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DEVELOPMENTS IN ARTIFICIAL INTELLIGENCE
A GLOBAL PERSPECTIVE

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PURPOSE
TECHNOLOGY has been progressing rapidly. The pathway to the global economy's progress has three major milestones already - the steam engine (industrial revolution), followed by era of mass production, and then the rise of computers (digital technology). The fourth one is the current age of artificial intelligence – also called Industry 4.0. The current study aims to shed light on the present scenario and applications of artificial intelligence, studies on related job displacement, demand and supply of robots (industrial, personal and service sector, cobots), robot density around the globe, frontrunner nations in the field of robotics, followed by spending on robotics, reference to the Indian scenario, and the corresponding social and business impact.

Design/Methodology/Approach: *A detailed study of literature was done - available in the form of articles, opinion pieces in newspapers, and reports of consulting organizations. A discussion on the various aspects (social/business/economic) of artificial intelligence has been done.*

Findings: *There has been a shift in the global market for robotics towards consumer and service uses, vis-à-vis industrial applications. As per the latest estimates, the country having the highest robot density, across the globe is South Korea. The spending pattern on robotics has been described. Social and business impact of robotics has also been analyzed.*

Originality/Value: *This paper has practical implications as it provides a bird's eye view on artificial intelligence by collecting and classifying the relevant literature, which might be of use to academicians, practitioners, and future researchers while conducting research on the similar subject area.*

Key Words: *Artificial Intelligence, Industry 4.0, Robot-colleagues, Robot density, Job Displacement, Industry of the Future.*

Introduction

Artificial Intelligence is not just the latest buzzword in corporate circles, academic discussions and management echelons, but is a leading contender in the race for the 'industry of the future'. Corporations have hung the 'open' sign for robots at the workplace. This makes a lot of employees vulnerable to the risk of job-loss as the same task can be performed by a machine, with perhaps more precision. This drastically reduces the role of current employees, if not making them completely redundant.

Who is most susceptible to losing their jobs to robots - factory workers, drivers, and the like? With the advent of algo-trading to automatically buy/sell shares in stock markets when the algorithm so prescribes,

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even the cushy job of financial analysts is at risk. The influx of robotics in workplace will not just sabotage blue-collar jobs, but put a dent across all major sectors.

Is it possible that we'll have a higher level of distressing job than our robot colleagues in the years to come? Would the desire for human touch in business, make managers job secure in the long-run? In niche areas of consultancy, where personalized attention drives reputations of business, would robo-advisors gobble up your consulting job? Can they match up to your standard of (intangible) deliverables? Or will our next CEO be just a robot running on code? The famous Alibaba founder believes that "in about 30 years, a robot will likely be on the cover of Time Magazine as the best CEO" (Ma, 2016).

Are we are heading towards the era of algo-management, with only data-driven decision making? Can gut feeling be mimicked by robots? Or is human intuition becoming irrelevant? Where does our real edge lie – in our courage, charisma, and vision? Would office politics go away for good, with the downside of your future robo-boss having lesser empathy than your present-day boss (if that's possible).

Objectives of the Study

1. To understand the current scenario and applications of artificial intelligence in detail
2. To explore the research studies related to job displacement caused by artificial intelligence
3. To outline the demand and supply of robots across the world
4. To identify frontrunner nations in the field of robotics, with special focus on the Indian scenario
5. To assess the social and business impact caused by developments in the field of artificial intelligence

Research Methodology

For the purpose of the study, secondary sources of data were used. A detailed study of literature was done - available in the form of articles, research papers in journals, opinion pieces in newspapers, books, reports of think-tanks, and reports of consulting organizations. Viewpoints of certain eminent personalities on artificial intelligence were also obtained from published sources like newspapers and their social media accounts.

The Current Scenario

Spectrum of Robotics

Contrary to popular perception, artificial intelligence will not just pose a challenge to monotonous, dull jobs, but even those jobs which are sophisticated in their essence – like that of financial analysts and lawyers. Kaplan (2015), an academician at Stanford and author of *Humans Need Not Apply,* says that automation will be "blind to the colour of your collar". With no sick leaves, near cent per cent accuracy and endless toiling, robots are an employer's delight because they're hassle-free when it comes to getting work done, without the complex entanglement of HR.

Sailthru (2017) analyses that AI is used majorly for search and for providing content and product recommendations, followed by data science, advertising, forecasting, and chatbots. Washington Post made use of a robot reporter to post real-time updates of the Rio Olympics 2016, while their sports reporters engaged in writing in-depth analytical pieces (Maffei, 2016). A study by Thenmozhi (2006) has shown that "AI have the capacity to learn the underlying mechanics of stock markets" (p. 1).

Driverless Cars

Volvo and Uber have started testing self-driving cars. Ford has also entered into a joint research with a Chinese company for self-driving vehicles. Apple and Google's ventures into driverless-car technology highlight the sectoral convergence taking place across multiple industries. Companies are now encroaching and poaching on each other's traditional area of operations. One robot has

already started flexing its arms and presently controls the performance evaluation of over 200,000 workers: Uber's automated managerial system (Marot, 2016).

Greeting and Assisting People

Henn-na-Hotel in Japan has multi-lingual robots for greeting guests, checking them in, reacting to their body language, and eye movements. In New York, a hotel named Yotel uses robots to make coffee, clean rooms, and take on sundry service jobs. Pepper (a humanoid 4 feet 7 inches-tall robot that has a round head and a screen pinned onto his chest) assists people who walk into two of the hospitals in Belgium at reception desk. His prowess to converse in 20 languages and the ability to detect whether the customer is a man, woman or a kid – makes him a strong substitute for the everyday blasé help-desk employees (The Guardian, 2016).

