Engineering the Future: The Socio-Economic Case for Gender Equality

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Executive summary

Technology and engineering suffer from a lower participation rate of women, holding back the pace at which these sectors can advance and their overall contribution to the economy. In the U.S. today, women account for 47% of total employment, but just 27% of manufacturing employment. These percentages are even lower in the engineering and IT sectors, with women encompassing only 14% of all engineers and 25% of IT professionals. This under-representation corresponds to leadership roles as well.

While the world has made significant progress in closing the gender gap in health and education – albeit with significant differences across countries and regions—the economic gap remains wide, especially in areas that are vital to growing the economy. According to the OECD, a strong negative correlation exists between a country's gender gap and its living standards. The OECD estimates that increasing female labor participation could boost OECD GDP by 5-12% over the next fifteen years. In the US, GDP could see a 10% rise by 2030. Also, companies with a more diverse workforce enjoy substantially stronger performance, with studies showing a 35% higher ROE compared to less diverse peers.

The stakes are becoming greater as the pace of innovation accelerates and digital technologies transform the industrial world. Both advanced and emerging economies already suffer from a significant skills gap. Job positions remain unfilled, which is holding back the growth of key industries and slowing economic development. The U.S. alone will need to fill approximately 2 million engineering and computing jobs within the next decade.

As new technologies require new abilities, the risk of the skills gap widening will only become greater. To prevent this from happening to ensure we're building the right pipeline of skills, we need to close the gender gap and leverage our entire talent pool. Addressing the gender gap will create a more diverse workforce, and research shows that diverse teams are better at problem solving and think more creatively. Unless they become more diverse, companies will not be able to cope with today's more disruptive innovation environment.

Closing the gender gap and building more diverse teams is essential to realizing the promise of the digital-industrial revolution that requires a wide range of skills.

But more will need to be done. Companies will need to ensure a level playing field, where women in tech and manufacturing have access to the same challenging assignments and the same career advancement opportunities as men. Companies, governments, and other organizations will need to work together to put the right system of incentives and support mechanisms in place to create right opportunities and balanced work environment that bring out the best in our technical workforce.

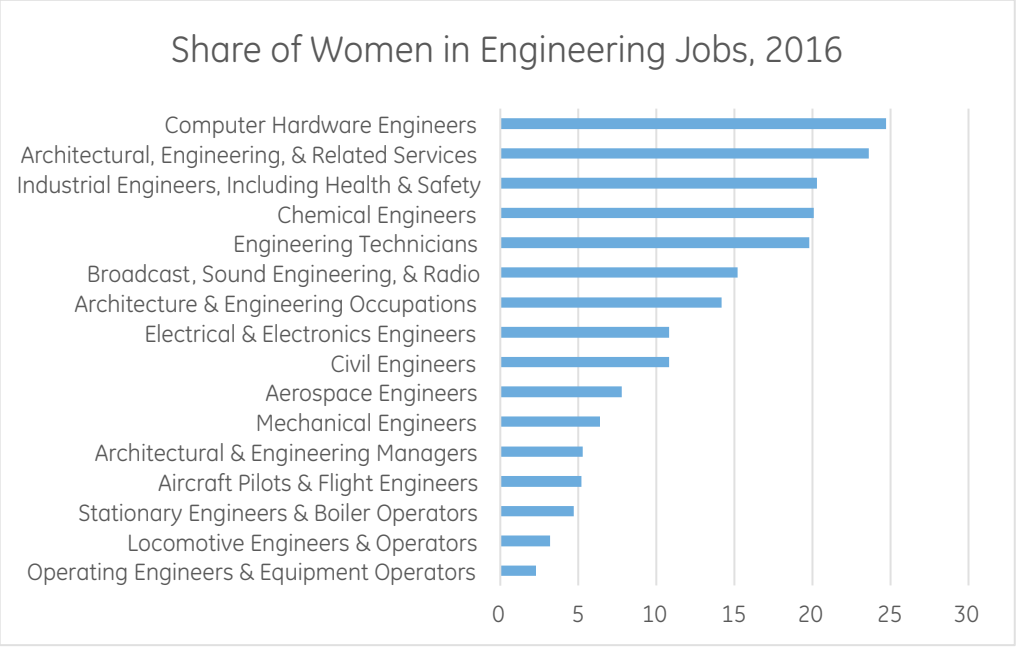
The moral case for gender equality is clear. The economic case is equally obvious: In the digital-industrial future, companies and countries that cannot close the gender gap, will not succeed.

