Future of Jobs – 2018

INTRODUCTION

With the advances in science and technology, especially in the areas of artificial intelligence, machine learning and robotics, a new era of automation is around the corner. This automation of jobs has had people worried, wondering if it shall put them out of jobs. With machines being created to out-perform humans in various tasks, be it those needing excellent manual dexterity or cognitive abilities, the worry among the masses is fair. In this report, we analyze the potential of automation of various job roles in India, and how automation of tasks will impact the demand of graduates in the job market.

Automation of tasks results in increase in process efficiency by improving quality and speeding up processes simultaneously, causing reduction in prices. This availability of improved, cheaper products and services causes increase in demand, which further leads to more production, hence creating employment. However, we will see a shift in skills that are high in demand. For example, as the production of a product is automated, we will see a reduction in price and a consequent surge in demand. Here, while the automation of production may have left some people out of jobs, it would have added jobs in functions like sales, marketing and operations. Thus, in this manner, instead of completely taking away a certain number of jobs off the market, we are able to replace older jobs with newer positions, requiring a different skill set.

We find that activities that require creative and strategic thinking, and emotional intelligence are less likely to be automated and are here to stay. Hence, it is imperative that we introduce changes in teaching curriculums and pedagogy so as to work upon cognitive abilities and soft skills from an early age. Training and development programs for working professionals are equally important as they help people skill up, whether to move higher up the ladder or take a tangential route and make a career switch altogether.

METHODOLOGY

This report analyses the automation potential of labor market in India. We analyze over 30 job roles and more than 100 skills that are required to perform activities on these job roles. In view of the technological advancements in the area of science and technology, a large number of activities on a job can be conducted using automated tools or bots, thus leaving a significant number of skills needed on certain jobs obsolete.

The 30 odd job roles considered in this analysis are a subset of job roles that graduates in India can be employed in. These job roles are based on O*net's taxonomy of job roles, as well as others inspired by popular professions in the labor market. The job roles are in-turn mapped to skills that are needed on the job and the importance of these skills – that is the importance of being proficient in the skill in consideration. Based on the potential for automation of various skills and their importance on a job, the automation potential of a job role was computed. These jobs are further categorized into various job functions, such as sales, marketing, operations management, and we discuss automation potential in these functions collectively.

In this analysis, we also cover the change in demand in open job positions across roles due to the high potential of automation of various activities on a job. In order to obtain demand for a job role, we collected open job positions in India through an automated survey of various job sites, examining over 10,00,000 jobs in total.

To conclude, we also try to understand if automation of various activities on a job will lead to a significant reduction in demand and thus could give rise to unemployment in the country.

I. DEMAND OF VARIOUS SKILLS AND JOB FUNCTIONS IN INDIA

Before discussing the potential of automation in various skills and job functions, it is crucial to understand the demand, or the number of open job positions in these areas.

Table 1. and 2. below give the number of open job positions in various skills and job functions as a percentage of total jobs in the country.

Skills	Skill Description	Demand %
English Comprehension	The ability to understand the written text and communicate effectively through written documents	100.00%
Deductive Reasoning	The ability to make inferences and decide actions based on data containing multiple textual instructions and simple symbolic rules	62.31%
Inductive Reasoning	The ability to learn and to derive objective rules based on specific instances of a rule's application	45.75%
Agreeableness	This refers to social conformity, cooperativeness, friendliness, and helpfulness. It is a "big five" personality trait	34.30%
Information Gathering and Synthesis	The ability to collate, comprehend, and evaluate information from multiple sources to make inferences and draw objective conclusions, and determine the appropriate course of action	33.74%
Extraversion	This is defined as disposition toward the outer world sociability, talkativeness, and assertiveness	28.21%
Emotional Stability	This is defined as the ability to stay even tempered and face stressful situations without getting upset	22.88%
Quantitative Ability	It is defined as the ability to understand basic number system, i.e., fractions, decimals, negative, positive, odd, even numbers, etc.	15.14%

