



SKILLS FOR FUTURE JOBS

Technology & the Future
of Work in India



WHITE PAPER

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Acknowledgements

The authors acknowledge and are grateful to a number of colleagues and experts who supported this study and helped to shape their overall understanding of the topic.

Research supported by

Microsoft India

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Key Learnings

Over five million young people are expected to enter India's labor force every year over the next decade. Meaningful and sustainable economic participation, already constrained by the 'service led' structure of Indian economic growth over the past two decades, will be further stressed by the rapid pace and ubiquitous scope of technological advancement. Technologies for artificial intelligence, advanced robotics, 3D printing, cloud computing, among others, are displacing existing jobs and work processes. Many of today's jobs may no longer exist in the next ten years, while many others will be transformed or created anew.

Job growth has indeed been slow over the past decades, but low levels of education and skilling are equally serious impediments to accessing and responding to new opportunities. While the exact impact on labor markets is hard to predict, it is clear that the low-skilled segment of the population faces a greater threat from technological displacement. Yet, advanced digital

and manufacturing technologies can also act as economic levellers, facilitating adaptive self-learning opportunities and creating new avenues for value creation. To leverage this opportunity, the question of skilling requires urgent and imaginative policy attention.

Government-led skilling initiatives are predominantly oriented towards sector specific technical or vocational training. While these skills are important, they are not broad-based enough to adequately prepare for the technology led-disruptions to the future of work. As routine manual tasks become increasingly automated, as the availability of large amounts of data creates new complex choices and decisions, and as the blurring of physical and virtual spaces creates new forms of working and collaboration, a more holistic and interoperable set of skills will become increasingly important. Building these core skills will allow for the development of meaningful and sustainable career pathways.

Insights

- 1 Foundational knowledge and meta-skills will continue to be important, particularly to facilitate learnability.
- 2 Humanistic, Communication, and Creativity skills will become more valuable, especially in the service sectors.
- 3 Digital Literacy alone will not be enough. Digital Fluency will be crucial.
- 4 Data Science skills will be critical for seizing digital economy opportunities.
- 5 The design and delivery of skilling programs must address gender based exclusionary practices.
- 6 Skilling initiatives will need to be oriented toward building meaningful careers, rather than specific job profiles.

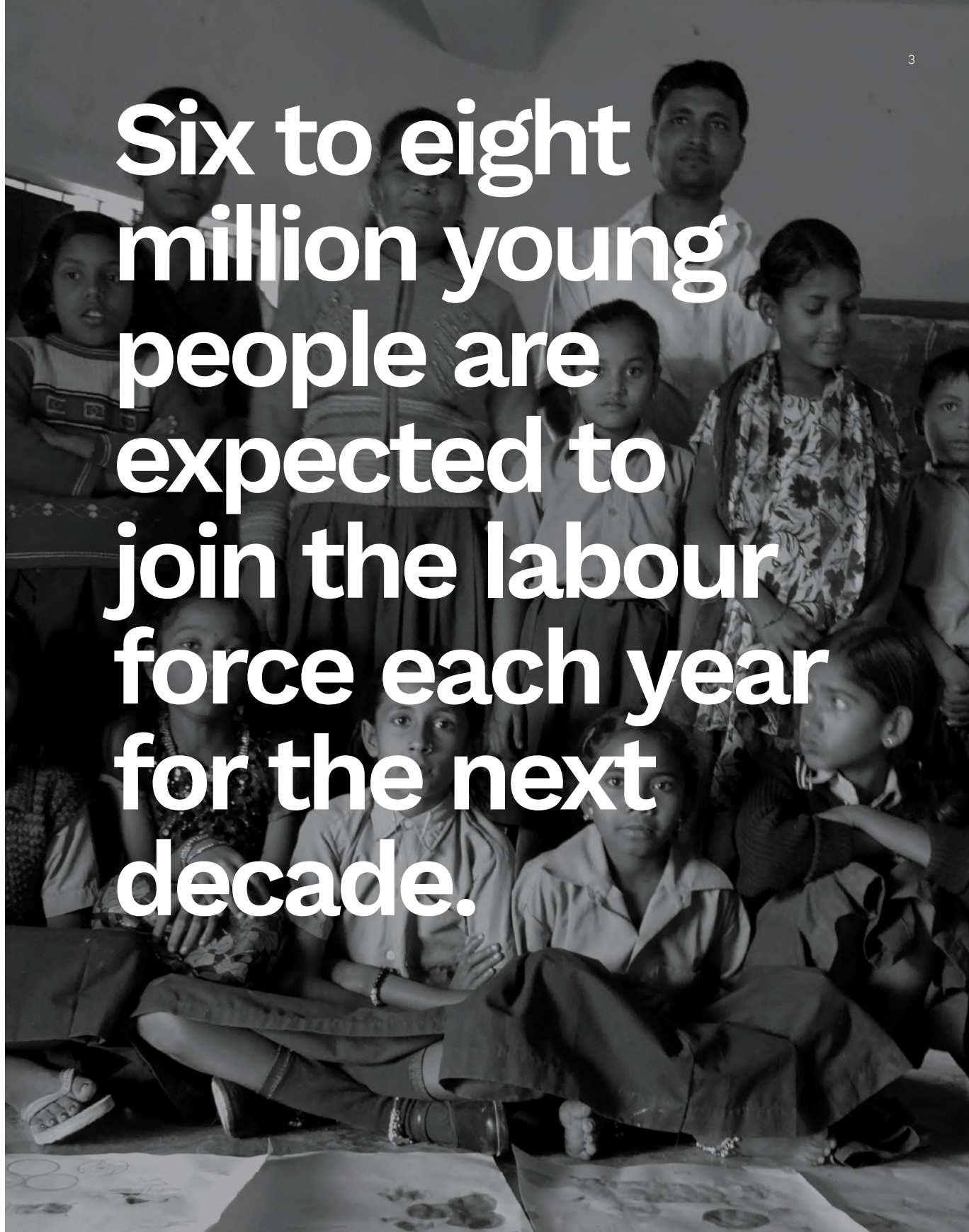
01

Introduction

The current wave of ubiquitous technologization will precipitate systemic changes in the ways in which we live, work, and relate to one another. Building on earlier advances in using electronics and information technology to automate production, emerging technologies for artificial intelligence, advanced robotics, cloud computing, and 3D printing, among others, are transforming economic opportunities and processes across the globe.

However, even while emerging technologies are being developed and deployed globally, technological trajectories and their impact will be shaped by, and mediated through, local socio-economic systems. In fact, a singular focus on technological impact obscures the issue of technology use i.e. the various ways in which people use technology will shape the impact of technological change, where these usage patterns reflect prevailing social structures and practices.

Conversations on technology and the future of work in India tend to oscillate between two macro-narratives: that new technologies are displacing jobs faster than they are creating new ones, or that the productivity gains brought about by technology will enable



Six to eight million young people are expected to join the labour force each year for the next decade.

In 2015, over 30% of India's youth was neither employed nor in education or training, one of the highest percentages in the world.

job-creation in the long run, along with new forms of value creation. Even without technological disruptions, job growth has been slow. Growth has been driven by capital deepening, rather than the utilization of India's labor surplus. Six-eight million young people are expected to join the labour force each year for the next decade.¹ In 2015, over 30% of India's youth was neither employed nor in education or training, one of the highest percentages in the world.² The specter of job-less growth combined with the already large gaps in education and skilling make the impact of technological change an urgent concern.

Skilling and re-skilling of the workforce to respond to changing job requirements will be critical. Appropriate and timely skilling initiatives, tethered to both an understanding of current labour market and foresight about the near future, will be critical for equipping India's youth to secure meaningful work opportunities.

Current government initiatives are predominantly focussed on industry or sector specific skills and vocational training. The National Skill Development Mission, launched in 2015, does not explicitly address the critical question of technological

Technological Drivers of Change

● Mobile Internet & Cloud Computing

The mobile internet has applications across business and the public sector, enabling efficient delivery of services and opportunities to increase workforce productivity. With cloud technology, applications can be delivered with minimal or no local software, enabling the rapid spread of internet-based service models.

● Digital Platforms

Supply and demand aggregation through digital platforms is transforming business models and ways of working. Platformization is creating new opportunities for economic participation, particularly avenues for self-employment and micro-entrepreneurship.

