A dialogue on trade and development in South Asia | Vol. 15, No. 4, 2019

TRADE insight

SOUTH ASIA IN FOURTH INDUSTRIAL REVOLUTION

FUTURE OF WORK | AGRICULTURE TECHNOLOGY | SDGs | INCLUSIVITY

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editors' note

Preparing for a new era

TECHNOLOGICAL disruption, initiated by the revolution in information and communication technologies, has upended the way humans communicate, reshaped traditional business models and compelled governments to rethink modalities for the delivery of education, healthcare and transportation services, among others. Building upon the 'third industrial revolution' of the second half of the twentieth century, when development of semiconductors, personal computing and the Internet got embedded into society, the Fourth Industrial Revolution (4IR) has ushered in an era that fuses the physical, digital and biological worlds using technologies such as artificial intelligence, robotics, Internet of Things, 3D printing, nanotechnology, biotechnology, and so on. Although still in their infancies, these technologies have created new types of industries, which demand new kinds of skill sets, and continue to do so at an exponential pace.

As 4IR technologies are making rapid progress, the South Asia region, with about 10 percent of its population without access to electricity, has not yet fully benefited from the fruits of even the second industrial revolution. Considering poor information technology infrastructure, limited technological skill sets of its people and archaic technological governance, South Asia is years away from getting into the thick of the action regarding the 4IR. For instance, unmanned cars plying on the streets of South Asian cities anytime soon may sound like a dream. However, as new technologies emerge, economic structures undergo tectonic shift and hence South Asia is not completely untouched by the 4IR. Some aspects of 4IR technologies have been adopted by South Asian countries in various ways. An example is the disruption of public transport system in major urban centres of the region by a handful of ride hailing platforms. Likewise, thousands of jobs in the textiles and garment industry are facing threats from sewbots (i.e., sewing robots) in India, Sri Lanka, Bangladesh and Pakistan. This is because, unlike the disruptive technologies of the past that shaped previous industrial revolutions, 4IR technologies are easily adaptable even for least-developed countries. Nevertheless, given the unprecedented scale, speed and scope of 4IR technologies, appropriate policies are required to facilitate technological adoption in multiple sectors, to create skilled human resources and to promote firms that make these technologies possible. It is high time that South Asian countries put in place the necessary policies.

When innovations make traditional technologies obsolete, a natural outcome is the displacement of labour. The developed world is already experiencing this phenomenon. Inability to engage displaced labourers into the new industrial model created by the 4IR is poised to emerge as a major challenge in countries like ours where unemployment and underemployment is already a major problem. Similarly, 4IR technologies could widen inequalities as the technically savvy and skilled population could reap immense benefits while those with limited or no digital skills are at risk of being left behind. Thus, policies need to find ways to engage the disenfranchised so that economic woes do not turn into political malaise.

This issue of *Trade Insight* attempts to examine the different issues pertaining to the 4IR through a South Asian lens. The articles explore the potential opportunities and challenges of 4IR adoption by South Asian countries, such as in relation to job markets, gender relations and attainment of Sustainable Development Goals, among others, and offer recommendations on how to deal with them. ■

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Content

Japan won't sign RCEP if India doesn't join

JAPAN is not considering signing the Regional Comprehensive Economic Partnership (RCEP) without India, the top Japanese negotiator said ahead of a series of diplomatic exchanges in November that include a visit to New Delhi by Japan's Prime Minister Shinzo Abe.

India announced in the beginning of November that it was withdrawing from the RCEP, which is considered a Chinese-backed regional trade pact, citing the deal's potential

impact on the livelihoods of its most vulnerable citizens. China said that the 15 remaining countries decided to move forward first and India was welcome to join RCEP whenever it is ready.

Japanese Deputy Minister for Economy, Trade and Industry, Hideki Makihara, said that they were thinking of negotiations including India.

Mr. Abe has sought to beef up ties with India across a range of fields to balance China's regional dominance. Both countries are also part of four-way security talks, the Quad, which is an informal consultative mechanism between four countries, including Australia and the US. Beijing has complained that this could stoke a new Cold War. *(economictimes.indiatimes.com/, 29.11.2019)* ■

Nepal receives climate change project grant from Green Climate Fund

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NEPAL has secured its first significant funding from the Green Climate Fund (GCF) for a project aimed at helping the country adapt to the adverse impacts of climate change.

The 24th board meeting of the Fund held in Sangdo, South Korea, on 13 November, approved the funding proposal of Nepal—one of the most vulnerable countries to the impacts of the climate crisis.

The meeting has given the green signal to awarding a US$39.3 million grant to the project titled 'Building Resilient Churia Region in Nepal'.

The Food and Agriculture Organization of the United Nations will implement the approved seven-year project, in partnership with Nepal's Ministry of Forests and Environment, in the fragile Chure range that has faced massive degradation in the past.

Set up in 2010 under the United Nations Framework Convention on Climate Change (UNFCCC), the GCF was created to support the efforts of developing countries to respond to the challenges of climate change.

Nepal had also received funding from the GCF twice in the past. In 2016, under the GCF's 'Readiness and Preparatory Support Programme', a programme to enhance country ownership and access to the funds, Nepal had received a grant of US$2.9 million via the United Nations Environment Programme to prepare its National Adaptation Plans.

Likewise, Nepal received another funding from GCF's 'Readiness Support' that provides up to US$1 million per country per year for strengthening the country's institutional capacities to access the funds.

The current funding has been approved for the project that will be implemented on the ground to help climate-vulnerable communities and ecology to adapt. *(https://kathmandupost.com/, 14.11.2019)* ■

Nepal, Bangladesh, India mull implementing BBIN motor vehicle deal without Bhutan

NEPAL, India and Bangladesh are mulling over putting into operation the Bangladesh, Bhutan, India and Nepal (BBIN) Motor Vehicle Agreement (MVA) even if Bhutan chooses to opt-out of the agreement.

Bangladeshi Prime Minister Sheikh Hasina proposed bringing the MVA among the three countries into operation at the earliest during a meeting with Nepal's Prime Minister KP Oli on the sidelines of the Eighteenth Summit of the Non-Alignment Movement held in Baku, Azerbaijan, on 26-27 October.

Although Nepal, India and Bangladesh have already ratified the MVA, Bhutan is yet to ratify it through its parliament. Earlier, Bhutan had said that it would not be able to endorse the agreement for the time being as it is in the process of addressing concerns raised by domestic stakeholders and completing the necessary formalities to ratify the agreement.

The Bhutanese government has yet to endorse the BBIN MVA, but the Royal Bhutan Government had earlier decided to give its consent for the entry into force of the agreement among the other three-member states without any obligations to it. Nepal has remained positive about implementing the agreement even if Bhutan takes times to complete the procedural issues. *(https://myrepublica.nagariknetwork.com/, 31.10.2019)* ■

WTO rejects most of India's claims against US steel duties

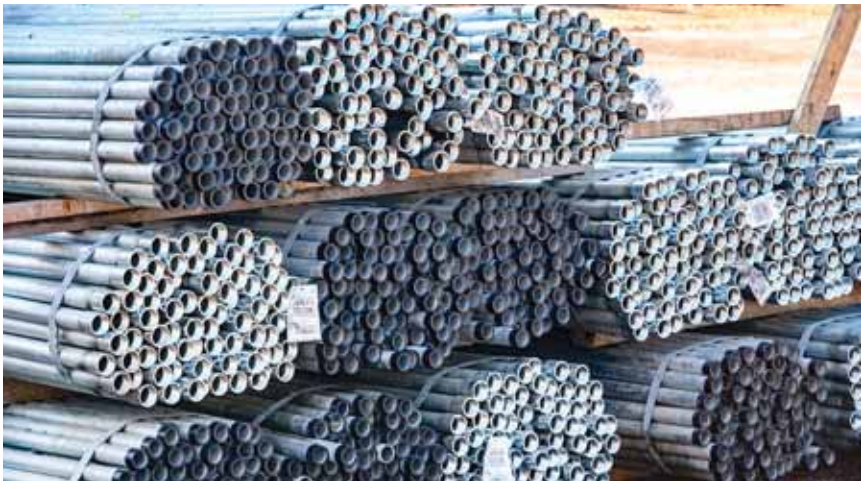
WORLD Trade Organization (WTO) adjudicators on 15 November rejected most of India's claims that the US was not respecting an earlier WTO ruling related to anti-subsidy duties on Indian steel.

India had complained that the US failed to meet an April 2016 deadline to comply with a WTO decision that faulted it over its imposition of countervailing duties on hot-rolled carbon steel products from India.

Despite US duties still applying, the WTO panel rejected many of India's complaints. But, it did say that the US needed to bring a legislative provision in line with WTO rules.

India brought its original complaint to the WTO in April 2012, after the US Department of Commerce set an import duty of nearly 286 percent on circular welded carbon-quality steel pipe product from India to offset government subsidies.

In 2014, the WTO found that for a variety of reasons, the US measures breached global trade rules. The two parties agreed that the US would comply with that ruling by 2016, but then disagreed over whether it had done so.



Pxfuel

Either side could appeal against the panel's latest findings. If a country does not comply with a WTO ruling, the other party can ask to impose sanctions.

In the extremely complex case, India argued that the market set the price of the steel pipe, but the US said the iron ore used to make it came from a state-run mining firm, the National Mineral Development Corporation, effectively subsidizing Indian exporters. *(https://www.aljazeera.com/, 16.11.2019)* ■

India's tea exports to Pakistan tank over 50 percent

UNCERTAINTY over payments amid growing tensions between India and Pakistan has led to a drop of over 50 percent in India's tea exports to Pakistan so far this calendar year.

Pakistan is the world's biggest tea importer after Russia in value terms. According to Tea Board data, India's tea exports to Pakistan during January-August 2019 stood at 3.14 million kg, valued at US$4.80 million, against 6.17 million kg (worth US$9.02 million) during the same period last year.

Exporters say that the main reason for declining tea exports is that nobody wants to stick their neck out and be seen as exporting to Pakistan at a time when cross-border skirmishes are common and Pakistan's assertions over the withdrawal of Kashmir's special status by India are creating controversies.

After the Pulwama attack, in which 40 Central Reserve Police Force personnel were killed in February this year, India increased import duty on Pakistani goods by 200 percent, even as the latter maintained the import duty on tea at 11 percent.

Pakistan has traditionally been a good market for budget tea varieties from South India.

According to sources, during times of strife between India and Pakistan, Indian exporters mostly route their consignments via other countries to stave off any trade crisis. Dubai in the UAE, Kazakhstan and Egypt are some hubs for such routing of tea to Pakistan.

Under this mechanism, tea from India is billed to a buyer in one of these countries. This buyer accepts the shipment and then forwards it in its original sealed form to Pakistani ports, and then to the intended final buyer in Pakistan. But the Pakistani buyer makes payment to the Indian exporter directly, not through intermediaries. "This time, however, such re-routing of tea is also not happening," rues an exporter.

Exporters fear that shipments might now get tracked as it is not too difficult to find out the final port of delivery or destination.

In fact, Tea Board data reveal that between January and August, exports to the UAE fell by 37.87 percent to 3.74 million kg, and those to Egypt by 69.77 percent to only 1.59 million kg. Exports to Kazakhstan fell by 16.41 percent to 3.31 million kg. *(https://www.business-standard.com/, 23.10.2019)* ■

Indian-Nepali joint venture for three power lines

THE Project Management Directorate under the Nepal Electricity Authority has signed a deal with an Indian-Nepali joint venture to carry out preliminary studies for the construction of three major 400 kV transmission lines.

Power Grid Corporation of India and Jade Consult of Nepal are joining forces to study substations and power lines stretching from Tingla in eastern Nepal to Dhalkebar substation, from the Budhi Gandaki Corridor to Ratamate, and from Damauli to Baphikot.

Power Grid Corporation is an Indian state-owned entity which is also constructing a 400 kV transmission line from the export-oriented 900 megawatt Arun 3 hydel scheme to Bathnaha on the Nepal-India border.

The scheme is part of the Asian Development Bank-funded US$21 million Preparatory Facility for Energy Project.

The project aims to have the transmission projects ready to go into construction by February 2021. The planned power lines are expected to boost the capacity of Nepal's power grid to transmit and handle a greater power load, and allow smooth export of electricity to India.

In July, the power utility also initiated the process to carry out preliminary studies for the construction of three transmission lines and seven high capacity substations in eastern Nepal.

The initiative is intended to support the government's target to evacuate more than 3,000 megawatts for domestic consumption and export. *(https://kathmandupost.com/, 05.12.2019)* ■

Trade disputes settlement system facing crisis

THE World Trade Organization (WTO) is facing a crisis in its system for resolving disputes between its members.

The WTO has an appeal 'court' that is the final arbiter on trade disputes and which is about to become unable to function. WTO rules say three judges have to hear each case.

On 10 December the number went below that level with only one of the judges remaining. The terms of the other two came to an end, and no replacements have been chosen. In fact there isn't even a process under way to find any as the US has refused to allow the recruitment of new judges.

Other WTO member countries have repeatedly proposed to start a selection procedure. At the end of November more than 100 members called for that but the US alone said no.

The US is objecting because it calls the WTO dispute system of 'judicial overreach' essentially that it interprets the WTO rules in a way that creates new obligations for WTO members.

One area that particularly irks Washington is dumping–when a foreign supplier sells goods abroad more cheaply than at home. The US and others have used a disputed method for assessing whether goods have been dumped and how much the price is below what it should be. It is not explicitly prohibited by the WTO rules, but the Appellate Body took the view that it was in effect against the spirit.

Yet it is not just about specific cases; it is a general concern that the US has about the rulings going too far, that create new WTO law.

So the impending loss of the appeal function does not mean the WTO will run off the road altogether. But it does mean it won't be firing on all cylinders. *(https://www.bbc.com/, 08.12.2019)* ■

UN climate talks end with limited progress on emissions targets

CLIMATE talks in Madrid have ended with a partial agreement to ask countries to come up with more ambitious targets to cut greenhouse gas emissions in order to meet the terms of the 2015 Paris accord.

Few countries came to this year's talks with updated plans to reach the Paris goals, though the EU finally agreed its long-term target of reaching net zero emissions by 2050. Experts say more ambitious emissions cuts are needed globally if the Paris pledge to hold global heating to no more than 20ºC is to be met.

This year's round of annual UN talks focused on narrow technical issues such as the workings of the global carbon markets, a means by which countries can trade their successes in cutting emissions with other countries

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that have not cut their own emissions fast enough.

By midday on 15 December, more than 40 hours after the deadline, agreement on that was still far off and so put off to be resolved next year.

There were fears that the more substantive issue of future emissions cuts would also be sidelined, but a 'high ambition coalition' made up of the EU and many smaller developing countries pressed for a resolution to ask all governments to formulate stronger national plans on cutting carbon. *(https://www.theguardian.com/, 14.12.2019)* ■

Value chain participation for development

GLOBAL value chains can continue to boost growth, create better jobs, and reduce poverty, provided that developing countries undertake deeper reforms and industrial countries pursue open and predictable policies, according to the World Bank's flagship publication.

The latest *World Development Report 2020: Trading for Development in the Age of Global Value Chains* calls attention to the slowing global trade and global value chain (GVC) participation which might dampen the growth trajectory of developing countries.

GVCs grew swiftly from 1990 to 2007 as technological advances—in transportation, information and communications—and lower trade barriers induced manufacturers to extend production processes beyond national borders. In recent years, however, trade and GVC growth have slowed. One reason is the decline in overall economic growth, and especially investment. Another reason is, the fragmentation of production in the most dynamic regions and sectors has matured. Recent increases in protection could also affect the evolution of GVCs. Protectionism could induce reshoring of existing GVCs or their shifts to new locations. Unless policy predictability is restored, any expansion of GVCs is likely to remain on hold. When future access to markets is uncertain, firms have an incentive to delay investment plans until uncertainty is resolved.

The emergence of new products, new technologies of production such as automation and 3D printing, and new technologies of distribution such as digital platforms are creating both opportunities and risks. But the evidence so far suggests that these technologies are enhancing trade and GVCs.