Function	Description	Demand
Software and Information Technology	Software and IT comprises of job roles such as Support Technician, Software Developer, Networking Engineer, Systems Analyst. In addition to having requisite domain knowledge, they are also required to possess a certain level of reasoning and quantitative ability.	31%
Sales	Sales is a crucial job function for any business as it results in generation of revenue for the organization. The key skills needed for someone to be a successful salesperson are logical ability, soft skills such as agreeableness and ability to influence others by rational discussions.	12%
Customer Service	Customer service is the support and advice provided by an organization to its customers in order to assist them and ease their buying experience and post sales queries.	9%
Marketing	Marketing is a function that designs and implements the promotion strategies for a business, including activities like market research and advertising. This requires skills that are less likely to be matched in competence by automation techniques. Some of these skills are creativity and a highly rational thought process.	7%
Core Engineering	Core engineering comprises of various engineering domains apart from software and IT. These include but may not be limited to electrical engineering, civil engineering and mechanical engineering.	7%
General Management	General management comprises of roles that require leadership and management of an enterprise as a whole, such as Business Managers, General Managers.	7%
Analytics and Consulting	Analytics and consulting is the practice of assisting organizations in improving their operations and processes through the analysis of existing issues and developing improvement plans.	4%
Accounting	Accounting comprises of recording, summarizing, analyzing and reporting financial data. An accountant is required to be highly logical and innovative, as the job requires them to constantly learn the new developments in policies and processes.	3%
Operations Management	Operations management comprises of tasks conducted in order to design and control business processes efficiently so as to ensure smooth production and/or delivery of services or products of an organization.	1%
Others		19%

Table 2. Open job positions in various job functions in India

A little less than one third jobs are in software and IT, and over 20% are sales and customer services jobs. Interestingly, core engineering jobs, in the various engineering domains like civil, mechanical, electrical, form only 7% of the total open positions. While, analytics and consulting, despite being a niche function, comprise 4% of the total open positions.
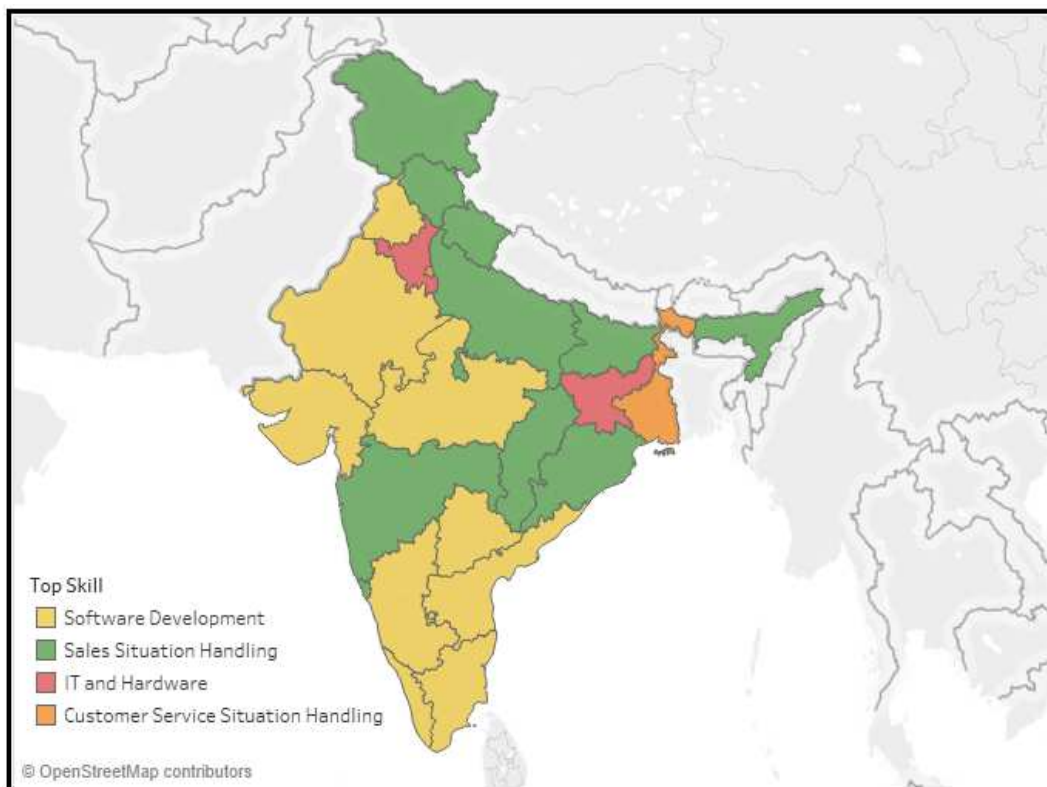

Image 1. Domain skills highest in demand

Image 1. shows the domain skills that are highest in demand in various states* in the country. While both software development and sales situation handling are the top skills in 10 states each, IT and hardware and customer service situation handling are the top domain skills in 2 states each.

In the following chapters, automation potential of skills and popular job functions are covered, along with the impact of automation of jobs on demand in the market.

*States with insufficient number of job openings are not included.