● Advances in computing power and big data

Realizing the full potential of technological advances will require having in place the systems and capabilities to make sense of the unprecedented flood of data these innovations will generate.

● Artificial intelligence and machine learning

Supported by advanced in computing power and big data, artificial intelligence and machine learning are making it possible to automate knowledge-worker tasks, that have long been regarded as impossible or impractical for machines to perform.

● Internet of Things

The use of remote sensors, communications, and processing power in industrial equipment and everyday objects will unleash an enormous amount of data and the opportunity to see patterns and design systems on a scale never before possible.

● Advanced robotics

Advanced robots with enhanced senses, dexterity, and intelligence can be more practical than human labour in manufacturing, as well as in a growing number of service jobs, such as cleaning, maintenance and transport.

¹ Ghose, A. (2016). India Employment Report 2016: Challenges and the Imperative of Manufacturing-Led Growth, Institute for Human Development.

² OECD (2017). OECD Economic Surveys: India, OECD.

Factors shaping Technological Adoption

- **Technological Feasibility**
 Technology has to be invented, integrated, and adapted into solutions for specific case use.
- **Cost of Developing & Deploying Solutions**
 Hardware and software costs
- **Labor Market Dynamics**
 The supply, demand and costs of human labor effect which activities will be automated.
- **Economic Benefits**
 Higher productivity and output alongside labour cost savings.
- **Regulatory and Social Acceptance**
 Legal rules and social norms will shape the speed and extent of technological adoption. Even when automation makes business sense, adoption can take time

Adapted from McKinsey, A Future that Works, 2017.



change. While industry specific vocational training remains important, a broader and more holistic view of skilling is required, one that enables young people entering the work to adapt to technological displacement and leverage new opportunities.

Foresight about the future is difficult to generate given the complex interplay between technological trajectories, social choice and labour markets. The methodology adopted for this study deals with the inherent uncertainty and lack of predictability about the future of work and skilling by putting forth six plausible propositions about the future of work and, related to that, the future of skilling. These propositions have been generated by 'patching-up' insights from the limited data and research available on the subject and in consultation with key informants within industry, policymaking and education.

02

Technological Displacement and Job Futures

The rapid pace of technological change will undoubtedly transform the future of jobs in India. However, the nature and speed of this transformation will depend on how technological trajectories intersect with the unique socio-economic structures characterizing the Indian economy. This section presents six plausible propositions about the impact of emerging technologies on the future of work.

Despite high automation potential across most sectors, the cost of advanced manufacturing technologies relative to the cost of labor is likely to make India a slow adopter. This could be a positive trend from an employment perspective, as the manufacturing sector is best placed to absorb India's low-skilled labor surplus. The services sector, that has been the principal driver of recent economic growth, is also likely to experience job displacement with increased deployment of cloud computing, artificial intelligence, big data and other such technology enabled solutions. Financial services and Information Technology services have been at the forefront of India's service-led growth, but their expansion has been primarily capital rather than labor intensive. As this trend continues and firms invest in emerging technologies, entry and mid-level jobs could be at risk. For at least some workers however, the end result

is likely to be job substitution rather than job displacement, as new higher-value jobs are created within the same sectors. Other key service sectors, such as education, health and tourism, have tremendous growth potential, and require increasing degrees of complementarity between machine capacities and uniquely human skills. In fact, the mechanization of routine tasks could improve the broader quality of work within these sectors.

With most of India's workforce employed in the informal sector, the number of people that are potentially at risk of job displacement is large. Analysis of the impact however is limited by a lack of employment data and job trends within the informal

sector. Preliminary studies do suggest however that informal workers are largely disconnected from 'high-tech' advances, though they are likely to experience a rise in productivity with broader upgrades in infrastructure, transport and communication systems. Importantly, digital platforms such as taxi and home-service aggregators can help organise informal workers.

Finally, multiple direct opportunities will be created to develop and deploy emerging technologies – the Internet of Things for example is expected to be a booming growth sector, fuelling also the need for cyber security professionals. These opportunities should be further leveraged to boost the care economy in India.

1 High automation potential across sectors

Estimates of job displacement differ. A study by the Oxford Martin School, for example, suggests that almost half of all jobs in the United States and other advanced countries are at risk of being substituted by computers or algorithms within the next 10 to 20 years.³ In contrast, a study by the Organisation for Economic Co-operation and Development (OECD) finds that than an average of 9% of jobs are at high risk of automation in OECD countries.⁴ Notwithstanding the methodology employed, it is fairly clear that developing nations will be more susceptible to the effects of automation because of the percentage of people engaged in low-skill and routine work. The increased use of robots is also facilitating the ‘reshoring’ of industries back to industrialized countries.⁵

Research based on World Bank data has predicted that the proportion of jobs threatened by automation in India is 69 percent.⁶ A 2016 study by the McKinsey Global Institute provides a detailed sectoral overview, both in terms of the number of jobs at risk and the number of people impacted. Analysing the impact of automation on individual activities rather than entire occupations, the report finds that the manufacturing sector has the highest

potential for automation at 67%, followed closely by accommodation & food services, and transportation and warehousing, at 66% and 61% respectively. Automation potential within the agriculture, forestry, fishing and hunting sectors is lower, at 49% of all activities; however, with almost three-fourths of India’s labor force employed in the agriculture and forestry sectors, the number of people affected by automation is likely to be high, at 328.9 million workers.⁷ While the exact scale of job displacement is hard to predict, the ease and sophistication of automation will drastically transform many jobs and tasks over the next ten years.

3 Frey, C. a. M. O. (2013). The Future of Employment: How susceptible are jobs to computerization? Oxford, Oxford Martin School, University of Oxford.

4 OECD (2016). Automation and Independent Work in a Digital Economy. Policy Brief on the Future of Work, OECD.

5 Frey, C. a. M. O. (2016). Technology at Work: The Future is Not What it Used to Be. Citi GPS: Global Perspectives & Solutions. Oxford, Oxford Martin School, University of Oxford.

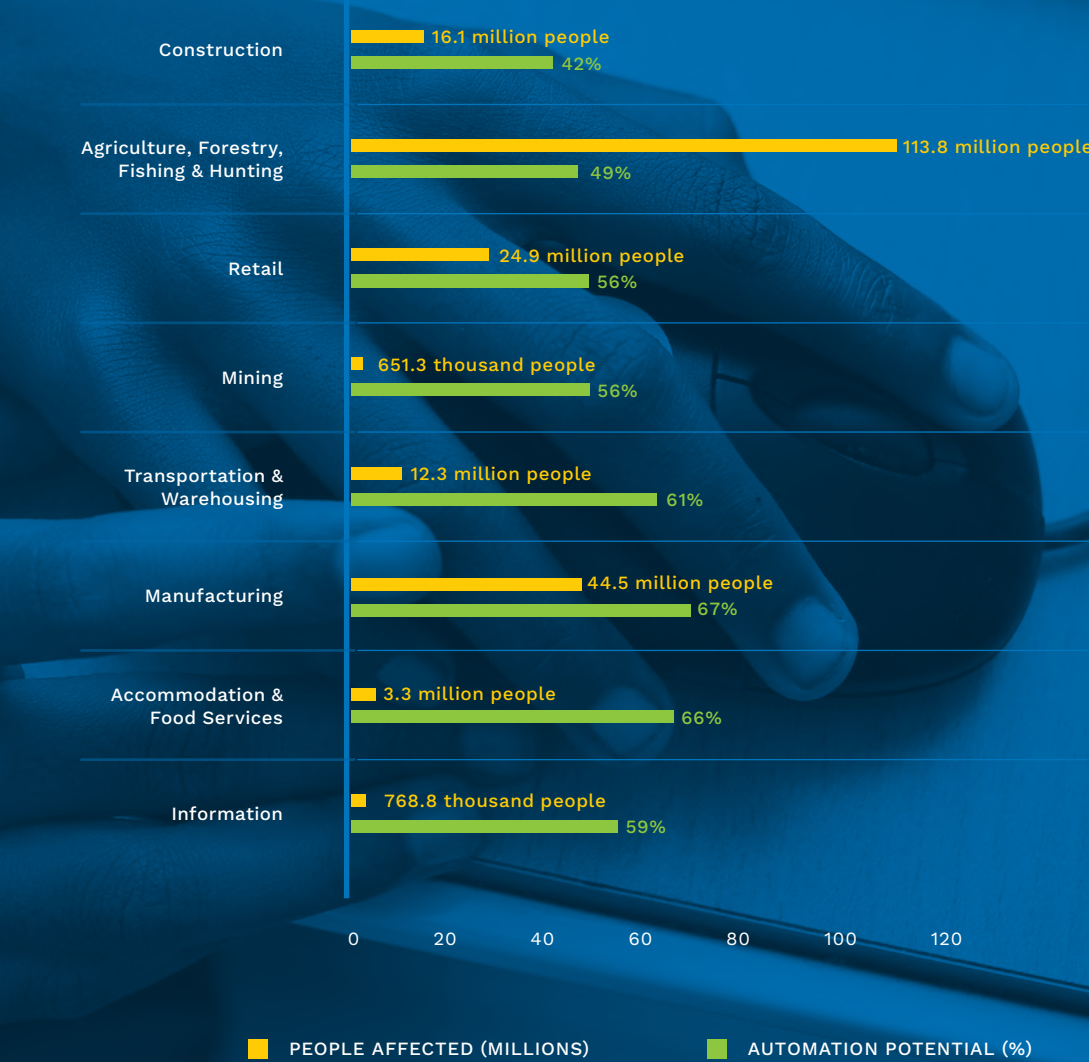
UNCTAD (2016). Robots and Industrialization in Developing Countries. UNCTAD Policy Brief.

