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Impact of automation on job market dynamics: Skill mismatch and unemployment

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Abstract
This research paper explores the complex relationship between automation and labour market dynamics, focusing particularly on skill mismatch and unemployment. With rapid advancements in arificial intelligence (AI), robotics and machine learning, economies are undergoing transformative changes. While automation drives productivity and innovation, it also poses significant challenges for the workforce, including displacement of routine jobs and widening skill gaps. This paper investigates the multifaceted impact of automation on different sectors with a particular focus on how skill mismatch contributes to structural unemployment. Through a mixed method approach involving literature review and analysis of recent labour statistics, the study aims to offer actionable policy recommendations.

Keywords: Automation, artificial intelligence (AI), unemployment, skill mismatch, robotics, job market

Introduction

Automation has become a defining force in modern economic change. Rooted in the First Industrial Revolution of the late 18th century, automation has evolved from steam-powered machines to intelligent systems powered by AI and big data. Each wave of technological advancement has increased productivity while simultaneously altering labour market demands. The ongoing fourth Industrial Revolution, characterised by digital automation, is intensifying these trends.

The impact of automation on labour markets is multifaceted. On one hand, it fosters efficiency and innovation; on the other hand, it displaces workers whose skills no longer align with market needs. This displacement often results in a phenomenon known as skill mismatch - where the skills possessed by workers do not correspond to those demanded by employers. As a consequence, economies experience both unemployment and job vacancies simultaneously.

Furthermore, automation's influence is not isolated - it intersects with globalization, urbanization and demographic change. These interactions have led to labour market polarization, increased wage inequality and geographical disparities in employment. This study explores these dynamics in depth to understand how societies can better navigate these transition toward an automated economy. It also addresses the ethical and socioeconomic questions that arise when machines begin to perform tasks traditionally reserved for humans.

In India, though economic growth is high but it is unable to generate enough employment for huge growing workforce. A large unemployment prevails in India due to skills gap. Skill gap is prevalent as many workers do not possess adequate education or training that modern industries require. Surveys also depict that most of the educated Indian youth often face very high unemployment rate due to lack of suitable jobs matching their qualifications. This paper examines how automation affect employment patterns and job displacement in India. We aim to provide comprehensive understanding of the various opportunities and threats posed by automation and also policies required to address skill gaps.

Objectives

- Understand how automation (including AI and robotics) changes the number and nature of jobs in India.
- Identify the extent of skill mismatch - the gap between workers' skill and the skills job

require - in the Indian labour market.
- Analyze how automation affects different economic sectors such as farming, factories, services and different groups like young people, women.
- Examine trends in unemployment and how they relate to technology and education.

Recommend policies and actions (like training programs, education reforms and industry incentives) to reduce skill mismatch and unemployment.

Literature Review

Several Global and India-specific studies have examined the impact of automation on employment patterns, highlighting rising concerns over skill mismatch and job displacement. Frey and Osborne (2013) [8] estimated that approximately 47% of jobs in the United States are at high risk of automation, mainly repetitive tasks. Manyika *et al*. (2017) [15] projected that by 2030, around 375 million workers worldwide may be required to change occupations due to automation and artificial intelligence (AI), with significant shifts occuring across sectors. Brynjolfsson and McAfee (2014) [3], in their work The Second Machine Age, emphasized how automation contributes to job polarization: while technology boosts productivity and creates high-skill, high-income jobs it also displaces middle skill roles, thereby widening economic inequality. The World Economic Forum (2020) also forcasted that 85 million jobs could be lost globally by 2025 due to automation, although 97 million new roles might emerge if skill development and policy interventions are strong.