II. POTENTIAL OF AUTOMATION AND ITS IMPACT ON THE LABOR MARKET

Automation of activities requiring various skills can be attributed to developments in artificial intelligence. Activities tagged to different skills are in the process of being mechanized due to the implementation of different technologies.

Information Gathering and Synthesis
It is the ability to collate, comprehend, and evaluate information from multiple sources to make inferences and draw objective conclusions, and determine the appropriate course of action.

Collating and comprehending information may need reading handwritten notes, viewing and understanding images, among other tasks.

Technologies that are enabling automation of information gathering and synthesis:

Handwriting Recognition
● Used to read amount figures from bank cheques
● Used to read mailing addresses from mails and couriers

Nearly 100% accuracy has been achieved in recognizing quality machine print, and 95% read rate in reading addresses from envelopes with 2% error rate.[1]

Image Recognition
● Used to organize image galleries and in image captioning
● Used in image and face recognition for the purpose of authentication
● Used in image search engines
Google has achieved 93.9% accuracy in image captioning.[2]

English Comprehension
English Comprehension is the ability to understand written text and spoken English language, and communicate effectively through written documents or speaking.

Reading, writing and speaking English correctly is needed in order to effectively communicate in the language.
Technologies that are enabling automation of English comprehension:

Speech Recognition
● Used in voice biometrics in authentication and crime investigations
● Used in hands-free assistants, like iOS's Siri
Microsoft[3] has achieved a new milestone of 5.1% word error rate in speech recognition.

Spelling and Grammar check

● Used in grading assessments, used at various levels – schools, employment, migration, etc.
The spelling and grammar checking systems[4] have achieved an accuracy of 50-60% in identifying errors.

Response Generation
● Used to automate customer service assistance.
● Used in automated response suggestion in emails and messages.
Factual response accuracy is very high and the AI systems are able to handle most of the query based responses. 85% of all customer interactions are expected to be handled without a human agent by 2020.[5]

Agreeableness
This refers to social conformity, cooperativeness, friendliness, and helpfulness. It is a "big five" personality trait.

Synthesizing emotions into robots
● Used to recognize human emotions based on facial clues and psychological responses – for instance, criminal investigation.
Synthesizing emotions has two parts – one understanding the emotions and second taking responsive action based on the emotions. Researchers are making staggering progress in building systems powered by AI to synthesize emotion.[6]

The potential of automation of various job functions is computed by taking into consideration the automat-ability of skills needed in order to successfully perform these functions, and the importance of these skills.

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1 https://www.parascript.com/blog/how-accurate-is-handwriting-recognition/

2 https://research.googleblog.com/2016/09/show-and-tell-image-captioning-open.html

3 https://www.microsoft.com/en-us/research/blog/microsoft-researchers-achieve-new-conversational-

4 http://www.danielnaber.de/languagetool/download/style_and_grammar_checker.pdf

5 https://www.ibm.com/blogs/watson/2017/10/10-reasons-ai-powered-automated-customer-service-future/

6 https://theconversation.com/amp/will-ai-ever-understand-human-emotions-70960

Function	Automation Potential
Accounting	61%
Analytics and Consulting	35%
Core Engineering	27%
Customer Service	64%
General Management	14%
Marketing	21%
Operations Management	53%
Sales	39%
Software and Information Technology	42%