6 Kim, Y. J. (2016). Speech by World Bank President Jim Yong Kim. The World Bank Group’s Mission: To End Extreme Poverty, World Bank.

7 Manyika, J., Michael Chui and Mehdi Miremad (2017). Harnessing automation for a future that works, McKinsey Global Institute.

Automation Potential in India

Sector-wise Breakup of Automation Potential



Manyika, J., Michael Chui and Mehdi Miremad (2017). Harnessing automation for a future that works, McKinsey Global Institute.

2 Manufacturing Sector will be a slow adopter

Considering the current operating costs of robots, it is unlikely that Indian manufacturers will make a quick and widespread shift to automation. Manufacturing wages for un-skilled workers adjusted for productivity stand at an average of \$5.25 in India, which is substantially below the cost of robots.⁹ Stringent labour laws for the dismissal of employees further reduce incentives for a widespread shift to robotics. Analysing the aggressiveness and pace of robotics adoption across the 25 largest manufacturing economies, a recent study by the Boston Consultancy Group categorised India as a ‘slow adopter,’ the only developing nation in this category and occupying one of the lowest ranks.¹⁰

It is important to note however that the jobs offered in many manufacturing units, particularly automobile and electronics plants, are increasingly in the form of casual and contractual employment and might therefore be easier to replace. Moreover, differences can be expected across the manufacturing sector. Heavy manufactuting (basic metals, chemicals, equipment manufacturing etc) is already a low-labor intensive sub-sector; advanced automation technologies are likely to lead to further capital deepening and labor replacement.¹¹ Textile, paper, wood, and leather are materials that are typically ill-suited for manipulation by robots; the scope for full automation is thus low in the short run. In addition, wages in these sectors are

fairly low; unless low-cost technological breakthroughs occur, significant adoption will not take place soon.¹²

Opinion is split on the job creation potential of the manufacturing sector in India. Advanced automation could result in a process of ‘premature deindustrialization’ in emerging economies like India. The declining cost of robots compared to labor could eventually lead to ‘re-shoring’ of large manufacturing plants to industrialized economies.¹³ Yet, economists also argue that manufacturing led economic growth still holds the best prospect for absorbing India’s low-skilled labor surplus.¹⁴ Small enterprises that leverage technologies for 3D printing and digital platforms that aggregate demand and supply can also create new employment opportunities within the manufacturing sector.¹⁵

9 Sirkin, H., Michael Zinser and Justin Rose (2015). The Robotics Revolution: The Next Great Leap in Manufacturing Boston Consultancy Group

10 Ibid.

11 Bhattacharya, A. a. A. B. (2017). India: Growth and Jobs in the New Globalization, BCG & CII.

12 Sirkin, H., Michael Zinser and Justin Rose (2015). The Robotics Revolution: The Next Great Leap in Manufacturing Boston Consultancy Group.

13 Rodrick, D. (2015). “Premature Deindustrialization.” NBER Working Papers.

14 Ghose, A. (2015). The dual economic logic for ‘Make in India’. Business Standard.

15 Maira, A. (2014). How to ‘Make in India’. Live Mint.



3

Services sector will benefit from complementarity, but routine tasks are likely to be automated.

India still tops global rankings for service offshoring, especially for core technology-induced tradable services (Information and Communication Technology and Other Business Services). Some studies predict that the offshoring of service jobs will reach a saturation point by 2022, as the wages in emerging markets close in on the wages in developed nations. Some of the biggest companies that pioneered outsourcing, like General Electric and General Motors, have already shifted their IT operations home.¹⁶

Across the services, routine and manual tasks are most likely to be automated. A recent study by HfS research predicts that in the IT sector, India will lose 640,000 low-skilled positions by 2021. In place of these lost jobs, the sector is expected to generate 160,000 mid to high-skilled jobs, leading to the shrinkage of the IT sector by 14% by 2021.¹⁷

Automation of certain tasks however could over time increase the value of other tasks. While the job of a bank teller might become obsolete, it will simultaneously create new opportunities for Relationship Managers; similarly, the work of a hedge fund analyst will be replaced by an artificially intelligent machine, while simultaneously increasing the importance of a financial advisor. New tasks and jobs created will hinge on increased complementarity between technology based products and human abilities and skills.

¹⁶ Economist (2013). On the Turn: India's Outsourcing Business. The Economist, ibid.

¹⁷ Mendonca, J. a. N. A. (2016). IT sector to lose 6.4 lakh "low skilled" jobs to automation by 2021: HfS. The Economic Times.

¹⁸ Bhattacharya, A. a. A. B. (2017). India: Growth and Jobs in the New Globalization, BCG & CII.

Education, healthcare, tourism, transport and storage enterprises have significant growth potential, creating 3-3.5 million jobs a year, in comparison to the 0.5-1 million jobs they currently create.



Within the services, sub-sectors like hospitality and retail are likely to experience dramatic transformations as a result of automation, digitalization, and the growing use of data analytics. Education, healthcare, tourism, transport and storage enterprises have significant growth potential, creating 3-3.5 million jobs a year, in comparison to the 0.5-1 million jobs they currently create. Construction will remain a significant job creator as the Government continues to develop national infrastructure. The financial sector has traditionally been a high growth sector, but not a large employer – this trend is likely to continue. Travel and tourism is also expected to become a high-growth industry by 2025.¹⁸