Firms in developing countries also show significant gains in productivity from GVC participation. A 1 percent increase in GVC participation is estimated to boost per capita income by more than 1 percent, or much more than the 0.2 percent income gain from standard trade. The biggest growth spurt typically comes when countries transition out of exporting commodities and into exporting basic manufactured products (for example, garments) using imported inputs (for example, textiles), as has happened in Bangladesh, Cambodia and Vietnam. GVCs are associated with structural transformation in developing countries, drawing people out of less productive activities and into more productive manufacturing and services activities.

> Slowing pace and reversal of trade reforms have had impacted the growth of global value chains.

However, the gains from GVC participation are not distributed equally across and within countries. Large corporations that outsource parts and tasks to developing countries have seen rising markups and profits, suggesting that a growing share of cost reductions from GVC participation are not being passed on to consumers. Within countries, exposure to trade with lower income countries and technological change contribute to the reallocation of value added from labour to capital. Inequality can also increase in the labour market, with a growing premium for skilled work and stagnant wages for unskilled work. Women also face challenges as GVCs may offer more women jobs, but they are generally found in the lower value-added segments. GVCs can also have harmful effects on the environment.

The report points out that a country's ability to participate in GVCs is by no means assured. GVC participation is determined by factor endowments, geography, market size, and institutions. These fundamentals alone need not dictate destiny as policies also play an important role. Policies to attract foreign direct investment (FDI) can remedy the scarcity of capital, technology, and management skills. Liberalizing trade at home while negotiating trade liberalization abroad can overcome the constraints of a small domestic market, liberating firms and farms from the limits of domestic demand and local inputs. Improving transportation and communications infrastructure and introducing competition in these services can address the disadvantage of a remote location. And participating in deep integration agreements can spur institutional and policy reform, especially when complemented by technical and financial assistance. Based on an analysis of the drivers of various types of GVC participation, this report identifies that national policies can and should be tailored to the specific circumstances of countries and to specific forms of participation in GVCs. ■

This piece is excerpted from the World Development Report 2020: Trading for Development in the Age of Global Value Chains.

Aid effectiveness for structural transformation

THE latest edition of a flagship report on least developed countries (LDCs) has called attention to the failure of the international community to create an international economic environment conducive to the structural transformation of LDCs.

The Least Developed Countries Report 2019: The Present and Future of External Development Finance – Old Dependence, New Challenges, published by the United Nations Conference on Trade and Development (UNCTAD), highlights the formidable challenge the LDCs are facing in the form of dependence on external development finance. Dependence on development aid and foreign direct investment to finance fixed investment and, more generally, sustainable development, is a crucial feature of the economies of the LDCs. Consequently, such dependence has a determining impact on the ability of these countries to reach their development goals, especially the Sustainable Development Goals (SDGs) and the objectives of the Programme of Action for the Least Developed Countries for the Decade 2011–2020 (Istanbul Programme of Action).

The report calls structural transformation—which is the transfer of resources to the higher productivity sector from low productivity—an enabler of sustainable development. Since financial resources available to LDCs are limited, the report advocates for LDCs and their development partners to sequence their policy and spending focus with an eye on the SDGs most relevant to structural transformation. Rapid progress towards achieving these goals is an enabler of the realization of the other goals.

The report points out that the positive growth performance of LDCs since the global financial crisis of 2008/09 has not been sufficient for these countries to accelerate structural transformation or reduce dependence on external resources (i.e., foreign savings) to finance fixed investment and development. Despite a difficult international environment, LDC exports of goods, and especially services, have seen a significant expansion. However, very limited diversification or upgrading of their export baskets and rapid expansion of imports overshadow this positive development for LDCs.

Likewise, aid dependency among LDCs remain comparatively high as 15 of the 20 most aid-dependent countries are LDCs. LDCs have been unable to attract market-based resources commensurate with their financial needs. The report reveals that LDCs have increasingly resorted to debt financing, more than doubling their external debt stock from US$146 billion to US$313 billion between 2007 and 2017. FDI flows continue to be concentrated only in a few economies, mostly in resource-rich countries. It is actually the official development assistance (ODA) disbursement that outstripped all other sources of external financing in 2017. Yet, ODA disbursements to LDCs have increased by only 2 percent annually since the Istanbul Programme of Action of 2011 and remain far from internationally agreed targets. The report also calls attention to increased loan to LDCs. The rise in ODA gross disbursements to LDCs since 2011 is chiefly due to increased ODA loans, whereas grants have remained essentially stagnant, or even declined, for most of the 2010s.

> LDCs need to sequence their policy focus with an eye on the SDGs most relevant to structural transformation.

The report proposes what it calls the Aid Effectiveness Agenda 2.0. It involves addressing the unfinished business of the original aid effectiveness agenda, which includes the need for donors to implement previous commitments on the volume of ODA. Likewise, another component is to address the challenges that emerge from ongoing changes in the aid architecture. These include, first of all, collaborating on private sector engagement in development cooperation.

Aid coordination and aid effectiveness have re-emerged as topical issues in development financing, as the number of players has increased tremendously and due to the scant level of implementation of the aid effectiveness agenda. Similarly, the report also calls for aid organizations not to exclude LDC governments in decision-making matters which directly and significantly affect development. The report calls for increased coordination between governments and donors to ensure integration of external development assistance with the priorities of recipient countries and also to ensure that any external support adheres to the strategic objectives of national development agendas. ■

This piece is excerpted from the Least Developed Countries Report 2019.

Future of agriculture

mechanization via automation

New technologies will transform different stages of farming, including, production, distribution, and consumption.

Sung Jehoon

The Fourth Industrial Revolution (4IR) refers to the fast progressing revolutionary era in which a variety of new technologies are using big data to integrate the physical, biological and digital worlds in a way that will affect all aspects of life. The 4IR primarily represents a variety of technological innovations in the following six areas: artificial intelligence (AI), robotics, Internet of Things (IoT), autonomous vehicles, three-dimensional (3D) printing and nano-technology.

4IR technologies are used in different fields such as information and communication, automobiles, energy, manufacturing services, security, bioenergy, and also medicine and agriculture. In this article, I discuss the use of 4IR technologies in agriculture and the prospects and challenges associated with it, as their use proliferates.

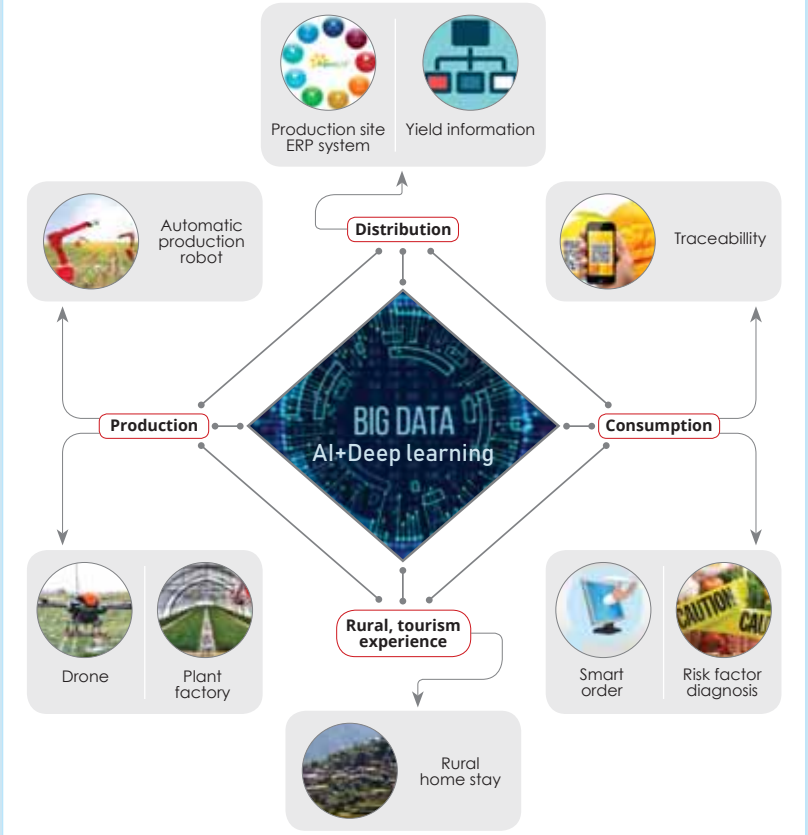
4IR and agriculture

About 200 years ago, more than 90 percent of the world's population was engaged in agriculture, whereas today the proportion is only about 28 percent. Among the different groups of countries, the percentage of the population engaged in agriculture ranges from 3 percent in high income countries to 63 percent in low income ones. Moreover, the age of individuals engaged in farming is increasing as well. In South Korea, the average age of farm households is 66.7 years, and 44.7 percent of the farmers are over 65 years old. At the same time, demand for food and other intermediate agricultural goods has been rising due to population growth. Considering these facts, the agriculture sector needs technological advancement to increase agricultural productivity. Developed countries have long been mechanizing, automating and modernizing agriculture. 4IR technologies appear to be able to accelerate and scale up these efforts.

4IR technologies will affect the agricultural sector primarily in three ways. First, precision farming will solve many current problems in agriculture. At present, there is rampant and inconsistent use of agricultural inputs (fertilizers, seeds and chemicals) and outputs. Similarly, 30–50 percent of the food produced worldwide is wasted. Use of water is not optimal since 80 percent of the water on the planet is used for agriculture but only 20 percent of viable crops are grown. Precision agriculture, through the use of different technologies such as geographic positioning system (GPS) guidance, sensors, robotics and autonomous vehicles, among others, will ensure accurate and controlled farming.

Second, 4IR technologies will significantly augment existing technology to predict weather patterns more accurately, thus improving farmers' preparedness. Agriculture is heavily dependent on the weather and existing technology has limited capacity to predict the weather pattern accurately. For this reason, farming is highly dependent on human experience and wisdom, and thus it is difficult to standardize responses. 4IR technologies can enable decision making based on variables that surpass human wisdom and experience. 4IR technologies can combine data from in-field sensors, drones and satellites

Figure 1
Future of agriculture



Source: Fourth Industrial Revolution and Agriculture, Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry, 2016.

to provide farming solutions such as measurement of soil conditions, better water management, and livestock and crop monitoring. Hence, the 4IR can be called an 'agro-friendly' revolution.

Third, use of 4IR technologies in agriculture could potentially reverse the trend of rural to urban migration. Because agricultural works could become relatively easier, capital, labour and technological resources that left farming villages in previous generations could be motivated to return during the 4IR.

Changes in food and agriculture systems in the 4IR era

As shown in Figure 1, 4IR technologies will lead to a greater amount of coordination and inter-dependency between various sectors. This will result in increased productivity while freeing up times for those engaged in farming. These technologies have the potential to transform different stages of farming, including, production, distribution, and consumption.

Production

Primarily, 4IR technologies will bring changes in agricultural production through smart farming, which refers to automatic control of the environment based on a customized database to raise different crops and animals. South Korea, which has pioneered the practice through test farms, is promoting smart farms under a project in three phases. The first phase is the convenience improvement stage. In this stage, facilities are upgraded with technologies that allow farmers to check crops' growth status via mobile devices. This removes the need for farmers to visit the farms physically to perform routine tasks such as monitoring temperature, humidity and carbon dioxide levels in a greenhouse, which they can now do through a smartphone and then control the environment. This was completed in 2017. After getting the farms upgraded to this level, the second phase focuses on farm productivity improvement. This phase will see increases in farm productivity through the use of precision controls. This phase is expected to be completed by 2020. Finally, the third phase will see that all of the pilot facilities are automated according to the growth conditions of the crop based on the crop's growth model. South Korea's Rural Development Administration provides support for the testing of various sensors and technologies in smart farms in order to help farmers quickly and efficiently move through the three stages.

Besides aiding greenhouse farming, 4IR technologies will also make a big difference in open-field agriculture. These technologies can be used in monitoring the area for crop growth, analyzing data in the decision-making stage, and applying inputs at variable rates using smart farm machinery.

Monitoring the area for crop growth conditions includes not only checking the health status of crops but also climatic information, environmental information, and growth information. Technologies to aid such monitoring is being rapidly developed to suit both large-scale extensive agriculture, as in the US, and intensive agriculture, as in South Korea. This will allow farms to maximize production volume and minimize the possibility of crop failure due to natural disasters, system errors, and other factors by acquiring data on growth, weather and agricultural equipment.

4IR technologies have made collecting large data easier, which helps farmers make precise decisions in a way that surpasses human intelligence, wisdom and experience. Envi-

ronmental data on cultivation can be used to evaluate market sales trends based on market preference analysis. Data on cultivation environment, pest information, climate and weather information, soil fertility, topographical relevance, etc. can be fed to farmers to optimize production environments.

In recent years, big data and AI are being used in genetic engineering with respect to agriculture and livestock. It is shown that it will be possible to cultivate crops that grow in extreme climates or droughts in a controlled environment. It will also be possible to transform animals' genes in order to make them more economical and suitable for local environments.

In addition to using big data to monitor and control the farm environment, variable rate application (VRA) of farm inputs using smart farm machinery will transform farms into smart farms. The VRA technology would not even require farmers to take decisions as it ensures the automated application of materials to a given landscape. AI-enabled machines apply inputs based on data collected by sensors, maps and GPS. For example, it could be possible that at night, when the farmer is asleep, a robot can enter the field, guided via GPS and electronic maps, finish any necessary agricultural work, and return to the house before dawn. This dream could be a reality in the near future.

4IR technologies are expected to aid the transformation of agricultural systems by overcoming difficult problems that are yet to be solved by existing technologies. They are expected to find solutions to malignant diseases, such as avian influenza, and food-and-mouth-disease, which cannot be solved with existing technologies.

Distribution

Distribution of agricultural products is another field in which innovations in 4IR technologies are set to bring about radical changes. In each previous industrial revolution, the distribution pattern of agricultural products changed significantly. The era prior to the first industrial revolution was that of self-sufficiency. There was very little processing of agricultural products since they were consumed unprocessed. After the first industrial revolution, which gave rise to manufacturing, some amount of processing of agricultural products started.

Through the second industrial revolution, with the advent of various technologies and improved productivity, surplus products began to emerge. Hence, processing and storage technologies were developed. During this period, many people shifted to manufacturing and services industries from agricultural production. There was a clear distinction between rural producers and urban consumers, which enhanced the necessity and importance of the distribution of agricultural products.

During the third industrial revolution, there was a massive increase in surplus production. Unlike in the earlier era, the central value of consumption moved from quantity to quality. Thanks to the increasing number of consumers, selective consumption has become more prevalent and distribution functions have become more important.

The introduction of a customized agricultural product ordering system, which takes into consideration the aging population and the expansion of single-person households in rural areas, including the control of shipment volume through big data and consumers' dietary style, suggest that 4IR technologies could revolutionize agricultural distribution system.

Information on prices of agricultural products, crops, distribution mechanisms, etc. are the basic data necessary to manage supply and demand. By applying 4IR technologies, comprehensive data, including on the volume of agricultural production, climate information, population structure and consumer data, can be analyzed in detail. In this way, it is possible to produce customized products to optimize supply and demand autonomously. At the same time, the government can adjust timing and output in order to stabilize prices.

Consumption

4IR technologies will make real-time linking of consumer and producer information possible. AI, linked with big data, will be able to stabilize transactions by connecting production information and transaction information.

The technology can even adapt to and aid an individual's consumption patterns. For example, smart refrigerators will be able to automatically order the deficient stocks in real-time, based on consumption. Such a refrigerator could also be linked to a system that manages family nutrition and health information. There could also be smart appliances with 4IR technologies that would cook food for family members based on the nutritional needs of the individuals in the family.