Robots are also beginning to be used as a support tool in the pediatric and geriatric departments. There has been an upscale in the demand for robots in retirement/care homes (Muoio, 2015).

Food Industry

Andy Puzder, ex-CEO of fast-food chains Carl's Jr. and Hardee's, was interested in putting robots in place of human workers, as he believes that they are easier to manage. In 2016, in an interview, Puzder was quoted saying that "unlike human workers, robots are always polite, they never take a vacation, they never show up late, there's never a slip-and-fall, or an age, sex, or race discrimination case" (Castillo, 2016).

Nolan (2017) highlights the viewpoint of Greg Creed, CEO of Yum Brands (that owns KFC, Pizza Hut, & Taco Bell) who said that, soon robots will play an even larger role in the fast food business within the next 10-15 years. Former McDonald's CEO, Ed Rensi explained that stringent work rules, rising minimum wages will pave way for automation. The over-regulation (franchisors are now responsible for the labor practices of franchisees) will lead to the industry investing in robots which will be cost-effective in long-run. Steve Easterbrook, incumbent McDonalds' CEO, declared that though the company looks forward to automating food preparation, the key idea is to let more employees directly interact with guests and enhance the customer's experience and service quality, and not just flip burgers. "Frankly, we will always have an important human element." In 2015, the burger chain had upped investment in employee wages and benefits. As per Easterbrook, this had led to a rise in customer satisfaction scores by 6% in the first quarter, compared to the same period last year (Taylor, 2016).

Logistics

Amazon makes use of 45,000 robots in its warehouses for taking care of the orders of its customers. It aspires to deliver by drone, someday (Aspiration: Prime Air). It's acquisition of Kiva, a robotics company, is a testament of its ambitions of drone delivery (Shead, 2017).

Foxconn, a Taiwanese company that assembles Apple iPhones, put in place robots, affecting the jobs of 60,000 factory workers (Wakefield, 2016).

Therapy

In certain therapeutic situations, robots might be used as surrogates to practice social and emotional communication. They have the advantage of modelling countless human behaviors, being objective, and non-judgmental and thus notch up the therapy treatment. The downside being that no matter how developed its cognitive abilities are, a robot can never fully comprehend the 'human experience'. It will always be what it is - a robot (Vitelli, 2014).

In Germany, a bizarre robot-priest called BlessU-2 is doling out blessings to church-goers. The bot is supposed to inspire discussion and debate: "We wanted people to consider if it is possible to be

blessed by a machine, or if a human being is needed", said Stephan Krebs of Protestant church, which is behind this initiative (Sherwood, 2017).

Robot CEO

Not just routine jobs, but even the C-suite is at risk of losing their positions to robots. One of the key functions of a CEO is data-driven decision-making. With advancements in predictive analytics and big data, decisions are optimized in an objective manner, slowly yet stealthily, eating away the role of a CEO. The times aren't far when there'll be a robot-board member for every Fortune 500 company.

The Robot Coup

The robot-CEO wouldn't act on whims, there'd be more transparency and less embezzlement and frauds. Their "algorithmic management style" would always follow the board's strategy. Robot CEOs can make more objective consistent decisions, led by facts and logic. Temperamental issues or background noises (like a bad day at work, mental fatigue, and excessive stress) will move out of the picture. In addition, they obliterate the need for company-sponsored exotic fancy vacations and holidays for the C-suite executives (Satorre, 2017).

One simply can't deny the existence of RPA (Robotic Process Automation). AI is moving ahead by leaps and bounds. With cognitive computing, human thought process can be simulated by computers in an overarching system which then self-learns repeatedly using pattern recognition and data mining, like Google's AlphaGo which recently defeated the world's best player in Go (an ancient Chinese board game), using self-taught moves.

At a conference in China, Jack Ma explained that machines are faster and have more rational ability than humans — without letting emotions get the best of themselves. This lends them an obvious edge (Ma, 2016).

Job Displacement

Trilling (2017) gives the examples of numerous reports and comments that the White House classified 9%-47% of American jobs as being "made irrelevant by machines" over the next twenty years. University of Oxford and Citibank estimated that "77% of Chinese jobs are at risk of automation" over the next 15 years (Citi, 2016).

Acemoglu & Restrepo (2017), two MIT economists, explained that the capitalization effect (creation of new jobs and wealth addition due to higher productivity) will outpace the job displacement effect for workers. However, in their recent working paper, the authors estimated that one additional robot per 1000 workers, leads to a fall in the employment-to-population ratio by about 0.18%-0.34% and in wages by 0.25%-0.5%. Additionally, robots appear to have a more negative impact on the employment of men than women.

Viewpoint

"Jobs will be lost, jobs will evolve, and this revolution is going to be ageless, it's going to be classless and it's going to affect everyone", believes Meg Whitman, chief executive of HP. "I think what we're reaching now is a time when we may have to find alternative careers through our lifetime", said Microsoft CEO Satya Nadella (Geller & Hirschler, 2017).

Erik Brynjolfsson, MIT Professor says that we will see enormous wealth but also vast social disruption. Government policies should incentivize companies by way of tax advantages and credits, for creating new and additional jobs for people, and not put robots (Brynjolfsson, Rock, & Syverson, 2017).

In his book, *Rise of the Robots*, Ford (2015) describes a complete overhaul of the economic system wherein humans will utilize their time better and be more entrepreneurial, thriving on regular incomes

generated by machines. McAfee & Brynjolfsson (2017) agree primarily with Ford's viewpoint. Mahdawi (2017) quotes that "2020s are going to be a decade *not* of unemployment, but of redeployment".

