2018).

Sustainable production

Fourth Industrial Revolution is one of the key aspects to achieve sustainable development across the world.

Quickening Sustainable Production is WEF System Initiative's project to shape the future of production. It emphasizes on harnessing the potential of innovation to achieve global competitiveness while delivering increased efficiency, improved human well-being, and less damage to environment (Leurent and Abbosh, 2019).

Carbon free economy

Fourth Industrial Revolution in its endeavor toward sustainable development intends to build a carbon-free economy as well. Clean energy and less carbon emissions are another major thrust area of sustainable development which is to be achieved through Fourth Industrial Revolution. It encourages a price on carbon emission (Regas, 2016). A carbon price will ensure appropriate investment of investors' money and will make the customers more aware and inclined toward buying products of those firms which produce less carbon footprints. Innovations equipped with 4IR technologies will also lead to sustainable urbanization. Cogeneration, coheating, cocooling, mobility on demand, digitally programmable space, intelligent street poles loaded with sensors to capture meteorological data, pollution data, and traffic movement may help in energy conservation and technology empowered cities (Schwab, 2016).

Concept of minimizing waste

With companies exaggerating in scope and size, technology can bring-in sustainability to the corporate world as. Companies like Estee Lauder, the cosmetic giant of USA, has discharged zero waste to ecosystem since 2003. In their owned, 23 manufacturing and distribution facilities, if any such waste is generated which cannot be recycled, it is incinerated to produce energy (Fortune, 2019). WEF and The Forum of Young Global Leaders recognized companies such as Cambrian Innovation (USA), Lehigh Technologies (Georgia), Enerkem (Canada) for using the most innovative ways to ensure three R's, namely, reduce, reuse, and recycle (Fortune, 2019).

Sustainability through Industry 4.0

Ingersoll Rand has been supporting many corporates to achieve business sustainability through Industry 4.0. Sustainability facilitates companies in enhancing their productivity by leveraging local manufacturing operations, their innovation through R and D centers and growth through expansion of footprints (Poddar et al., 2019). All this is achieved with the help of 4th IR technologies such as AI, IoT, and other latest technologies involved in mitigating the climate change.

Technology and patents

Technological innovations come with patents which is disadvantageous for least developed and developing nations. It is in the best interest of both developing and developed nations that the developing nations have access to proenvironmental technologies (Nagar, 2018). According to TRIPS (Trade Related Intellectual Property Rights) Agreement, developed countries should be incentivized for technology transfers to least developed countries, but it does not make any reference to environment-friendly technologies (TRIPS Article 66.2). In 2008, few companies, namely, IBM, Nokia, Pitney Bowes, and Sony introduced the Eco-Patent Commons, a copyrighted project intended to offer licenses. EPC provides environment friendly technology patents without charging any patent fees (Balta, 2015).

Circular economy

The circular economy challenges the concept of waste. What goes around as the product comes around as the waste and it needs to be recycled or reused by company (Potocknick and Gawel, 2019). Circular economy holds a huge scope for India as well. Circular economy concept is being promoted by companies in India where they are implementing business models that are based on reduce, reuse, and recycle paradigms. (Goyal et al., 2016).

Challenges to 4th IR and SDG

According to the World Economic Forum, 21st century is meant for maximizing the human well-being and facilitating the availability of basic human needs for free (World Economic Forum, 2018). However, with such a major job loss due to automation, the real challenge lies in skilling, training, and educating people for emerging jobs, which have potential in the future and are irreplaceable by machines (Sterling, 2019). Lack of skilled IT professionals is already holding back the digital transformation in era of 4IR (Tandon, 2018). Further, Fourth Industrial Revolution has also flamed the debate of brooding inequality in society (Byanyima, 2018). As the technology moves forward, billions of people are left behind, especially in under-developed and developing economies. Deprived of necessities, Fourth Industrial Revolution has very less relevance for all these people. Globalization is another factor which is fuelling-up discontent around the world. With 1% of rich holding 82% of world's wealth, globalization along with Fourth Industrial Revolution needs to narrate a new story (Byanyima, 2018). Inclusiveness is of utmost importance to spill the positive impact of Fourth Industrial Revolution to every human around the world. (Nath, 2017).