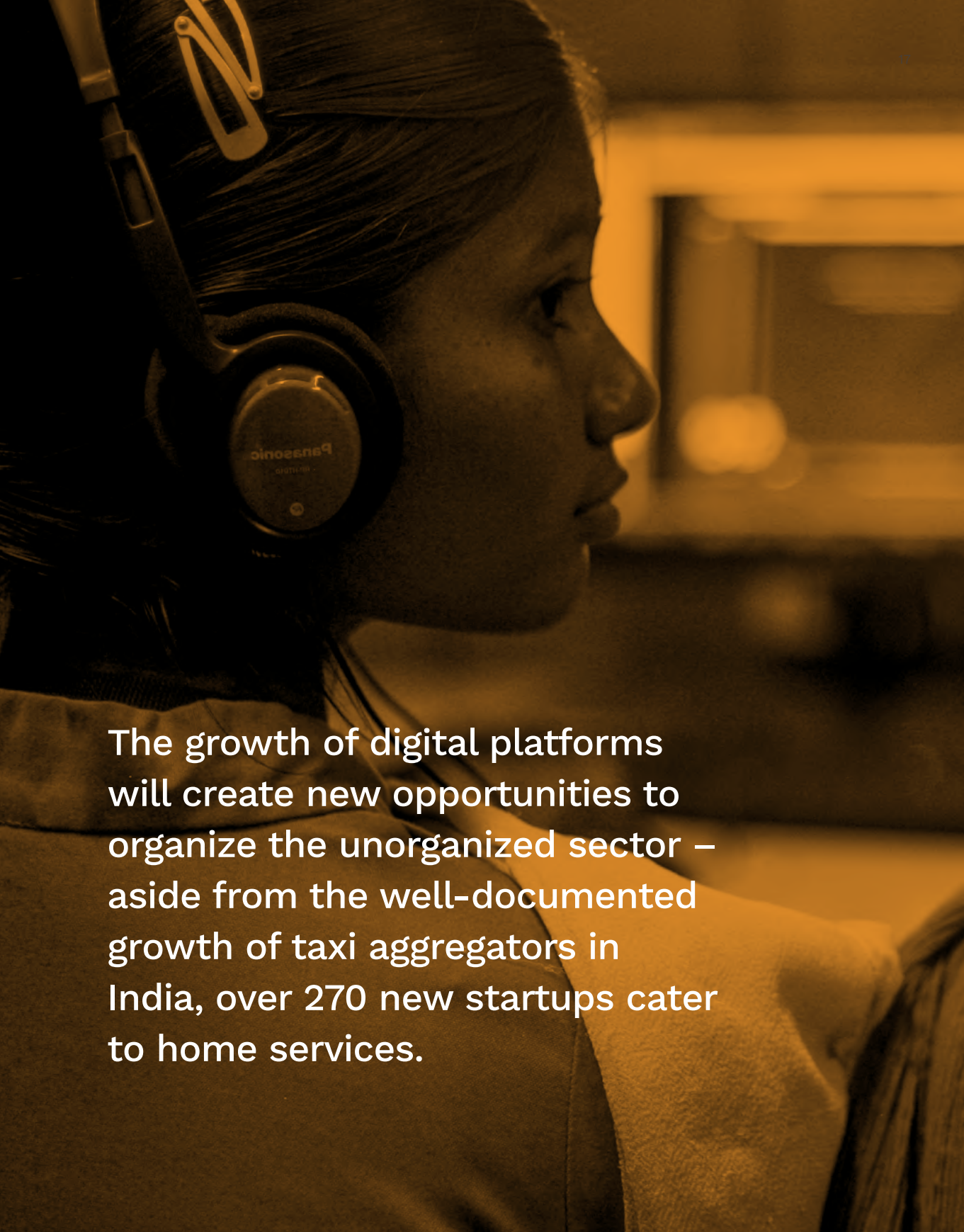
¹⁸ Bhattacharya, A. a. A. B. (2017). India: Growth and Jobs in the New Globalization, BCG & CII.

4

Low-Tech and Ecosystem Upgrades will be most relevant for the Unorganized Sector

Limited data on employment numbers and quality in the informal sector prevent robust analysis. Recent studies based on case studies from the unorganized sector show that informal workers are largely disconnected from many technological advances. At a firm level, informal firms are unable to seize the competitive advantage offered by new technologies – often because of the prohibitive cost of such technologies. Rather, investments in new technologies in the informal sector are often steps up ‘technology ladders’, such as improved stoves, improved carts, or improved sewing machines.¹⁹ The focus on ‘high-tech’ schemes that target large industrial machines can end up obscuring more affordable, smaller technology inputs that can revolutionize micro-enterprises. For example, of a survey among tailors in India, 25.1% requested the efficiency-enhancing Juki sewing machine, a machine that has in-built programs for designs, patterns and buttons, and costs INR 10,000 in the market.²⁰

Labor productivity is likely to be positively impacted by technology-enabled improvements in transport, communication, and financial infrastructure. The growth of digital platforms can also create new opportunities to organize the informal sector – aside from the well-documented growth of taxi aggregators in India, over 270 new startups cater to home services.²¹ The agriculture and handicraft sectors, two of the biggest employment generators, can benefit from digital platforms that aggregate demand and supply, enabling producers to directly access new consumers and markets.



The growth of digital platforms will create new opportunities to organize the unorganized sector – aside from the well-documented growth of taxi aggregators in India, over 270 new startups cater to home services.

¹⁹ Casey, J. a. K. H. (2016). Technology and the Future of Work, Practical Action & Wiego.

²⁰ Nazareth, K. a. V. P. (2016). Deploying technology to grow micro-enterprises in India. Transformations in Technology, Transformations in Work, Just Jobs Network.

²¹ Chopra, A. (2017). How UrbanClap grew on-demand service at a time. Live Mint.

Women in India are 27% less likely to have Internet access than men.

5 **Women will face greater and differentiated challenges.**

Gender-based digital exclusion will constrain opportunities for women to benefit from the new digital economy. Women in India are 27% less likely to have Internet access than men. Only 28% of Indian women own a mobile phone, compared with 40% of men.²² This digital gender gap is a result of three main factors: access and affordability, education and digital skilling, and socio-cultural norms and practices, which together work to constrain their ability to leverage digital economy opportunities.²³

Remote and flexible work opportunities created through the platformization of work are likely to create new economic opportunities for women in the service sector as well as create avenues for entrepreneurial ventures. However, women are also likely to be acutely impacted by the automation of routine tasks, particularly in the IT sector. Since the 2000s, India has benefitted from the BPO explosion, delivering back office

support, call centre work and data transcription services, among others. These kinds of low-skill back office processing jobs have provided women an avenue for economic participation – women comprise 59 percent of the labor force.²⁴ However, these jobs are also at high risk of automation. Women also face cultural barriers to using and acquiring new technological and learning tools, and are thus often assigned to tasks involving unskilled labor, many of which have high automation potential.

22 Gurumurthy, A. (2014). Digital Technologies and Gender Justice in India : An analysis of key policy and programming concerns, IT for Change.

23 Aneja, U. a. V. M. (2017). Empowering Women in a Digital Age in India. The Effects of Digitalization on Gender Equality in the G20 Economies. A. Sorgner, Kiel Institute for the World Economy.

24 Chang, J. a. G. R. (2016). ASEAN in Transformation: How Technology is changing jobs and enterprises. Working Paper. Geneva, International Labor Organisation.

Spotlight: Green Economy

In the last decade, the notion of green growth and green economy has received policy attention in emerging economies, as means to support economic growth and job creation while also preventing unsustainable extraction of natural resources, reducing carbon emissions and curbing environmental degradation. Public policies and consumer awareness are likely to further drive the expansion of green jobs.

Skills and qualifications will need to be upgraded across industries to align with greener technologies, processes and regulatory landscapes. Certain sectors – for example, those that are heavily dependent on fossil fuels - will shrink as a result of new policies. Green sectors will create new opportunities.

Four key sectors for green jobs in India



Green Transportation
Emphasis on public transit systems and a switch to new fuels and energy efficient mobility is likely to create the need for differently trained engineers, mechanics and operators.



Green Energy
India has set ambitious targets for increased installations of various green energy technologies – solar, wind, bio-energy and mini-hydro.



Green Waste Management
India lags behind in systems for waste collection, segregation, storage, transportation, processing and disposal of waste, including e-waste.



Green Construction
The built environment is expanding exponentially, as the government builds basic infrastructure and the country undergoes massive urbanization.



6 **The digital economy will create new opportunities, and should be leveraged for advancements in the care economy.**

The digital economy will continue to foster productivity and efficiency growth, creating new avenues for wealth and job creation. Ecommerce is expected to create 1.49 million jobs by 2021, with an annual growth rate of 36%. For every job that is created by the e-commerce industry, further 3-4 jobs can get created in downstream industries - 50% of logistics and warehousing jobs, for example, are currently linked to e-commerce platforms.²⁵ Digital finance is also expected to create 21 million new jobs by 2025.²⁶ The Internet of Things market in India is expected to grow to \$15 million by 2020.²⁷ India is one of the fastest growing start-up bases worldwide and stands third in technology driven product start-ups, after the US and the UK. A 2015 industry report by NASSCOM finds that the boom in the start-up ecosystem has generated employment for around 80,000 to 85,000 people in total. The majority of new start-ups are B2C (Business to Consumer businesses), primarily concentrated across three segments - eCommerce, consumer services and aggregators, followed by hyper-local, health-tech, edu-tech and analytics.²⁸

By some estimates, India currently has a shortfall of 1 million anesthesiologists, 2 million primary school teachers, 1.5 million policemen, and 5000 judges.²⁹ Millions of livelihoods could be generated in the care economy - from child raising to education, from sick to elderly care, from providing security to generating knowledge.³⁰ These care economy needs are not obviated by the growth of the digital economy; on the contrary, the importance of the care economy increases as it presents an opportunity for livelihood creation, along with societal development. Emerging technologies should be leveraged for advances in the care economy.