In *Capital in the Twenty-First Century,* Piketty (2014) gives an extreme example of "entirely robotized economy in which one can increase production at will." The robots produce the entire output and the factor returns go completely to those who own the robots and thus the income distribution is 100% capital, 0% labor. Though this is an unreal (hypothetical) scenario, but it definitely points out to the skewed factorial income distribution in the era of automation.

Price (2016) elaborates on the viewpoint of Stephen Hawking who believes that artificial intelligence will leave "only the most caring, creative or supervisory roles remaining and accelerate the already widening economic inequality around the world."

Some of the critical things we do in life don't fit under the label of 'being productive'. Kelly (2013) explains that productivity is for robots. He says, "Generally any task that can be measured by the metrics of productivity — output per hour — is a task we want automation to do. Humans excel at wasting time, experimenting, playing, creating, and exploring. None of them fare well under the scrutiny of productivity. That is why science and art are so hard to fund. But they are also the foundation of long-term growth. Yet our notions of jobs, of work, of the economy don't include a lot of space for wasting time, experimenting, playing, creating, and exploring."

Demand and Supply of Robots

Industrial Robots

Generally, a new industrial robot costs somewhere between $50,000- $80,000. If application-specific peripherals are added, the cost can increase up to $150,000. There has been a marked increase in the number (units) of robot sales. In 2015, it rose by 15% to 253,748 units. The forecasted supply is about 414,000 units for 2019, with a growth of 13% per year, on an average (IFR World Robotics, 2016).

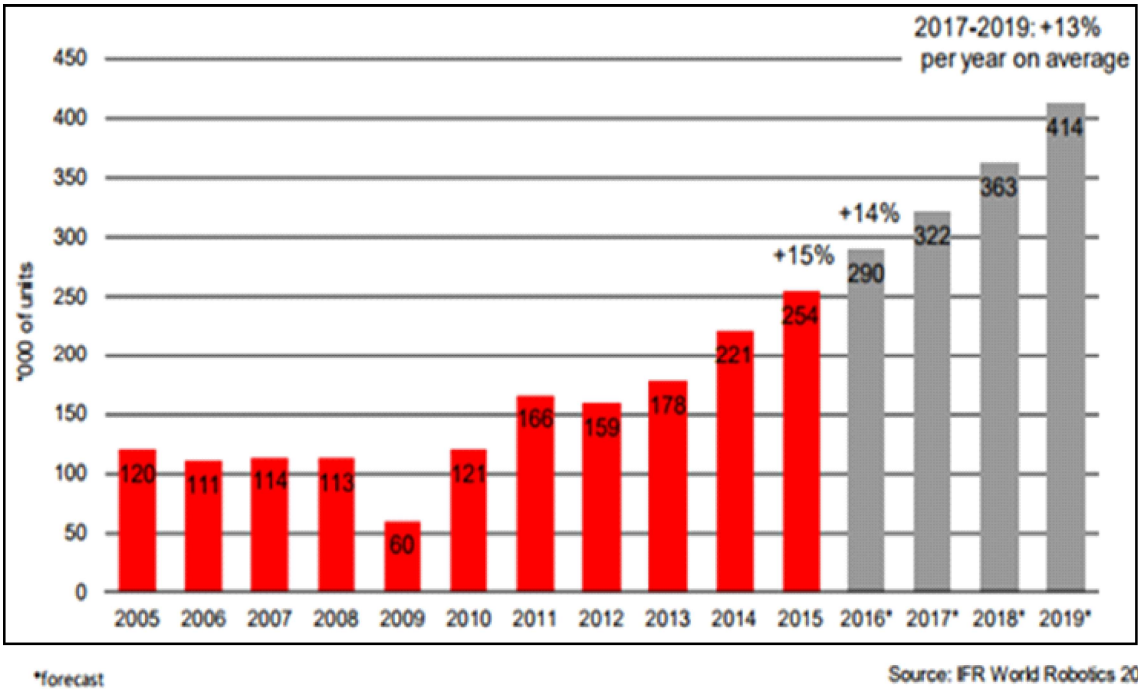


Figure No. 1: World-wide Annual Suppy of Industrial Robots (2001-2019)

The supply of industrial robots is on the rise, with major contribution by Asia and Australia.