INDIA AND FOURTH INDUSTRIAL REVOLUTION

Toward Fourth Industrial Revolution

In 22nd edition of World Congress on Information Technology organized by NASSCOM (National Association of Software and Services Companies) organized in 2018, the Indian Prime Minister Shri Narendra Modi highlighted various initiatives taken by the government to percolate the technology and its usage for the masses. eNAM is an online agricultural portal, offering the best prices to the farmers and Umang App offers 185 Government services. Atal Innovation Mission is launched with an aim to ensure that relevant technological skills are imbibed in the children at young age (Modi, 2018).

NASSCOM has also inaugurated its "Skills of the Future" platform which provides an industry driven eco-system in tandem with information technology (IT). It emphasizes on 155+ skills, across 70+ job roles on ten emerging technological innovations, namely, AI, blockchain, and Fourth IR Technologies (Future Skills, 2018).

Research and Development

India has the 6th largest R and D investment and is expanding its already internationalized innovation clusters such as Bengaluru and Hyderabad. There are 1200 R and D centers of multinational corporations in Bengaluru (Choongjae and Youngchul, 2018).

Indian Government's Initiatives for 4th IR

The government has also initiated to invest rigorously in 4th IR technology. NITI Aayog has prepared a roadmap which includes setting-up of five research excellence centers, 20 institutes for transformational AI and a cloud computing platform called AIRAWAT (Agarwal and Seth, 2019). Engineering Export Promotion Council along with the Department of Heavy Industry has set-up four demonstration centers that will help to project manufacturing as a smart and intelligent activity. They are aimed to enhance the competitiveness of Indian industries. These are:

- Center for Industry 4.0 (C4i4) Lab in Pune
- AIA Foundation for Smart Manufacturing at IIT Delhi
- I4.0 India at IISc (Indian Institute of Science, Bengaluru) and,
- Smart Manufacturing Demo and Development Cell at CMTI (Ghosai, 2019).

Development of New Business Models Incorporating Recent Technology

Today India is not just importing the technology developed by the advanced economies but is also creating its own technologies by tailoring the global technologies as per the local needs and customs. There are three types of prevailing business models, namely

- (i) Innovations which are happening in west but are used in other countries as well. It includes sharing economy-based enterprises such as Uber and Airbnb.
- (ii) Solutions which are developed for local needs only. These are low-tech and low-budget solutions that work in emerging markets. India's financial inclusion using mobile technology is an apt example for it.
- (iii) Another is an origin from emerging markets but have the potential to scale up across the globe. India's OYO model is a good example of how low-to-middle level hotels can be connected through technology to provide cheap and efficient hospitality services (Sharma, 2017).

Advancements in Production and Marketing with 4th IR

Most of the Indian firms are experimenting with new ways of production, marketing, studying consumer behavior, and delivering customer services with the Fourth Industrial Revolution. They are increasingly using AI, robotics, 3D Printing, Cyber-physical systems to increase the efficiency and to deliver best possible value to their customers. For example, dyeing at Raymond production facilities is a fully automated process where the color precision is required to be accurate to 1/1000th of a gram. This is achieved through 4th IR technology only. Marico, the \$900 million personal care products giant, has embraced technology in a very dynamic way. The company has more than 400 sensors in their plants to gather data pertaining to productivity and downtime planning. The sensors are installed across energy meters, flow meters, temperature and pressure gauges, RPM sensors, level transmitters, and visual flow sensing devices. The sensors are based on IoT technology. (Sharma, 2017).

Global information data and measurement company Nielsen are pioneering the use of neuroscience in India. Nielsen is tapping into neuroscience to measure the consumers' subconscious responses to various inducements and stimuli. Vodafone (India), in association with Nielsen, has applied the neuroscience technology to understand the consumers' thought process and their responses to the advertisements. Vodafone used electroencephalography and eye tracking to study effectiveness of its "Super Dad" Advertisement

(Sharma, 2017). Increased automation and robots adoption do not seem to cause loss of employment in the aggregate but what is needed is reskilling and upskilling. (Ramaswamy, 2017).