Technology and engineering: desperately seeking women

Technology and engineering suffer from a lower participation rate of women, holding back the pace at which these sectors could develop and their overall contribution to the economy. The numbers are staggering.

Women account for a mere 14% of all engineers (up from 1% in 1960) and only about 25% of information technology jobs (according to the latest BLS statistics).[1] The 25% of women in information technology jobs is the highest share of women compared to all other engineering fields. As the chart below shows, the share of women in aerospace and mechanical engineering drops into the single digits.

BLS data suggests that among the STEM professions, women tend to lean more toward a career as social scientists. They currently make up 63% of all workers in this field, with decent numbers for mathematicians/statisticians (45%) and life scientists (47%).



Source: BLS, 2016

In 2011, a survey of 5,500 women with engineering degrees in the U.S. found that 40% either did not pursue an engineering career after graduation or had left the profession altogether.[2] Among the major tech giants, women make up only 13-24% of the tech-related jobs and 17-30% of leadership jobs at each respective company.[3]

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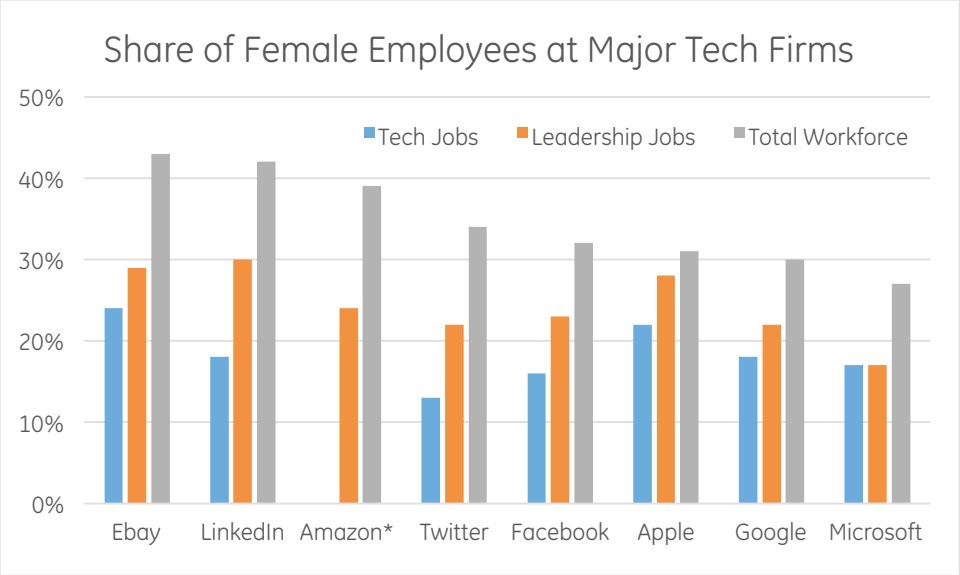
[1] BLS, 2016. https://www.bls.gov/

[2] Collis, A. "The case for change: why engineering needs more women." The Guardian, 17 September 2013. https://www.theguardian.com/careers/women-in-engineering-pay-gap

[3] Rosoff, M. "Here's how the big tech companies measure up when it comes to female workers." Business Insider, 8 March 2016. http://www.businessinsider.com/gender-equality-in-tech-companies-2016-3