In the Indian context, studies reflect similar concerns. According to a joint report by EY, FICCI and NASSCOM (2017) [7], nearly 46% of India's workforce would need reskilling by 2022, especially in light of rapid digitization across industries. Mckinsey Global Institute (2019) [16] estimated that automation might affect upto 60 million jobs in India by 2030, but stressed that sectors such as healthcare, construction and digital services have the potential to generate new employment opportunities if skill gaps are addressed. NITI Aayog (2018) [19] observed that only 20% of engineering graduates in India are employable due to lack of practical and technical competencies, advocating for widespread reform in the higher education and vocational training system. Aggarwal, Kapoor and Mohan (2020) [1] identified skill mismatch as a major contributor to this problem, underscoring the disconnect between academic curricula and the skills demanded in modern workplaces. Similarly, Mehrotra and Parida (2022) [17] examined India's "educated unemployment" issue, wherein a large number of graduates are unable to find suitable jobs, largely due to poor alignment between education and industry needs.

These findings collectively suggest need for proactive policies that promote lifelong learning, reskilling and labour market flexibility. Though automation poses significant risks to employment, it can also be an opportunity to redefine job roles and create more skill-intensive work.

Methodology

This research adopts a qualitative and descriptive approach, focusing on understanding the impact of automation on job market dynamics in India, particularly in terms of skill mismatch and unemployment. The study relies entirely on secondary data, meaning it draws insights from existing reports, academic articles and policy documents. The aim is to identify patterns, challenges and recommendations based on existing knowledge and data.

Analysis and Discussion

Sectoral Impacts of Automation

Automation is changing the way many industries are working in India. While it is improving efficiency and productivity, it is also affecting jobs - some roles are disappearing and new ones are being created. Different sectors are facing these changes in different ways. Here is a simple explanation of how automation is impacting key sectors

1. Manufacturing Sector

The manufacturing industry is one of the first and most affected by automation. Robots and machines are now doing tasks like welding, assembly and packaging. This has reduced the need for low-skilled workers especially in industries like automobile, textile and electronics. However, there is a growing demand for skilled workers who can operate and maintain machines, handle automation software and manage production system.

2. Information Technology and Software

In the IT sector, routine jobs like data entry, testing and simple coding are being automated using artificial intelligence (AI) and machine learning. However, automation is also creating new job opportunities in areas like cybersecurity, cloud computing, data science and AI development. Companies now need employees with advanced digital and analytical skills rather than basic computer knowledge.

3. Agriculture Sector

Although automation in agriculture is not much penetrated in small farms but machines like automatic harvestors, drones and irrigation sensors are being used in some areas. This helps in increasing productivity but at the same time may reduce the need for manual labours. There is scope for rural youth to get trained in operating and repairing agricultural machines.

4. Retail and E-Commerce

Automation is transforming the retail industry through self-checkout machines, automated billing, and online platforms. E-commerce companies like Amazon and Flipkart use robots in their warehouses to sort and move products. This reduces the number of traditional retail jobs but increases demand for tech-based roles such as digital marketing, logistics coordination, and app management.

5. Banking and Financial Services

Banks are using automation for online transactions, customer service chatbots, ATM services, and fraud detection systems. Many clerical jobs are being replaced by software. However, skilled professionals are needed for tasks like managing digital platforms, cybersecurity, and financial data analysis.

6. Healthcare Sector

In healthcare, automation is used in diagnostic machines, robotic surgeries, and patient record management. While it

reduces the burden on medical staff, it does not replace doctors or nurses. In fact, more trained professionals are needed to use and maintain medical technology, creating demand for both technical and clinical skills.

7. Education Sector

Automation in education includes online learning platforms, smart classrooms, and AI-based learning tools. While traditional teaching methods are changing, teachers are still needed. In fact, there is a new demand for educators who are skilled in using technology to make learning more effective and interactive.

Thus, automation is not removing all jobs but is changing the types of jobs that exist in each sector. It reduces the need for routine, low-skilled work and increases the need for skilled, tech-savvy workers. The challenge for India is to train its workforce to match the skills required in this changing job environment.

