

A Gendered Future of Work

Perspectives from the Indian Labour Force

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Abstract

This paper will contextualise the narrative around Industry 4.0 and the future of work with reference to the female labour force in India. It begins by detailing the structure and composition of female labour force participation (FLPR) in the country, with specific reference to the theory of the 'U-shaped curve' depicting the relationship between FLPR and economic growth in developing economies. It will go over the demographic and industry-wise distribution of the female labour force, as well as some of the contextual reasons behind the declining rate of participation, such as the income effect and cultural barriers to access and inclusion. The paper will focus on two sectors, IT-BPO and electronics manufacturing, for contextualising labour relations and task content for the female workforce, as also the potential impact of technological adoption. It will go over global projections for skill-biased technological change in the female workforce through Industry 4.0 globally, focusing on automation and platformisation. Finally it gives some policy recommendations to better equip industry and government bodies in dealing with the short and long term impact of technological disruption.

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Introduction

The question on the future of work across the high-income, and some middle and low income, economies, has recently been raised with regards to technological disruption in ‘Industry 4.0.’¹ Industry 4.0 has been defined as the deployment of cyber-physical systems across economic sectors, with one of the consequences being the automation of tasks previously being performed using human labour; what separates Industry 4.0 from previous ‘revolutions’ is the impact it portends to have on cognitive tasks.² Automation is predicted to have an effect on two types of areas: the “structure of employment”, which includes occupational categorisations and nature of tasks, and “forms of work”, including interpersonal relationships and organisation of work.³ Thus, while the task content of occupations could be affected by technological disruption and augmenting or automating technologies, the organisation of work relations could become flexible and atypical.⁴

Building from historical evidence, the diffusion of automation technologies can be anticipated to take place differently across economic contexts with middle and low income economies expected to be incomplete and under-utilising adopters of technology. Moreover, an occupational analysis projects occupations in developing economic contexts to be at a significantly higher risk of being automated than those in developed economic contexts.⁵ However, these concerns are somewhat offset by the barriers to technological adoption that exists in developing countries such as lower wages, and a relatively higher share of routine non-manual jobs.⁶ With high-income countries typically being early and quicker adopters of automation technologies, the differential technology levels across countries have been in fact been utilised to understand global inequality.⁷ Consequently,

¹ World Economic Forum, 2018. ‘The Next Economic Growth Engine: Scaling Fourth Industrial Revolution Technologies in Production’, http://www3.weforum.org/docs/WEF_Technology_and_Innovation_The_Next_Economic_Growth_Engine.pdf

² *ibid.*

³ A. Piasna, J. Drahokoupil, 2017. ‘Gender inequalities in the new world of work’, *Transfer: European Review of Labour and Research*, Vol. 23, Issue 3, pp. 313–332.

⁴ Organisation for Economic Cooperation and Development, 2017. ‘Future of Work and Skills’, *Paper presented at the 2nd Meeting of the G20 Employment Working Group*.

⁵ World Trade Organisation, 2017. ‘Section C, The Impact of technology on labour market outcomes’, *World Trade Report*, https://www.wto.org/english/res_e/booksp_e/wtr17-3_e.pdf

⁶ *ibid.*

⁷ M. Rosenzweig & A. Foster, 2010. ‘Microeconomics of Technology Adoption’, *Yale University Economic Growth Centre Discussion Paper No. 984*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1540038

the labour-cost advantage that middle and low income countries enjoy may be eroded leading to what may be understood as re-shoring/back shoring - a reversal of offshoring.⁸ This may especially be the case in sectoral contexts where middle and low income countries may have failed to capitalise on the labour-cost advantage by evolving supplier networks to complement the assembly activities.⁹

Extensive work over the past three decades has been conducted on the effects of liberalisation and globalisation on employment for the female workforce in the global South, pointing to conditional empowerment and exploitation as females move out of domestic spaces to factories and offices which simultaneously reproduce and challenge patriarchal relations. However, reshoring and technological disruption on employment under Industry 4.0 have yet to be explored to any degree of granularity for this population, which arguably will be one of the first to face its effects.¹⁰ Some of the industries where re-shoring is expected to impact first are slated to be those of textile and apparel and electronics manufacturing,¹¹ which are also industries in middle and low income economies that females are typically overrepresented in.¹²

The need for this analysis becomes exigent in a labour market such as India's, which has been experiencing a decline in female labour force participation (FLPR) steadily over the past two decades. This has been attributed to socioeconomic and cultural reasons, which are explored in some detail below. Interventions in the policy framework to support female participation then need to account for short to long term challenges posed by technological disruption and reshoring. This paper will explore this question through two perspectives: the effect of automation on the female labour force globally, and historical and contemporary analyses of female labour participation in India.¹³ We will take a feminist economics perspective, addressing the social organization and constitution of

⁸ International Labour Organisation, 2017. 'New Automation Technologies and Job Creation and Destruction Dynamics,' *Employment Policy Brief*, https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_553682.pdf

⁹ K. Milington, 2017. 'How changes in technology and automation will affect the labour market in Africa,' *Knowledge, evidence and learning for development*, Helpdesk Report, <http://www.gsdrc.org/wp-content/uploads/2017/10/Impact-of-automation-on-jobs-in-Africa.pdf>

¹⁰ A.Sorgner, E. Bode, & C. Krieger-Boden, 2017. 'The Effects of Digitization on Gender Equality in the G20 Economies,' *Kiel Institute of the World Economy*.

¹¹ See footnote 8

¹² D. Kucera & S. Tejani, 2014. "Feminization, defeminization, and structural change in manufacturing", *World Development*, Vol. 64, pp. 569-582.

¹³ It should be noted that the terms labour force and workforce are being used interchangeably for the purpose of this paper.

'work', and the distribution of power in the workspace.¹⁴ Drawing on the perspective that the current phase of technological disruption does not constitute a "radical break" and must be viewed in the context of historical continuities, historical analyses of effects on female workers will be explored.

Structure of the Indian Female Workforce

India ranked 139 of 142 countries in a study by the World Economic Forum measuring economic participation and opportunity globally.¹⁵ Factors that contribute to determining gendered economic inequality in such indices include: declining FLPR; women's exclusion from "capitalist" employment and growth; concentration of women in informal and tertiary sectors; and increasing socioeconomic inequality between men and women with increasing development.¹⁶ FLPR has been declining in India for over two decades now: it fell from 25.9 in 2011-12¹⁷ to 23.7 percent in 2015-16.¹⁸ Participation varies widely across states, with 71 percent in Nagaland and 20 percent in Uttar Pradesh.¹⁹ This tendency is masked in national statistics, which do not reflect skewness of tasks vis-a-vis gender.