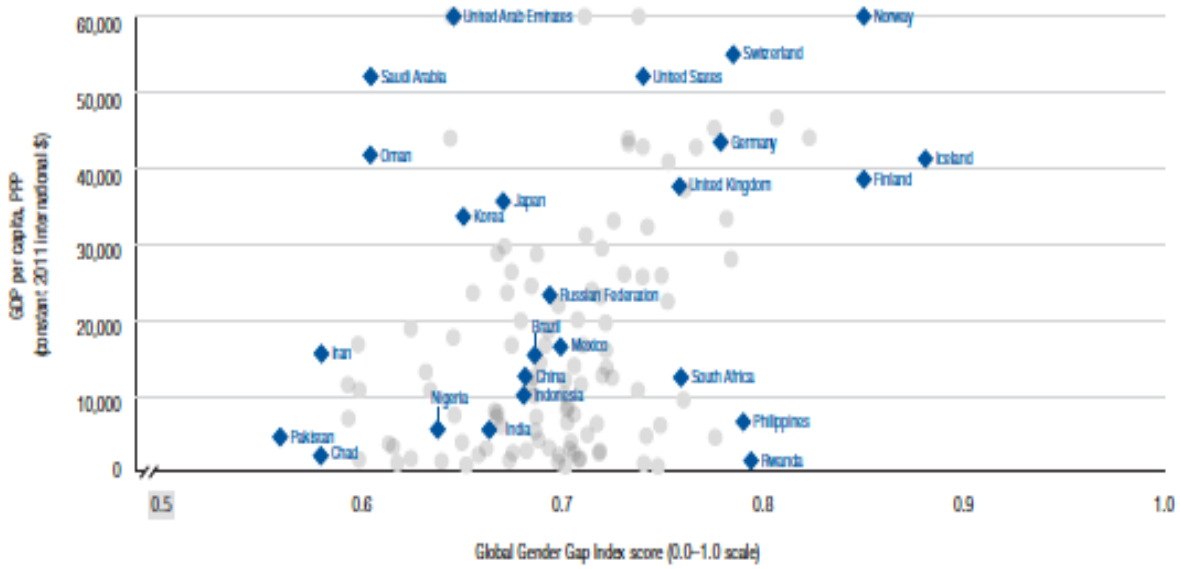
*Amazon does not categorize tech jobs

Source: Business Insider, 2016

The economic imperative for closing the tech gender gap

Closing the gender gap brings a wider pool of highly qualified talent, which lead to better teams, more innovation, and higher productivity. To leave the gender gap unaddressed is like leaving money on the table—it creates a substantial economic cost. Closing the gender gap increases the probability of finding the best talent for any given job, whether it's on a factory floor or in a research lab. And the economic benefits are clear: The World Economic Forum's (WEF) Global Gender Gap shows a high correlation between a country's economic growth and its gender gap.[4] In other words, the greater the contribution of women across industries, the faster living standards can rise.

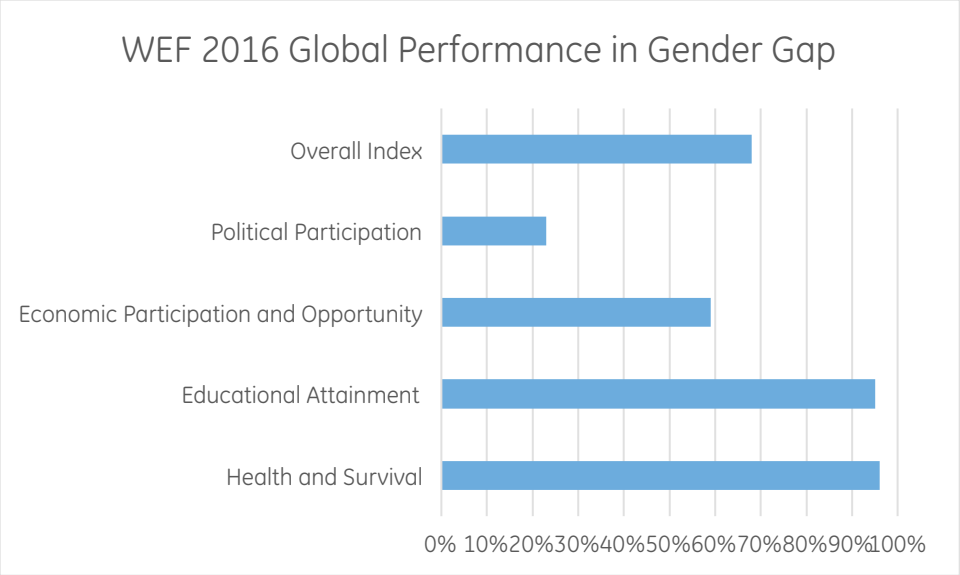
[4] The World Economic Forum. "Global Gender Gap: The Case for Gender Equality." 2015. http://reports.weforum.org/global-gender-gap-report-2015/the-case-for-gender-equality/