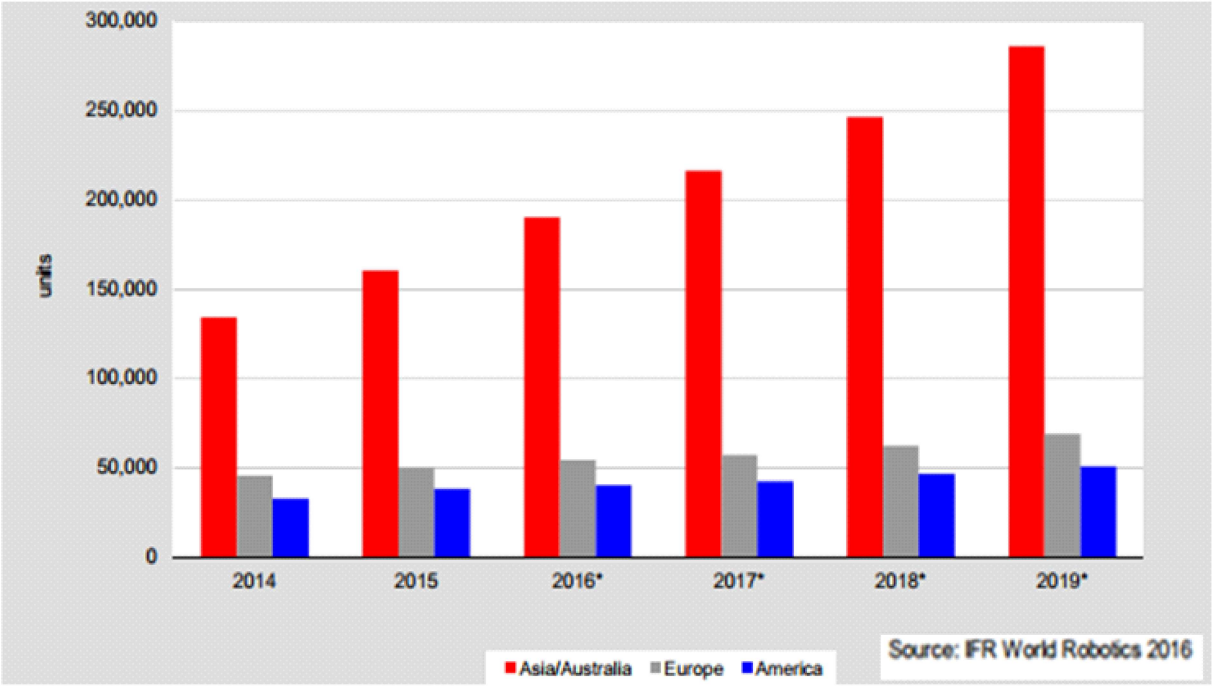


Figure No. 2: Annual Supply of Industrial Robots 2014-15 and forcast for 2016-2019

Sirkin, Zinser, and Rose (2015) estimate in their BCG report that 3/4th of industrial robots operate in four main industries: computers/ electronics, electrical appliances and components, transportation equipment, and machinery.

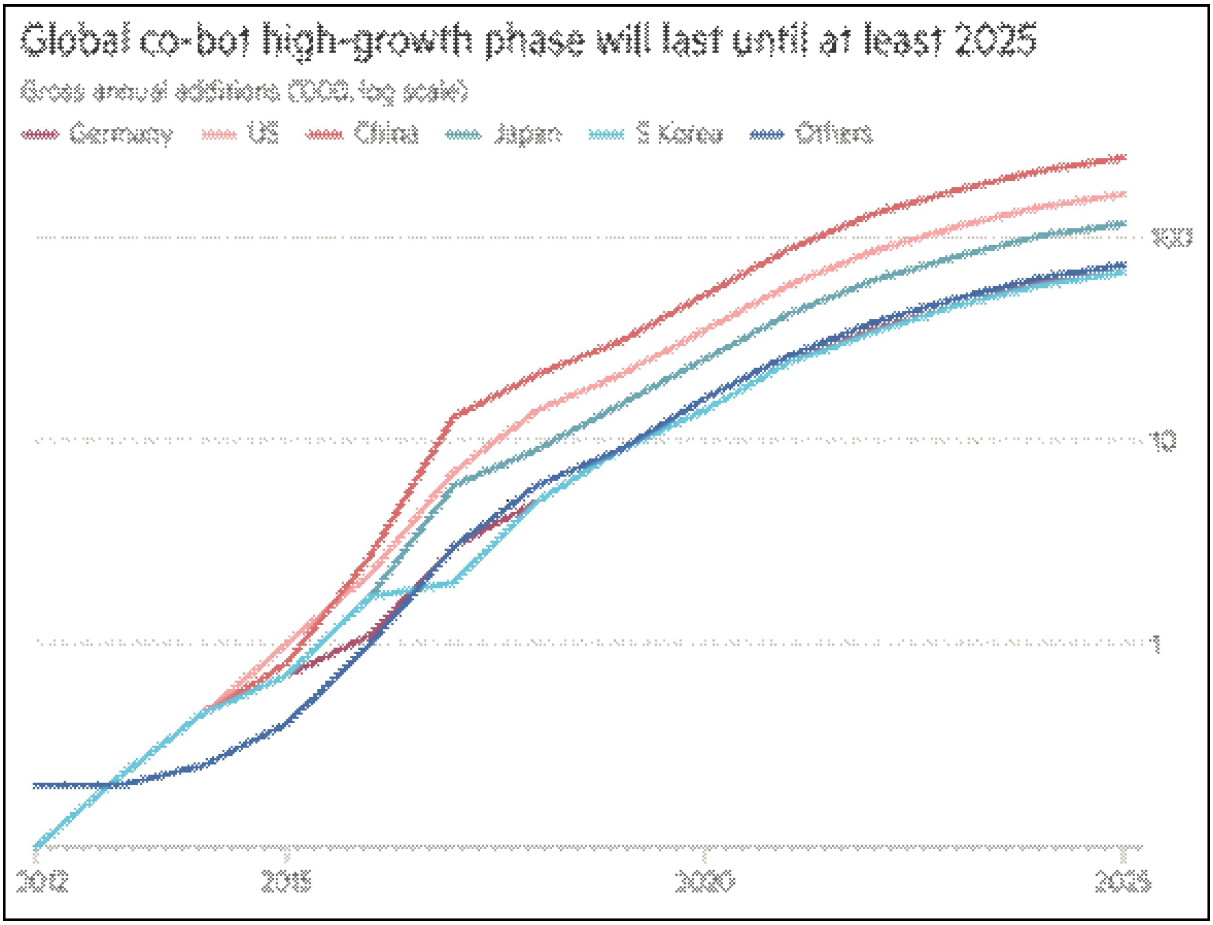
As per IFR World Robotics (2016), the 5 major markets that were the recipient (in terms of volume) of 75% of total robot sales are: China, Korea, Japan, USA, and Germany, in the year 2015. There was a marked increase of 70% in sales volume from 2014. The robot-adoption is mainly concentrated in the automotive and electronics sectors. At 2015-end, value of global robot market was $ 11.1 billion.