Furthermore, 3D printing will allow people to be, individually and creatively, involved in food process-

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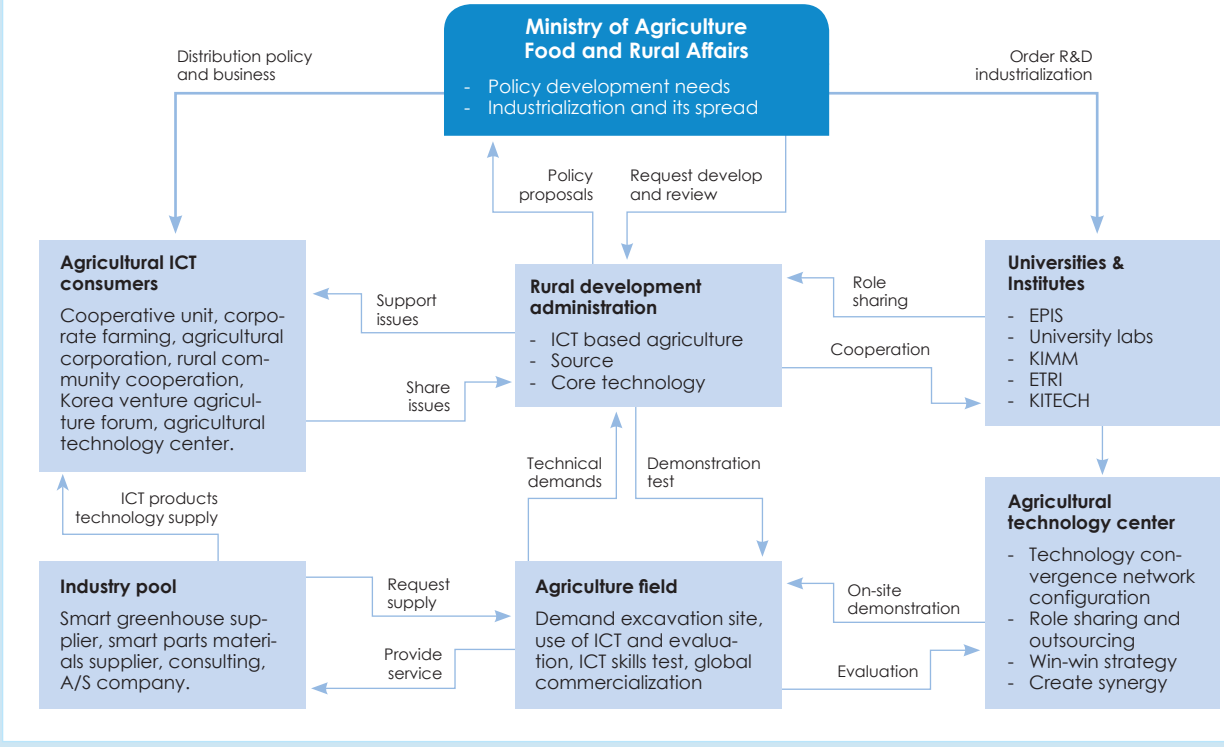
Figure 2
Korean smart farm and its collaboration system



Source: Author's compilation.

ing. It will also aid the production of farm materials, agricultural machinery parts and tools. 3D printers can also be used to make healthy functional foods for children and the elderly, including soft processed food that are easy to chew.

Preparing for the 4IR

Just as the first, second and third industrial revolutions did, the emergence of new technologies always entails the destruction of an existing order. Breaking the existing order creates a gap in which opportunities can emerge. 4IR technologies present a chance to increase agricultural competitiveness and an opportunity to overcome the structural weaknesses of the current agricultural system and the limits of intensive agriculture. There are three steps that we must take in order to ensure that the agriculture sector benefits from the 4IR.

First, we must analyze the impact of the 4IR on our agricultural ecosystem. It is necessary to analyze the impacts on all fronts of agriculture, the effects on rural and agricultural life, and the effects on agricultural structure and work.

Second, we need to understand that data is the main resource in the 4IR. Hence, data quality is key. Data should be standardized so that quality agricultural data can be continuously produced and managed.

Third, we must facilitate the construction of infrastructure that supports technology-based agriculture. Support should be provided to infrastructures such as the Internet network, 5G communication network, cloud service system, etc. in order to allow them to integrate easily into the agricultural industry.

If research and development supports the fusion between heterogeneous technologies and heterogeneous industries, and the agricultural industrial ecosystem allows creative talents to freely exercise their capabilities, the agriculture sector can benefit immensely from the 4IR. Thus, collaboration and convergence between digital, physical and biological worlds are important in the 4IR era. This would also require collaboration between policy makers and private sector entities representing digital technology, biotechnology and agriculture, among others. South Korea's experience of working on the smart farm development project, as illustrated in Figure 2, could be an example as it is being implemented through collaboration between many organizations. ■

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Leveraging 4IR technologies for South Asia's development

South Asian countries need to put their acts together and be prepared for the 4IR era.

Ratnakar Adhikari

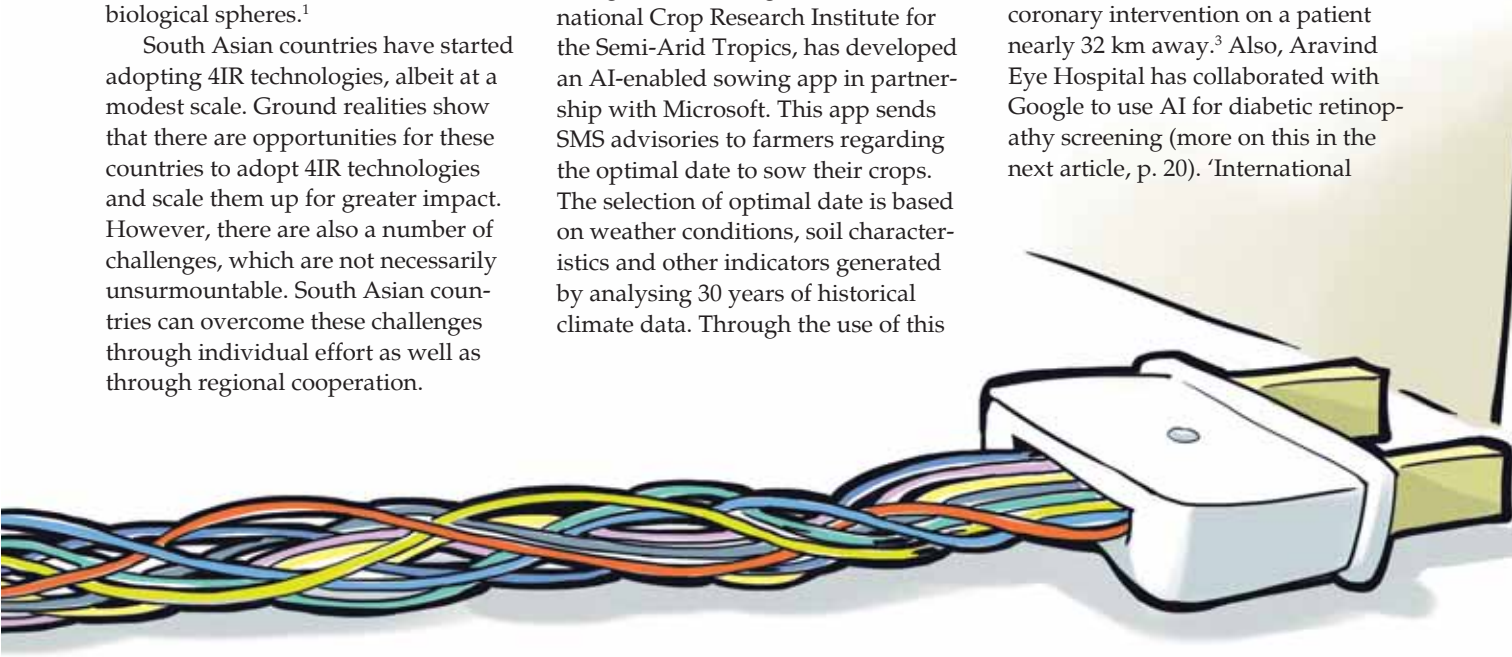
South Asian countries could not fully exploit the potential of the previous three industrial revolutions. Now they stand at the cusp of the Fourth Industrial Revolution (4IR), which is characterized by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres.[1]

South Asian countries have started adopting 4IR technologies, albeit at a modest scale. Ground realities show that there are opportunities for these countries to adopt 4IR technologies and scale them up for greater impact. However, there are also a number of challenges, which are not necessarily unsurmountable. South Asian countries can overcome these challenges through individual effort as well as through regional cooperation.

Prospects of 4IR technologies in South Asia

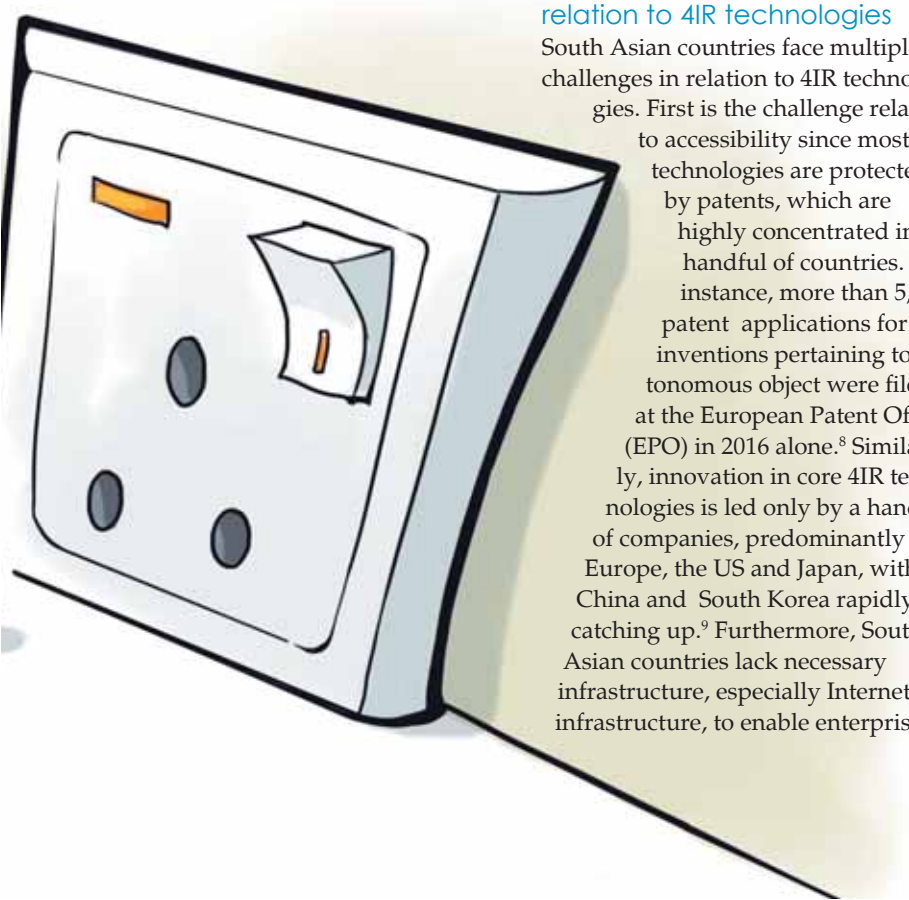
One of the most well-known technologies driving the 4IR is Artificial Intelligence (AI). In South Asia, a promising use of AI has been in the area of agriculture. For example, an Indian non-government organization, International Crop Research Institute for the Semi-Arid Tropics, has developed an AI-enabled sowing app in partnership with Microsoft. This app sends SMS advisories to farmers regarding the optimal date to sow their crops. The selection of optimal date is based on weather conditions, soil characteristics and other indicators generated by analysing 30 years of historical climate data. Through the use of this app, farmers in Devanakonda area in Andhra Pradesh achieved, on average, 30 percent higher yields.[2]

Similarly, healthcare is another sector where AI is being used. In December 2018, a cardiologist in Ahmedabad, India, performed the world's first in-human tele-robotic coronary intervention on a patient nearly 32 km away.[3] Also, Aravind Eye Hospital has collaborated with Google to use AI for diabetic retinopathy screening (more on this in the next article, p. 20). 'International



Business Machine (IBM) Watson for Oncology', a cognitive-computing platform, is used by Manipal Hospitals to help physicians identify personalized cancer care options across the country.[4]

Another 4IR technology that is being used in South Asian countries is 3D printing. With the 3D printing market expected to reach US$32.78 billion by 2023, the opportunity for South Asian countries are not only limited to fabrication but can extend to exporting 3D printing devices. This is already happening in India where Ethereal Machines, the winner of 'Best of Innovation' award at Consumer Electronics Show 2018 in Las Vegas, is manufacturing 3D printers.[5] Bangladesh has gone a step further with Planeter—a Chittagong-based company that is manufacturing commercial robots, including a 3D concrete-printing robot—exporting 11 robots to South Korea in 2018.[6] With 3D-printed bridges already becoming a reality, the potentials of 3D printing is enormous in infrastructure that can transform the rural, disconnected and last-mile areas in countries with difficult geographic terrain such as Afghanistan, Bhutan and Nepal.



Similarly, blockchain technology, which is not yet fully used in South Asia, can be utilized effectively to facilitate relatively free, paperless trade, not least because document compliance process in the region, barring a few exceptions, can be an excruciating affair. Its use in enhancing traceability of products from farm to fork, thereby providing confidence to consumers about the source and quality of agricultural products, is relatively unexplored in the region, although it is being successfully adopted in other countries such as Ethiopia and Vietnam.

Also, the prospects of job creation through 4IR in South Asia is immense. For example, a company called Cloud Factory, which has offices in the UK, US, Kenya and Nepal, use their workforce in Kenya and Nepal to undertake most of the lower end work such as data inputs, scrubbing and processing, and quality control for AI. In Nepal alone, the company provides employment opportunities to around 2,800 young people, aged 18-30 years, many of whom work on a part-time basis, while pursuing their regular formal studies.[7]

South Asia's challenges in relation to 4IR technologies

South Asian countries face multiple challenges in relation to 4IR technologies. First is the challenge related to accessibility since most 4IR technologies are protected by patents, which are highly concentrated in a handful of countries. For instance, more than 5,000 patent applications for inventions pertaining to autonomous object were filed at the European Patent Office (EPO) in 2016 alone.[8] Similarly, innovation in core 4IR technologies is led only by a handful of companies, predominantly in Europe, the US and Japan, with China and South Korea rapidly catching up.[9] Furthermore, South Asian countries lack necessary infrastructure, especially Internet infrastructure, to enable enterprises and individuals to use 4IR technologies (more discussed below).

Prohibitively high prices on the use of 4IR technologies and devices is another challenge. However, competition, innovation and economies of scale in some of these technologies have contributed to making them more affordable. For example, the prices of 3D printing services have reduced considerably over the past few years, making them more affordable, not only for industrial use but also for households. Today some 3D printers cost less than US$300.

Similarly, another challenge relates to skill sets. Application of 4IR technologies demands both hard skills (such as cloud computing, AI, analytical reasoning, people management and user experience design) and soft skills (such as creativity, persuasion, collaboration, adaptability and time management). Moreover, the skill sets in demand are likely to change frequently, both in type and priority order.[10] This means it would be critical to develop 'future-proof' skills, which is easier said than done, not least because South Asian countries are confronted with major challenges preventing the development of in-demand skills.

Most countries in South Asia, which have limited resources to provide basic education, will find it difficult to meet the growing demands for resources and will only be able to meet this requirement through external assistance or by engaging the private sector. Moreover, in a skills market, where flexibility and adaptability are key to develop skills fit for the future, rather rigid education systems in many South Asian countries can make it difficult to develop these 'future-proof' skills.

The fourth challenge relates to the lack of requisite policies. Examples include information and communications policy that imposes universal service obligations on providers, thereby connecting even the 'last-mile' users to the Internet; fiscal policy that incentivizes firms to invest in research and development (R&D) on 4IR technologies to enhance their productivity;

trade policy that liberalizes ICT services or reduces tariffs on the imports of ICT materials; investment policy that removes the cap on foreign ownership of industrial enterprises dealing with 4IR-related technologies; and public-private policy that allows both public and private sectors to work together to enhance digital connectivity overall, among others. Moreover, 4IR technologies are cross-cutting in nature, and hence demand coordination among different ministries and departments and associated policies. Most South Asian countries lack inter-agency coordination in general, which is a hindrance to the application of 4IR technologies.

These challenges notwithstanding, some efforts are underway in South Asian countries in overcoming them as I briefly discuss below. Yet, these are not sufficient and countries in the region need to put in significantly more efforts to benefit from 4IR.