This decline is despite growth in the GDP, lowered fertility rates, and increase in overall literacy rates over the same period - all of which are viewed as drivers of workforce participation.²⁰ In the period following 2007, India has seen declining employment elasticity, a measure of employment growth response to GDP growth, of 0.15 per cent - attributed in large part to the withdrawal of rural women from the workforce.²¹ To put this

¹⁴ While we cover areas that affect sexual minorities, such as gender-based violence online, the discussion will be limited to effects on the female labour force, largely due to lack of data on similar effects on non-binary workers in the workplace.

¹⁵ World Economic Forum, 2017. 'The Global Gender Gap Report', http://www3.weforum.org/docs/WEF_GGGR_2017.pdf, (accessed 10 August 2018).

¹⁶ K. Mammen & C. Paxson, 2000. 'Women's Work and Economic Development', *Journal of Economic Perspectives*, Vol. 14, No. 4, pp. 141-164.

¹⁷ S. S. Bhalla & R. Kaur, 2010. 'Labour Force Participation of Women in India: Some Facts, Some Queries', *Asia Research Centre, Working Paper 40, London School of Economics*, 2010, pp 1-26.

¹⁸ Report on 5th Annual EUS, Labour Bureau

¹⁹ A. Basole et al., 2018. 'State of Working India 2018', *Centre for Sustainable Employment*, Azim Premji University.

²⁰ *ibid.*

²¹ S. Polaski, 2016. 'The Future of Work in India and Beyond', *Indian Journal of Human Development*.

figure into context, the employment elasticity was consistent at around 0.30 per cent for a period of 18 years from 1991 to 2007.²²

36 percent of females of working age are employed in rural India, while urban areas see a participation rate of only 21 percent.²³ 135 of 148 million working women are concentrated in the informal sector²⁴ and within that, in household industries and seasonal and temporary employment.²⁵ Disaggregating this data further shows a stark class divide - upper class females have greater access to regular salaried jobs in the formal sector, whereas lower class females are concentrated in the self-employed or casual labour categories.²⁶ Moreover, job growth has been found to be concentrated in sectors employing males in urban areas, while sectors, especially labour-intensive ones, that historically employ females have seen a gradual decline in job growth.²⁷ Occupational choices for female workers have been constrained in the Indian context by jobless, capital intensive growth,²⁸ and an atypical structural transformation of the Indian economy²⁹ as a consequence of the premature deindustrialisation³⁰ being witnessed.

Moreover, there is a significant gender gap in wages, with an average wage gap of 39.5 percent across industries.³¹ Technological change has historically narrowed the gender wage gap in developed nations, as well as increasingly severing the relation between worker output and overall productivity.³² Factors disrupting this pattern, including limited investment in human capital, weaker state capacity in enforcing regulation on equal

²² S. Polaski, 2015. 'The Current Reality and Future of Work, in India and Beyond', *MOLE-IHD-ILO public lecture*, Deputy Director-General (Policy), International Labour Organisation.

²³ L. Andres, et al., 2017. 'The precarious drop: Reassessing patterns of female labour force participation in India,' World Bank Group, Policy Research Working Paper 8024.

²⁴ Gender and Economic Policy Discussion Forum, 2012. 'Empowering women through skill development - challenges and opportunities'.

²⁵ S. Mehrotra, 2018. 'The Indian Labour Market: A Fallacy, Two Looming Crises and a Tragedy', *Centre for Sustainable Employment Working Paper*.

²⁶ N. Srivastava & R. Srivastava, 2009. 'Women, work, and employment outcomes in rural India -FAO-IFAD-ILO', *Workshop on Gaps, trends and current research in gender dimensions of agricultural and rural employment: differentiated pathways out of poverty*.

²⁷ *ibid*.

²⁸ R. Hasan, D. Mitra, & A. Sundaram, 2013. 'What explains the high capital intensity of Indian manufacturing?', *Indian Growth and Development Review*, 6(2), 212-241.

²⁹ S. Mehrotra & J. Parida, 2016. 'Why is the Labour Force Participation of Women Declining in India?', *World Development* 98, pp 360-380, <https://doi.org/10.1016/j.worlddev.2017.05.003>

³⁰ D. Rodrik, 2015. 'Premature Deindustrialisation', *John F. Kennedy School of Government, Harvard University*, http://drodrik.scholar.harvard.edu/files/dani-rodrik/files/premature_deindustrialization_revised_2.pdf?m=1447439197

³¹ National Sample Survey Office, Ministry of Statistics and Programme Implementation, 2012. 'Report on Second Annual Employment-Unemployment Survey'.

³² S. E. Black, A. Spitz-Oener, 2007. 'Explaining Women's Success: Technological Change and the Skill Content of Women's Work', *National Bureau of Economic Research*.

and/or living wage, and the influence of conservative social norms must be taken into account in the context of emerging economies. This is indicative of the low time-value of female labour, and has been largely attributed to cultural factors that lead to discrimination in workplaces, rather than gaps in productivity. Feminist economists have pointed out that the sexual division of labour in the household and workplace is contingent on this devaluation of the time and labour of female workers.³³ The extent of this devaluation is reflected in the high percentage (62.43%) of invisibilised and unacknowledged females in the working age group primarily involved in unpaid domestic tasks.

FLPR is higher for workers from SC, ST and OBC groups than Hindu females from upper castes, although the share of employment of female workers from higher socioeconomic backgrounds is higher in regular salaried jobs.³⁴ Poor rates of participation among higher caste groups, despite the marginal increase over the years in regular salaried employment, is a result of two factors broadly: historical upper-caste patriarchal cultures that construe income generated by the female as subsidiary to male-generated income, and barriers to employment for females in specific kinds of jobs and tasks.³⁵ Concurrently, FLPR in lower caste households has been found to be driven by distress than choice, and is then concentrated in low paid contractual jobs in the informal sector.³⁶ It should also be noted that these figures are captured by national censuses and surveys, which have been critiqued for being unable to capture and classify female labour accurately, which leads to over and under estimation across categories.

NSS data for the FLPR reveals that as of 2011-12, the distribution of female workers in each sector was: 11% in agriculture, 29% in manufacturing industrial work, 5% in non-manufacturing industrial work, and 55% in services.³⁷ Female workers had thus moved out of agriculture primarily into services, within which a majority were traditionally female dominated industries such as education, retail trade, domestic work, and other services like hair dressing. Occupational segregation in manufacturing, has

³³ J. Parr, 1988. 'Disaggregating the Sexual Division of Labour: A Transatlantic Case Study', *Comparative Studies in Society and History*, Vol. 30, No. 3, pp. 511-533.