Exploring Blockchain

Public sector has been exploring the opportunities with famous technology of the Fourth Industrial Revolution, i.e., blockchain, with 40 plus blockchain initiatives being executed recently (Future Skills, 2018). Unfortunately, there is huge demand – supply gap in skilled blockchain developers. In fact, according to a study, 99.75% of Indian developers do not have the right skill set to deal with blockchain platforms (Gupta, 2019). Realizing the scope of blockchain, there is a proposed blockchain also by the name "IndiaChain" which will transform the functioning of public administrative services to make systems more transparent and efficient (Singla, 2019).

INDIA AND SUSTAINABLE DEVELOPMENT JOURNEY

India is home to 1/6th of world population and hence India holds the key SDG Achievements as well (NITI Aayog, 2020). Ambitions of electrifying universal rural areas, greater road and digital connectivity, immense growth of clean and renewable energy, sanitation, and housing for all and elementary school education worldwide, etc., are always on focus and emphasis (NITI Aayog, 2020). India's premier think tank NITI Aayog has been entrusted with coordinating SDGs and mapping the schemes accordingly (NITI Aayog, 2020). The SDG India Index 2019 and Dashboard, developed by NITI Aayog, give an assessment of the progress made by states and union territories toward the attainment of SDGs (NITI Aayog, 2020).

Extreme poverty, as measured by the world bank's International poverty line, has dropped from 21.2% in 2011 to 13.4% in 2015 (World Bank Report, 2018). Multi-dimensional poverty has also reduced to 27.5% during the period 2005–2006 and 2015–2016, leading to over 271 million people coming out of poverty (Oxford Poverty and Human Development Initiative, 2018). China has also reduced extreme poverty successfully from 60% in 1990 to 12% in 2010. As stated by Development Economist Jayita Ghosh, situations of extreme poverty are worst in the South Asia (Roche and Mehta, 2014). Although every household is covered under Public Distribution System (PDS) of grains in India, about 40.5% of 6–59 months children are

anemic and 34.7% of children under the age of 5 are stunted (NITI Aayog, 2020).

Several initiatives by GoI contribute directly to the advancement of UN's SDGs. The Aadhar Scheme is acknowledged as world's largest national identification number project. It not only gives a biometric-based legal identity but also facilitates direct transfers of government's subsidies to its beneficiaries. As of June 2015, 87.2 crore (872 mn) have been enrolled in the project which is more than 72% of Indian population (Technology and Action for Rural advancement, 2015). Pradhan Mantri Jan Dhan Yojana (PMJDY) is a major financial inclusion program till date, across the world. The government has already paid out a cumulative amount of INR 1.6 trillion (USD 25 billion) to approximately 329 million beneficiaries through Direct Benefit Transfers (NITI Aayog, 2017). Pradhan Mantri Jan Dhan Yojana has turned out to be a vital instrument for financial inclusion. With 377 million new bank accounts being opened under this scheme, INR 1079 billion has been deposited in these newly opened bank accounts (NITI Aayog, 2020).

Another scheme, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) offers legal assurance of a minimum of 100 days/year of waged employment per household for unskilled rural workers. The program has generated over 2 billion person - days of employment during the year 2016 (NITI Aayog, 2017). Till 2019, 85.26% of people of rural India were provided employment under MGNREGA (NITI Aayog, 2020). The Research and Development (R and D) expenditure has been stagnated between 0.6 and 0.7% of GDP (Gross Domestic Product) in the past two decades (NITI Aayog, 2020). The size of the Indian economy, in 2018–19, is estimated to be USD 2.72 trillion with per capita income of \$2,015 for the year 2018. It aspires to become a USD 5 trillion economy by the year 2025 (NITI Aayog, 2020).

The digital penetration of India is also increasing at a rapid pace. For every 100 persons, 88 have mobile connections and 49 are internet subscribers (NITI Aayog, 2020). India is among top five in the area of space exploration. India is ranked 9th and 12th worldwide on the number of scientific papers published and patents, respectively. However, India's spending has always been low in research and innovation. India spends just 0.85% of GDP on research and innovation which is quite low while comparing to other developed as well as developing countries (Technology and Action for Rural advancement, 2015).

Sustainability and achieving SDGs are on priority not just for the governments but also for the corporates as well. Big

business houses such as Mahindra, Tata, and Flipkart have already recruited sustainability officers. The companies are also investing in sustainable initiatives to make a mark in sustainable development. ITC has been constantly working on water recycling and carbon positive for more than 10 years. Business groups such as Bosch, Tata Consultancy Services, Infosys, and others are aiming for reducing carbon footprints with every elapsing year (Poddar et al., 2019).