State of play and way forward

South Asia is not completely excluded from enjoying the benefits of 4IR technologies just because they are protected by patents. There are three ways in which these technologies can be acquired. First, they can be acquired through imports, which entails obtaining a licence from the IP holders by paying agreed royalties. Royalties may be costly for many companies in South Asia, hence they need to conduct a thorough cost-benefit analysis before importing the relevant technology.

Second, the use of open source technology can offer a potential avenue, as some 4IR technologies are available as open source technologies, which can be freely used. Indeed, some platforms are even openly encouraging the free use of their technologies. For example, in the area of AI, the OpenCog Foundation's project called SingularityNET, dubbed the world's decentralized AI network, "lets anyone create, share and monetize AI services at scale".[11]

A third option to acquire technology is to generate technology within the country, for which investment in R&D is a prerequisite. However, South Asian countries' expenditure on R&D shows that they are not major contributors to technology generation. For example, according to the latest World Development Indicator, R&D expenditures in various countries in South Asia in 2016 ranged from 0.11 to 0.62 percent of their respective GDPs.[12]

Regarding infrastructure, access to electricity does not pose a significant problem for many South Asian countries. The entire region's access to electricity is 89.9 percent, which is higher than the global average of 88.8 percent. However, Bangladesh and Pakistan have lower access to electricity than the regional and global averages.

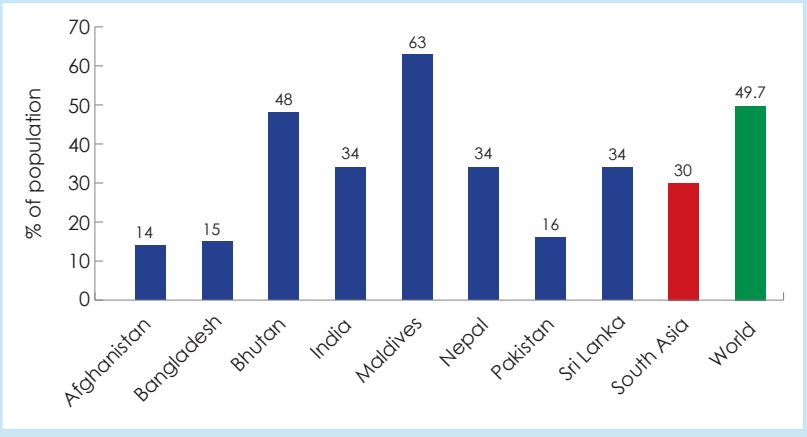
Regarding access to the Internet, the South Asia region has a long way to go, particularly for countries such as Afghanistan, Bangladesh and Pakistan. South Asia's regional average of access to the Internet is 30 percent, which is lower than the global average of 49.7 percent, although there are wide variations among countries (see Figure).

Clearly, more can and should be done to increase South Asian countries' access to the Internet, for which regional cooperation can be an effective mechanism. Improved connectivity to submarine cable via India for two landlocked countries in the region (Bhutan and Nepal) could significantly reduce the cost and enhance Internet performance in these countries. In fact, a rather ambitious Master Plan for the Asia-Pacific Information Superhighway (2019–2022), prepared by the United Nations Economic and Social Commission for Asia and the Pacific, already provides a blueprint for actions to be undertaken in four pillars to enhance connectivity in the wider region. These are physical infrastructure upgrade and interconnection, Internet traffic management, building regional network resilience, and promoting broadband access in underserved areas.[13]

In the area of skills set, there are a few noteworthy initiatives already under way in South Asia. In Nepal, an AI scholarship scheme with the target of training 10,000 students as part of a global AI training programme to address talent shortage was launched by Fusemachines, which has offices in Nepal and three other countries. The initiative aims to provide highly competitive students access to the proprietary AI learning platform and content, proprietary AI coding platform, a community of AI experts and mentors, and on-site weekly training in local classrooms.[14]

Similarly, in India, to boost innovation, school students are being imparted knowledge on 3D printing

Figure
Individuals using the Internet (2017)



Source: World Development Indicators, World Bank.

under the Government's initiative named Atal Tinkering Labs (ATL). One of the beneficiaries of the scheme, 3Dexter, a Delhi-based company, provides experiential learning on 3D printing at schools. The company, which sells printers and sets up 3D designing labs at schools, also offers training and education around 3D printing at schools from third grade onwards.[15] At the same time, in order to address skills mismatch between existing talent and AI-ready talent, Intel India has trained more than 150,000 developers, students and professors since 2017.[16] Likewise, in Bangladesh, Planeter has successfully trained more than 6,000 students on microcontroller and robotics since its inception.[17]

There is also potential for regional cooperation in the area of skills development, where new methods of distance learning such as e-learning or online training can be utilized at the regional level to strengthen the skills profile of the entire region. A study by KPMG India and Google shows that India's online education market is expected to grow from US$247 million to US$1.96 billion and the number of users from 1.6 million to 9.6 million between 2017 and 2021.[18] Other South Asian countries too are probably adapting to this trend. However, it should be possible for those countries, which are either at the lower-end of the learning curve or that do not provide diversity and competitiveness to match India's online education providers, to take advantage of this opportunity. Service providers in India too should tap into the opportunity by tailoring online courses to suit the needs of other South Asian countries. Similarly, there is potential for regional cooperation in designing regionwide policies, for example, on competition, investment, intellectual property protection, data protection and security.

While these initiatives already underway in South Asia are encouraging, these need to be scaled up as well as replicated, with some fine-tuning, where required. South Asian countries need to put their acts together for better preparedness. For this to happen, engaging the private sector is *sine qua non*.[19] Regional cooperation, among other things, could be helpful in this area. The relatively resourceful private sector from countries such as India, Pakistan, Sri Lanka and Bangladesh can invest in other countries in the region. However, this necessitates having a regional framework for the promotion and protection of investment, although this may not be a replacement for sound domestic policies to attract and retain foreign direct investment.

Finally, during the recently concluded South Asia Economic Summit XII, held in Colombo in September 2019, lack of evidence-based, well-grounded research, both in the region as well as in individual countries, was highlighted as a major constraint to sound policy making. Although lack of data and availability of funding could have contributed to such a gap, it is incumbent upon think tanks in South Asia to create some sort of foundation for initiating research in this critical area. Government, think tanks, universities and private sector should then work together to apply the findings of such studies to help enterprises and institutions in South Asia to acquire and benefit from 4IR technologies. ■

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4IR and developing world

Commercialization, use and adoption of 4IR technologies have broad implications that extend well beyond the products and services that they are used to make.

Nir Kshetri

Radical innovations and technologies have brought about a fundamental shift in the global economy. This phenomenon, commonly referred to as the Fourth Industrial Revolution (4IR), is attributed to disruptive technologies such as blockchain, Internet of Things (IoT), artificial intelligence (AI), autonomous vehicles, remote sensing (satellite imagery and drones), wearables, robotics, genome editing, augmented reality, 3D printing, big data, and biotechnologies. Many of these technologies continue to converge. The confluence and convergence of these technologies have made it possible to make decisions and take actions that can have profound impacts on our economy, health and well-being, environment and social relations.

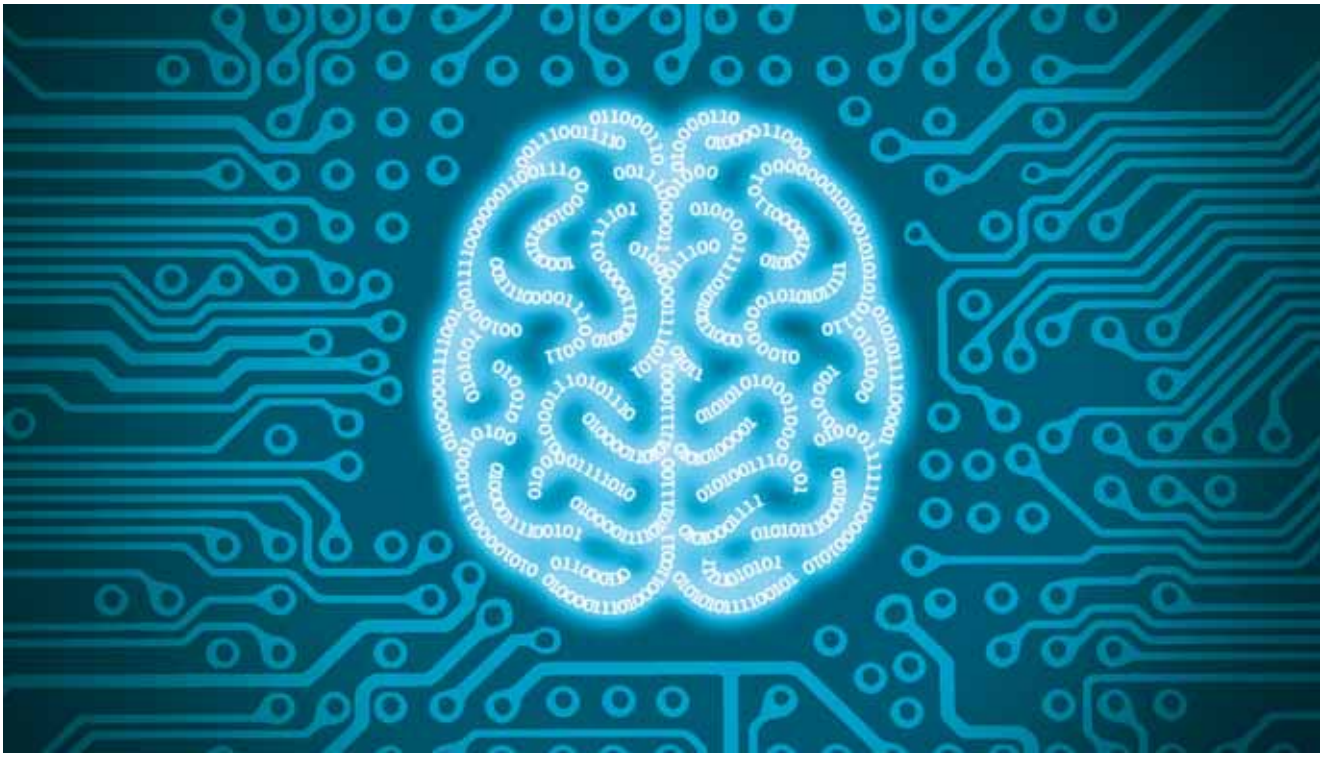
This article provides an overview of the numerous benefits and opportunities as well as costs and risks of 4IR technologies in South Asian economies, particularly India. For simplicity, the discussion is mostly limited to AI, which is arguably "the fundamental and most pervasive emerging technology" of the 4IR.[1] AI refers to a wide-ranging smart technology that provides machines the ability to perform tasks that typically require human intelligence.

4IR in relation to previous industrial revolutions

Steam power was the triggering force of the first industrial revolution, which started from about 1760. The UK, given its mastery over the technology, commanded the most benefits from the first industrial revolution. The second industrial revolution was referred to as the technological revolution, in which electricity was the key technology that aided mass production. The electricity-powered assembly line production was supported by development of complementary communication and transportation technologies such as telegraph and railways. Among the major beneficiaries of the second industrial revolution were the US, western European countries and Japan, among others.

In the third industrial revolution, computers and information communication technologies facilitated the evolution of the digital age. The US emerged as the global leader in this era, thanks to its well-known technology companies such as IBM, Intel, Google, Microsoft and Apple. An unintended consequence of the third industrial revolution was that the share of the US and other industrialized countries in global manufacturing reduced. Technology allowed fragmentation of production processes across borders allowing lead firms, located in developed countries, to engage only in coordination, marketing and logistics while manufacturing and production activities were moved to cheaper locations such as China and other emerging economies.[2]

The 4IR is considered to be a continuation of the third industrial revolution since both involve the utilization of digital technologies. However, the 4IR is being facilitated by a wide variety of technologies that fuses the digital, physical and biological worlds.



Research and development, commercialization, use and adoption of 4IR technologies have broad implications that extend well beyond the products and services that they are used to make.[3] Combining 4IR technologies together will have broader and more powerful impacts on societies and economies. The scope offered by automation and robotics, enabled by AI technology, is expected to transform the way manufacturing and logistics are being handled, while the IoT could change the way human activities are undertaken. However, countries are far from harnessing the full potential of the 4IR, not even the developed ones. Indeed, it is argued that no country in the world has yet reached 'the frontier of readiness' when it comes to utilizing 4IR technologies.[4]

Considering the limited technological prowess of developing countries, most of them have not even been able to draw maximum benefits from the third industrial revolution.[5] They have lagged behind mainly due to insufficient development of complementary infrastructures that enable information and communication technology (ICT) to proliferate. For instance, in least-developed countries (LDCs), more than 27 percent of the population does not have cellphones and more than 80 percent lacks access to the Internet (see Figure, next page). Nevertheless, some developing countries, including in South Asia, have been adopting and advancing the use of 4IR technologies in different ways.

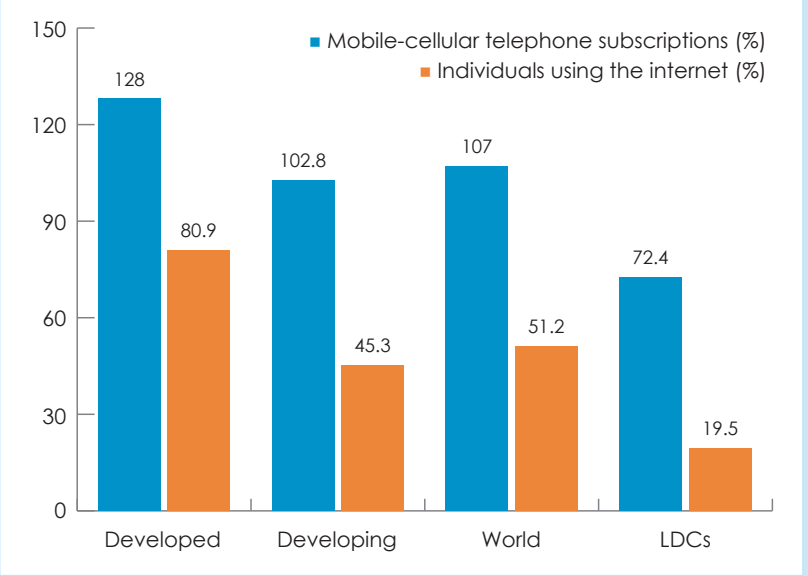
Benefits and potential opportunities offered by the 4IR

4IR technologies can bring several benefits to South Asian economies. Despite their limitations, these economies have been active in creating and utilizing 4IR technologies, with India at the forefront. In 2016, India was reported to have 233 companies that work in AI programming and development.[6]

India has proven to be one of the rising AI-related product developers. These products and platforms serve digital activities as well as traditional brick-and-mortar manufacturing, retail trade, financial services and many more. Especially new technology sectors, such as the e-commerce industry, have exhibited a higher propensity to adopt 4IR technologies. For instance, Indian e-commerce platforms use AI to make recommendations to users based on their past engagements, provide virtual assistance, make predictive sales and automate warehouse and logistics services. Top Indian players utilizing AI include Amazon, Flipkart, BigBasket, Oyo, Swiggy, Zomato, and Byjus. India's largest hotel chain Oyo uses dynamic pricing to set room prices to maximize profitability. The prices are based on a large number of indicators such as traffic patterns, upcoming events in nearby areas, and historical occupancy rates.[7] AI can help better in predicting big trends and the next best product to offer on its online platform. Another use of AI has been in improving the supply chain.[8]

AI-based solutions would help companies target customers more effectively and reduce costs. Insights

Figure
Penetration rates of cellphones and the Internet



Source: International Telecommunications Union.

from user behaviour are also used to make decisions to design better products.[9] Mad Street Den, a Chennai-based start-up, helps e-commerce platforms catalogue their products based on user behaviour. The company has developed several AI-assisted tools for online retailers.[10] According to the company's study, on average, online shoppers spent 72 minutes on websites with its software, compared to 25 minutes without it.