Source: WEF, 2015

Despite progress in other areas, the gender gap in economic participation is exactly where the world has made the least progress: The WEF Global Gender Gap, which was introduced in 2006 and covers 145 countries, measures the disparity between men and women in labor force participation, health, education and other issues. As of 2016, the WEF estimated that 96% of the health outcomes gap and 95% of the education gap has been closed – though with significant variations across regions and countries. However, only 59% of the gap in economic participation (defined as participation, wages, and career advancement) has been closed. Latin America has made the largest absolute improvement over the past decade, followed by the Asia Pacific region.[5] In Latin America, for instance, 6 of 25 countries have fully closed both the educational attainment and health gender gaps – the best performance of any region. Meanwhile, Asia hosts 3 of the 5 most-improved countries in the health and survival gender gap since 2006, with 4 having closed the gap completely. China leads the globe in overall labor force participation of women, at nearly 76%.

[5] The World Economic Forum. "The Global Gender Gap Report 2016." http://reports.weforum.org/global-gender-gap-report-2016/



Source: WEF, 2016

Closing the gender gap in economic participation would bring substantial economic benefits. The OECD estimates that increasing female participation in the labor force could boost OECD GDP between 5 and 12% over the next 15 years. In the U.S., GDP could rise about 10% by 2030.[6] The McKinsey Global Institute estimates that increasing women's participation to full potential could add up to $28 trillion (26%) to global GDP by 2025. A more conservative estimate -- assuming improvement to the highest levels within each respective region -- suggests a $12 trillion boost in annual GDP by 2025. Gains in various sectors could amount to nearly $1 trillion each in added GDP, including internet, automation, and cloud computing.[7]

The Future of Work raises the stakes

The lower share of women in technology and engineering already carries a substantial economic cost for companies and for societies overall. Industry already suffers from a significant skills miss-match: In the U.S. and other advanced economies, a significant number of job positions remain unfilled for lack of qualified candidates. The U.S. will need to fill nearly 2 million engineering and computing jobs within the next decade.[8] In emerging markets, the scarcity of qualified workers holds back key industries like oil and gas, power, healthcare, and slows the development of a broader manufacturing sector.

But the stakes get even higher as digital innovation accelerates the transformation of industry across the global economy. As new technologies scale across industry, including additive manufacturing, augmented and virtual reality and others, they will require new skillsets. Unless the entire work age

[6] OECD. "Achieving stronger growth by promoting a more gender-balanced economy." 15 August 2014. https://www.oecd.org/g20/topics/employment-and-social-policy/ILO-IMF-OECD-WBG-Achieving-stronger-growth-by-promoting-a-more-gender-balanced-economy-G20.pdf

[7] Woetzel, J, Madgavkar, A, Ellingrud, K, et al. "How advancing women's equality can add $12 trillion to global growth." McKinsey Global Institute, September 2015. http://www.mckinsey.com/global-themes/employment-and-growth/how-advancing-womens-equality-can-add-12-trillion-to-global-growth

[8] American Association of University Women. "Solving the Equation: The Variables for Women's Success in Engineering and Computing." 26 March 2015. http://www.aauw.org/research/solving-the-equation/

population has the opportunity and the incentive to acquire these new abilities, the skills gap will only become wider.