INDIA'S SUSTAINABLE DEVELOPMENT AND ROLE OF FOURTH INDUSTRIAL REVOLUTION

JAM Trinity

India envisages to reduce poverty and inequality with JAM (Jan Dhan - Aadhaar - Mobile) (NITI Aayog, 2020). In the Economic Survey of 2014–2015, Arvind Subramanian introduced the acronym JAM, to refer to three technologies that could transform the lives of poor and uplift them from impoverished conditions. The combination of financial inclusion, biometric identification, and digital access is expected to revolutionize the lives of underprivileged in India (Subramanian, 2018). The government is trying to get best out of Fourth Industrial Revolution Technology IoT to get all the information and services on a single-networked platform. One such initiative is DigiLocker which provides access to 1.9 billion digitized documents till date (NITI Aayog, 2017).

Digitizing Services

Although India is already delayed in making optimum use of the technology, increasingly all the government work and services are being shifted online to make them handy. The Government of Delhi and VFS Global provide ten commonly used services at doorstep and endeavors to scale-up to 100 services in time to come (Ojha, 2018).

Clean and Renewable Energy

India is making major investments toward clean and renewable sources of energy to achieve sustainable development in energy domain as well. Due to recent investments, clean energy installations and one of the largest renewables auction market worldwide, India ranks 2nd most promising market after Chile, as per the ClimateScope Report by energy researcher Bloomberg New Energy Finance (Thomas, 2018).

The Indian government has set an ambitious goal of 175GW of clean energy generation by March 2022. Fourth Industrial Revolution Technologies may play a key role in harnessing the power of renewable energy and transmitting its benefits common people, ensuring no transmission leakages. Karnataka, the only Indian state to generate five Giga Watts of solar power, also generates energy from other sources such as wind (4.7 Giga Watts), and hydro/biomass which contributes to 2.6 Giga Watts (Sangriya and Nayak, 2015) (T V Ramchandra, 2007). The most impressive fact is that renewable energy produced by Karnataka is at par with what is produced by Netherlands and Denmark, the countries are pioneers in producing renewable energy.

Sustainable Cities

The World Economic Forum has assessed how the state of Andhra Pradesh could benefit from harnessing new technologies and indicates that there could be an annual opportunity of \$5 billion for Andhra Pradesh by the year 2022 if it integrates more and more Fourth Industrial Revolution Technologies (Charlton, 2018).

Centre for the Fourth Industrial Revolution, India

The center for the Fourth Industrial Revolution (India), which is a joint initiative of World Economic Forum and the Government of India, intended to serve as a trusted space for the government, top organizations, academia, civil society and international corporations, to codesign, assess and scale-up policy agendas, industry standards, norms, and guidelines for governing Fourth Industrial Revolution Technologies and their applicability in sustainable development (Russo and Zopf, 2018).

Addressing Agricultural Problems with 4th IR

World Economic Forum (WEF) Center is using 4th IR technology with Government of Maharashtra to modernize agricultural practices in the state. It will collaborate with the government and private players to chart out all the agricultural lands across districts with the help of drones. These plots will help on multiple fronts, namely, assessing crop health, generating prescription maps with location-based fertilizer recommendations, inspecting irrigation and other infrastructures, analyzing soil quality, and assessing and predicting crop volume (Russo and Zopf, 2018). By empowering farmers with technology, agricultural productivity could be improved which will help to combat rural poverty as well (Brende and Sonmez, 2018).

Digitized PDS

As per the Economic Survey 2018–2019 Volume 2, the ration cards and beneficiary details in all states and union territories have been digitized. The online allocation of food grains and supply chain computerization is complete except in few states and union territories. The government is interested in replacing PDS with Direct Benefit Transfer (DBT) since long. However, the research shows that replacing PDS with DBT could be problematic and complex (Alexander, 2019).