³⁴ *ibid.*

³⁵ S. Das, et al., 2015. 'Women Workers in India: Why so Few Among So Many?', *International Monetary Fund*. See also U. Chakravarti, 1993. 'Conceptualizing Brahmanical Patriarchy in Early India - Gender, Caste, Class and State', *Economic and Political Weekly*, Vol. 28, Issue 14, pp. 579-585, for a historical perspective on cultural gender norms attached to higher castes across Hindus and Muslims that associate higher social status to the confinement of females in the home.

³⁶ V. Abraham, 2009. 'Rural Employment Growth in India: Distress Driven?', *Economic and Political Weekly*, Vol XLIV, No. 16.

³⁷ See footnote 31

implied that female workers are employed mainly in apparel, textiles, and tobacco products.³⁸

The shift from agriculture to manufacturing in low income economies is more beneficial for male workers than female workers, at least initially.³⁹ Goldin explains this phenomenon in the following manner: economic development in low income contexts brings about an initial decline in women's labor force participation, arrives at a plateau, and then rises again.⁴⁰ The initial decline has been attributed to a combination of income effect - rising incomes leading to a fall in FLPR as female workers step out of distress driven employment, and education levels rise.⁴¹ The rise after the plateau is attributed to the substitution effect, which indicates that after a certain level of increase in income and educational levels, females tend to get back into employment in manufacturing and services.⁴²

This is reflected the lack of females in employment despite gender parity in secondary and primary education, which has been achieved nationally.⁴³ A number of factors need to be demarcated to understand this further. Parity is a recent development, and does not preclude a 24% literacy gap remaining across age groups, which partly explains the lack of females in employment.⁴⁴ Another factor is the poor quality of schooling has created barriers to employment for the Indian labour force overall, which is further exacerbated for female workers due to the lack of enabling infrastructure in schools such as safe transportation and public toilets.⁴⁵ Other factors include females opting to continue to study post secondary education to access better opportunities through higher education; and constrained employment choices due to social norms and lack of mobility.⁴⁶

Lack of opportunities compounded by jobless growth, mismatch in demand and supply of labour, gendered wage gaps, and poor conditions of work keep female workers out of

³⁸ See footnote 25

³⁹ C. Goldin, 1990. 'The U-shaped female labour force functions in economic development and economic history', *Oxford University Press*.

⁴⁰ *ibid.*

⁴¹ C. Goldin, 2006. 'The quiet revolution that transformed women's employment, education, and family', *American Economic Review*, Vol. 96, Issue 2, pp. 1-21.

⁴² H. Husain, 2016. 'Economic development, women empowerment and U shaped labour force function: Time series evidence for Bangladesh', *Asian Economic and Financial Review*, Vol 2, Issue 12, p. 719-728.

⁴³ See footnote 25

⁴⁴ See footnote 23

⁴⁵ P. Schultz, 1988. 'Education Investment and Returns', *Handbook of Development Economics*, Vol. 1.

⁴⁶ *ibid.*

employment despite being active job seekers.⁴⁷ Mismatch of demand and supply of labour is also indicative of gaps in education and skilling, which have been identified as central to equipping the labour force for dealing with technological disruption and atypical work.⁴⁸ It then becomes relevant to contextualise skilling frameworks for female workers, especially given its relevance to mitigating the impact of technological disruption.

Intersection of Gendered Skilling and Automation

In terms of classification of workers as skilled in the Indian workforce, there exists a significant gender gap, with estimates ranging from 65 to 98 percent.⁴⁹ Skill is a difficult concept to define – leading to contextual and subjective conceptions. Having said that, Beechey’s conceptualisation of skill provides a useful framework to understand skill as one of: (a) an objectively defined competency, (b) control over conception and exception and (c) socially defined occupational status.⁵⁰ In other words, skills are not socially neutral and are both socially defined and constructed, and a socially defined occupational status may be more or less independent of objective competencies.⁵¹

This forms the basis for the creation of skill hierarchies that, in the context of the Indian labour market, are less emblematic of the skill content of the job and instead, more emblematic of biases leading to discrimination basis the type of work being undertaken as well as of the category of person possessing the skill.⁵² To illustrate, skill hierarchies created owing to the type of work is best understood by looking at how urban, industrial and non-manual work is treated as skilled work,⁵³ thus unfairly prejudicing tasks requiring a high degree of skill such as agricultural work. The latter skill hierarchy, in the Indian

⁴⁷ S. Mehrotra et al., 2013. ‘Low Female Employment in a Period of High Growth: Insights from a Primary Survey in Uttar Pradesh & Gujarat’, *Institute of Applied Manpower Research*.

⁴⁸ See footnote 4

⁴⁹ Wheebox, 2018. ‘India Skills Report 2018: Future Skills, Future Jobs,’ <https://wheebox.com/india-skills-report-2018.htm>

⁵⁰ V. Beechey, 1982. ‘The Sexual Division of Labour and the Labour Process: a critical assessment of Braverman,’ in S. Wood (ed.), *The Degradation of Work?: Skill, Deskilling, and the Labour Process*, London: Hutchinson.

⁵¹ S. Wood, 1987. ‘The De-skilling Debate: New Technology and Work Organisation’, *Acta Sociologica*, Vol. 30, No. 1, pp. 3-24.

⁵² R. Srivastava, 2008. ‘Education, Skills and the Emerging Labour Market in India’, *The Indian Journal of Labour Economics*, Vol. 51, No. 4.

⁵³ H. Braverman, 1974. ‘Labour and Monopoly Capital’, *Monthly Review Press*, New York.

context, is most evident in the context of jobs requiring a high degree of skills (such as midwifery) finding a place at the bottom of the skill hierarchy owing to these jobs being traditionally practised by 'lower' castes.⁵⁴ Furthering the argument for the above outlined social construction of skills is its ability to serve as a normative framework for understanding the state of women's jobs.