Moreover, as both technology and business models evolve at a faster pace and in more disruptive ways, companies will need to become more adaptable, nimble, creative and quickly able to pivot as circumstances change. Behavioral research has demonstrated that more diverse teams are better at thinking creatively and problem-solving.[9] Studies have shown that among Fortune 500 companies, those that are more diverse (where women account for a greater share of the workforce and have higher promotion rates than in other companies) have up to 53% better financial performance than less diverse peers—together with stronger job growth and higher profits. This includes a performance boost by about 35% on ROE and 34% on total return compared to less diverse companies.[10] Another study found that companies with more gender diversity had nearly $599 million more in average sales revenue compared to those with less gender diversity.[11] Also, economists at MIT found that shifting from an all-male or all-female office to a more gender diverse group could increase revenue by 41%.[12]

Without closing the gender gap, we will be unable to realize the promise of the digital-industrial revolution. Within GE, our most innovative and creative units include a high proportion of female employees. For example, our Digital Foundries, staffed by highly technical teams of UX designers, software developers and data scientists, have a share of female employees ranging from one-third in Shanghai to one-half in Paris.

The Digital-Industrial revolution can help

At the same time, the digital industrial revolution can help attract more women to technology and engineering. The factory floors of the digital-industrial age are very different from the traditional stereotypical views of 'dirty, rough and noisy.' The factories of the future, or so-called "Brilliant Factories," are clean, high-tech environments, which resemble a top-notch science lab rather than a nineteenth century factory floor. The tasks performed on the Brilliant factory floor are less arduous, more creative, and digitally augmented. It is a working environment well suited to highly skilled individuals, both women and men. As this new reality becomes more widely recognized, we believe it will help boost women's interest in manufacturing.

Attracting women to STEM careers is not the only challenge; retaining and promoting female workers in a so far male-dominated field is the second step in addressing this issue. In a recent Deloitte survey, a large share of women working in manufacturing expressed a preference for shifting to

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[9] Page, S. "The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies." Princeton University Press, 2007.

[10] Catalyst. "The Bottom Line: Connecting Corporate Performance and Gender Diversity." 2004. http://www.catalyst.org/system/files/The_Bottom_Line_Connecting_Corporate_Performance_and_Gender_Diversity.pdf

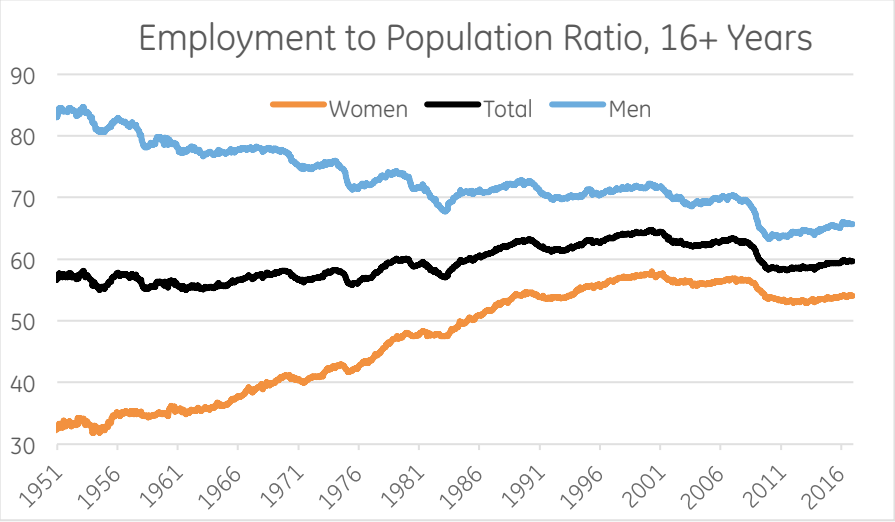
[11] Herring, C. "Does Diversity Pay?: Race, Gender, and the Business Case for Diversity." University of Illinois at Chicago. American Sociological Review, 2009, Vol 74 (April: 208-224).