Table 3. Automation potential of various job functions

- Among others, functions involving activities that require creativity and logical reasoning largely, are here to stay and have lesser automation potential. For example, Marketing is a function that shows very less ability to be automated at 21%. This is because marketing requires implementation of a fair amount of creative solutions along with critical and logical reasoning to make rational decisions in the process.
- In addition to this, functions that need people management and inter-personal skills also remain low on automation, as these skills are still far from getting replaced by automated methods. Hence, functions like general management and sales are low on the automation scale, at 14% and 39% respectively.
- While customer service is another domain that requires interaction with people, the processes in this function can be highly repetitive and do not need higher order skills like reasoning to perform most of the activities. Thus, over one-third of the activities in a customer service role can be automated.
- Core engineering functions, including domains like mechanical, electrical, electronic and civil engineering, also have low automation potential. While there is large share of activities in the engineering domains that can be automated, including repetitive tasks needing manual and finger dexterity, there is and will always be a much larger share of activities that need critical reasoning and logical ability. For instance, in order to introduce more efficient and accurate methods in the functioning of a production line, it is required that an individual understands the process entirely and is able to draft and implement innovative solutions.
- Functions involving activities such as collecting and processing of data have high potential of automation with the introduction of various software that mechanize the process. This leads to the high automat-ability in functions like accounting and analytics where a large part of the job is collection, cleaning and processing of data. However, activities like analyzing the data and drawing inferences that make an impact on business processes require high level of inductive and deductive reasoning, and thus are still far from being automated.
- In the software programming domain, even with the easy availability of thousands of tools, components and libraries that can handle a large portion of the development work, human intervention is needed to support, extend and integrate these solutions with others. In addition to this, project management and domain expertise need absolute human involvement as the activities involved need people management, planning and strategizing.
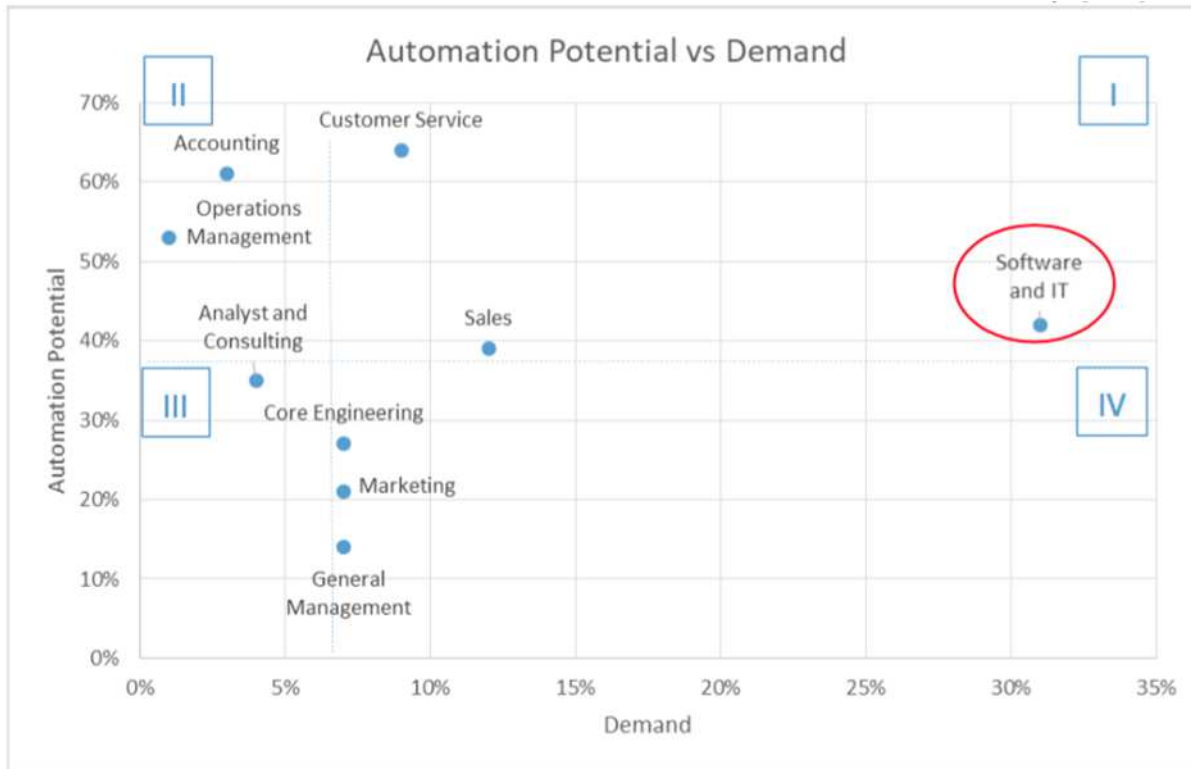
Image 2. Domain skills in demand and their automation potential

In image 2., the graph plots job functions based on their demand in the job market against their automation potential.

Out of the four quadrants on the graph, quadrant I is of the utmost criticality, where jobs with higher demand and higher automation potential lie. These jobs are likely to disrupt the job market by a large extent.

Software and Information Technology comes out to be the domain highest at risk, with demand as high as 31% in the function, the potential of automation of these jobs is 42%. Customer service lies at the edge with high automation potential of 64% and a 9% demand, along with Sales, at 39% automat-ability and 12% demand.

III. IMPACT ON EMPLOYMENT

The introduction of computers saw a wide protest in India from neo-luddite groups, with people being worried that "computers were capitalists who would steal their jobs". Over 60 years since the first computer was brought to the country, we have grown to be one of the largest information technology hubs in the world, employing over 31% of the population in the information technology industry alone. The concept of automation has existed since over centuries. Even with inventions in the primitive times, man has introduced automation in processes in some or the other way. These automations have resulted in improvement in efficiency, speed and quality, and reduction in errors. And so, while there has been reluctance from some groups like the neo-luddites, who constantly oppose forms of modern technology, claiming we may lose our jobs or become slaves at the hands of machines, the world has observed almost a consistent increase in employment.