That skills are not socially neutral is also illustrated by the increasing recognition of the undervaluation of certain skills which women can currently perform at higher productivity levels than men.⁵⁵ It has been further argued that skill hierarchies - categorising jobs as 'women's jobs' and 'men's jobs' are not just reflective of the production system but also an expression of a patriarchal system linking craft identity with masculinity or femininity.⁵⁶ As Wood has succinctly articulated, "Jobs are created as masculine or feminine, with their skill content continually redrawn so as to assert male exclusivity."⁵⁷ For instance, a historical assessment of occupational segregation in the United States indicates that the entry of female workers into specific roles has had a detrimental effect on the social status of that profession - upon entry of female workers, clerical tasks were further divided up into lower paying tasks and managerial level tasks, which were then found to be disproportionately segregated along gender.⁵⁸

This is particularly relevant in understanding what the future of work holds for the female labour force. As Autor argues, technological change could be of two types - skill biased or routine biased change, in both of which low- skilled and/or entry level workers bear the brunt of disruption, by being involved in low skilled and/or routine and hence automable tasks. In their work on the effects of automation on labour in the European Union, Piasna and Drahokoupil find, based on ISCO occupation classification of workers in the EU, that non-manual jobs cohere to Autor's theory of technological change.⁵⁹ In the context of the Indian labour force, this would imply that low skilled jobs such as those in the manufacturing industry would be at greater risk than those in services. This approach, however, can be challenged in the context of low income economies given the availability

⁵⁴ For an in-depth analysis of the social characteristics on the Indian labour force, see NCEUS, 2007, Conditions of Work and Promotion of Livelihood in the Unorganised Sector, National Commission for Enterprises in the Unorganised Sector, Government of India, New Delhi.

⁵⁵ See footnote 29

⁵⁶ C. Cockburn, 1986. 'Women and Technology: Opportunity is Not Enough', in K. Purcell, S. Wood, S. Allen and A. Waton (eds.), *The Changing Nature of Work*, Macmillan, London, pp. 173-87.

⁵⁷ See footnote 51

⁵⁸ J. Morgall & G. Vedel, 1985. 'Office Automation: The Case of Gender and Power', *Economic and Industrial Democracy*, Vol. 6, pp. 93-112.

⁵⁹ D.H. Autor, 2015. 'Why are there still so many jobs? The history and future of workplace automation', *Journal of Economic Perspective*, Vol. 29, Issue 3, pp. 3-30.

of cheap labour and consequent lack of incentive for introducing more expensive technologies. For instance, a key factor in the mechanisation of certain manual tasks during the Green Revolution - an instance of technological disruption, was the easy availability of locally manufactured and cheap technology.⁶⁰

The second theory of job loss through automation is that of “ICT - based polarisation”, which argues that faster growth in ICT will propel a shift from middle-skilled to high-skilled workers, especially in ICT intensive industries, with so-called ‘low-skill workers’ remaining largely unaffected.⁶¹ This is attributed to the nature of tasks, wherein routine cognitive and manual tasks are likelier to be replaced than non-routine cognitive tasks, and non-routine manual tasks remain unaffected. This would mean that routine cognitive tasks such as those dominated by females in the IT-BPO sector would be at a higher risk than non-routine manual tasks in other sectors, such as healthcare, security, and domestic work. Going by the “ICT-based polarisation” theory, the concentration of female workers in the informal sector in India puts them at a lower risk than males in the short term, but will harm female workers in the long-term as higher returns and job growth gets concentrated in jobs with ICT-based tasks.

This will be further exacerbated by the barriers to access digital information, tools, and skills for females,⁶² leading to “Involuntary skills-based exclusion” that hurts sections of the population that are unable to participate in social life using ICTs.⁶³ The gender gap in India in the number of internet users grew from 11% in 2013 to 12% in 2016,⁶⁴ taking the total number of female internet users in India to 29%.⁶⁵ There exists a further 36% gender gap in mobile phone usage.⁶⁶ This is the result of a combination of socio-economic and cultural barriers; educational and literacy gaps, constraining social skills norms, lack of technical skills, and/or confidence levels among female users are major barriers.⁶⁷ There

⁶⁰ M. Prahladachar, 1982. ‘Income Distribution Effects of Green Revolution in India: A Review of Empirical Evidences’, *Economic Development Centre, University of Minnesota*.

⁶¹ G. Michaels et al., 2014. ‘Has ICT polarized skill demand? Evidence from eleven countries over 25 years’, *Review of Economics and Statistics*, Vol. 96, Issue 1, pp. 60-77.

⁶² A. Demirgüç-Kunt et al., 2017. ‘The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution’, *World Bank Group*.

⁶³ P. Walton, et al., 2013. ‘A Digital Inclusion: Empowering all Australians’, *Australian Journal of Telecommunications and the Digital Economy*, Vol. 1, Issue 1, pp. 9.

⁶⁴ International Telecommunication Union, 2016. ‘ICT Facts and Figures’.

⁶⁵ United Nations Children’s Fund, 2017. ‘Children in a Digital World: The State of the World’s Children’, https://www.unicef.org/publications/files/SOWC_2017_ENG_WEB.pdf, (accessed 10 August 2018).

⁶⁶ L. Scott, 2018. ‘From Santiago: Gender Equality and the Fourth Industrial Revolution’, *Double X Economy*.

⁶⁷ Quest Alliance, 2017. ‘Skills for Future Jobs: Technology and the Future of Work in India’.

have also been instances of pushback for female users by dominant upper caste males, citing reasons of moral threat posed to traditional familial structures by females' use of technology that give access to public spaces, either online or offline.⁶⁸ As this demonstrates, social attitudes, lack of mobility, and cultural assumptions have a significant impact on access to opportunities for both digital and financial inclusion for females.

Further, the prevalence of gender-based violence online has been a significant barrier to accessing digital spaces by females, in terms of both, the lack to an equitable and safe space, and resultant self-censorship amongst victims of such violence.⁶⁹ The combination of lack of digital and technical skills, and a hostile environment online, has limited use of online tools and access to information amongst females and sexual minorities. The lack of relevant and contextual content, as well as a further lack of content in Indic languages are also barriers to meaningful use. The implication of this is constrained access to digitally accessible economic opportunities, critical information, and social networks.

The skill-based approach to measuring the effects of automation on the female workforce is even more relevant in the context of a society such as India's, with social norms that rigidly regulate the kinds of tasks performed by females. Following the Green Revolution, for instance, Agostino finds evidence of social norms, as opposed to inadequate skill sets amongst female workers, creating barriers for entry for females into productive jobs - especially those witnessing high growths following technological disruption.⁷⁰ He also identifies social norms as the primary barrier for females to perform profitable tasks within agriculture, such as harvesting and sowing. Social norms further prevent women from taking up blue-collar and manufacturing occupations also play a central role in determining occupational choices, especially in economies undergoing industrialisation.⁷¹

⁶⁸ AFP, 2017. 'Uttar Pradesh Village Bans Women from Using Mobile Phones', *Livemint*.

⁶⁹ IT for Change, 2017. 'Submission on Online Violence Against Women to the Special Rapporteur on Violence Against Women'.

⁷⁰ A. Agostino, 'Technical Change and Gender Wage Inequality: Long-Run Effects of India's Green Revolution', *School of International and Public Affairs, Columbia University*, 2016.