25 KPMG (2016). Impact of E-commerce on Employment in India, KPMG.
26 Manyika, J., Marc Singer and Olivia White (2016). How digital finance could boost growth in emerging economies, McKinsey Global Institute.
27 NASSCOM (2016). Indian IOT Market set to grow upto USD 15 billion by 2020, NASSCOM.
28 NASSCOM (2015). Start-Up India: Momentum Rise of the Indian Start-up Ecosystem, NASSCOM.
29 Bali, V. a. A. K. (2017). Unless Carefully considered, Universal Basic Income could have disastrous consequences. The Wire.
30 Saxer, M. (2017). The Human Economy, Friedrich Ebert Stiftung.



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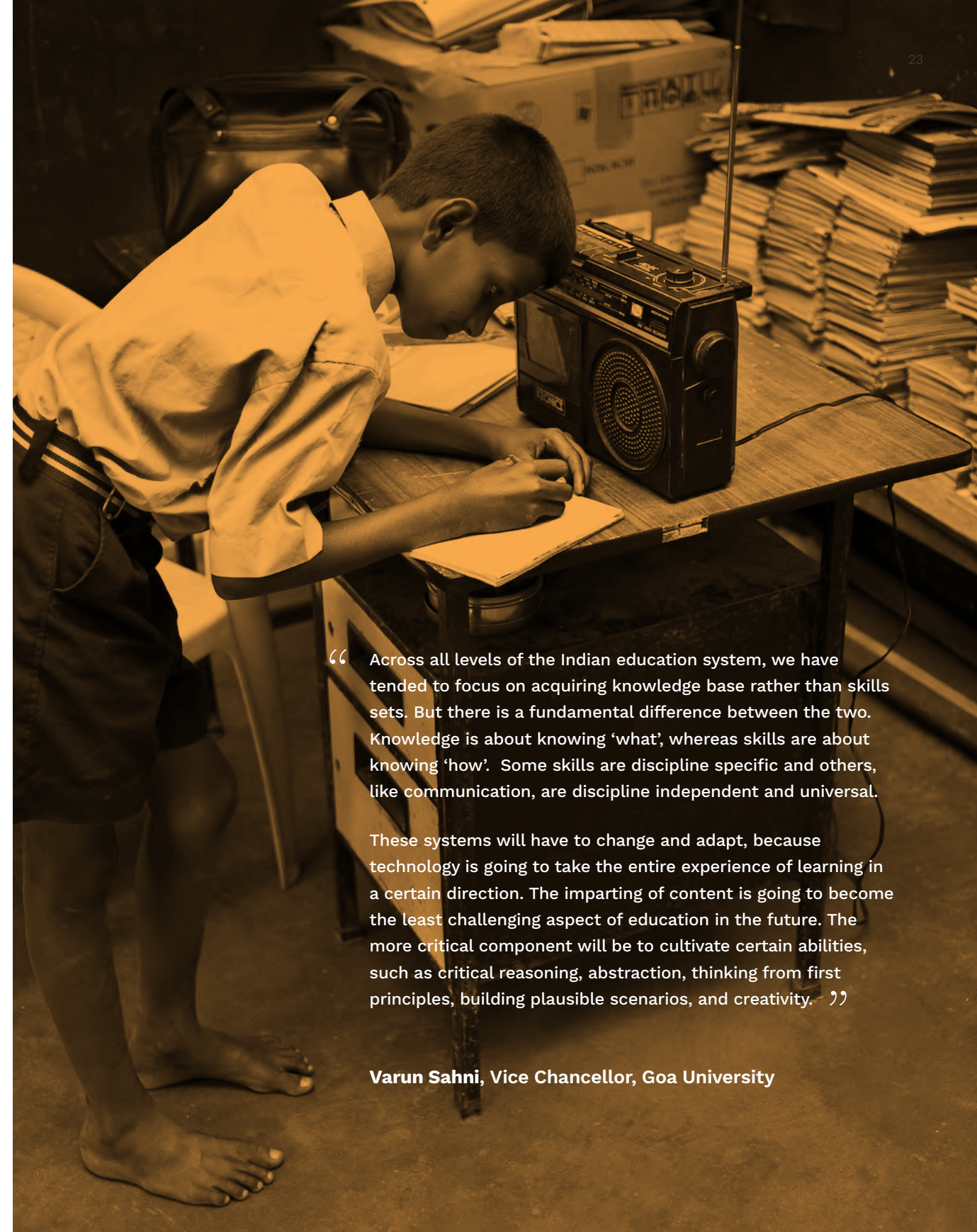
03

Skills for Future Jobs

The disruptive and creative effects of technological transformation on the future of work and skilling in India will be gradual. The lag between technological deployment and technological adoption will leave ample windows for skilling initiatives. Even as routine and manual jobs will be displaced at faster rates, new jobs will also be created that will depend on complementary human skills and machine capacities. The jobs least likely to be substituted are ones that involve managing and assisting people, where expertise is applied to decision-making, planning, or creative work, or interacting with customers, suppliers, and other stakeholders.

Basic foundational knowledge combined with meta-skills for problem solving will become even more important, precisely because they provide the foundation for life-long learning and learnability. Equally necessary will be humanistic, communication, and creativity skills. These will provide the complementarity required by a technology enabled service sector. Digital skills will be a core foundational skill, though the level of mastery and associated skill set will vary across job families and tasks. Basic digital literacy however will

soon not be enough – digital fluency, particularly to enable self-learning will be critical. Digital mastery will be a pre-requisite for data science - an increasingly important skill as data becomes central to most businesses across the globe. The level of mastery could vary, from data interpretation and data visualization, to advanced machine learning and cognitive computing. A future skilling strategy should look beyond the technical skills required for specific job profiles, and instead seek to cultivate a set of core skills that can help chart meaningful and sustainable careers. The future of work will reflect a complex and often unpredictable interplay of numerous socio-economic and political factors. Core skills will help build resilience and adaptive capacity to future disruptions.



“ Across all levels of the Indian education system, we have tended to focus on acquiring knowledge base rather than skills sets. But there is a fundamental difference between the two. Knowledge is about knowing ‘what’, whereas skills are about knowing ‘how’. Some skills are discipline specific and others, like communication, are discipline independent and universal.

These systems will have to change and adapt, because technology is going to take the entire experience of learning in a certain direction. The imparting of content is going to become the least challenging aspect of education in the future. The more critical component will be to cultivate certain abilities, such as critical reasoning, abstraction, thinking from first principles, building plausible scenarios, and creativity. ”

Varun Sahni, Vice Chancellor, Goa University

1

Foundational knowledge and Meta Skills will continue to be relevant, particularly to facilitate Learnability

Foundational knowledge and meta-skills are critical competencies required for meaningful economic participation. Foundational knowledge is traditionally understood as forming the basis of all learning, comprising of core subject knowledge (sciences, language, history, geography etc.), cross-disciplinary knowledge, and language skills. Rapid technological advancement will not obviate the need for these core competencies, even while the content, pedagogy and delivery mechanisms are likely to transform with digital ICT technologies and big data analytics. Rather, fluency with foundational ideas and concepts will be necessary for both advanced analytical skills and technical knowledge. However, the scope of foundational knowledge must be expanded to include digital literacy, to be both employable and facilitate self-learning. Core subjects of mathematics, statistics, and logical reasoning are also likely to become more prominent alongside growth in artificial intelligence, Internet of Things, and other data driven industries. Language skills will continue to be critical - English language skills will be important not only as demand around communication and ICT rises, but also as a means to access self-learning platforms.

The automation of routine and manual tasks alongside the creation of new job and career possibilities around organization and analysis of data will make meta-skills for analytical reasoning, creative problem solving, abstraction, and critical thinking even more important. The rapid explosion of ICT has made information easier and cheaper to access; the processes of synthesis, analysis, and application will consequently become both more demanding and necessary.