4IR technologies have also helped expand healthcare services. For instance, the Madurai-based Aravind Eye Hospital uses AI to diagnose the risk of blindness. It uses neural networks[11] as a new screening method, which uses complex mathematical systems and learns tasks by analyzing large amounts of data. For instance, by analyzing millions of retinal scans with signs of diabetic blindness, a neural network learns to identify blindness conditions.[12]

The 4IR has stimulated the creation of new industries and new employment opportunities. For instance, big global companies are taking major initiatives to perfect machine learning, which has led to the emergence of the data-labelling industry. This industry employs thousands of workers in India and other developing countries. Some examples of data-labelling include teaching self-driving cars the meanings of road signs or the difference between a child and a fox. The India- and US-based data annotation company iMerit had 2,200 employees in India to label data generated by manufacturing, medical imaging, autonomous driving, retail, insurance, agriculture and other industries.[13]

Besides economic benefits, 4IR technologies can also contribute to achieving social functions, such as maintaining law and order. For example, India's Uttar Pradesh state is reported to employ AI-enabled platform, Jarvis, developed by an Indian AI start-up, Staqu, in the state's 70 prisons. The platform analyzes data from hundreds of surveillance cameras installed in the prisons to detect violation and illegal activities, and notifies such activities to prison authorities.[14]

Indian start-ups' progress in AI has attracted western multinational enterprises, which have intensified their activities to co-own these digital innovations. Companies such as Microsoft, Google, Walmart and Amazon are taking initiatives to enhance India's AI profile. Microsoft, for instance, announced a plan to set up AI laboratories in 10 Indian universities to develop up to 5,000 AI-skilled workforce.[15] In September 2019, Google announced the establishment of Google Research—an AI lab—in Bangalore. The lab will focus on areas such as healthcare, agriculture and education.

Along with the private sector's push into AI, India has also launched a number of public sector initiatives. In June 2018, NITI Aayog, India's government think-tank, published the *National Strategy for Artificial Intelligence*. The report focuses on healthcare, agriculture, education, smart cities and infrastructure, and smart mobility as the areas of interest. The report also highlights the #AIforAll initiative, which aims to leverage the transformative technologies to ensure social and inclusive growth and to help other developing countries replicate those solutions. The Expenditure Finance Committee of the Government of India has given clearance to NITI Aayog's INR 70 million grant for the government's national AI programme.[16] Similarly, India has recently announced a plan to launch the country's first human genome mapping project, called the Genome India project. The plan in the first phase of the project is to catalogue the genomic data of 10,000 Indians.[17]

While our discussion so far has centred on AI, other 4IR technologies also have the potential to bring economic and social transformations in South Asia. For instance, blockchain technology allows a fast and efficient way of financial transaction in societies that face the most difficult environments. When remote places that lack financial infrastructures such as ATM machines and banks face disasters such as earthquakes or storms, blockchain can help humanitarian organizations provide cash assistance faster than other available

means. The World Food Programme's Innovation Accelerator started 'Building Blocks' pilot in Pakistan in early 2017. In the first stage, food and cash assistance were provided to needy families in Pakistan's Sindh province. No banks were involved, and beneficiaries received goods directly from merchants.[18]

Challenges in adopting 4IR technologies

There are many challenges and obstacles that need to be overcome for widespread adoption of 4IR technologies, particularly in South Asia. Perhaps the most serious challenge is the lack of relevant skills necessary for the use of 4IR technologies in South Asian economies. Finding programmers and developers with a firm grasp of machine learning has been a massive challenge for companies in South Asia.[19] For instance, India, in spite of churning out engineering graduates in millions, is estimated to have only about 50–75 AI researchers.[20] According to Aspiring Minds' *Annual Employability Survey 2019*, 80 percent of Indian engineers are unfit for an engineering job. The survey also found that only 2.5 percent of them have AI skills required by the industry.[21] India has also faced a severe shortage of qualified faculty members to teach AI courses in its universities.[22]

Second, many of the 4IR applications are data intensive, requiring massive computing power. South Asian economies lack the required computing power to perform such functions. For instance, among the world's 500 most powerful supercomputers as of June 2019, India had fewer than five compared to 219 in China.[23]

Third, from the perspective of AI, Natural Language Processing (NLP), which allows interactions between computers and human languages, is arguably the most mature and widely adopted application that has gained enough machine learning capabilities with real-world experience. Machine learning algorithms for NLP are mainly developed for the English language that is spoken by a small proportion of people in South Asia. They also lack lexical resources, such as dictionary databases, terminology glossaries and user-created contents, which makes it challenging to build NLP algorithms. NLP algorithms' performance depend on the availability of a large amount of text containing all possible permutations and combinations of meanings. Documents such as legal contracts, news articles and research reports need to be incorporated into an NLP algorithm to increase its performance. Only small quantities of such documents are available for most Indian languages.[24]

Fourth, the success of AI technologies is tightly linked to fifth generation (5G) cellular network since 5G networks enable ultrafast communications. They have a higher bandwidth, lower latency, and a higher degree of reliability.[25] However, 5G technology is yet to be launched in South Asian countries. India is expected to launch 5G network in 2020, after which it might take up to five years to fully deploy it.[26] Likewise, 5G network is expected to be available in Pakistan also by 2020.[27] There are also plans to introduce this technology in Nepal in the near future.[28]

Fifth, a large proportion of the South Asian population lives in rural areas. For instance, whereas rural population is 45 percent of the total population in the world, the proportion is 80 percent in Nepal.[29] This makes it difficult and costly to build infrastructures such as 5G networks.

Finally, cultural incompatibility may become a major barrier to the adoption of some of the 4IR technologies in South Asia. For instance, AI is being used in human resource management (HRM) in many countries all over the world. AI adoption in HRM may face resistance in South Asian countries since a large proportion of recruitment and promotion decisions in these countries are based on favouritism, nepotism and political loyalty. While it is a legal requirement for listed Indian companies to appoint independent directors, a large proportion of such companies fail to comply, thanks to the culture of nepotism and favouritism. In organizations domi-


Flickr

Finding programmers and developers with a firm grasp of machine learning has been a massive challenge for companies in South Asia.

Lack of skills in 4IR technologies is a major problem that may seriously affect the adoption of these technologies in South Asia.

Pxhere

nated by such culture, AI-based HRM decisions are likely to be met with overt and covert resistance by organizational decision makers.

Concluding comments

Major technologies related to 4IR are changing at an unprecedented pace and scale. Some encouraging signs have already emerged to show that organizations in South Asia are taking initiatives to benefit from these technologies. For instance, a variety of efforts at national and organizational levels have been undertaken to create and utilize 4IR technologies. There have been some successful applications of 4IR technologies such as AI in South Asian economies.

Lack of skills in 4IR technologies is a major problem that may seriously affect the adoption of these technologies in South Asia. Other key challenges are related to the lack of computing power and poor infrastructures, due primarily to the fact that a large proportion of the population in these economies live in rural areas. These challenges need to be addressed to ensure that South Asian economies do not fall further behind in the global economy in the 4IR era. ■

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Gender implications of 4IR

Impact of 4IR on men and women will be significantly different given the structural and systemic nature of gender inequalities that persist in our societies.

Pragati Koirala

An unprecedented level of technological advance is heralding a new era—the Fourth Industrial Revolution (4IR)—which is transforming long-established systems around us. Technologies that have ushered in the 4IR, such as 3D printing, autonomous systems and advanced robotics, are changing the way goods and services are produced, while the advent of platform economy has changed the way goods and services are exchanged commercially. Moreover, the platform economy has brought about profound changes in the traditional employer-employee relationship and has given way to myriad short-term contractors, also known as gig-workers. As we stand at the cusp of this structural change, it is important to look at it also from a gendered perspective because the impact of 4IR on men and women will be significantly different given the structural and systemic nature of gender inequalities that persist in our societies, for example, in relation to employment, access to resources and technologies, and so on.

Female employment and 4IR

Automation of work is likely to impact women more than men. For example, according to the International Labour Organization (ILO), in Southeast Asian countries women are 1.5 times to twice as likely as men to be in jobs such as in garment industries and call centres that face high automation risk.[1]

4IR is not only going to take away existing jobs, but also create new ones. Yet, women are going to face more job losses than benefit from new job creation. In absolute terms, men are expected to face nearly 4 million job losses and 1.4 million gains, that is, approximately one job gained for every three jobs lost. Women, on the other hand, are expected to face 3 million job losses and only 0.55 million gains, that is, more than five jobs lost for every job gained. If the gender gap persists, nearly one new STEM (science, technology, engineering, and mathematics) job will be gained for every four jobs lost for men, but only one new STEM job will be gained for every 20 jobs lost for women.[2]

In South Asia, women are mostly into jobs in sectors such as apparel and textile industry that is highly labour-intensive, and thus at risk of automation. Introduction of robotics and automation in this industry might have a huge impact on female labour force participation in the region. There is a dearth of research on the implications of 4IR on jobs in South Asia, let alone research on gender implications of 4IR. Hence, it is difficult to state precisely what the implications of 4IR on women's jobs will be in South Asia. However, given the estimates of job losses in countries such as Vietnam and Cambodia, where garment and apparel industries that employ a large proportion of women, it is highly likely that job loss outcomes in South Asia could be similar to those countries.

Pervasive gender inequality

With all the achievements humanity has accomplished, solving the problem of gender inequality has proved to be elusive to say the least. In order to analyze the gendered impact of 4IR, it is necessary to understand the current gender inequalities, as these inequalities, if not acted upon, are more likely than not to carry over to the future. Across the world, only 49 percent of women over the age of 15 are employed, compared to 75 percent for men.[3] South Asia has one of the lowest female labour force participation rates.

Similarly, gender gap in managerial and leadership roles persists even in sectors that employ a higher proportion of women. For example, LinkedIn found that 60 percent of its users in the healthcare sector were women, but only 45 percent of those women were in leadership positions.[4] Across all industries, women make up, on average, 35 percent of junior level staff, 25 percent of mid-level staff, 15 percent of senior level staff and 10 percent of chief executive officers.[5] This clearly shows that women are


Flickr

Occupation segregation between men and women does not seem to be going away even in the 4IR.

underrepresented in leadership roles across the industry.

The role of unpaid care work on the low participation of women in the labour force cannot be overlooked. The average time spent on unpaid care work by women and men in the Asia-Pacific region is 262 minutes and 64 minutes, respectively.[6] Thus, the care burden is disproportionately higher on women, which limits their participation in the labour force.

Digital gender gap

Reaping the benefits of 4IR necessitates access to the Internet and digital devices to use the Internet. In South Asia, only 17 percent of women had access to the Internet in 2017.[7] Similarly, South Asian women are 28 percent less likely than men to own a mobile phone and 58 percent less likely to use mobile Internet.[8] Such inequality in access to the Internet and digital devices will affect women significantly more than men.

Of course, gender digital divide cannot be expected to be narrowed by simply improving access to the Internet and digital devices. However, these are the first barriers to cross to reach an equitable world. Beyond this, and importantly, there is an urgent need to reduce gender gaps in higher level information and communication technology (ICT) skills and employment in ICT fields. Globally, only 30 percent of researchers in science, technology and innovation are women.[9] Similarly, meagre 6 percent of software developers and mobile phone application developers are women. Also, women make up only 22 percent of AI professionals.[10] These gaps need to be reduced substantially in the immediate future.

The promise of gig economy

Platform-based economy, commonly known as the gig economy, has changed the traditional concept of jobs by offering an alternative in the form of short-term contracts or 'gigs'. The widely used narrative of the gig economy has been the promise of flexibility to workers, thereby bringing into the labour market those who are loosely connected or not connected at all, especially women, and minority and disadvantaged groups. In the case of women, who spend significantly more time in unpaid care work that constrains their labour market participation, the argument that work flexibility enables women to have a work-life balance has become the holy grail for solving the problem of gender inequality. However, this will likely result in wage gaps between males and females. The reason for this is that women shoulder higher burden of care responsibilities and thus engage in paid work for a smaller number of hours than men do. In doing so, they accumulate less experience than men, which results in lower pay.

Moreover, in the gig economy, the possibility of finding the next job depends on the ratings received, which partly depends on the number of hours worked and the experience accumulated. Having to continuously compete with those who have accumulated more ratings and experience on the platform does not bode well for women with less experience.

Also, occupation segregation between men and women does not seem to be going away even in the gig economy. Although gender disaggregated data of the gig economy in South Asia is not available, evidence from elsewhere shows occupational segregation. For example, in the UK, on the Hassle platform, which provides cleaning services, 86.5 percent of workers are women, while on the food delivery platform Deliveroo and ride-sharing platform Uber, 94 percent and 95 percent, respectively, are men.[11] In South Asia, where women lag far behind men in many measures, they could ultimately be limited to domestic service jobs or other low paying jobs traditionally segregated as a woman's job.

There is also the possibility of displacement of women workers from routine manufacturing, which could create an abundance of workers in the gig economy. This could lower the wages, increase competition to get the next gig, and decrease the bargaining power of women, especially those who are in the lower end of the power dynamic, thus opening up the possibility of exploitation.

Despite the problems associated with the gig economy, it could provide leapfrogging opportunities for women by providing work flexibility, lowering barriers of entry into the job market and reducing time to find jobs, thus bringing those into the labour market who would otherwise have opted to stay out. Moreover, the gig

economy could also absorb, to some extent, less educated and low-skilled women displaced from other manufacturing jobs because of automation. Policies must, however, ensure that digital platforms provide real opportunities for women and not exploit their vulnerability.

Policies for gender equality

Policy makers should embrace 4IR as an opportunity to reduce gender inequality. First and foremost, they should amend laws that restrict women's participation in employment and other economic activities. The argument of providing work flexibility to women so that they can manage their care responsibilities is prejudiced by traditional gender norms and stereotypes. Rather, unpaid care responsibilities should be shared by both men and women, and the state should also provide support in managing care. Paternity leave or parental leave, not just during the birth of the child, in addition to maternity leave, could lighten the child care burden of women and encourage them to re-join the workforce. Affordable childcare, old age care and healthcare, among others, are also necessary to encourage women to participate in economic activities.

A study finds that by 2022, no less than 54 percent of all employees will require significant reskilling and upskilling.[12] Without efforts to reskill and upskill, there will be a large number of unemployed people on the one hand, and on the other, there will be a scarcity of skilled employees. For reskilling and upskilling, ensuring access to affordable Internet and Internet devices is necessary, but this is not enough. Especially women should be provided with the digital skills essential in the age of 4IR.

Conscious efforts should be made to increase the number of women joining the STEM field, which has been mired by the traditional societal notions of it being men's domain. This notion has to be abolished and more women should be encouraged to enter the field. Scholarships and quota for women could boost the number of women joining the field. Work culture also needs to change so that more women, who have joined the field, are retained.

In order to bridge the gender gap, more women should be in decision-making roles, be it in business or politics. This will ensure that more gender-sensitive policies and decisions will be made, thereby lowering the barriers for new entrants in the field. Moreover, having women role models in leadership positions will motivate more women to aim for leadership positions even in male-dominated fields. Building women's capacity in leadership through mentoring, and providing networking opportunities, among others, can help women succeed in such roles.

The changing nature of work structure and employer-employee relations have meant the erosion of social protection and benefits for employees. In the gig economy, where jobs are broken down into tasks and performed by individual, short gig-based contractors, the risk borne by employers has been increasingly passed down to workers. The gig economy has provided the much-needed flexibility that women workers need, in addition to lowering their entry barriers to labour markets. However, trade-offs of irregular employment, unpaid waiting times, constant competition, and absence of social protection provided by traditional jobs, could have a detrimental effect. While men are more likely to work gigs for additional income, women are more likely to rely on gig work for their primary source of income. Add to that the gender wage gap and the longer hours men are able to work, and the gender gap could widen. Hence, it is necessary to provide some basic social protection such as minimum wage, pension schemes and health insurance, among others, to ensure the welfare of gig workers, especially women.

While men work gigs for additional income, women are more likely to rely on gig work for their primary source of income.

Finally, gender disaggregated data on the implications of 4IR on jobs in South Asia is scant, to say the least. Without data, it is difficult to identify the scale of the problem and even more difficult to prescribe solutions. Therefore, gender disaggregated data is absolutely essential for evidence-based policy making to ensure that women benefit from the 4IR. ■

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4IR and its impact on jobs

with reference to textiles and clothing industry

Considering the rise of AI-led automation, it is an imperative to step up efforts to educate and train existing as well as future workforce with skills required for the future.