THE FLIP SIDE OF THE COIN: WHAT ISSUES INDIA MAY FACE

Worries about the effect of technology on job losses are known to everyone. In 1931, Keynes – the famous economist, warned about the prevalent technological unemployment due to our discovery of means for economizing the use of labor, out-running the pace at which we can explore new uses/work for them (Schwab, 2016). The Fourth Industrial Revolution with its disruption is expected to bring two key changes:

- First, there is a ruining effect as tech-based disruption and automation replaces capital for labor; forcing them to become unemployed or to reallocate their skills elsewhere.
- Second, this destruction effect is accompanied by a capitalization effect in which gives rise to the demand for novel goods and services which in turn creates new jobs, businesses, and even industry sectors (Schwab, 2016).

As per Future of Jobs Report, 75 million jobs may be displaced at global level while 133 million extra roles may appear at the same time (World Economic Forum, 2018). An over – reliance on automation for an over – populated country like India will shrink job creation. The present unemployment rate is estimated to be around 6% (NITI Aayog, 2020). Economy needs to generate entirely new opportunities for 12–13 million new university graduates who come into workforce every year. Further, the country is expected to lose 1.5 million jobs annually too (Sharma, 2017). According to a report by people strong, one in four job losses in India will happen on account of automation (Laha, 2017). In IT Sector, more than 2 lakh engineers will lose their jobs in years to come (PTI, 2017).

As per Future of Jobs Report by World Economic Forum, at organizational level, 83% of the companies surveyed in India look to automate work in coming years and 54% of existing workforce need re-skilling (World Economic

Forum, 2018). Hence, the government and the companies need to invest a lot in training, development, up-skilling, and re-skilling of the Indian workforce to make them ready for Industry 4.0. Fourth Industrial Revolution and Digitization will bring more and more gadgets, devices, and hardware. The electronic waste thus generated is a menace for environment. India is evolving as a substantial e-waste generator. E-waste in India is mounting at a rate of 500% every year, with only <5% being recycled (Pandya, 2018). India has only 312 authorized e-waste recyclers and dismantlers as on June 2019. (Ministry of Electronics and Information Technology, 2019) About 95% of India's e-waste is recycled in gray market, in a crude manner. The need of hour is E-waste management techniques such as Extended Producer Responsibility (EPR) and Producer Responsibility Organization (PRO) (Garlapati, 2014). (Kumar and Dixit, 2018).

THE WAY AHEAD AND CHALLENGES FOR INDIA

If Fourth Industrial Revolution to reach its fate in India, a substantial investment is required to be directed toward research and innovation by the Indian government. Like the Chinese government, India needs to make an explicit target to bring itself into the realm of "Innovation Nation". China keeps "Zizhu Chuangxin" meaning indigenous innovation as the central notion to become an innovation nation. Zizhu literally means "self-directing." It stresses on autonomy and strategic control at the national level and domestic enterprise level involving organizational learning, technology building, and technology selection (Zhou et al., 2016). Although the political apparatus is different in India and China, what India needs to focus on is the strengthening of domestic companies for promoting research, innovation, and development. India should also develop government financed research institutes which is very common in South Korea (Lim, 1999). India has reached 52nd position in Global Innovation Index 2019 but there is still a long way to go (Press Trust of India, 2019). Moreover, if we think Jugaad innovation – the cheaper adaptation of existing innovations will make us an innovation nation, then that is somewhere, we are highly mistaken (Jishnu, 2015).

The China's path of innovation has been shaped both by top-down (mostly powered by state owned enterprises) and bottom-up strategies. China's estimates of innovation performance, for example, have improved to 49% of the EU level in 2015 (huge jump from 35% in 2006) as the country shifts the focus of its economic model toward innovation and services (Schwab, 2016). Japan exclusively believes in building innovative enterprises that fuels the

innovation of the nation. These enterprises are built with three key ingredients:

- Strategic control through cross shareholding, stable shareholding, and professional managers
- Organizational integration through various Japanese management methods such as Total Quality Management (TQM), Kaizen, and 5S and lastly,
- Financial commitment which means patient capital to bear the sweet fruits of innovation and technology (Zhou et al., 2016).

A same model of enterprises can be experimented in Indian Industry to propel it through Fourth Industrial Revolution and make it a pioneer in same. The technology solutions will surely help in achieving various SDGs. India, to reap the benefits of Fourth Industrial Revolution Technologies, should develop a manufacturing base, which is quite weak in India at present. Weak manufacturing base is attributed to many reasons, namely, lack of skilled labor, lack of labor reforms, high material cost, and lack of synchronized supply chains (Mukherjee et al., 2019). A strong manufacturing base will help to implement 4th IR technologies and ensure sustainable and efficient production.