China is the largest market, receiving 27% of the total supply of industrial robots, which is forecasted to grow to 40% by 2019. It has surpassed Japan, which was previously the largest market for industrial robots, in 2013. The supply of industrial robots to China increased by 36% per year, on average, between 2010 and 2015. However, by 2025, China is aiming to indigenously build 50% of its total robot-demand (IFR World Robotics, 2016).

It is estimated that by 2019, there will be a global stock of 2.6 million industrial robots in operation. As per forecasts, robot installations will increase by 13% CAGR from 2017 to 2019: the highest being in Asia/Australia region, at around 15% (IFR World Robotics, 2016).

Cobots

Hollinger (2016) writes that the cobot (collaborative robot) market has been estimated to balloon up from $100 million in 2015 to $3 billion in the subsequent five years, till 2020. These cobots are far easier to train and deploy than big industrial robots.



Source: Hollinger (2016)

Figure No. 3: Global Co-Bot High-Growth Phase

Post-Brexit, many migrants might have to let go of their seasonal and low-skilled jobs. Employers will have little chances of finding domestic replacements, due to high labour costs. While large companies can deploy industrial robots, small and midsize companies are likely to turn to cobots.

The Asia Pacific market (APAC) is expected to grow at highest CAGR for cobots between 2016-2022. This impetus comes from the demand of MSMEs for collaborative industrial robots in China, Japan, India, and South Korea, as well as the rising investments in countries like India to boost manufacturing under 'Make in India' Campaign (IDC, 2018).

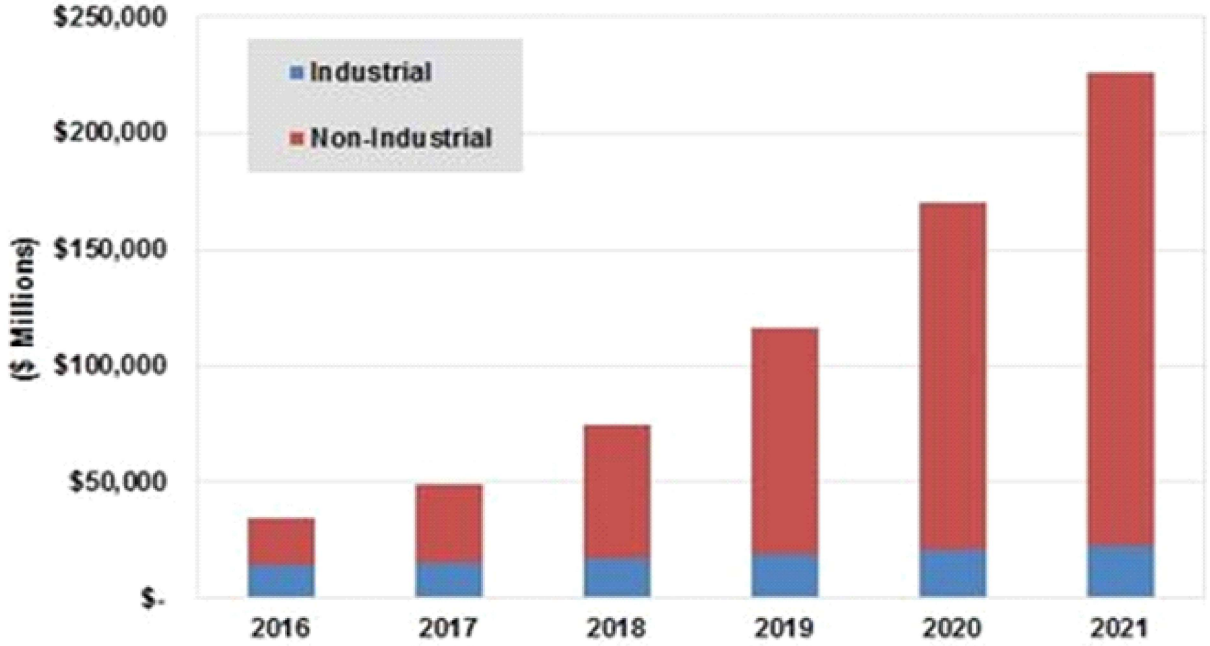
Service and Personal Robots

The estimated turnover of service robots is $23.1 billion between 2016-2019. They are forecasted to grow the fastest in logistics and defense. There are projections that 333,000 units of service robots will be sold in the same time frame for commercial use while 42 million will be used for personal and domestic life (IFR World Robotics, 2016).

IFR World Robotics (2016) reports that "in the service robot segment for professional use, sales of medical robots rank ahead of agricultural and logistics robots." It was also found out that during 2016-2019, the following trends emerge- "medical: (diagnosis, surgical assistance, and rehabilitation)

- sales value expected to rise to $ 7.2 billion; agriculture: (especially milking robots) expected increase upto $ 5.7 billion; logistics: (major share of automated guided vehicles) – expected sales value of $ 5.3 billion." North America and Europe have the largest share of service robot suppliers.

In 2016, non-industrial robots (59%) overtook industrial robots (41%) in terms of market size. The former has been taking on multiple roles, like that of personal assistants, delivery vehicles, surgical assistants, autonomous vehicles, unmanned aerial vehicles, etc. (Tractica, 2017).