31 **WEF (2016).** The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. Global Challenge Insight Report, World Economic Forum.

32 **Accenture (2017).** New Skills Now: Inclusion in the Digital Economy, Accenture.

33 **WEF (2016).** The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. Global Challenge Insight Report, World Economic Forum.



A recent survey by the World Economic Forum estimates that 50% of subject knowledge acquired in the initial years of any technical degree will be out-dated by the time the student graduates.

Rapid technological change can quickly make existing knowledge and skill sets redundant. A recent survey by the World Economic Forum estimates that about 50% of subject knowledge acquired in the initial years of any technical degrees will be out-dated by the time the student graduates.³¹ Another recent study postulates that 65% of children starting school today will hold jobs that do not exist yet.³² Learnability will thus be one of the most essential employability skills in the near future.³³ Learnability refers to the desirability and capability to develop new skills that are in demand, in order to meet the needs of a changing employability marketplace. The importance of learnability as a skill is likely to increase alongside the pace of technological disruption.

Learnability will be one of the most essential employability skills in the near future.

Communication must be defined broadly, to include all forms of verbal and non-verbal communication – from articulation, writing and listening skills to body language and conflict resolution.

2

Humanistic, Communication and Creativity Skills will become more valuable, especially in the service sectors.

There are significant aspects of human labour that cannot be replaced by new technologies. It is these skills that will need to be developed to support complementarity and create higher-value employment opportunities. Such skills can be referred to as humanistic skills, and broadly comprise of soft-skills and non-cognitive skills.

Soft skills are social and personal skills. Social skills refer to collaborating, coordinating and communicating abilities (e.g. interpersonal and teamwork), while personal skills reflect individual character traits (e.g. hard work and professionalism) and emotional intelligence.³⁴ Non-cognitive skills include empathy, relate-ability, cultural sensitivity, ethical judgement, and cooperation along with verbal and non-verbal communication skills. These skills are particularly relevant for the services sector, which relies on 'affective labor' – i.e. work that is intended to produce or modify emotional experiences in people.

“ At an entry level, the focus is on technical, domain specific skills. From the mid to upper levels, equal weightage is given to technical and humanistic skills. As there are multiple rounds in the hiring process, different levels focus on a range of skill sets across quantitative and social dimensions. At the executive leadership level, there is a great deal of emphasis on soft skills and communication skills, alongside the standard requirements of experience and organisational capacities. ”

Kiranmai Pendyala
Corporate VP & COO – AMD R&D

34 Kurekova, L. a. M. B. a. H. C. (2012). "Qualifications or Soft Skills " Neujobs Working Paper.

Technologists increasingly recognize the need for creative story-telling skills as complementary to advanced programming skills, to enable AI systems to match the fluency of human interaction.



Beyond the service sectors, non-cognitive skills play a key role in all work environments. While leadership abilities, including the organisation and management of all factors of production, are essential to every successful business/institution, employees at all levels require humanistic skills on a daily basis. Employers demand strong character traits (personal skills) such as professionalism, self-motivation, hard work, and ethical judgement, accompanied by social skills for teamwork, healthy peer relations in the workspace, collaboration and cooperation.

Communication and creative skills will also be crucial across sectors, and are closely intertwined with humanistic skills, such as emphatic listening, situational understanding, and story-telling. Employers continue to identify communication as one of the basic competencies across job profiles. Communication must be defined broadly, to include all forms of verbal and non-verbal communication from articulation, writing and listening skills to body language and conflict resolution. Individuals need keen discerning abilities to judge specific situations and respond accordingly.³⁵ Machine learning and artificial intelligent communication systems have advanced rapidly, but are yet to match the reflexivity of human communication.

Creative traits are perhaps the most complex, ranging from creative problem solving, lateral and abstract thinking, to storytelling. These are built on effective communication and humanistic skills, as well as basic technical awareness of the area of work. Creative skills are marked by their transformative nature - whether it is problem solving through lateral thinking or storytelling, the emphasis lies on new and imaginative approaches. Technologists are in fact increasingly recognizing the need for creative storytelling skills as complementary to advanced programming skills, to enable AI systems to match the fluency of human interaction.³⁶

³⁵ Morreale, S. a. M. O. a. J. P. (2000). "Why Communication is important: A Rationale for the Centrality of the Study of Communication." Journal of the Association for Communication Administration.

³⁶ Majumdar, D. (2017). The AI secret sauce: Skills sets that will make you ready for the post-AI world. Factor Daily.



Digital Literacy: Levels and Skills

Basic Literacy Ability to access information, conduct basic functions and use basic technical tools.	Generic Use technology for basic professional purposes.
Digital Fluency Analyse, evaluate and process multiple streams of information.	Complementary Reposition existing work using new ICT mediums.
Digital Mastery Create content.	Specialist Program and develop applications, and manage use of new technologies.

Adapted from: Chetty, K. a. U. A. (2017). Bridging the Digital Divide: Skills for the New Age. G20 Insights.

3 Digital Literacy alone will not be enough. Digital Fluency will be crucial.

It is widely accepted that digital literacy is central to socio-economic life in the 21st century. UNESCO defines digital literacy as a set of basic skills required for working with digital media, information processing and retrieval. It also enables participation in social networks for the creation and sharing of knowledge, and supports a wide range of professional computing skills.³⁷ Digital literacy is increasingly a gateway skill for employability. It also enables the learning of other skills and is therefore a catalyst skill.

The definition however remains contested within and between discourses of academia, business and education. Two dominant classifications are along levels of literacy – basic, fluency, and mastery, and the nature of skill required – generic, complementary, and specialist.

Basic digital literacy will increasingly be a core foundational skill. However, the rapid pace of technological development and deployment will make digital fluency crucial for life-long and self-learning. While digital literacy should be introduced at the school level, as part of foundational skills, fluency demands a more rigorous, lifelong engagement with digital tools, platforms and learning itself.

37 UNESCO (2011). Digital Literacy in Education Policy Brief, UNESCO Institute for Information Technologies in Education

An indicative sampling of digital literacy across domains of work

	★ LITERATE Entry level jobs	★★★ FLUENT Intermediate level jobs	★★★★★ MASTERY Expert level jobs
	Routine and Manual Tasks		Non-Routine, Analytical Tasks
Information	Finding and sharing content	Categorization and organization of data; Identifying information gaps	Content creation, critical synthesis and evaluation
Computer	Competency in using basic software and hardware tools	Adopt new technologies to existing processes; Basic trouble-shooting	Use IT tools for advanced research, learning, and application
Media	Access, navigate, and edit text, sound, and video content	Apply basic design principles and organize content for messaging and communication	Mixed media content creation and analysis
Communication	Basic to advanced software tools	Communicate via multi-media platforms	Produce and critically evaluate non-linear texts and three- dimensional worlds online

Adapted from: Chetty, K. a. U. A. (2017). Bridging the Digital Divide: Skills for the New Age. G20 Insights.

At a minimum, entry-level jobs, generally involving routine work, will require a broad set of generic skills related to information and communication technologies. These skills are considered gateway skills, enabling the learner to better grasp entry-level concepts in other subject areas such as Media, Communication and Technology. Complementary skills however will be increasingly important, as they permit workers to reposition and adapt existing tasks and work processes to new digital technologies and changing work requirements. Similar to digital fluency, complementary skills will enable adaptability, and will be necessary for higher-value employment. Depending on the sophistication of the task, intermediate or expert level jobs often require workers to possess ICT specialist skills. ³⁹

Digital Literacy can also be mapped in terms of the specific digital skills required across specific domains of work. A survey of the literature reveals four key sub-domains pertaining to digital skilling - Information, Computer, Media, and Communication literacies. ⁴⁰ The adjacent table provides an indicative sampling of the various types of digital skills, at differing levels of fluency, required across these disciplines. This table is meant to be indicative rather than conclusive – the specific skills required across each discipline are dynamic and evolving.

Alongside the technical components of digital literacy, it is equally important to consider the cognitive and ethical issues that arise with the widespread use of digital technologies. Cognitively, a user is constantly processing content, evaluating, critiquing and synthesising multiple sources of information. Many job tasks will require navigational abilities to identify which information sources are relevant. Concurrently, the user must also be cognizant of what constitutes appropriate use of digital tools. Knowing how to discern what is appropriate while using digital technologies is as important as using the technology itself. Digital spaces are not neutral and the application of human judgement is crucial to tackle issues of plagiarism, consent, data mining and exploitation.