With every passing year as we bring in new technology to automate processes and make them more efficient, it would be incorrect to say that we lose as many jobs in the process. Instead, we replace some number of jobs and create employment in newer areas. Back in the 1400s, when Gutenberg invented the printing press, luddites were worried that the laborious manuscript writers would be put out of work. Similar reactions were received as a result of other inventions like the automated knitting machine, the tractor, the computer, and many more. However, in each of these cases, automation resulted in improved, cheaper products and services. As a result, the demand for these products and services grew in the market, and consequently led to creation of more jobs than were lost to begin with. Thus, while there may be a short-term threat to jobs in certain areas, automation leads to increase in employment in newer areas.

In order to keep up with automation of tasks, it has become necessary to develop soft skills that enable a person to adapt in new roles and responsibilities. Soft skills are attributes such as communication skills, teamwork, problem solving, emotional intelligence. These attributes are independent of the functional skills a person possesses and are defined by their inherent personality developed over time. Soft skills not only help in efficiently conducting tasks on a person's current job, but also make a person more trainable to be able to take up newer challenges. Additionally, soft skills are the reason why certain tasks cannot be automated, for instance, creative and strategic thinking, people management, inter-personal skills are some of the traits that are hard to be performed by machines, and will continue to be conducted by humans for a long time now.

Thus, while automation may cause a short-term disruption in the labor market, transition to newer roles shall become easier if people improve soft skills and cognitive ability.

Here are the top 5 job functions that have lower potential to be automated in the near future, and are also high on demand:

- Data Analysis
- Marketing
- Human Resource Management and Training & Development
- Project Management in various domains, for instance, engineering, IT
- General Management

States in India where highest decrease in number of jobs is observed due to automation are given in table 4. below.

State	% Decrease
Delhi NCR	45.1
West Bengal	42.2
Haryana	39.3
Uttar Pradesh	39.0
Rajasthan	37.8
Madhya Pradesh	37.8
Karnataka	37.8
Tamil Nadu	37.6
Telangana	37.5
Andhra Pradesh	37.2

Table 4. Estimated decrease in number of jobs due to potential automation

A high reduction in jobs is observed in some of the highly critical areas that have higher employment rate in the country. Delhi NCR, Karnataka, Tamil Nadu, Telangana and Andhra Pradesh have over 40% of the country's jobs, and are severely hit by the mechanization of work activities.

Maharashtra remains less affected by automation – with over 18% jobs of the country in the state, the region loses a little over 18% jobs due to mechanization.

The alarming figures in table 4. call for a change in curriculums and pedagogy in schools and colleges that is dynamic and adapts to the fast changes in the job economy, especially with the new skills in demand. More emphasis on training and development for working professionals is equally imperative.

Aspiring Minds is a global leader in job skills assessments and credentialing. We envision a merit-driven talent ecosystem enabled by efficient job skills matching and reliable and intelligent assessments. Powered by machine learning, AI, psychometry and statistics, these state-of-the-art assessment tools are used by companies across a wide variety of industries to help recruit the right people, develop requisite skills benchmarks, and to assess workforce health.

Pioneering large scale credentialing analogous to a GRE-for-employment concept, the flagship product AMCAT is the most popular employability test in the world today. AMCAT helps to place over two million candidates in the 'right' jobs every year. Backed by our proprietary adaptive assessment technology and machine learning algorithms – AMCAT provides adaptive, standardized and reliable measurements of generic employability skills (language, cognitive, behavioral) while also assessing a wide range of functional skills.

Aspiring Minds helps companies dramatically improve their recruitment efficiency. We are presently associated with more than 3500 corporations in sectors ranging from BFSI, IT, ITeS, hospitality, and retail. We also work with job seekers to help them evaluate their professional skills, earn industry recognized credentials and find appropriate career opportunities.

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10 Principles of Strategic Leadership

Source & Courtesy: https://www.strategy-business.com/article/10-Principles-of-Strategic-Leadership

1. Distribute responsibility.
2. Be honest and open about information.
3. Create multiple paths for raising and testing ideas.
4. Make it safe to fail.
5. Provide access to other strategists.
6. Develop opportunities for experience-based learning.
7. Hire for transformation.
8. Bring your whole self to work.
9. Find time to reflect.
10. Recognize leadership development as an ongoing practice.

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