[12] Dizikes, P. "Study: Workplace diversity can help the bottom line." MIT News Office, 7 October 2014. http://news.mit.edu/2014/workplace-diversity-can-help-bottom-line-1007

retail, life sciences, and tech/media, which tend to be better at attracting and retaining women.[13] The same survey found that almost half of the women polled said that the overall "perception of manufacturing" contributes to the underrepresentation of women in the sector—confirming that the Brilliant Factory revolution will help redress the balance. However, retaining female workers, and fully leveraging their potential, will also require an effort to ensure that women can compete on a level playing field and have access to the same opportunities for challenging assignments and for career advancement as men.

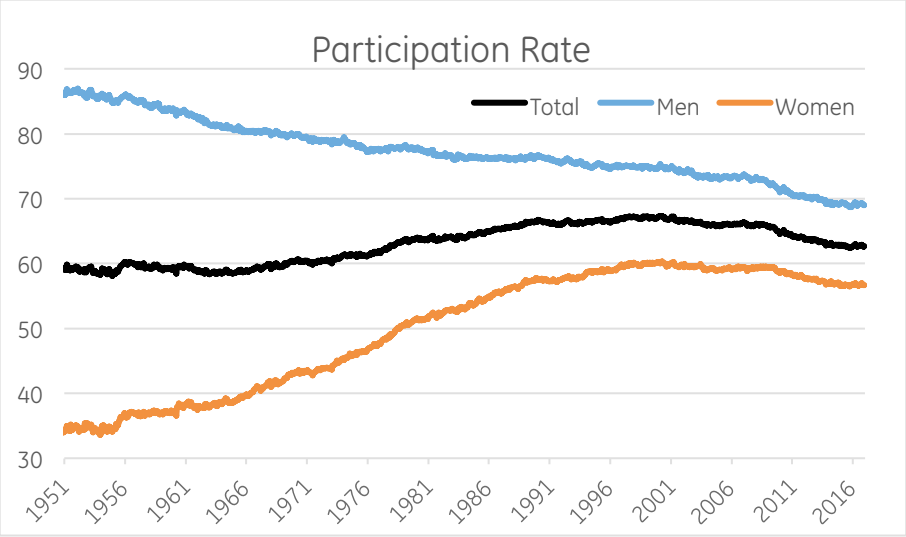
It starts at school

According to the BLS, only about 54% of women 16+ years in the U.S. hold jobs in the traditional labor market, compared to nearly 66% for men (which happens to be near historical lows). Although women comprise 50% of the U.S. population, their labor force participation rate (56.7%) remains well below that of their male counterparts (69%).