Amit Kumar

Recent developments in artificial intelligence (AI), robotics, 3D printing and Internet of Things (IoT) have launched the world into a new automation age. Many refer to it as Industry 4.0, or the Fourth Industrial Revolution (4IR), where AI-led technologies, robotics and computers are capable of performing not only routine tasks but also those tasks which hitherto were believed to be accomplished only by humans, such as those involving judgments and emotions. The level and intensity of the impact of this technological development on employment and jobs are widely deliberated across the world.

Given the recent drive towards adopting 4IR technologies in developed countries, there is no doubt that this is going to affect mainly the manufacturing sector in developing countries, particularly in South Asia. Since the manufacturing sector, especially labour-intensive ones such as textile, clothing and footwear, serves as a major employment and revenue generating sector in developing countries, there is an imperative to take timely policy decisions to minimize and mitigate the negative consequences of 4IR technologies on such light-manufacturing industry. This article mainly focuses on the textiles and clothing sector.

Driving factors

Rising labour costs in developing countries, improved productivity due to technology and reduction in customization and response times have played critical role in compelling companies in the US and Europe to go for technological innovation such as automation (including AI and robotics). Rapid adoption of 4IR technologies by companies in the US and Europe in product design and manufacturing sectors is coming at a time when average wages in traditional manufacturing in off-shore locations have soared 15–20 percent per year for the last few years.[1] Likewise, potential productivity gains due to the adoption of automation technologies is a motivating factor. Some of the recent studies have revealed that there will be an improvement of 15–20 percent in productivity if companies adopt technologies such as AI and robotics. This will then offset the cost disadvantages that companies face due to offshore low-cost locations.[2]

With faster automated technologies at play, companies can rectify errors in production in much less time compared to far-off units in Asia and produce customized products, based on customers' choice, at lesser time.[3]

4IR's impacts on jobs

There are a variety of scenarios regarding the impact of 4IR technologies on jobs. While some reports estimate that AI-led automation would lead to job losses across various sectors, there are others which highlight possible rise in employment opportunities.

According to a World Bank report, the share of occupations that could experience significant automation is actually higher in developing countries than in more advanced ones.[4] About 69 percent of the jobs in India are susceptible from the point of technological feasibility, while this share declines to about 40 percent if both technological feasibility and adoption time lags are considered. However, the report argues that the impact will

not be immediate as it will be moderated by lower wages and slower technology adoption.

There is a widespread fear that the increasing use of AI-based automation in developed countries could put at risk the traditional labour-cost advantage of developing countries. Automation might fuel re-shoring various economic activities, particularly manufacturing jobs, back to developed countries, thus causing a big blow to developing countries' manufacturing sector.[5] There is a fear that AI-driven automation will potentially lead to huge job losses of manual labour in the middle-skill order such as factory workers and technicians.[6] Moreover, low-skill industrial roles are susceptible to automation, which is a threat to countries such as India that is still struggling to build large-scale labour-intensive manufacturing sector.[7]

However, there are others who believe that predictions of job losses due to 4IR technologies might have been overstated, especially in the context of developing Asia. This is because, according to a report, "First, the typical job consists of several tasks, only some of which may be automated. Second, even if it is technically feasible to automate a task, doing so may not be economically viable. Third, especially in the context of low- and middle-income countries, where much growth potential remains, rising demand for goods and services offers a countervailing force to automation-driven labour displacement. Finally, technological change and economic growth have always gone hand in hand with the creation of new industries and occupations; there is no reason this time must be different".[8]

Impact on textiles and clothing sector

China is the largest exporter of textiles and clothing in the world. It is interesting to note that countries from South and Southeast Asia such as India, Vietnam, Bangladesh, Pakistan and Indonesia are also among the top ten exporters of textiles and clothing.

In the last few years, exports of textiles and clothing from Bangladesh, Vietnam and Cambodia rose phenomenally. Textiles and clothing export from Bangladesh increased from US$16.4 billion in 2010 to US$30.9 billion in 2017, whereas in the case of Vietnam, textiles exports rose from US$13.3 billion in 2010 to US$32.8 billion in 2017.

Table
Share of employment in the TCF sector

Country	Percentage share
Cambodia	77
Bangladesh	63
Vietnam	38.8
Pakistan	46.7
India	29
Indonesia	29

Source: ILO (2016).[9]

The share of wage employment in the textiles, clothing and footwear (TCF) sector, relative to all manufacturing sectors, is much higher in many Asian developing countries, including India, Bangladesh, Pakistan, Cambodia, Vietnam and Indonesia (See Table). In India, the textiles sector is one of the largest providers of employment. It employs about 22 million people directly and about 54 million people indirectly. It is also the largest provider of employment to women and workers with low educational qualification.[10] Weaving and ready-made garments manufacturing are the two larger sub-sectors within the textiles sector. Weaving provides employment to about 7.4 million people while the latter employs about 17.43 million people in India.[11] In Bangladesh too, the textiles sector provides about three million manufacturing jobs and accounts for about 81 percent of Bangladesh's exports.[12]

A large number of employment generation in the textiles and clothing sector in developing countries is due to the sector being highly labour-intensive.[13]

According to an International Labour Organization (ILO) Report, the disruptive impact of robotics on the textiles sector can be substantial, as robotic automation poses a significant threat to job displacement. There are apprehensions that one robot has the potential to replace about 100 workers in a typical Indian textiles manufacturing plant.[14] Similarly, in Bangladesh, knit production, which accounts for nearly half of its textile/apparel exports, is also relatively easy to automate.[15] This is likely to disproportionally affect female workers, who make the majority of workers in the textiles and garment sector.

However, these threats might not be imminent. Currently, deployment of industrial robots is seen mostly in manufacturing sectors such as electronics and automobiles (39 percent share of total robot use), while industrial robots' deployment in the textiles, apparel and leather sectors is a meagre 0.1 percent.[16] A recent report by the United Nations Conference on Trade and Development also states that robot deployment in textiles, apparel and leather sectors has been the lowest among all the manufacturing sectors.[17] It is worth noting that although this sector ranks second in terms of the technical feasibility of automating many of its routine tasks using robots, the economic feasibility of such automation appears to be the lowest. It is argued that the 'sewbot' technology is such highly priced that its diffusion in the Asian textiles industry would be rather slow and time-taking.[18]

This could mean that in the near future, there might not be much negative impact of 4IR technologies on employment. However, in the medium to long term, as the availability and affordability of textile robots increases, many activities that are presently done manually can be taken over by robots, thus leading to job losses. It needs to be noted that because the routine task intensity is very high in the textiles and apparel sector,[19] this sector ranks second in terms of the technical feasibility of automating many of its routine tasks using robots.[20] With estimates suggesting that induction of cheaper 'sewing robots' will massively reduce apparel production cost,[21] it is likely that countries such as India and

Bangladesh could lose their cost-competitiveness in apparel production. In addition to this, domestic textile companies in India and Bangladesh have also given some indication that they would be going for robotization in the medium-term future to ensure labour cost saving, fast and quality production, and getting rid of problems of rising attrition and absenteeism.[22]

Conclusion and way forward

As discussed in the above sections, many of the activities in the textiles and clothing sector are highly amenable to robotization. Considering the fact that technologies are getting cheaper, there are chances that the economic feasibility of using them will increase. There could be adverse implications in terms of job losses, affecting India and other South Asian countries. Given this, South Asian countries need to remain prepared to address the ensuing challenges.

Governments as well as firms in South Asia need to step up their efforts to educate and train existing as well as future workforce with skills required for the future. Schools and colleges should include courses on AI and robotics in their curriculum. In India, for example, the government has recently approved a major budgetary support to skill/upskill professionals working in the ICT sector.[23]

The private sector can also help in providing job-ready skills to the informal workforce. Countries can take a cue from India's National Skill Development Corporation, which works with many private training firms to provide industry-specific skills.[24]

All this is more critical for the workforce engaged in the textiles sector because majority of these employees have low academic qualification and are less skilled, which make them vulnerable in terms of finding an alternative job. In case of job displacement, efforts should be made to provide relevant skills to the affected workforce to help them find alternative job opportunities in other sectors.

Setting up of a South Asian training hub for providing capacity building education and training in 4IR technologies to researchers, students and industry professionals can be envisaged. Given its huge expertise in the ICT sector, India can take the lead in establishing such a regional centre.

Similarly, it would be appropriate and timely to explore domestic and regional markets for textiles and garments to lower the dependence on the west-oriented export model on the one hand, and on the other, to cater to the growing middle-class demand. Diversifying exports in terms of products and exploring new markets should also be prioritized. Greater engagement with regional value chains can be explored within the textiles and clothing sector to offset the negative impact of shrinking western markets. Domestic manufacturers need to shed their excessive reliance on western markets. Enhanced regional trade integration among developing countries can help them retain the market size in these countries.

Besides these, there is a need to rethink the social protection policy framework. According to the ILO's *World Social Protection Report 2017-19,* the proportion of workers covered by at least one social security programme/scheme in India is only 19 percent. Given this low social safety net, the vulnerability of workers could get worse in case of job losses owing to 4IR technologies. Therefore, ideas such as provision of livelihood insurance, universal basic income and taxing the robot need to be discussed urgently within the policy community and appropriate policy guidelines should be formulated in all South Asian countries. ■

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Realizing the sustainable development goals in the 4IR

Investment in new technologies is necessary to accelerate the progress towards SDG achievement in South Asia.

Ganga Tilakaratna and Janani Perera

In 2015, members of the United Nations adopted the 2030 Agenda for Sustainable Development and committed to achieving the 17 Sustainable Development Goals (SDGs) to ensure a better and sustainable future for all. The SDG framework is built on three pillars of sustainable development: economic, social and environmental. It emphasizes the principle of leaving no one behind, highlighting the need to ensure inclusive growth. Given its complex nature, achieving SDGs requires consistent policies, sustained political commitment, as well as unprecedented levels of resources. Four years since the endorsement of the SDGs, the progress made widely varies across regions and countries.

As revealed in the *Asia and the Pacific SDG Progress Report 2019,* published by the United Nations Economic and Social Commission for Asia and the Pacific, South Asia is on track to achieve a handful of SDGs, including on zero poverty (SDG 1), good health and well-being (SDG 3), quality education (SDG 4) and affordable and clean energy (SDG 7). However, the region is regressing in terms of clean water and sanitation (SDG 6), climate change (SDG 13) and responsible consumption and production (SDG 12).[1] South Asia should also accelerate its progress regarding other goals such as zero hunger (SDG 2), gender equality (SDG 5), decent work and economic growth (SDG 8), industry, innovation and infrastructure (SDG 9), and sustainable cities (SDG 11). Despite the limited progress made with regard to goal 10 on reduced inequalities and goal 17 on partnerships for goals, the current progress of this region is insufficient to achieve the SDGs by 2030. Given such a state of affairs, several measures, in particular advancing science, technology and innovation, are necessary to accelerate the progress on SDGs in South Asia.

New global era

Today we stand on the edge of the Fourth Industrial Revolution (4IR), which has almost changed the way we live and work. 4IR technologies such as Artificial Intelligence (AI), Internet

of Things (IoT) and blockchain have effectively opened endless opportunities for the entire humankind. Unlike previous industrial revolutions, 4IR is progressing at an exponential rather than a linear rate and is gradually transforming the entire system of production, management and governance.[2] Given its purview and complexity, it is impossible to predict how it will unfold in the future. However, it is argued that 4IR technologies have the potential to combine the physical, digital and biological spheres to ensure a better and sustainable future for all,[3] which derives a definition for sustainable development in 4IR. Against this backdrop, it is important to explore whether and how 4IR technologies can facilitate the achievement of SDGs.

Opportunities created by 4IR to accelerate the SDGs

4IR technologies could possibly accelerate the realization of SDGs by ensuring environmental sustainability, economic sustainability and social sustainability. We briefly discuss each of these below.

Environmental sustainability

A combination of 4IR technologies offers a substantial promise in ensuring environmental sustainability. Smart systems, process optimization, real-time monitoring and management, prediction and early warning capability are few of the many tech applications available in this regard. Big data analytics can ensure the generation of clean energy, while cloud computing can enable improved energy planning and forecasting, which will ultimately facilitate the sustainable use of energy resources. Virtual power plants can support efficient energy generation, while IoT and cloud-based platforms can provide reliable power supply. There is a massive potential to use 4IR-enabled technologies in solar-powered systems and smart meters to improve energy efficiency in buildings.[4] PowerGen, an Africa-based tech company, has installed solar-powered micro-grids across Kenya and Zambia at a rate equivalent to the amount spent on kerosene.[5] In relation to biodiversity conservation, drones and autonomous vehicles can be used to monitor habitat losses and detect activities that threaten biodiversity.

Another crucial area that 4IR tech applications can help accelerate progress in the area of environment is dealing with climate change and its impacts. For example, advanced modelling techniques, big data analytics and cloud computing can be applied to develop weather predictions, which is useful in developing early warning systems for natural disasters and in communicating disaster information in real time.[6]

Economic sustainability

4IR tech applications hold potential in addressing the pressure imposed by dynamic demographic patterns on agriculture and food sustainability. In fact, IoT, robotics and AI can strengthen crop productivity, resilience, and food distribution. Phytech, an agriculture IoT company with specialization in providing plant-based practice applications, is using 'Plant Internet of Things' to help monitor micro variations of plants and send warnings to farmers' smartphones.[7] Shreenagar Agro Farm, one of the leading agribusinesses in Nepal, uses an app called Shreekisan App and a knowledge platform named Shreekisan Innovation Hub to empower farmers through knowledge.[8]

> Advancing science, technology and innovation are necessary to accelerate the progress on SDGs in South Asia.

In the context of SDG 8, technological developments can generate new employment opportunities and connect rural areas through internet-enabled entrepreneurship. In addition, increased female employment in creative industries, e-commerce and other automation-proof sectors, and addressing of gender biases in recruitment through AI-enabled software could have a positive impact on gender equality.

With regard to sustainable cities (SDG 11), transport and logistics management play a crucial role. 4IR technologies can be utilized in integrating transport systems, monitoring real-time traffic, managing pollution and establishing vehicle-to-infrastructure communications. In Malaysia, Digital Economy Corporation and Kuala Lumpur City Council, in partnership with Alibaba, have developed a technology that can predict traffic congestion and provide recommendations to increase traffic efficiency in the capital city.[9]

Social sustainability

4IR technologies can play important roles also in health and education sectors. For example, 3D printing can be used to produce human organs. Organs produced in this way can be exact replica of the patient's organs. Similarly, it has become possible to conduct long-distance surgeries. Such surgeries, performed by advanced robots, have proven a successful option in neurological, urological, gynaecological and cardiothoracic surgical procedures. Furthermore, big data analytics allow faster and better clinical decision making in which patients can be treated by identifying their disease characteristics against larger and previously known cases.[10] For instance, DeepMind, an Alphabet-owned company, is using predictive analytics models and data sharing tools to identify patients at risk.[11]

However, in order to reap the full benefits of 4IR technologies, employees must be equipped with technological know-how, problem-solving skills and critical thinking abilities.[12] For this, the existing education system needs a paradigm shift from its current focus on specialization to individual-specific skill sets.

Emerging technological developments under 4IR have brought in new forms of learning such as information and communication technology-based

learning applications.[13] The introduction of various online learning materials, open online courses, tutorials and freely available online information allow individuals to learn from experts regardless of their physical location. The usage of AI in the education sector cannot be neglected. In China, a start-up named Master Learner uses AI (Super Teacher) to mark students' homework, which allows teachers to spend more time teaching and directly interacting with students.[14]

Perils of 4IR

Despite these potential benefits, 4IR technologies could also have adverse implications for economic, environmental and social aspects of sustainable development. Job losses caused by automation and robotics could adversely affect employment and poverty reduction. Certain industries with a higher share of female employment such as business process outsourcing and textiles and clothing are highly vulnerable to automation. Job losses in such sectors not only affect employment (SDG 8) and poverty (SDG 1), but also gender equality (SDG 5).