⁷¹ M. Lansky et al., 2017. 'Women, Gender and Work Volume 2: Social Choices and Inequalities', *International Labour Office*.

Gendered Occupational Segregation and the Future of Work

The gendering of skills is closely linked to occupational segregation, at least from evidence that has emerged from advanced industrial countries.⁷² The central claim therein is that general skills are more gender-neutral than firm-specific skills that discriminate against women.⁷³ Deriving from Becker's analysis,⁷⁴ firm-specific skills are those that are acquired through on the job training and valued by the current employer. They consequently lack portability owing to the difficulty of assessment of such skills by outside employers. General skills, on the other hand, are effective in their portability as they are certified in an objectively recognizable form (such as diplomas) for outside employers. The underlying rationale is that not only are skill categorisations gendered and segmented, but their acquisition is too. This segmentation, it is argued, has been evidenced in the context of technological change, both in India and elsewhere, with regards to the acquisition of mechanical skills being treated as the domain of women.⁷⁵ Similarly, it is argued by those focusing on differences in school systems that vocational high schools (at least in the advanced industrial economies) promote acquisition of skills that further "gender-typed" occupational choices.⁷⁶

There are several theories that seek to explain gendered occupational segregation, each providing unique insights. Explanations by labour economists can be categorised into human capital theory and statistical discrimination theory. Briefly put, human capital theory argues for a causal relation between lower education levels among women owing to lesser investment in women's education and gendered occupational segregation.⁷⁷ The statistical discrimination theory, focusing on modelling employer behaviour, argues that

⁷² M. Estevez-Abe, 2005. 'Gender bias in skills and social policies: The varieties of capitalism perspective on sex segregation', *Social Politics*, Vol. 12, Issue 2, pp. 180–215.

⁷³ *ibid.*

⁷⁴ G. Becker, 1964. 'Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education', *University of Chicago Press*.

⁷⁵ See footnote 47

⁷⁶ See M. Charles, et al., 2001. 'The Context of Women's Market Careers: A Cross-National Study.' *Work and Occupations*, 8:371–396. See also J. Rubery & C. Fagan, 1993. 'Occupational Segregation and Women and Men in European Community', *Social Europe Supplement*, Office for Official Publications of the European Community.

⁷⁷ See footnote 74

recruitment determinations are made relying on the assumptions of the greater likelihood of women quitting their jobs.⁷⁸

Rejecting these economic theories are cultural theories favoured by both sociologists and feminist economists. Instead of the mainstream economics' assumption of assuming economic rationality as the primary basis of sex-based discrimination, they draw attention to cultural norms about gender roles and the process of socialisation⁷⁹ as determinants of discriminatory managerial practices and women's career choices.⁸⁰ The argument here is that horizontal segregation occurs due to gendered stereotyping of jobs while vertical segregation is a result of cultural norms equating authority with masculinity.

Another theoretical approach focuses on institutional barriers to entry, especially laws designed for the promotion of female participation in the workforce. For instance, it is argued that while equal opportunity laws may pave the path for more women entering traditionally male-dominated (high status) occupations, restrictions on night-shifts present a strong barrier to entry in jobs that require work at odd hours.⁸¹

A more contemporary theoretical framework assimilating several facets of the above mentioned theories is a hybrid developed by Charles and Grusky.⁸² Arguing that sex-segregation has several facets, they seek to address issues of horizontal and vertical segregation independently. They go on to identify the two causal factors as gender egalitarianism and post-industrialism. They argue that high levels of gender egalitarianism serve as an antidote to vertical segregation, but it is postindustrialism (i.e. the expansion of the services sector) that further exacerbates the horizontal segregation of women into non-manual job roles. In doing so, and therein lies the uniqueness of the theory, they incorporate both a cultural variable (i.e. the extent of gender egalitarianism) while also accounting for a structural variable (i.e. the size of the services sector). This becomes particularly relevant in anticipating the challenges that will be faced by the Indian economy witnessing a ballooning of its services sector.

⁷⁸ D. Aigner & G. Cain, 1977. 'Statistical Theories of Discrimination in Labor Markets', *Industrial and Labor Relations Review*, Vol. 30, Issue 2, pp. 175–87. E. Phelps, 1972 'The Statistical Theory of Racism and Sexism', *American Economic Review*, Vol. 62, Issue 4, pp. 659–61.

⁷⁹ R. Milkman, 1986. 'Gender at Work: The Dynamics of Job Segregation by Sex during World War II', *University of Illinois Press*, Urbana.

⁸⁰ M. Conway, et al., 1996. 'Status, Communitarity and Agency: Implications for Stereotypes of Gender and Other Groups', *Journal of Personality and Social Psychology*, Vol. 71, pp. 25–38.

⁸¹ M. Chang, 2000. 'The Evolution of Sex Segregation Regimes.' *American Journal of Sociology*, Vol. 105, pp. 1658–1701.

⁸² See footnote 76

Gendered occupational segregation, both vertical and horizontal, will be key factors in determining the impact of Industry 4.0 on the female labour force. Vertical segregation here is understood to mean the lack of female representation in jobs typically construed as high-status such as managerial roles.⁸³ Horizontal segregation, on the other hand, refers to gendered differentiation found cross-sectorally - for instance, manufacturing and craft jobs see female underrepresentation while service sector jobs employ a relatively higher percentage of female workers than manufacturing.⁸⁴

A 2016 report by the World Economic Forum assesses the future of jobs in nine industries by interviewing senior management of the ten largest global companies in each industry.⁸⁵ The report, with one of the regional focus areas being India, concludes that automation will cause losses in industries that have successfully employed and retained women, such as manufacturing and office administration, and create jobs in STEM-based industries, that have historically been incompetent at retaining female workers. Secretarial work, which contributes heavily to female middle class income in both emerging and developed economies, in particular is poised to be affected by Industry 4.0.⁸⁶ Lack of growth in the short term has been predicted in occupations that typically employ a larger percentage of females, such as secretarial and human resource management in the textile, logistics, retail, and financial services sectors in India.⁸⁷ Occupations in which job growth will be concentrated, including customer relations and sales, have historically witnessed a lower concentration of females in the same sectors.⁸⁸

Men and women globally are predicted to bear the brunt of job loss equally in terms of absolute numbers, which implies a widening gender gap since females will be bearing a disproportionate level of job loss through disruption owing to a pre-existing lower percentage of FLPR.⁸⁹ Unequal vertical distribution of power across the workforce, as discussed in the previous section, has also been traced across industries globally,⁹⁰ implying a centering of decision-making and planning power in the workspace, even as

⁸³ See footnote 72

⁸⁴ *ibid.*

⁸⁵ World Economic Forum, 2016. 'The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution'.