39 Ibid.

40 Covello, S. (2010). A Review of Digital Literacy Instruments. Syracuse University.

Pirzada, K. a. F. K. (2013). "Measuring the relationship between Digital Skills and Employability." European Journal of Business and Management 5(24).

OECD (2016). Skills for a Digital World. Working Party on Measurement and Analysis of the Digital Economy, OECD.

4

Data Science skills will be critical for seizing digital economy opportunities

Advanced computing, big data and machine learning has led to the creation of data science as a new field of work. Data science involves using automated methods to analyse massive amounts of data and to extract knowledge from them. It encompasses a wide range of activities, from data interpretation and data visualization, to advanced machine learning and cognitive computing. It is relevant across sectors; from stretching research boundaries in the humanities and social sciences, to creating new fields within the sciences, to revolutionizing the way businesses and markets run.

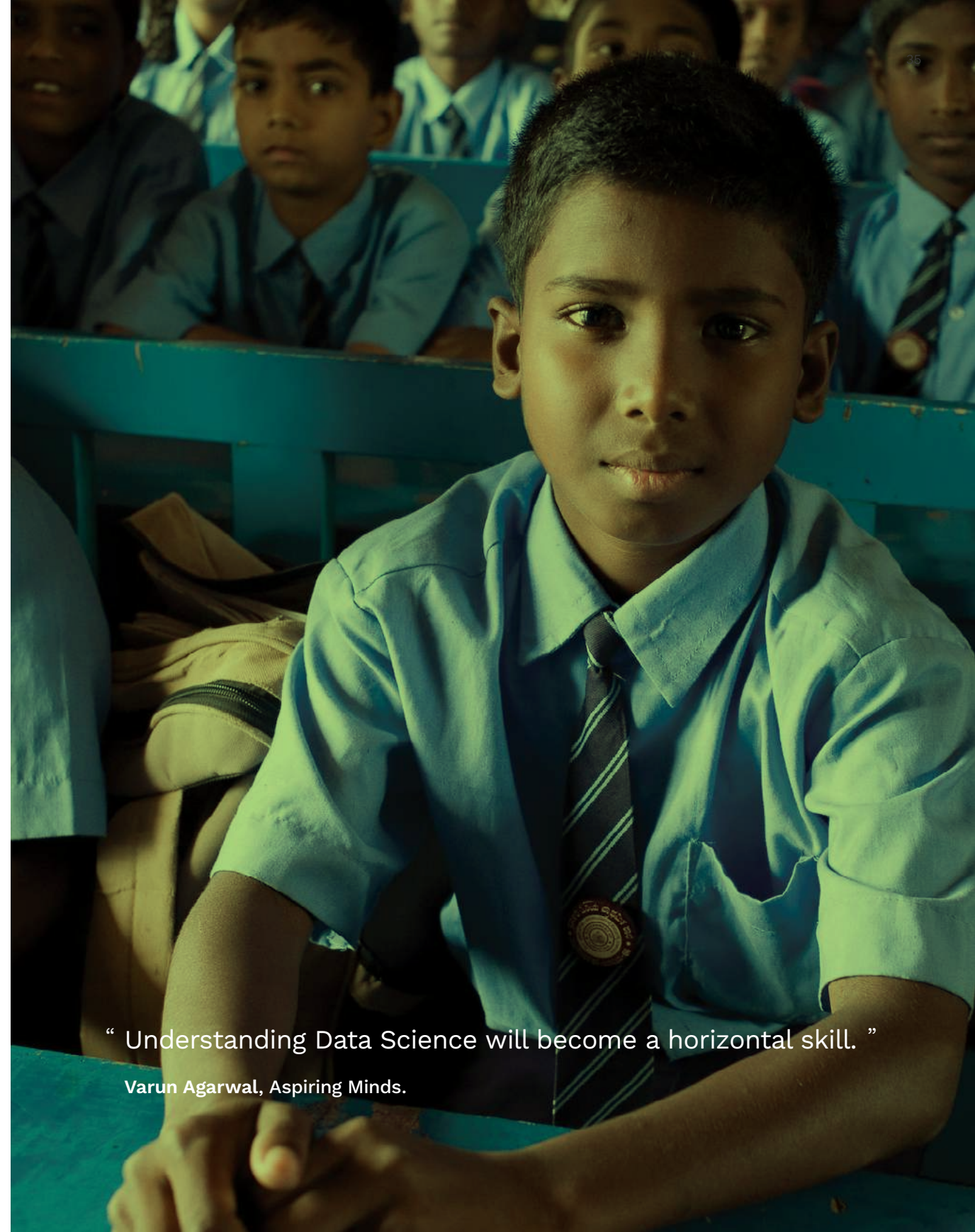
Leveraging data-driven business opportunities will require a range of skills - data engineering skills to develop robust data infrastructure, data analysis skills to extract value from data, and business skills to apply new data-driven insights.⁴² Depending on the degree

of complexity, data science requires skills in mathematics, computer science, statistics, and programming skills. Data scientists will increasingly be required to have creative visualization and story-telling skills. Programmers need to be innovative as they analyse, model, and link data into meaningful narratives. Science, technology, engineering and math (STEM) skills are critical for data science, but the capacity to effectively use these skills will be shaped by a broader aptitude for creative problem solving and storytelling.

“ Understanding Data Science will become a horizontal skill. ”

Varun Agarwal, Aspiring Minds.

42 Mateos-Garcia, J., Husain Bakshi and George Windsor (2015). Skills of Datavores: Talent and the Data Revolution, Nesta.



It is necessary to create informal, life-long learning spaces.

5 **The design and delivery of skilling programs must address gender based exclusionary practices.**

The skill set required by women to prepare for the future of work is not different from that required by men. Women predominantly work in back-end and low-skilled jobs, and thus face a high risk of job displacement; conversely, women are also well positioned to leverage new opportunities created through remote working and e-commerce platforms. The difference across genders is in their ability to access and freely use digital technologies. Restrictions on mobility, for example, often result in women losing access to community internet centres and training facilities. In large sections of the country, school drop-out rates for girls increase as they grow older. Informal education and life-long learning spaces will therefore be important to impart digital fluency skills to women. More broadly, this highlights that skilling initiatives to equip women and other social groups with capabilities for future jobs cannot work in isolation; skilling will have to be undertaken alongside broader social policy interventions.

“ Technical competence will no be enough. Critical thinking, teamwork, a spirit of experimentation and problem solving skills are becoming increasingly important. ”

Vinnie Jauhari, Microsoft India

6 **Skilling initiatives should be oriented toward building meaningful careers, rather than specific job profiles.**

Jobs are made up of numerous tasks. The advent of advanced digital and manufacturing technologies will transform the nature of these tasks, continually and often unpredictably. What is needed therefore is a core set of skills that enable young people to effectively adapt and respond to these task transformations; and to build resilience to the technological disruptions to the future of work. These core skills will create capacities for self-driven economic opportunities and aspirations, not all of which will follow linear job trajectories. A careers perspective can be inculcated, using these core skills to chart a longer-term perspective on meaningful and sustainable economic participation.

In the tables below, we identify the key task and skills transformations across three examples,

cutting across the formal and informal sectors - a micro-entrepreneur running a manufacturing business; a salesperson on a shop floor; and a travel agent in a booming tourism sector. In doing so, we highlight the core skills that will be required to successfully adapt to these transformations. As the tables below illustrate, digital fluency combined with communication skills and creativity are core competencies across varied task transformations.

“ The top four skills for a young person entering the BPO sector are: the ability to learn and learning agility; collaboration and confidence; technological affinity; and domain specific skills. ”

Amit Aggarwal, Genpact

Indicative snapshot
of select task and
skill transformations

Occupation
Micro-entrepreneur

TASK TRANSFORMATION

- Direct B2C transactions through e-commerce platforms.
- Supply side management through aggregator platforms.
- Additive Manufacturing through 3D printing technologies.
- Digital Marketing

CORE SKILL COMPETENCIES

- Digital Fluency
Foundational Knowledge.
- Digital Fluency
Foundational Knowledge.
- Digital Mastery
Foundational Knowledge.
- Creative Skills
Digital Fluency.