The earnings of small and marginal farmers have dipped by 30% due to increased input costs, weather – related issues affecting crop yields, fluctuating prices and lack of technological, and financial and market access (Bouton, 2019). The technology needs to touch the roots and especially reach to the farmers who are living the impoverished lives and need an immediate support from the government. Innovation in agriculture would help to increase the yields which will not only draw them out of poverty but will also play an overhauling role in combating hunger. Specific social media platforms for farmers are also required, just such as Agri – Google, Krishi Facebook, and Krishi LinkedIn can be chartered out for the farmers (Lele and Goswami, 2017).

CONCLUSION

The Industry 4.0 technology has the power to change the fate of people of India. If used appropriately, it may help us to build an inclusive and self-sustained society. It can help the government and various policy-makers to solve the prevailing issues of scarcity, hunger, and disparity, etc., and hence lead to achieving UN SDGs faster. This theoretical research work is a conceptual attempt to analyze various facets of sustainable development and Fourth Industrial Revolution in Indian context. It explores the Indian initiatives taken for specific SDG domains (NITI Aayog, 2020). It further explores the existing or prospective

application of 4th IR technological solutions to ensure sustainable development in the country as discussed and summarized in Table 1. In 21st century, technology can be a possible answer for majority of the issues faced. Fourth Industrial Revolution gives us an array opportunities. However, what is need of hour is appropriate government support to encourage research and development of Fourth IR solutions for achieving SDGs .Solutions which prove to be successful should then be utilized at ground level.

IMPLICATIONS

Fourth IR Technology can yield lofty results if proper policy formulation, execution and implementation is practised. Many fear that automation at such a large scale will lead to job loss, however such technology solutions would require upskilling, reskilling and would create more employment opportunities and economic growth (Ramaswamy, 2017). Greater technological infrastructure would be enabled

Table 1: Sustainable Goals, Indian Initiatives, and Present Status of 4th IR Technology

SDG	SDG goal	Indian initiatives	Digitized (Database/ Services)	Use of fourth IR technology	Prospects	References
1	No Poverty	MGNREGA Social Safety Net (PMJDY for Banking and Insurance Services)	Yes	No	Blockchain in Banking/Insurance Sector, Smart Contract in Insurance Sector	(Cocco et al., 2017) (Gatteschi et al., 2018)
2	Zero Hunger	Public Distribution System (PDS) by FCI (GoI)	Yes	No	Blockchain in PDS	(Kamble et al., 2018) (Hatiskar and Pai, 2018)
		Increasing Annual Yield of Grains	No Uniformity	Precision Farming, Drone Mapping, AI etc.	Effective Implementation of 4 th IR Initiatives	(Mishra et al., 2003), (Brende and Sonmez, 2018)
3	Good Health and Well-being	Making Medical Services Available Common Masses	No Uniformity	Use of Robotics and AI in Surgeries	Genome Editing, Remote Health Monitoring Devices	(Jayakrishnan, 2019); (Dhai, 2018); (Jones and Pimdee, 2017)
4	Quality Education	Increasing Enrolment in Schools and Higher Education	Yes	No	AI and Robotics	(Shahroom and Hussain, 2018); (Sharkey, 2016); (Edwards and Cheok, 2018)
5	Gender Equality	Improved Sex Ratio Better Female Wages	No	No	Training of Women in Fourth Industrial Revolution Technologies	(Howcroft and Rubery, 2018)
6	Clean Water and Sanitation	Clean Drinking Water Better Toilet Facility Wastewater Management	No	No	Clean Water and Sanitation Sensors, Private Waste Operators	(Pellini et al., 2019); (Sivaramakrishnaa, 2019)
7	Affordable and Clean Energy	Intensifying Electrification Promoting Clean Fuel	No	No	AI in Renewable Energy	(Jha, et al., 2019)

(Contd...)