⁸⁶ *ibid.*

⁸⁷ T. Chapman, et al., 2018. 'The Future of Work in India: Inclusion, Growth, and Transformation, an Enterprise Survey', *Observer Research Foundation and World Economic Forum*.

⁸⁸ *ibid.*

⁸⁹ See footnote 85

⁹⁰ M. Kosoff, 2015. 'Women hold just 11% of Executive positions at Silicon Valley Tech Companies,' *Business Insider*.

other, ancillary tasks get decentralised across different work spaces through remote work.

⁹¹ This could imply that different patterns of horizontal and vertical segregation will impact the future of work differently across the globe.⁹²

The Female Workforce and Electronics Manufacturing

We will now look at the electronics manufacturing industry to contextualise the above discussion on the impact of Industry 4.0. We chose to focus on this sector in our study for two reasons: its contribution to the GDP, which stands at 1.2 percent, and the relatively high concentration of females in the workforce within manufacturing industries.⁹³

Globalisation has been associated with providing access to employment opportunities,⁹⁴ increased overall household income and associated freedoms, such as greater decision-making power in the household and spatial mobility, to lower class female workers. However, a majority of such jobs have been characterised as being of poor quality, with low wages and poor working conditions.⁹⁵ Electronics manufacturing was one such industry that blossomed in India in the period of liberalisation, and has been critiqued for substandard working conditions and lack of adherence to any of the conditions laid out under the ILO's "decent work framework" (which includes "opportunity for work, work security, fairness of income, social protection, and freedom of association"⁹⁶).

Occupational distribution in electronics manufacturing is historically heavily skewed in favour of males, with over three times men in occupations at the top of the tier, and over two times in mid-level occupations.⁹⁷ Female workers in the sector are concentrated

⁹¹ J. Kraft & J. Siegenthaler, 1989. 'Office Automation, Gender, and Change: An Analysis of the Management Literature', *Science, Technology & Human Values*, Vol. 14, No. 2, pp. 195-212.

⁹² M. Charles, and D. B. Grusky, 2004. 'Occupational Ghettos: The Worldwide Segregation of Women and Men', *Stanford: Stanford University Press*.

⁹³ See footnote 19

⁹⁴ G. Kelkar, et al., 2002. 'IT industry and Women's Agency: Explorations in Bangalore and Delhi, India', *Gender, Technology and Development*, Vol. 6, Issue 1, p. 63-84.

⁹⁵ T.L. Caraway, 2007. 'Assembling Women: the Feminization of Global Manufacturing', *Cornell University Press*.

⁹⁶ International Labour Organisation, 2013. 'Decent work indicators: Guidelines for producers and users of statistical and legal framework indicators', *ILO Manual*, Second version.

⁹⁷ See footnote 31

largely (44.3%) in “unskilled” or “semi-skilled” jobs and at the entry level.⁹⁸ Top five roles for female workers are blacksmiths and toolmakers, assemblers, precision workers, painters and building cleaners, and manufacturing labourers.⁹⁹ Women are hired in roles with repetitive manual labour, which requires high levels of accuracy, dexterity, and concentration. These are skills female workers are perceived as “biologically” embodying, ignoring the investment by the family in socialisation - or “hidden training” - at the household.¹⁰⁰ The sexual division of labour in the factory can thus be seen as an extension of the household. These skills are implicitly taken into account by managers during the hiring process, but not recognised, accredited, or compensated.¹⁰¹

This also contributes to the undervaluation of such labour, underscoring the ideological and political gendering of skill classification.¹⁰² In fact, in a fieldwork-based study across factories in North India, Chhacchi finds skill level to correlate with neither education nor experience, with workers highly educated and illiterate workers distributed across the spectrum.¹⁰³ Barriers to gaining higher classifications for female workers have been underscored by the concentration of females in low skilled work despite having higher levels of qualifications.

Since the impact of automation on the female labour force is difficult to measure, researchers have attempted to identify the gender gap in the intensity of complex and repetitive tasks and on-the-job learning.¹⁰⁴ A number of tasks pointed out above, including assembly and painting, are being automated across industries, putting females in the low and mid skill level categories at risk of being pushed further down the skill classification, or stagnating at low levels despite years of experience or education. This coheres with historical trends in electronics manufacturing, which indicate that as the valuation of technical skills in fresh entrants increases, extant skills are risk of being downgraded and devalued.¹⁰⁵

⁹⁸ See footnote 31

⁹⁹ M. Shree, 2015. ‘Women in labour market: An analysis of Indian electronics manufacturing industry’, *Indian Journal of Social Science and Organizational Behaviour*, Vol. 4, Issue 1&2.

¹⁰⁰ *ibid.*

¹⁰¹ A. Chhacchi, *Gender, Flexibility, Skill and Industrial Restructuring: The Electronics Industry in India*, Working Paper, Institute of Social Studies, 1999

¹⁰² A. Phillips & B. Taylor, 1980. ‘Sex and Skill: Notes towards a Feminist Economics’, *Feminist Review*, Vol 6, pp. 79-88.

¹⁰³ See footnote 101

¹⁰⁴ See footnote 3

¹⁰⁵ See footnote 101

Electronics manufacturing, like other manufacturing sectors, has had a historical preference towards “fresh green labour,”¹⁰⁶ showing a decline in the participation of married women and increase in single (never married, widows, or deserted) women over the past two decades. This is due to both supply and demand factors resulting from pressure of care duties in married females.¹⁰⁷ In terms of caste, female workers in the electronics manufacturing industry have been found to be largely belonging to lower strata (ST, 46%), while males mostly belong to upper strata (56%).¹⁰⁸ This difference has been ascribed to predominance of migrants in the female workforce, who are forced to take up insecure and lower paying jobs due to poverty and lack of opportunity - or “distress driven” employment,¹⁰⁹ as mentioned above.

This demographic composition is relevant to understand the “ideal workforce” demanded by electronics manufacturing, which has low levels of care burdens (therefore requiring less leave), and willingness to take on contract-based work at low wages. Regimes of constant surveillance and supervision by male managers are posited as constraining the autonomy of workers. Female workers also have very little presence in trade unions, even though it’s been found to be positively related with higher wages and decent work conditions,¹¹⁰ This is particularly relevant for determining the future of work for females, as collective representation has been seen to equate to more bargaining power for them in particular. This is primarily due to undervaluation and vulnerability of female workers causing them to be less likely to bargain for pay on an individual basis than males.¹¹¹

These trends are relevant to contextualise the future of work in electronics manufacturing. While there is very little data from the ground regarding the automation or adoption of ‘Industry 4.0’ technology in the industry, the manufacturing sector as a whole is expected to adopt technologies in specific tasks, such as painting and manual assembly, some of which are dominated by female workers in electronics manufacturing. The discussion above reflects a flexible and underpaid workforce with very little access to collective bargaining, leaving them with lesser tools to effectively deal with precarity and

¹⁰⁶ *ibid.*

¹⁰⁷ I. Mazumdar, N. Neetha, 2011. ‘Gender dimensions: employment trends in India, 1993–94 to 2009–10’, *Economic and Political Weekly*, Vol. 46, No. 43, 2011, pp. 118-126.