Further, it is estimated that there will be more than 26 billion IoT devices by 2020.[15] Since IoT components are often disposed within five years, there will be a massive problem of e-waste releasing into the environment, which may hinder the progress of sustainable use of marine resources and terrestrial ecosystems (SDG 14). In addition, extensive data collection by IoT and blockchain technology-enabled decentralized data keeping could have negative effects on privacy and security of individuals.[16]

4IR and the SDG data challenge

For the accomplishment of the 2030 Agenda, it is essential to have accurate, timely and comparable data for all SDG indicators. In the Asia-Pacific region, 75 percent of the indicators lack sufficient data, which is the biggest challenge in the monitoring and evaluation of SDG progress in the region.[17] According to the World Bank, big data technology can help address these data challenges. Currently, the World Bank is assisting several countries, through the three Bs approach (Build, Boost and Broker), in which they use big data technologies such as satellites, sensors, mobile phones, social media and drones. For instance, the World Bank supports India to use night-time satellite images to ensure electrification in rural areas, whereas Uganda is assisted in using satellite data for reliable and real-time insights into climate change, which can increase crop productivity.[18]

In addition, IoT and blockchain technologies can be employed in collecting and monitoring data. Through IoT-enabled devices such as smart appliances, smart TVs and security systems, data can be collected and saved, to be retrieved at any time. Decentralized ledger systems empowered by blockchain technology allow storing a massive amount of data that can be accessed by anyone at any time. These may help address some of the data challenges related to SDG indicators, within and across countries.

Conclusion

It is important to explore the potential of 4IR technologies to accelerate the progress towards SDG achievement in South Asia. This would require investment in new technologies, particularly in acquiring them and preparing for the digital transformation. Existing education systems of South Asian countries also need to be upgraded in a way to grasp new employment opportunities generated through 4IR. Institutional capacities to adopt and implement new technologies should be enhanced by introducing structural reforms. Moreover, robust data and privacy policy should be in place to address the misuse of sensitive data and to build trust among stakeholders. In a nutshell, 4IR technologies offer both challenges and opportunities. It is important to harness the opportunities so as to counter the negative impacts of 4IR and thereby ensure the attainment of SDGs. ■

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Can Nepal's exports to Bangladesh be bolstered?

Evidence suggests that a preferential trade agreement that eliminates or substantially reduces tariffs and para-tariffs in Bangladesh can make it an accessible market for Nepal.

Kshitiz Dahal

Kakarvitta (Nepal)–Panitanki (India)–Fulbari (India)–Banglabandha (Bangladesh) road corridor, the route through which almost all of Nepal-Bangladesh trade happens, is a mere 54 km stretch. Judging by the distance, the size of Bangladesh's economy, and its impressively persistent economic growth over the past decade, one would assume Bangladesh to be a major export partner of Nepal. However, the reality is different. While Nepal's imports from Bangladesh have risen substantially since 2006, its exports to Bangladesh, which comprise of a handful of products[1], have experienced a stern decline (see Figure, next page). This is in spite of Nepal having a free trade agreement with Bangladesh and both being parts of a few regional initiatives that aspire to enhance trade. Against this background, this article makes a case that there are several products that Nepal can export to Bangladesh and discusses the barriers that are impeding exports of these products.

What can Nepal export to Bangladesh?

While supply side constraints such as low productivity, high transportation and transit costs, and poor quality infrastructure undoubtedly play a part in Nepal's diminished exports, there are nevertheless several products that Nepal exports significantly to the world, and carries the potential to export them to Bangladesh as well. For instance, an ongoing research on the prospects of agricultural exports from Nepal to Bangladesh[2] finds at least 74 agricultural products that Nepal can potentially export to Bangladesh. The methodology for identifying such products simply entailed finding the agricultural products that Nepal has been exporting to the world in a significant amount and ensuring that these products have substantial import demand in Bangladesh. In particular, after compiling agricultural trade data of Nepal and Bangladesh for a period of five years (2013-17) at 6-digit Harmonized Systems level, the method employed the following steps:

1) Only those products that demonstrated decent commercial prospects were retained. For Nepal, products with an average export value exceeding US$50,000 were chosen. Similarly, for Bangladesh, only those products exceeding US$100,000 in average import value were retained.
2) Products that exhibited declining imports in Bangladesh were removed.
3) To ensure that the products selected are not flukes, only those products that were exported or imported more than once in the five-year period were selected.

A further criteria could be imposed whereby only those products that have lower unit value of export than Bangladesh's unit value of import would be retained. However, considering that a slight disadvantage in price could be remedied through reforms like preferential trade agreement, improved logistics, etc. and the fact that higher unit value of export might also be because of a superior product in terms of quality, this criteria was not imposed.

Besides the products selected through this method, the study also added to its list of potential exports the agricultural products that have been designated as priority products by the Government of Nepal in the *Nepal Trade Integration Strategy (NTIS) 2016* and in another study conducted by the Ministry of Industry, Commerce and Supplies.[3] Similarly, the list also included products identified by exporters and relevant associations as having high export potential to Bangladesh.

The identified products include animal products (meat, dairy, honey); vegetables; fruits; tea, coffee and spices; medicinal plants; animal/vegetable oils/fats; prepared food-

stuffs/beverages; animal feed and essential oils.

Impediments

The reasons for Nepal's unimpressive export volume to Bangladesh include high tariffs, para-tariffs, and payments and logistics issues, among others.

Taxes, taxes, and more taxes

Among many barriers and potential obstacles, the tariff barrier stands out. Bangladesh imposes high tariff (25 percent customs duty) on many of the identified products. Current and potential exporters as well as relevant private sector bodies also identify high tariffs as the chief barrier impeding Nepal's exports to Bangladesh.

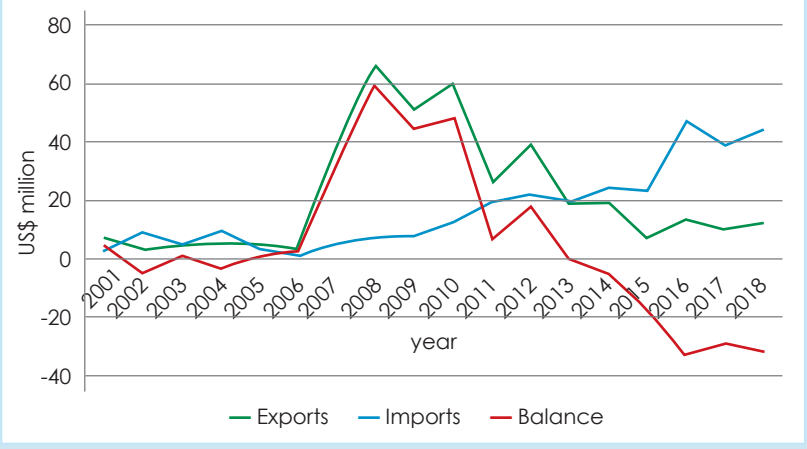
The tariff barriers are exacerbated for Nepal by the fact that Bhutan enjoys duty-free and charges-free exports for 18 products under the Bangladesh-Bhutan bilateral trade agreement. Several of these products (e.g., large cardamoms, ginger, vegetables, fruits, juices) are also the products that Nepal could export to Bangladesh.

In addition to customs duty, Bangladesh imposes five other taxes on imports: Supplementary Duty (SD), Value Added Tax (VAT), Advance Income Tax (AIT), Regulatory Duty (RD), and Advance Trade VAT (ATV). RD and ATV are strictly para-tariffs as they are levied solely on imports. Similarly, AIT is also withheld only on imports, to be settled when the importer files for income tax. Furthermore, even apparently trade-neutral taxes, imposed both on imports and domestic production, such as VAT and SD, act as para-tariffs in many instances, as some domestic productions are largely exempt from these taxes through statutory regulatory orders.[4] These para-tariffs amplify the tax burden and hence act as a strong barrier, thus discouraging exports (Table, next page).

Nepal and Bangladesh both are signatories to the Agreement on South Asian Free Trade Area (SAFTA), which has envisaged reducing tariffs and other barriers to trade. However, Bangladesh has included many products that carry export potential from Nepal to Bangladesh in its sensitive list and shielded them from customs duty reduction. Moreover, the products that qualify for a lower customs duty under SAFTA still incur high taxes owing to high para-tariffs in Bangladesh. The tariff barriers are further exacerbated by the lack of information among exporters in Nepal on the concessions they are awarded through SAFTA as well as procedures they have to follow to get the stipulated concessions.

Figure

Nepal's trade with Bangladesh



Source: IMF DOTS and Nepal's Trade and Promotion Centre.

Payment issues

Bangladesh's restriction in making advance payments against imports is identified by Nepali exporters as a major issue while exporting to Bangladesh. Allowing advance payments by Bangladeshi importers to Nepali exporters before the goods are shipped makes it easier for exporters to finance their export. Furthermore, the provision of advance payment obviates the need for trading through letter of credit (L/C), which is a relatively cumbersome and costly process for importers, when imports are of small amounts. While Nepal allows advance payment through draft/telegraphic transfer (TT) up to US$40,000 for imports, Nepali exporters are not able to get similar facility while exporting to Bangladesh. Bangladesh appears to allow advance payment of up to US$10,000,[5] but this facility is available only for authorized dealers, and only under certain conditions. In any case, Nepali exporters are not able to avail advance payment.

Another payment issue, according to exporters, is the habitual delay in L/C payment and reduction in payments by Bangladeshi importers, citing discrepant L/Cs.

Logistics issues

Nepali exports to Bangladesh need to transload (transfer goods from one truck to another) at the custom yard in Bangladesh. This process of transloading causes delays. Similarly, traffic congestions at custom checkpoints also cause delays. Furthermore, some exporters and clearing/forwarding agents cite sub-optimal state of warehousing facilities, customs infrastructure, and parking spaces at Bangladesh customs as obstacles while exporting to Bangladesh.

Procedural obstacles

One of the major procedural obstacles, according to traders, is the need to inflate the valuation of their goods at Bangladesh customs in order to meet Bangladesh's reference price. This results in higher duties and charges to be paid, in effect decreasing the price competitiveness of Nepali exports.

Table
Examples of tariffs and para-tariffs in Bangladesh

Product	HS	Custom duty (%)	SD (%)	VAT (%)	AIT (%)	RD (%)	ATV (%)	Total Tax Incidence (%)
Fats and oils derived from milk	040590	25	20	15	5	3	5	91.37
Tomatoes, fresh or chilled	070200.11	25	20	15	5	3	5	91.37
Black tea (fermented) and partly fermented tea	090230	25	20	15	5	3	5	91.37
Sugar confectionery not containing cocoa	170490.10	25	45	15	5	3	5	130.19
Other food preparations, n.e.s.	210690.90	25	20	15	5	3	5	91.37

Source: Duty Calculator, Bangladesh Customs (http://www.bangladeshcustoms.gov.bd/trade_info/duty_calculator)

For example, ginger worth US$225 per tonne in Nepal clears Bangladesh customs being valued at US$900 per tonne, and *chiraito* (a medicinal plant) worth US$1,250 per tonne in Nepal is valued at Bangladesh customs at US$1,600 per tonne.

Similarly, harassment at Indian borders and the need to make informal payments at both Indian and Bangladesh customs are other instances of procedural obstacles.

Quality issues (for instance, concerning radioactivity) and certification (radiation testing, phytosanitary certificate) are occasionally used against Nepali exporters at Bangladesh customs. Currently they seem to be an exception rather than the norm. However, quality and certification issues are still a nuisance to Nepali exporters as Bangladeshi certification requirements such as radioactivity certification and fumigation certification are used to make L/C discrepant and hence delay payment and/or reduce payment to Nepali exporters. Furthermore, since Bangladesh imposes a plethora of non-tariff measures (NTMs) on many of the potential exports from Nepal, the quality and certification issues might emerge in the future as a major barrier when exports start to increase.

Way forward

Since the evidence suggests that tariffs and para-tariffs are the primary obstacles deterring Nepal's exports to Bangladesh, a preferential trade agreement (PTA) between the two countries, which eliminates or significantly reduces tariffs and para-tariffs, can make Bangladesh an accessible market for many of Nepal's potential export products. However, since negotiations for a PTA might require some preparations, and hence time, perhaps Nepal should negotiate duty-free and charges-free entry to Bangladesh for the products in which Bhutan enjoys these facilities. For some of the products, disseminating information about SAFTA and making it easier to export using facilities provided by SAFTA could also overcome the tariff barrier.

Since the lack of advance payment is raised as one of the major issues by exporters, the Nepal government could negotiate with the Bangladeshi government to reciprocate facilities provided by Nepal, such as allowing advance payment against import up to a certain amount through draft/TT without much hassle. Likewise, negotiating with Bangladesh to resolve quality and certification issues such as radioactivity certification, fumigation certification, rail receipt, etc. that are being used to make L/C discrepant is another step that could resolve payment delays and reduced payment that exporters currently witness. Preparing for a mutual recognition agreement (MRA) in select products of interest to Nepal could also be perspicacious to resolve these issues. The MRA, by preventing the need for excessive inspection, testing, and certification requirements, will also prevent a myriad of NTMs prevalent in Bangladesh from being transformed into non-tariff barriers.

Similarly, expediting the operationalization of Bangladesh-Bhutan-India-Nepal Motor Vehicles Agreement will allow Nepali trucks to enter directly into different locations in Bangladesh. This will prevent the cumbersome process of transloading and hence reduce delays and costs associated with these delays.

To conclude, negotiations with Bangladesh to create a more conducive export market for Nepali exporters through reductions in export-preventing tariffs and through promoting rules-based trade rather than somewhat arbitrary trading environment (payment delays and fraud, certification nuisances, harassment, informal payments, procedural obstacles, etc.) could resolve many of the issues impeding Nepal's exports to Bangladesh. ■

Notes

1 For example, in 2018, a single product (Lentils) constituted around 94 percent of total exports from Nepal to Bangladesh.

2 SAWTEE's ongoing research on Nepal-Bangaldesh trade.

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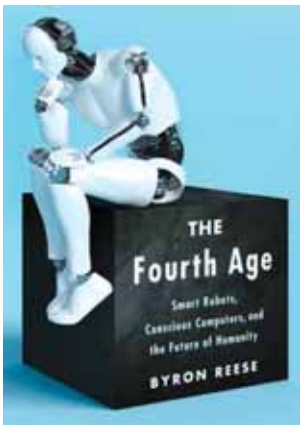

Humanity in the age of robots

Title: The Fourth Age: Smart Robots, Conscious Computers, and the Future of Humanity
Author: Byron Reese
Publisher: Atria Books
ISBN: 1501158562

Ahmed Qadir

Alec Ross dedicated an entire chapter on artificial intelligence (AI) and another on robotics in his 2016 book, *The Industries of the Future.* The same year, Klaus Schwab dedicated an entire book to the Fourth Industrial Revolution (4IR) that will be underpinned by, among other things, artificial intelligence and the Internet of Things.

Byron Reese's *The Fourth Age: Smart Robots, Conscious Computers, and the Future of Humanity* is a recent addition to the repository of books on AI and robotics. Since Reese is a tech entrepreneur, he has the credentials and experience to share his thoughts on AI and robotics.

Cloud computing, big data, algorithms, all have taken centre stage in the vocabulary of economics and business, mainstreaming the ideas of the 4IR. This era has also shown how data is collected, monetized and used with unintended consequences for privacy.

The book starts with the beginning of humanity and tells the story of humans and how we came to live the lives that we are living today. There are historical facts, mixed with mythological tales and anecdotes. The four ages are the technological sets of innovation that changed humanity significantly. Reese classifies the first age as 'Language and Fire', the second age as 'Agriculture and Cities', the third age as 'Writing and Wheels (transportation)' and the fourth age as 'Robots and AI'.

I personally found Reese's writing on the first three stages difficult to go through; I didn't need the history lesson. But that's not to detract from his efforts. The reader is not just thrown into some wild technobabble but is gradually introduced into the subject matter. My personal interest was in the chapter on inequality, but again, the focus on Universal Basic Income seemed more suited to a book on economics. The book posits that relentless progress in the fourth stage has the potential to change the trajectory of humanity far beyond the relatively incremental changes caused by previous technological advances such as the printing press, steam power and electricity. Of course, during their time, these technologies were revolutionary. Reese feels that questions that come out of this transition are profound, for they relate to what it means to be human. The ultimate purpose of his book is to explore these ideas and to figure out just how much activity, both mental and physical, we can delegate to machines, and what would be its implications on the world.