Table 1: (Continued)

SDG	SDG goal	Indian initiatives	Digitized (Database/ Services)	Use of fourth IR technology	Prospects	References
8	Decent Work and Economic Growth	Increasing Annual Growth Reducing Unemployment	No	IoT, Robotics, and AI Used by Private Players	Intelligent Manufacturing Using 4 th IR Technologies	(Zhou J. , 2013); (Bahrin et al., 2016) (Sharma, 2017)
9	Industry, Innovation and Infrastructure	Increasing Internet Penetration Labor Force in Manufacturing Sector	No Uniformity	No	Training of Labor Force in 4 th IR Technologies, Industrial Cyber Physical Systems	(Abdurrahman, 2018) (Colombo et al., 2017)
10	Reduced Inequalities	MGNREGA Social Safety Net (PMJDY for Banking and Insurance Services)	Yes	No	Blockchain in Banking / Insurance Sector, Smart Contract in Insurance Sector	(Cocco et al., 2017) (Gatteschi et al., 2018)
11	Sustainable Cities and Communities	Better Urban Sewage Treatment System Housing for All	Smart City, Sewer Cleaning M/cs	Yes	Smart City Robots instead of Manual Scavenging	(Jones and Pimdee, 2017); (Deogaonkar et al., 2018)
12	Sustainable Consumption and Production	Replenishing Ground Water Recycling Hazardous Waste Increasing Bio Power Capacity Effective Segregation of Waste	Waste Processing M/cs and Plants	No	Zero Waste, Robotics and AI for Waste Management	(Jha, et al., 2019); (Agamuthu, 2017) (Deogaonkar et al., 2018)
13	Climate Action	Increased Use of Renewable Energy Reduced Carbon Footprints	More than 80 GW Installed Capacity for Renewable Energy	No	Rapid Innovation for Low Carbon Emissions	(Rockstorm, 2018)
14	Life Below Water	Aquaculture Developing Coastal Water Quantity Index	No	No	Cognitive Ocean Network	(Lu, et al., 2019)
15	Life on Land	Increasing Forest and Tree Cover Wildlife Protection	No	No	Drone Operations for Wildlife	(Gonsalez and Johnson, 2017)
16	Peace, Justice and Strong Institutions	Aadhar Identity Reduction in Crime Rate	Yes	No	Linking Aadhar and Blockchain	(Mudliar et al., 2018)

thus leading to digital inclusion. Continuous Research and Development will lead to new technology solutions. With Digital inclusion, financial inclusion will come in tandem (Bansal, 2014). Robust Supply chains (Kamble et al., 2018) will ensure prompt deliverability of products. Modernization of agri supply chains and Public Distribution System (Hatiskar and Pai, 2018) would ensure food security to the underprivileged. Modernised farming will yield grain surplus (Mishra et al., 2003) thus reducing farmers' plight. The vision of Indian Government to make major cities Smart Cities will manifest if all these aspects are being equipped with technology. Advanced waste management and circular economy will not just make cities cleaner, but will create new business and job opportunities (Agamuthu, 2017) (Goyal et al., 2016). All these sustainable development goals would be pursued without damaging environment or wildlife and keeping carbon emissions in control. (Gonzalez and Johnson, 2017). However a major setback which is faced by India for application of Fourth IR technology is that many domains of SDG haven't been digitized which makes Fourth IR application difficult. This aspect has been highlighted in Table 1 specifying that whether SDG areas are digitized or not and if they are digitized, then what is the extent of digitization

LIMITATIONS AND FUTURE RESEARCH AGENDA

The paper is not devoid of limitations. Firstly the paper is based on pure theoretical work lacking empirical evidence to validate the findings. Future research should be based on developing framework backed by empirical evidence. Though 4IR is not much prevalent in India, however there are specific sectors like private manufacturing sector and healthcare (Sharma, 2017) which make good use of 4 IR technologies in India. Data could be collected from such organizations to draw a comparative study how 4IR technologies yield better results in all aspects. The paper aimed to capture holistic view of SDGs thus making it oblivious of detailed analysis of individual SDGs. Hence for future research, individual SDGs can be picked up to draw comparative analysis of 4IR versus non 4IR settings, so as to ensure deeper detailed analysis of individual SDG. Models like Technology Adoption Model (Davis, 1985) and Technology Readiness Index (Parsuraman, 2000) could be tried and tested. TRI has been used in combination with TAM to predict the technology adoption in the past (Pattansheti, 2016).

CONFLICTS OF INTERESTS

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