¹⁰⁸ See footnote 31

¹⁰⁹ B. Mehta, M. Shree, 2017. ‘Women’s Employment in Modern Indian Industry’, *Indian Journal of Labour Economics*.

¹¹⁰ *ibid.*

¹¹¹ P. Custers, 2012. ‘Women, Labour and Capital Accumulation in Asia’, *2nd edition, Monthly Review Press*, New York.

technological disruption in the short or long term. The following discussion will contextualise these trends in the platform economy, as a growing portion of the services sector in the country.

Precarity in the Gig economy: the Female Workforce in India

Online digital labour platforms have been identified as a potential avenue for increasing female participation, given the opportunities afforded to females through flexible work.¹¹² As an economy undergoing structural change from agriculture to services, platform-based growth has been touted as providing immense potential for employment in the services.¹¹³ The narrative around easing female participation through remote and platform-based work focuses on the economic inclusion of females by enabling greater flexibility to balance care duties with paid work and reducing reliance on physical space and presence, as well as enabling workers to pick their own hours and tasks.¹¹⁴ Additionally, providing flexibility to both male and female workers has also been posited as potentially re-balancing the domestic burden more equitably.¹¹⁵

Potential for remote work and hiring processes to anonymise worker profiles and thereby reducing gender-based biases in hiring has also been identified.¹¹⁶ In terms of intersectional inclusion, analysis by Sundararajan and Fraiberger suggests that in the platform economy “surplus gains enjoyed by below-median income consumers are significantly higher than those enjoyed by above-median income consumers.”¹¹⁷ They conclude that this is a result of fairly liquid peer-to-peer rental marketplaces facilitating

¹¹² R. Kathuria et al., 2017. ‘Future of Work in a Digital Era: The Potential and Challenges for Online Freelancing and Microwork in India’, *Indian Council for Research on International Economic Relations*.

¹¹³ *ibid.*

¹¹⁴ U. Aneja & V. Mishra, 2017. ‘Digital India is no country for women. Here’s why’, *Observer Research Foundation*.

¹¹⁵ A. Barzilay, A. Ben-David, 2017. ‘Platform Inequality: Gender in the Gig Economy’, *Seton Hall Law Review*.

¹¹⁶ *ibid.*

¹¹⁷ S. Fraiberger & A. Sundararajan, 2015. ‘Peer-to-peer rental markets in the sharing economy’, *NYU Stern School of Business Research Paper*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2574337, (accessed 12 August 2018).

participation on the supply side by below median consumers, owing to their greater propensity towards avoiding the fixed costs associated with ownership of assets.¹¹⁸

However, the platform economy has been critiqued for creating hybrid models of employment relations, with some aspects of formality, such as greater employer control, and some aspects of informality, such as lack of job security and benefits. This implies a lack of investment in the labourer by the employer, including benefits such as those covering death, illness, maternity, etc., as well as protection against discrimination. Scaling and institutionalization of contractual labour in the gig economy has been seen by workers' movements and trade unions as a set back to progress in providing social security and decent work.¹¹⁹ Similarly, unregulated competition amongst workers has been critiqued for lowering wages and putting employers at a distinct advantage. Gendered wage gaps have been documented across platforms, with females earning lower than men for performing the same tasks.¹²⁰ Conversely, female employers are quoted higher wages by both male and female workers for the same tasks.¹²¹ A number of platforms, especially those designed for manual tasks, have been critiqued for allowing customers to select workers based on their personal characteristics rather than work experience. In the absence of anonymisation, there is clear evidence that platforms are at risk of retrenching or even enhancing existing biases in employment and task distribution.

Specifically with reference to the distribution of labour, platformization has been critiqued for the potential to retrench disproportional care burdens on females and increase vulnerability by scaling flexible work, instead of making structural changes to the distribution of labour.¹²² Flexible work and the possibility of combining paid and unpaid work could provide opportunities for women in care, but could also lead to the deterioration of their working conditions and increase in hours, given the requirement of constant availability to both duties of care and paid work. Disproportional domestic burdens on female workers indicate the increased importance of looking at living conditions and gender relations in the living space to assess the same in the working space, particularly as boundaries between the two erode further.

¹¹⁸ *ibid.*

¹¹⁹ *ibid.*

¹²⁰ C. Cook et al., 2018. 'The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers', NBER Working Paper No. 24732, *Law and Economics*.

¹²¹ H. Galperin, 2018. 'The gig economy may strengthen the "invisible advantage" men have at work', *Quartz at Work*.

¹²² N. Doorn, 2017. 'Platform labor: on the gendered and racialized exploitation of low-income service work in the 'on-demand' economy', *Journal of Information, Communication and Society*.

Females across the global North and South have been found to be undertaking part-time flexible work to accommodate disproportionate care duties, leading to increasing precarity.¹²³ These trends could have significant effects in an Indian context, given that one of the primary reasons for low FLPR is the disproportionate burden of domestic duties on females - which is the largest within all countries for which data can be accessed.¹²⁴ Moreover, as discussed above, there are significant gender gaps in literacy,¹²⁵ internet usage,¹²⁶ mobile phone ownership,¹²⁷ and bank account ownership¹²⁸ - some of prerequisites of effective participation in the platform economy. Emblematic of these structural impediments is the case of ride-hailing platforms in India which despite a burgeoning increase in ride-hailing passengers has seen negligible female participation as drivers with only 8 women drivers currently active on the Uber platform.¹²⁹

The following section will discuss policy measures aiming to address some of these concerns, with the aim of optimizing FLPR while also providing decent working conditions in current and emerging forms of employment.

Policy Recommendations

Based on specific opportunities and challenges in the Indian context, as outlined above, the following policy measures have been recommended for various stakeholders, including government, industry, and academia:

¹²³ G. Ferrant et al., 2014. 'Unpaid Care Work: The missing link in the analysis of gender gaps in labour outcomes', *OECD Development Centre*.

¹²⁴ S. Das, et al., 2015. 'Women Workers in India: Why so Few Among So Many?', *International Monetary Fund*.