Source: Tractica (2017)

Figure No. 4: Total Industrial and Non-Industrial Robotics Revenue, World Markets:2016-2021

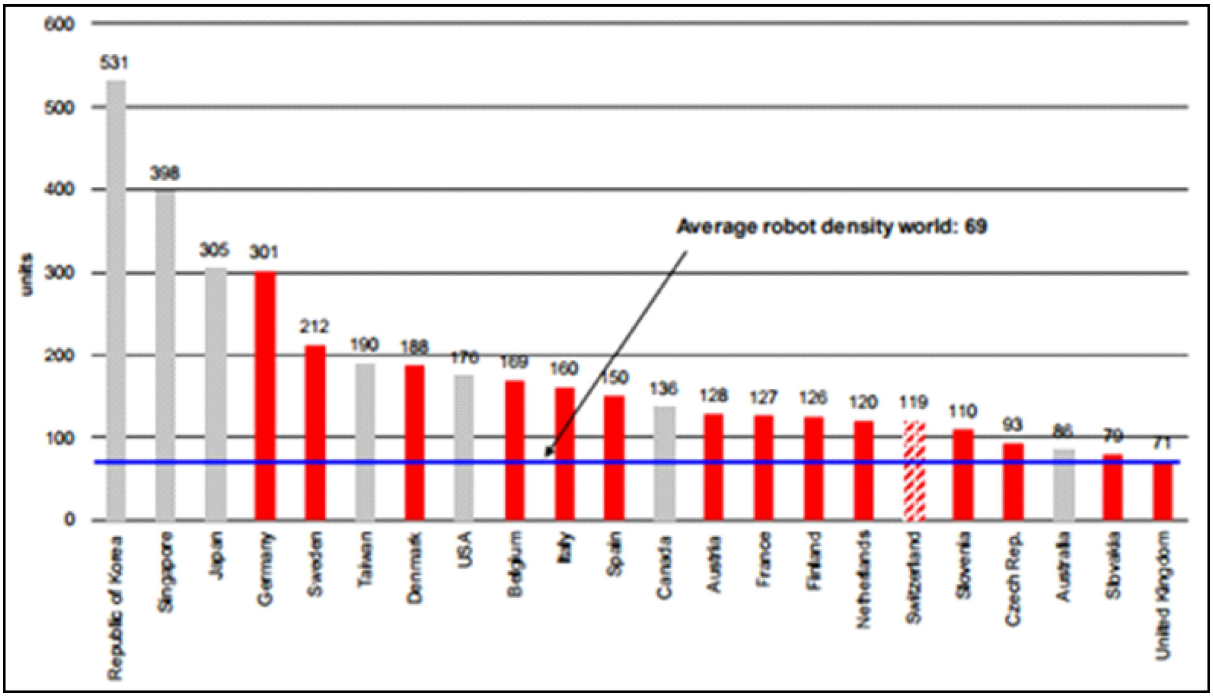
According to estimates by Business Insider (2015), there has been a shift in the global market for robotics towards consumer and service uses (earlier dominated by industrial application). By 2019, there will be a whopping $1.5 billion market for consumer and business robots, growing at 17% CAGR during the period of 2014-2019, 7 times quicker than the industrial robot market. The estimate stated that "3 prominent categories leading the consumer/office robot market are home cleaning and maintenance, telepresence (telecommuting to events or remote offices), and advanced robots for home entertainment."

Robot Density

In 2015, South Korea had the highest robot density: 531 multi-purpose industrial robots per 10,000 employees. The average robot density was 92 units in Europe, 86 in America, and only 57 in Asia, as against the global average of 69. These statistics have risen in the next year, as can be seen from the following figure. The world average has increased to 74 (IFR World Robotics, 2016, 2017).

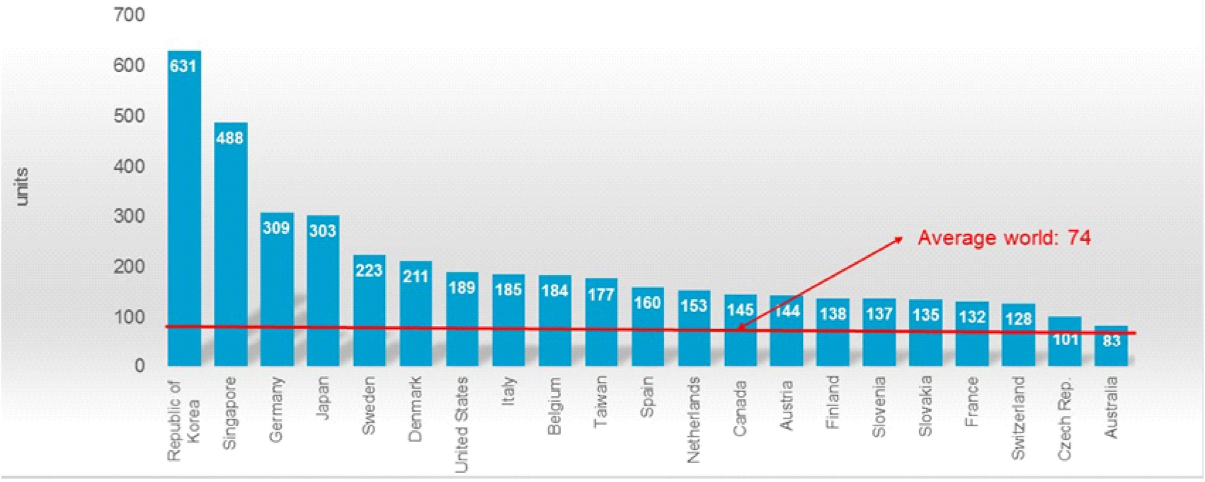
Frontrunner Nations in the Field of Robotics

Whether by design or accident, those countries with rapidly aging populations have the most robots currently, like South Korea, Japan, and Germany. Though China's robot density is only 49, but it has the world's fastest-growing robot population.