Occupation
Salesperson (retail)

TASK TRANSFORMATION

- Personalized interaction with customers based on past preferences and purchases.
- Support digital kiosks for product information through persuasion and storytelling.
- Troubleshooting basic failures in automated billing systems.

CORE SKILL COMPETENCIES

- Communication Skills
Data Science (Basic)
- Humanistic and Communication Skills.
Digital Literacy.
- Meta-Skills
Digital Fluency

Occupation
Travel Agent

TASK TRANSFORMATION

- Provide clients a customer friendly alternative to direct online booking.
- Track customer preferences and market dynamics to offer personalized service.
- Forecast and Communicate travel trends

CORE SKILL COMPETENCIES

- Digital Fluency
Humanistic Skills
- Data Science (Basic)
Communication Skills
- Data Science (Basic to Advanced)
Communication + Creative Skills

04

Call to Action

Young people entering the digital economy over the next five to ten years will need to equip themselves for a rapidly changing and uncertain future of work, a future that will both hold new opportunities and challenges. Quest Alliance will need to progressively align its learning and training efforts, programming and institutional processes to the dynamic future of work. For QUEST, whose target population is youth that have dropped-out of school and youth who have finished school but not continued on to college, programs need to prioritize: digital fluency; core cross-cutting skills; and learnability.

1

Digital Fluency will increasingly become a gateway skill and a catalyst skill for most jobs. It is already recognized as being a central component of foundational knowledge. Even more importantly perhaps, it will be an indispensable skill to promote self-learning and life-long learning. In the longer run, QUEST should aim to create a system of

certification for Digital Fluency that is well recognized by potential employers in industry. Digital fluency is also the first step towards developing data science skills. Understanding and communicating data analytics will become increasingly important across industries, and will increasingly become a requirement across multiple domains. Advanced data science skills for machine learning and cognitive computing will enable access to new avenues for value creation and career acceleration.





2

Domain specific, technical and vocational training will undoubtedly be important, but only if accompanied by a set of core skills. Workers in the digital economy will need to: process vast amounts of information; think systematically and critically; be effective and responsive communicators; demonstrate empathy and relatability; be creative and emphatic; navigate choices and make complex decisions. These core cross-cutting skills not only create the complementarity necessary for increasing human-machine interaction, but also facilitate adaptive-ness and resilience to a changing future of work. STEM subjects, for example, will continue to be important, but it is their application and communication that will be increasingly expected. These requirements do not create a demand for new skills but rather increase the importance of some human competencies that have always been valuable.

3

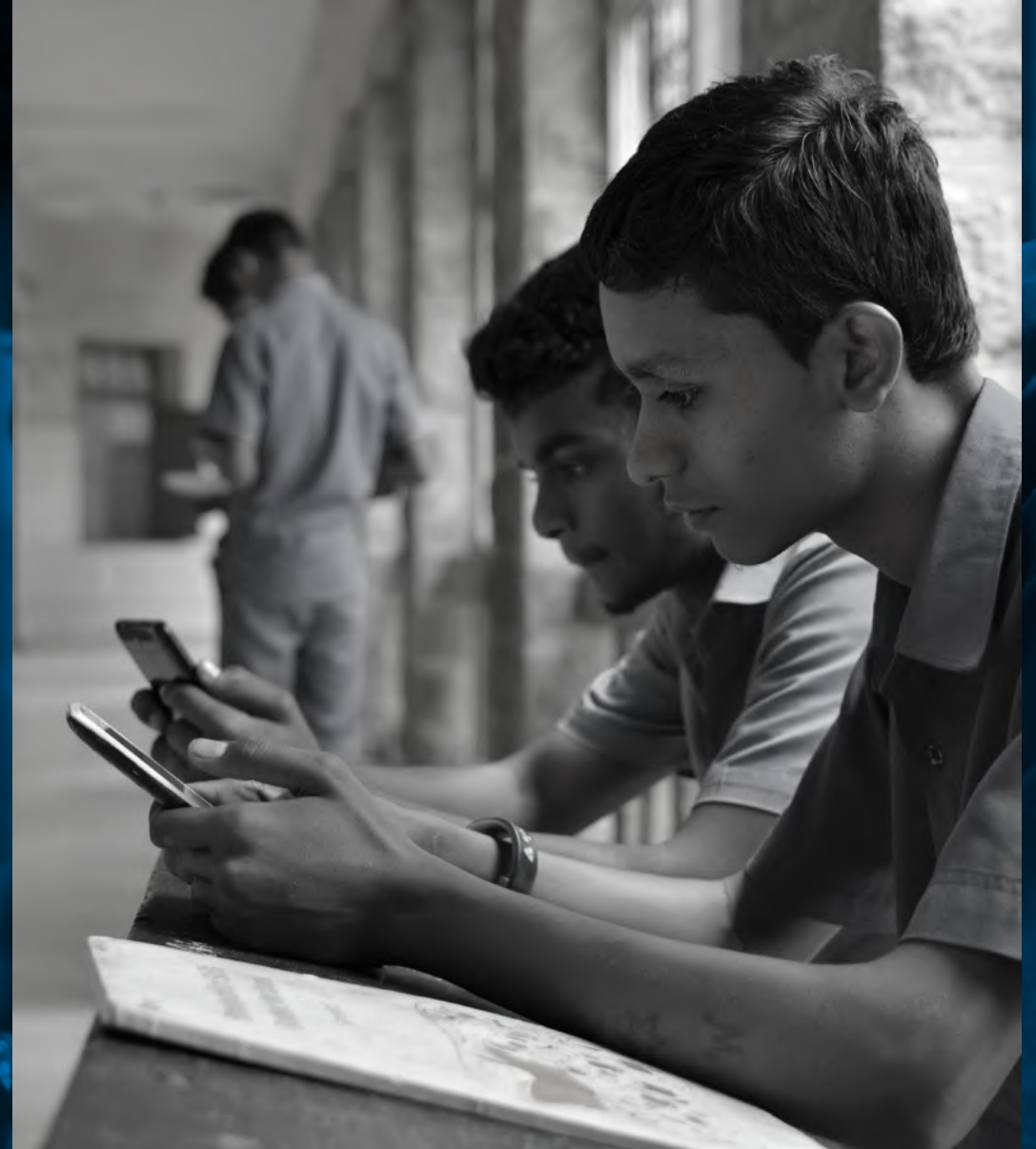
Rapid task transformation across job profiles are likely across jobs and occupations. Young people entering the workforce needs the skills to adapt and effectively respond to these task transformations. Task based technical re-training can be delivered by employers and recruiters, in response to specific industry demands. Skilling initiatives by Quest Alliance should however aim to inculcate learnability as a core skill and an attitude of life-long learning. This is increasingly identified as an essential skill by employers. This will also create the foundation for long-term sustainable and meaningful careers, involving perhaps multiple jobs, rapid task transformations, and entrepreneurial ventures.

4

Quest programs and interventions will need to be designed recognizing exclusionary social practices, particularly towards girls and women. Social hierarchies might get exacerbated because of the digital divide. Modifications will need to be made to existing and future programs to ensure that digital skill and other training is not limited to a particular gender or dominant social group. Digital Fluency will be particularly important for the economic empowerment of girls and women.

5

QUEST will need to develop stronger capacities for horizon scanning and tracking of emerging trends. A Learning Observatory could be established for interactive and dynamic assessment of opportunities, change drivers, and disruptors. QUEST will need to develop new partnerships to support 'real-time' assessment and evaluation of its training programs and field based activities. Feedback loops between research and practice will be needed. This points to the need for a 'whole of system' view of the future of work and learning, enabled by stronger partnerships, outreach and engagement across government, industry and academia.



Quality Education & Skills Training (QUEST) Alliance is a not-for-profit trust that equips young people with 21st century skills by enabling self-learning. Quest designs scalable solutions that enable educators to address critical gaps for quality education and skills training.

<http://www.questalliance.net/>

Tandem Research is a multi-disciplinary research collective generating policy insights at the interface of technology, society, and sustainability. We believe in finding iterative solutions to real world problems through evidence based enquiry and public engagement. This report is part of Tandem Research's program on the Future of Work in India.

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