¹²⁵ Office of the Registrar General & Census Commissioner, 2011. 'Literacy And Level of Education, India,' http://censusindia.gov.in/Census And You/literacy_and_level_of_education.aspx, (accessed 10 August 2018).

¹²⁶ See footnote 65.

¹²⁷ GSMA, 2018. 'Connected Women - The Mobile Gender Gap Report 2018', https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/04/GSMA_The_Mobile_Gender_Gap_Report_2018_32pp_WEBv7.pdf, (accessed 10 August 2018).

¹²⁸ World Bank Group, 2017. 'The Global Findex Database 2017 - Measuring Financial Inclusion and the Fintech Revolution'.

¹²⁹ Driving Toward Equality: Women, Ride-Hailing and the Sharing Economy, World Bank Group, https://www.ifc.org/wps/wcm/connect/ec101088-8a12-4994-9918-14455b8e2cd9/00418+IFC+DTE+R_eport_Complete_Layout+Final2-pxp.pdf?MOD=AJPERES, (accessed 10 August 2018).

- Aneja and Mishra argue that technology-focused reskilling, such as teaching female workers to use PayTM, could bring financial autonomy in the short run, but could retrench the cultural division between public and private spaces for females in India.¹³⁰ The inadequacy of existing skilling measures in bringing females into employment has also been documented.¹³¹ Skilling curricula needs to integrate technological, entrepreneurial, and basic skills to offset the long-term inadequacy of purely technological reskilling.
- Skilling centres developed through public and private sector collaboration between the National Skills Development Centre and Quality Council of India, which have increased manifold over the past few years, have been critiqued for lack of standards for curricula, practical training sessions, and trainer qualifications.¹³² Policies to make the system more efficient include creating a national-level board for vocational training, reskilling Industrial Training Institute trainers, improving the student-trainer ratio, and creating a stake for employers, than independent private bodies, in state-led vocational training.¹³³ Locating skilling initiatives close to industry clusters, and designing state-specific initiatives, to ease transition into employment has also been recommended.¹³⁴
- Female-only colleges with STEM courses and vocational and technical training, close to hubs in tier 2 and 3 cities and towns which are a hub for employment can be useful for easing barriers to entry, including mobility and safety. Further, curricula in STEM courses could be made more interdisciplinary, as well as improve gender biases. Peer-to-peer networks and apprenticeships could be promoted for females in STEM.¹³⁵
- Social welfare systems tied to regular, long-term employment penalize female workers given their tendency to drop out of employment.¹³⁶ There is a need for

¹³⁰ See footnote 114

¹³¹ A. Sengupta & T. Chapman, 2018. 'India needs innovative ways of skilling and educating'. *Observer Research Foundation*.

¹³² S. Mehrotra & A. Pratap, 2018. 'Rebooting the system for a skills upgrade', *The Hindu*.

¹³³ *ibid.*

¹³⁴ *ibid.*

¹³⁵ Organisation for Economic Cooperation and Development, 2017. 'Policy brief on the future of work - Going digital: The future of work for women', *OECD Publishing*.

¹³⁶ S. Kushi, I. McManus, 2017. 'Social policies don't always help men and women equally. Which ones work best?', *The Washington Post*, https://www.washingtonpost.com/news/monkey-cage/wp/2017/01/10/social-policies-dont-always-help-women-and-men-equally-we-did-the-math-on-which-work-best/?noredirect=on&utm_term=.83d2fd3baa57, (accessed 12 August 2018).

contextually appropriate social security measures with impact assessments on different social groups being affected, and devising measures accounting for female workers in contractual or temporary forms of employment. For instance, the recent Maternity (Amendment) Bill 2017 increased the leave provided to 26 weeks from 12 weeks. While it is expected to lead to greater short-term unemployment as companies get further disincentivized from hiring females, especially SMEs and startups, this is predicted to be offset by the long term positive impact on both participation and retention.¹³⁷

- Given the centrality of disproportional care duties in keeping women out of paid employment in India and globally, affordable child care could go a long way in increasing female labour force participation and retention. For instance, the anganwadi system in rural India has been quite successful in some states, including Andhra Pradesh and Himachal Pradesh,¹³⁸ in providing essential health and education services to children in between the ages of 3 and 6.
- GBV continues to be entrenched in workplaces, especially in those industries in which the representation of females in top management and decision-making roles is low. The ILO recommends a focus on policies to prevent sexual harassment and discrimination at work, and institution of accessible redressal mechanisms at work to improve participation by females and other minorities.¹³⁹ While the trauma of online violence has been recognized by feminist actors in India, there exists no specific legislation to address GBV online - legislation thus needs a greater push by civil society organizations and feminist movements.
- Measures to increase collective bargaining, which results in increased bargaining power held by females in both living and work spaces, have been shown to have a proportional effect on labour force participation. Self-help groups (SHG) geared towards financial inclusion have proved the impact of greater bargaining power on mobility.¹⁴⁰ Policy pushes to empower collective platforms such as unions and SHGs driven by female workers would be instrumental in creating frameworks of agency and mobility.

¹³⁷ *ibid.*

¹³⁸ J. Dreze, 2017. *'Sense and Solidarity: Jholawala Economics for Everyone'*, Permanent Black.

¹³⁹ See Women and the Future of Work: Beijing +20 and Beyond, *International Labour Organisation*, 2015.

¹⁴⁰ P. Dasgupta, 2016. 'Essays on Intra Household Bargaining Power of Women in India', *Virginia Polytechnic Institute and State University*.

Conclusion

Existing literature has reiterated the difficulty of measuring the gender ratio of the risk of automation. Apart from looking at demographic shifts within the workforce, studies on automation have attempted to identify patterns in the distribution of risk. Research on the Indian workforce has delineated salient social categories, such as education, class, caste, and religion, that were found to be significant in various cross-sections. Worker characteristics such as marital status and membership in labour unions has also been found to be significantly related.

Future research on women and the future of work will then need to contextualise global trends in local contexts, especially through empirical research on the impact of technological disruption. Questions about skill-biased or ICT-based polarization, and platformization remain at a theoretical level and need to be answered through context-specific empirical research. It needs to be assessed whether precarity and formal employment continue to be distributed along similar socio-religious and demographic metrics, or are disrupted with the ongoing process of automation, to understand how the female workforce in the country will be structured in the coming years and design specific solutions to increase labour force participation. Future research will also have to reiterate or challenge the reciprocal effect of automation on various aspects of the nature of work, as delineated by the ILO's 'decent work framework', including flexibility, security, and wages. Finally, the effects of technological disruption or lack thereof also need to be studied in other marginalized groups, such as sexual minorities and lower class workers in the informal sector.