Reese seems to think robotics and AI will be good for humanity as they enhance workers' productivity. There will be new job creation while low-wage manual work will disappear. When this happens, everyone gets a better job. He writes, "technology multiplies human labour, which allows for the perpetual increase of prosperity. However unequal the distribution of that wealth, we will enter a world of such plenty that even those with the least will have abundance." He feels that with AI and robots, much can be done to lower the price of food and end world hunger.

But one does require an educated workforce to take advantage of new technologies. Reese says that the greatest skill humans have is to be able to learn new things. That is something that machines can come close to but perhaps not to the level of human ability. What we do every day consists largely of skills we have learned over time. Although machine learning could equip machines with this ability, to what extent is still a question.

Whether we are positioned somewhere before the start of the fourth age or perhaps right in the middle of it, where do we go from here? The question is 'Can computers become conscious?' An artificial general intelligence will raise questions on ethics and rights. Reese cites a Star Trek episode to question whether an intelligent robot has similar rights to a sentient being. In a chapter on robots and war, he wisely lists down possible scenarios that can go wrong.

For anyone who is interested in the rise of AI and robotics and resulting social, economic and political transformations, this should be one of the books to read, but not the only one.

Amidst speculations of dystopian future overrun by machines on the one hand and of high-tech future with 'lavish lives of plenty' on the other, this book explores the various societal views on robotics, jobs, AI and future of humanity and encourages readers to be optimistic. ■

Mr. Qadir is Director General at Competition Commission of Pakistan.

DECODING BIG DATA

Big data rely on algorithms that allow the system to automatically learn from large datasets, detect patterns and make predictions.

Alabhya Dahal

With the increased generation, use and importance of data in various fields of the economy, 'Big Data' has emerged as one of the most used terms in the technology world today. Big data mostly refers to the use of predictive analytics or certain other advanced data analytics methods that extract value from data using machine learning and other similar technologies.

Big data is not only about the size of data. Gartner succinctly synthesizes all the different characteristics of big data in his widely cited definition: "Big data is high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation."[1] Hence, besides the large size of the data, big data is generated rapidly, and comes from a wider variety of sources than traditional data. These criteria form the basis for the currently accepted three Vs of big data: volume, velocity, and variety.[2]

Flickr

The three Vs of Big data

As mentioned above, three Vs—volume, velocity, and variety—are the defining features of big data.

Volume refers to the size of data. Big data, as the term suggests, is characterized by a large volume of observations. The size of such observations can range anywhere from terabyte to petabyte. However, there is no fixed threshold as to how large the data should be in order to qualify as big data. Rather than just the size of one data set, a high volume also considers the structure and complexity of the data.

Velocity refers to the speed in which the data is generated or changed. Trends and hashtags in social media can be examples of data with high velocity. Trends in media generates large data within a small period and can change rather swiftly.

Variety refers to the fact that data can come from different sources in different formats. For instance, data can be in the form of texts, audiovisuals, numbers, cryptic codes, sensors, etc. and can be collected from multiple sources such as the Internet, social media platforms, smartphones, log records, etc. The more complex a data structure becomes, the higher variety it has.

With the proliferation of technologies in the daily lives of people, massive amount of data are being generated every day at a great speed. At the current pace, 2.5 quintillion bytes of data are being generated each day, and amazingly, over 90 percent of data that exist today were created only over the last two years.[3]

Where do big data come from?

Any public information posted by a user on the Internet can become data. Such data are also known as web data. Web data constitutes a large chunk of big data. Web data are generated when users upload their information in the public domain, such as by filling surveys, making online transactions, entering keywords for searches, providing online reviews, clicking on certain links, etc. A webpage tracking location or a user checking in at a particular place also creates web data. Web data are created at an exponential rate, with over 5.8 billion searches being made in Google every day.[4]

Social media, which is one of the most popular platforms on the Internet, also creates tonnes of data regularly. More than 3.5 billion people around the world use social media.[5] Pictures, comments, posts, tweets, etc. that are regularly added in the social media thus generate a colossal amount of data. A user's activity, taste and preference, location and interest can all be prognosticated from their social media usage.

Another major source of big data is machine data. Information generated by equipments and sensors in machines creates machine data. Basically, any information created in digital format by computerized equipment is machine data. Equipments and sensors can be medical devices, surveillance cameras, trackers, geo-location and mobile network usages, etc. Transactions made by cards or log records also generate large datasets. These data have different forms and are created at a very fast pace.

Numerous other examples are available regarding what big data constitutes and the diverse sources that generate them.

Big data analytics

Big data differs from traditional data in many ways. Big data is more dynamic, could be stored in a variety of format and is changing continuously. While traditional data are more structured, big data are more likely to be unstructured or semi-structured as it is generated rapidly from different sources and in different formats. Traditional data accumulation is slow and data flow is controlled, but big data is characterized by accumulation of large volume of data within a very short period of time. Thus, it could be full of noise requiring complex procedures to clean them. As a result, analytics with big data is different than that with traditional data.

One thing to note is the difference between big data analytics and data mining. While both make use of large datasets, big data analytics is more about finding patterns, relation and correlation in a large dataset while data mining is discovering and exploiting details and knowledge in a dataset. Data mining, thus, is applicable to both traditional and big data, whereas big data analytics pertains to big data.

With big data now becoming more accessible, machine learning and artificial intelligence (AI) have become the new leading analytical techniques. These techniques rely on algorithms that allow the system to automatically learn from large datasets, detect patterns and make predictions. These techniques differ from traditional analytical tools in that traditional analytics are more focused on fitting the model in the given sample, therefore minimizing in-sample error, whereas machine learning models are focused on reducing out-sample error (increasing the accuracy of prediction), thereby minimizing the errors in predicted value. As a result, big data analytics has been a game-changer for business analytics.

While big data is seen predominantly as a business tool, other sectors such as healthcare services have also greatly benefited from it. Big data analytics are used in the diagnosis of medical conditions as well as for evidence-based research in the health sector. According to a recently published study, a Google AI model made a more accurate prediction than trained doctors in diagnosing breast cancer.[6] With the help of big data analytics in healthcare, certain medical conditions may be detected faster, thereby enhancing chances of successful cure. Likewise, big data analytics can also help identify and prevent spread of epidemics. Use of big data analytics is also growing in other areas such as sports, services, education and social sciences.

Big data analytics provides a new edge in analytics. Although data and analytics are not new concepts, big data analytics is shifting the field to a completely new paradigm. Estimation and prediction are more accurate, thereby increasing the accuracy of findings, and consequently the confidence in the robustness of findings. With machine learning techniques and AI, businesses are cutting down their losses, the healthcare sector is making more accurate identification of diseases and disabilities, the banking sector is identifying fraud more easily[7] and the benefits extend to many more sectors. Therefore, big data analytics has a huge impact on all sectors of the economy and society. In fact, in the near future, the sustainability of any industry will largely depend on their ability to utilize big data. ■

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Interaction on fiscal federalism in Nepal

SOUTH Asia Watch on Trade, Economics and Environment (SAWTEE) organized an interaction programme on fiscal federalism in Biratnagar, Province 1, in Eastern Nepal on 27 December.

Mayors/chairpersons, deputy mayors/vice-chairpersons and chief executive officers of local governments in Morang district were informed about their rights and responsibilities concerning expenditure and taxation. The local government officials voiced concerns about continued uncertainty regarding revenue collection.

The Province 1 Federation of Nepalese Chambers of Commerce and Industry and Biratnagar Metropolitan City were the co-organizers of the event. Participants interacted about their revenue-raising rights and responsibilities. The event was held as part of the National Agricultural Market Development Programme, of which SAWTEE is a co-facilitator. ■

E-commerce can spur intra-South Asia trade: *World Bank*

E-COMMERCE can become a driver of growth across South Asia and boost trade among the region's countries, but its potential remains largely untapped, says a new World Bank report.

The report, *Unleashing E-Commerce for South Asian Integration,* notes that although e-commerce has grown significantly in South Asia, online sales accounted for a mere 1.6 percent and 0.7 percent of total retail sales in India and Bangladesh respectively, compared to 15 percent in China and around 14 percent globally.

Increasing the use of e-commerce by consumers and firms in South Asia could potentially help boost competition and firm productivity, and encourage diversification of production and exports, the report added.

"E-commerce can boost a range of economic indicators across South Asia, from entrepreneurship and job growth to higher GDP rates and overall productivity," said Sanjay Kathuria, World Bank Lead Economist and co-author of the report, during the report launch organized by the World Bank and CUTS International in New Delhi on 16 December.

Bipul Chatterjee of CUTS International said that e-commerce can be a good platform for further integration of South Asia. "The report deals with the entire ecosystem around e-commerce, and hence can be looked at as a framework for future regional integration," he said.

Sustainable development in digital age

SUSTAINABLE Development Policy Institute (SDPI) organized the 22nd Sustainable Development Conference (SDC) on 'Sustainable Development in a digital age' on 3-5 December in Islamabad.

The overarching theme of this year's SDC was inspired by the Fourth Industrial Revolution and an era of digitalization that has changed ways that human beings interact in the face of rapid revolution in technologies.

Digitalization is an opportunity for Pakistan to solve its core problems, Federal Minister for Planning, Development, Reforms and Special Initiatives of Pakistan, Asad Umar, said.

Dr Abid Qaiyum Suleri, Executive Director, SDPI, called upon the government to fast track its decision-making process and institutionalize its mechanisms for devising a policy framework to embark upon the digital revolution. ■

A survey of over 2,200 firms in South Asia showed that the top concerns on cross-border e-commerce sales included e-commerce related logistics, e-commerce and digital regulations, and connectivity and information technology infrastructure. These barriers are significantly higher when trading with other South Asian countries.

The main international e-partners of firms in South Asia are China, the UK and the US, and not other South Asian countries. ■

IPS discusses Sri Lanka's economic outlook and policy priorities

DESPITE significant gains from macro reform measures in fiscal, monetary, and exchange rate policy management from mid-2016, the overall positioning of the Sri Lankan economy in 2019 was weak, with the country making a painfully slow recovery after a series of setbacks, notes the annual, flagship report of the Institute of Policy Studies of Sri Lanka (IPS).

It further points out that with 10 consecutive quarters of growth below 3.5 percent—a significant laggard compared to the rest of the South Asian countries—policy measures to revive growth will be at the top of the economic agenda, post-election.

While some reforms have been implemented, these have gained little economy-wide traction. As Sri Lanka prepares the groundwork for a new phase of economic growth and development, new tools to assess and understand competitiveness must be heeded, the report cautions.

Transformative technologies such as artificial intelligence, robotics, and 3D printing, under the banner of the Fourth Industrial Revolution (4IR), are proving to be invasive, complex and disruptive. For countries with ageing populations, like Sri Lanka, which must rely on productivity as a key driver of future growth, the challenges need to be understood and opportunities grasped.

In this context, this year's *Sri Lanka: State of the Economy 2019* report on the theme of 'Transforming Sri Lanka's Economy in the Fourth Industrial Revolution' examines the many areas of the Sri Lankan economy—world of work, education, migration, gender, health, financial inclusion, trade, agriculture, and climate change, among others—where 4IR technologies will come into play as defining features of the country's economic future.

The newly released report provides a critical assessment of Sri Lanka's economic performance and near-term outlook for growth and macroeconomic stability. Each year, the report also examines crucial medium-term policy priorities to achieve sustained growth and strengthen socio-economic development outcomes for the country. ■

Conflict Resolution
in Post-Earthquake Nepal

Disasters caused by exogenous natural phenomena have resounding social, political, economic and demographic impacts. The scarcity of resources in its aftermath and the power struggle to gain an upper hand in relief and rebuilding create new conflicts or exacerbate existing ones. Moreover, badly planned state aid interventions, that feed the perception that certain sections are being more favoured than others, fan conflicts.

Disasters destroy lives and livelihoods of people and create scarcity of resources—such as food, shelter, drinking water, title to land, access to livelihood opportunities, among others. As the communities compete with each other for their access, the rise of conflicts or disputes is natural. Moreover, in a society marked with historical discrimination within and between communities, based on ethnicity and caste, conflicts are always simmering underneath the surface, if not out in the open. Further, in places such as Nepal, where state mechanism is not fully capable to come to the rescue and recovery of those affected, judicious distribution of reconstruction aid is doubtful. Hence, conflicts during post-disaster reconstruction are almost inevitable.

Given the scale of Nepal's 2015 earthquake, the mammoth task of reconstruction and the complex socio-economic characteristics of Nepali society, it is necessary to understand the different issues of conflict that arose during the course of reconstruction. It is equally important to explore the measures taken, or should be taken, to resolve those issues. Only then, will social cohesion be created that is able to expedite the rebuilding process and, ultimately, the formation of a resilient community.

Disaster-induced conflicts

Generally, rapid-onset disasters such as earthquake and floods are considered less likely to contribute to widespread conflict in comparison to slow-onset disasters, such as drought and desertification. As the impact of slow-onset disasters are gradual and take time to unfold, the scarcity and worsening vulnerabilities and escalating battle for resources

POLICY BRIEF NO. 41, 2018

Policy Brief: Conflict resolution in post-earthquake Nepal
Author: Dikshya Singh
Publisher: SAWTEE

Thinking Resilience
in a Post Disaster context

Ajaya Dixit

Resilience building is a process within the ongoing social and political dynamics in the context of multiplicity of hazards

Despite its vulnerability to multiple natural hazards, Nepal is poorly prepared to minimize disaster risks. Post-disaster efforts are largely guided by rescue of those affected by the event. Generally, neighbours and local communities are the first responders. The government provides immediate support in the form of cash, drinking water, emergency shelter, basic medicine and food items, but relief distribution is poorly organised. Many times, the processes, coordinated by state agencies with support from humanitarian organisations, are ad hoc. Also, in most cases, support to the affected people is seen to wane after the first-order distribution of relief. Those

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Policy Brief: Thinking resilience in a post disaster context
Author: Ajaya Dixit
Publisher: SAWTEE

Individual Grants
IN POST-EARTHQUAKE RECONSTRUCTION EXPENDITURE

Kishor Maharjan

The destruction and damages caused by the 2015 Gorkha Earthquake called for mobilization of large amount of money for reconstruction. As the funds poured in, from domestic and international sources, to the earthquake stricken districts to help the reconstruction, the public doubts about proper utilization of those funds also surfaced. Ensuring that the funds actually reached the needy, without any leakage has always been of utmost importance to all the stakeholders.

Considering the initial hiccups in relief and recovery, questions have often been raised about efficiency and effectiveness of transfers of funds meant for reconstruction from government to beneficiaries. Therefore, it is pertinent to assess the reconstruction spending to ensure that the funds are reaching the needy on time. A simple expenditure tracking, even on a case study basis, would surely be helpful to assess the effectiveness of the funds and to indicate anomalies. This study, therefore, attempts to analyse expenditure in the government's reconstruction program and track reconstruction grants to individuals. In doing so, the process of fund flow to beneficiaries has been investigated and related issues highlighted before finding ways for improvements in the system.

In order to fulfil this objective, a thorough review was made of the various legal procedures put in place by government. Budget statements of two fiscal years, post-earthquake were examined. The focus was on the National Reconstruction Authority (NRA) allocation and the individual headings pertaining to reconstruction. Economic Survey 2016/17, the Red Book 2017/18, Earthquake Affected Private House Reconstruction Grant Distribution Procedure 2016 and various newspaper reports were also reviewed.

POLICY BRIEF NO. 43, 2018

Policy Brief: Individual grants in post-earthquake reconstruction expenditure
Author: Kishor Maharjan
Publisher: SAWTEE

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South Asia Watch on Trade, Economics and Environment (SAWTEE) is a regional network that operates through its secretariat in Kathmandu and member institutions from five South Asian countries, namely Bangladesh, India, Nepal, Pakistan and Sri Lanka. The overall objective of SAWTEE is to build the capacity of concerned stakeholders in South Asia in the context of liberalization and globalization.

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