Source: IFR World Robotics, 2016

Figure No. 5: Robot Density



Source: IFR World Robotics, 2017

Figure No. 6: Number of Installed Industrial Robots per 10,000 Employees in the Manufacturing Industry 2016

The demographic time bomb ticking in Japan and Germany due to their aging populations, have made them foremost candidates for robot revolution – both the countries have been early adopters of automation, along with being manufacturing giants (Germany attributes 1/3rd of its GDP to manufacturing exports; while for Japan it is 12%). Rising robotization may help cushion the adverse demographic impact. China's manufacturing industry had grown due to low cost labor, while German industry has prospered

into advanced automation by high labor costs. As demography changed and cheap and hardworking labour became scarce, a need was felt for automated machines and robots (Bloomberg, 2017).

The burgeoning growth in robotics in China is attributed to three pull factors: increase in the cost of labour, rapidly maturing and growing age of the population, and heightened competitiveness across the globe. The three push factors stated are "national initiatives, innovation, and investment in robotics". China wants to assert its prowess and become the key supplier of low-cost robots to developing economies like India and other Asian countries. It is motivated by the ardent desire to retain manufacturing within its borders, despite the 350% rise in hourly wages of workers over the last 10 years (IDC, 2016b).

As per IFR World Robotics (2016), Japan has most (Yaskawa, Fanuc, Epson, Kawasaki, Nachi Fujikosh) of the top 8 industrial robot makers in the world and is called the "kingpin of world robotics". Asia accounts for more than half of the world's robot output, primarily due to efforts by China and Japan. Taiwan's Foxconn (Hon Hai Precision) doesn't disclose its sales of industrial robots to IFR – so it's likely that the Asian chunk is actually bigger than it is reported. Major players in the robotics industry: KUKA, ABB, Yaskawa Electric, and Fanuc are gradually shifting base to China (largest market for robots); ABB relocated its global HQ of robot division in Shanghai. These are also referred to as the Big Four in the industrial robot segment. Also, EU is one of the most robot-dense places in the world, as majority of the countries with above-average robot usage per 10,000 employees are located there.

Spending on Robotics

IDC (2016a) has categorized robotics under 'The 6 Innovation Accelerators' for digital transformation. It forecasts growth in global spending on robots and drones at 19.6% CAGR, from $71 billion in 2015 to $201.3 billion in 2022.

Industry-wise: This spending is dominated by "discrete and process manufacturing industries, representing 33.2% and 30.2% of the total outlay" in the year 2015. The other top three industries as regards to robotics spending are resource, healthcare, and transportation. Estimates say that this spending will nearly double in process manufacturing and healthcare, by 2019 (IDC, 2016a).

"Services-related spending, like applications management, education & training, hardware deployment, systems integration, and consulting, will grow to more than $32 billion in 2019". This will make it the largest as well as the fastest-growing category in terms of robotic expenditure (IDC, 2016a).

Area-wise: The Asia/Pacific region accounts for approximately 65% of the outlay. The second rank is bagged by Europe, Middle East, and Africa (EMEA) with a spending of $14.6 billion, followed by Americas at $9.7 billion. It is forecasted that the spending will "nearly double in APAC over 2015-2019, making it the fastest growing region followed by the USA" (IDC, 2016a)

Indian Scenario

There's an annual market of 1,000 big robots in India, which will shoot up to 5,000 by 2019 (Thakkar & Kumar, 2016).

Jaipuria (2016) highlights an interesting survey conducted by FICCI and Tata Strategic Management Group. This survey indicates that advanced robotics is the way for Make in India campaign, as per Indian companies. Such futuristic trends like sensor-based robots that mimic human intelligence, can help Indian leapfrog past China. "Currently developed countries including Scandinavian countries are leading adoption, largely due to fast evolving ecosystem of robot manufacturers and integrators. India can leapfrog towards advanced robotics and compete with China for adopting of advanced robotics," said the study note.

In such a move towards robotics, Tata has come up with Brabo (short for Bravo Robot), India's first in-

house industrial robot, developed at a cost of Rs 10 crore. It is made in India and made for India: financed by Tata Capital, designed by TAL, styled by Tata Elxi, parts manufactured (except motors and drives for robo arm) at Tata AutoComp Systems. TAL offers affordable and cost-effective robotic solutions with focus on MSMEs (Thakkar & Kumar, 2016).

Tripathi (2016) draws upon a research conducted by ASSOCHAM, estimating that "upto 10 million jobs might be taken over by AI over the next 5 years". It was further suggested that "the Union Government should integrate robotics as key components of its flagship 'Make in India,' program for attracting global manufacturers to set up their highly efficient and automated supply chain facilities in the country. Centre should create a national policy perspective for automation consisting of top-level experts, representative of business, government, and labour as it will set down the roadmap and guidelines to make this transition as painless as possible while assuring the stakeholders that the benefits will be widely and equitably shared."

Social and Business Impact

1. *Interacting with robots*: With AI making an entrance in the cubicles at the workplace, some office workers are warming up to their robo-colleagues by giving them female names: back-end staff for ANZ bank in Bangalore call their robo-colleague Lakshmi, while Nippon Life Insurance Company in Japan addresses them as robomi-chan, or "pretty little robot". Assigning them a human personality is a move to integrate them into the social pecking order in the office.

   Waters, Nakanishi, & Kwong (2017) write about the interesting pattern of projecting female personalities onto the new 'intelligent' voice-controlled and automated assistants, like Amazon's Alexa and Microsoft's Cortana. (Apple's Siri being the exception). The authors also quote Chrissie Lightfoot, co-founder of Robot Lawyer Lisa (designed for producing legal documents without any human's assistance): "People do feel more comfortable dealing with females than males in tricky matters."