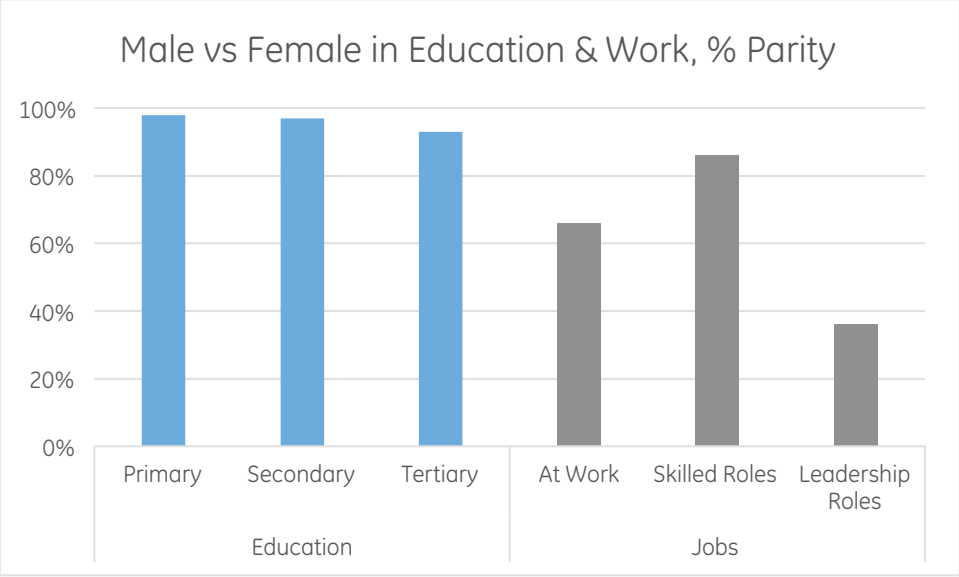
Source: BLS, 2016

[13] Deloitte. "Women in manufacturing study: Exploring the gender gap." 2015. https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-mfg-women-in-manufacturing-2015-study.pdf



Source: BLS, 2016

This is a surprising statistic when considering the fact that women outnumber men in higher education. According to the U.S. Census Bureau, women make up about 55% of all college students (including both undergraduate and graduate programs). The OECD estimates that on average, there will be approximately 1.4 female to male students in higher education among the OECD countries by 2025.



Source: WEF, 2016

However, within the school system, women are underrepresented in STEM education, and the trend is getting worse. According to a study from Bloomberg, only 17% of today's computer science grads are women, trending down from 37% in 1985.[14]

Given these statistics, it is then inevitable that women will be under-represented in technology and engineering roles. But why do so few women graduate in STEM disciplines?

On the face of it, the K-12 system in the U.S. does not seem to encourage female students to pursue education in STEM or in manufacturing-related disciplines. The vicious cycle of expectations and lack of role models also seems to be a factor. The low percentage of women working in tech and manufacturing implies that female students are less likely to consider those sectors as natural career choices; and they have fewer female role models to inspire them to choose a career in tech.[15] Finding ways to incentivize women in STEM education and in the workforce could help solve many lingering challenges and boost economic performance at both the business and national level. Promoting and valuing gender diversity will better position companies to attract and retain talented employees to capitalize on the new skills required in the digital world.

GE sets goals to further address gender imbalance

As GE becomes the leading digital industrial company, we must find ways to best utilize our human capital and technology resources. This will require efforts to significantly increase the representation of women in technical roles.

Business has a critical role to play in accelerating and intensifying efforts across the technology sector. By building on a strong foundation- from the 20- years of the Women's Network to the introduction of contemporary benefit programs - GE has set goals of having 20,000 women fill STEM roles at GE by 2020 and obtaining 50:50 representation for all our technical entry-level programs.

GE's holistic approach outlines clear actions, including the expansion of universities from which GE recruits talent, with more focus on institutions that have a contemporary gender mix, and the introduction of a Chief Technology Officer Advisory Council to inform future retention strategies, including career advancement and leadership development opportunities.

GE also will continue to benchmark, explore and implement employee programs and benefits that foster an inclusive culture to enable flexibility for working families and where all employees can thrive. These programs or benefits include but are not limited to: Parental leave, family-friendly work, affordable childcare and enhanced parental leave.

Research in this analysis has shown that a more gender-equal playing field could lead to significant productivity and performance gains. For GE, the increased volume of diverse ideas stemming from this commitment would champion this growth through accelerated innovation at the cutting edge.

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[14] Clark, J. "Artificial Intelligence has a 'Sea of Dudes' Problem." Bloomberg, 23 June 2016. https://www.bloomberg.com/news/articles/2016-06-23/artificial-intelligence-has-a-sea-of-dudes-problem

[15] Chen, X and Soldner, M. "STEM Attrition: College Students' Paths into and out of STEM Fields." U.S. Department of Education, National Center for Education Statistics, November 2013. https://nces.ed.gov/pubs2014/2014001rev.pdf