2. *Power dynamics:* The complex power play in companies would undergo a dramatic shift. Managers' ego will take a blow due to automation reducing their span of control. To tackle this issue, managers in ANZ Bank in Bangalore are credited for not just the humans under their clout but also for the number of robots, to make them feel more significant and valuable.

3. *Gap in skill-set*: There will be a major dent on the existing skills-set of employees. We would need to acquire skills for operating and programming the robots.

4. *Emergence of new jobs:* New jobs will emanate in technology sector. Monotonous and repetitive work will get weeded out and the new jobs will be better, in terms of compensation. Randle (2016) highlights the views of US Deputy Secretary of Labor, Chris Lu, that the changing economy will bring new opportunities for people — if they possess the skills. Employers keep cribbing they don't have enough staff for data analytics and for running advanced machine tools.

5. *Rising inequality:* Semuels (2017) in his article, quotes a lecturer James Bessen, Boston University School of Law, "The problem is that those new jobs are not ones that those low-skilled workers can easily fill, and those people are now out of luck. This, in turn, exacerbates inequality". There might be a more skewed income distribution with a larger share of the pie belonging to those with premium technological skills – acquired by way of technical education and the ability to reskill oneself all throughout the working life.

6. *Social Unrest:* There is a possibility of mounting social conflict across all sorts of industries. Due to mass unemployment in the future, automation might spark social upheaval.

7. *Increasing importance of Liberal Arts:* Robots can't really replicate human creativity – and thus innovative/artistic jobs are likely to pop up. Randle (2016) gives the example of Ford Motor Company,

wherein they've recruited a futurist to make illustrations of what's likely to come ahead in the automobile sector – environmental issues, making car parts out of tomato stems, trees, straw and all types of alternative materials, emerging the footprints of new technologies.

8. *Possibility of emotional affinity with robots:* No matter how bizarre it sounds at the outset, but by designing robots with a human-like semblance, there's a chance of developing emotional association towards them. Lin (2016) ponders over the question of relationship with humans and cites Carpenter (2016), who has addressed these complex issues of attachment, trust, and dependence on robots in her book, *Culture and Human-Robot Interaction in Militarized Spaces: A War Story*. Despite distinct awareness by people that these robots are mere machines and tools, there's still some degree of (pseudo) social interaction. After all, people do have a tendency to become attached to keepsakes, a painting or a book because of sharing a connection or some history with them.

With the expanding gamut of robot's roles like caregiver, teaching assistant, industrial colleague, the emotional responses towards them would vary vastly – across a continuum – with reactions ranging from fascination and delight to frustration of denting a trophy car to the irreparable loss of a pet. It may lead to harboring of trust issues in the long-run, in its extreme form. We're yet to figure out a way to deal with such robotic interactions and sooner or later, such norms would have to evolve – culturally, socially, and legally.

Conclusion

The society is undergoing a new revolution in the age of artificial intelligence, called Industry 4.0. In the times to come, both society and businesses will be impacted because of the pandemonium created by Industry 4.0. Buchanan (2016) writes about forecasts made by Nobel Prize winner and author of *Thinking Fast and Slow* - Daniel Kahneman, who in turn makes conjectures about CEO's job being endangered in the future, saying that "There is little or no evidence of cases in which expert judgment does better than intelligently constructed formulas. We develop intuition with the data we collect in a lifetime. AI will be able to do better. How we live with that - I don't know."

A Long Way to Go?

If minimum wages are low, it is cheaper for companies to hire humans in place of robots. Giang (2015) quotes the noted economist Robert Atkinson, "If you're an employer, you don't have much incentive to replace workers or add tools because [employees] cost so little,". However, if they have to be paid more due to labor laws, then employers might be keen for a robotic workplace. This will accelerate the speed with which robots will be a part of our lives.

There's a long way before human instinct can be replicated by robots. It wouldn't happen overnight. But possibly in our lifetimes (who knew touchscreens would be the new normal, 50 years back).

In reality, all the jobs might not be actually automated due to a plethora of economic, legal, and regulatory hurdles. Example: Who will bear liability in case of a mishap of driverless vehicles – car manufacturer, sensor provider, or the software that makes the driving decisions?

Will History Repeat Itself?

There have always been murmurs about potential job losses because of automation. It was initially believed that the agrarian mechanization would destroy the world economy. In 1800s, 80% of U.S. workforce worked on farms. Now, it's just 2%. People have transitioned to service sector jobs.

But, is robotization a similar phenomenon? It's more broad-based and though there will be more jobs in predictive analytics sector, nanotechnology, and the like, but it's unlikely that it would be enough for all the workers to shift. Generally the viewpoint is that, luddites were wrong about the economic implications of new technology and even if there were short-term setbacks on livelihoods

of a certain section, the long-term gains were way greater to offset the losses. But, will we witness the end of the luddite fallacy soon?

The smart machines can partake in self-learning: something which has been the core domain of humans. This changes the broad fundamentals on which the economy rests.

Recommendations

Due to the frenzy created by Industry 4.0, organizations, and human CEOs would be faced with issues they have never seen previously. Their past experience would be less relevant than before. Their challenge would be adopting new business models and nurturing a culture about how employees see their place in the organization, how they feel and deal with the new and how they mingle with robots in the same setting. In short, they need to be charismatic storytellers to help shape cultures, to embrace the newfound change. The knack to think beyond the routine code and algorithms is exactly what will tide us over in this maelstrom of restructuring of the social fabric. A CEO's adeptness as regards to engaging with teams, motivating and inspiring them, and his innate creativity is something that the robot-boss will have a hard time competing with.

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