Skill Mismatch and its Effects

"Skill mismatch" means people's abilities do not match job requirements. This gap is quite large in India. Many graduates with degrees or certificates are often unable to find suitable jobs for themselves. For example, only a small percentage of engineering graduates are employable without proper training. This mismatch has two sides. Some workers are under-qualified for modern jobs. On the other hand, some are over-qualified with advanced degrees but they take low-skill jobs. Automation intensifies this as an entry-level factory job may disappear, leaving a worker unemployed despite having general education.

One of the main reasons for this mismatch is the outdated curriculum in many educational institutions, which often fails to include the latest technological developments or industry-relevant skills. Most courses are still heavily focused on theory and lack practical training, making it difficult for students to apply their knowledge in real work environment. The gap between academic instruction and industry requirements is widened by the lack of collaboration between educational institutions and employers. Additionally, the speed at which technology is transforming industries has far outpaced the pace of curriculum updates and formal training programs. In rural and semi-urban areas, students often lack access to career guidance and awareness about market trends, leading them to pursue degrees that may not be useful in the job market.

The effects of skill mismatch are visible across Indian economy. One major impact is the high rate of unemployment among educated youth. Many graduates, especially those from non-technical backgrounds remain jobless because they do not possess the digital, analytical or practical skills required by employers. Others are underemployed, working on low-paying jobs that do not match their qualifications, simply to survive. This not only wastes human potential but also affects mental well-being and career growth. For businesses, hiring employees who are not adequately skilled leads to low productivity and inefficiencies. As a result, the overall competitiveness of industries declines, affecting India's economic growth.

Moreover, skill mismatch contributes to rising social inequality. While individuals with in-demand digital or technical skills are able to secure high-paying jobs, those with outdated or general qualification are left behind, deepening the income gap. According to the India Skills Report 2024, only around 45.9% of graduates are considered job-ready. Similarly, NITI Aayog (2020) [19] noted that more than 50% of India's youth lack employment skills. The International Labour Organization (ILO) also reported in 2023 that nearly 30% of Indian youth fall under the NEET category - Not in Employment, Education or Training.

Automation is creating new jobs like programming, machine operation, data work but India's workforce is struggling to fill them. This give rise to structural unemployment where job exist but people don't have skills to fill them. This gap can be narrowed by better education and training.

Demographic Variations

The impact of automation on jobs in India is not the same for everyone - it varies depending on factors like age, gender, education level and location. Young people, especially recent graduates are more likely to be affected by skill mismatch because they often enter the job market without enough practical experience or relevant technical skills. On the other hand, older workers may struggle to adapt to new technologies, especially if they have worked for many years in traditional roles without digital training. Gender differences also play a role - automation has had mixed effects on women's employment. While digital platforms and remote work have created new opportunities for women, especially in urban areas, many low-skilled women workers in sectors like textiles or domestic work are at risk of job loss due to machines taking over routine tasks.

There are also major differences between urban and rural areas. Urban youth usually have better access to education, internet and skill development programs, which helps them adapt faster to technological change. In contrast, rural workers often lack digital literacy and face limited opportunities for training, making it harder for them to compete in an automted job market. Educational background matters too. People with higher education and technical degrees are more likely to benefit from automation, as they can shift into new roles like data analysis, AI development or digital marketing. Meanwhile, those with only basic schooling or outdated qualifications are more vulnerable to job loss or underemployment. These demographic differences show that automation does not affect everyone equally - some groups benefit while others face more challenges in finding and keeping good jobs.

Unemployment Trends

India's unemployment rate has risen in recent years due to multiple factors. Some of the reasons are rapid population growth, economic shifts and the ongoing impact of automation and skill constraints. In India, educated youth unemployment is several times higher than that of those with fewer years of schooling.

The Covid-19 pandemic added to these challenges as many people temporarily lost jobs or switched to lower paying, informal work. As economic activity recovered in 2021-2022, unemployment rates declined slightly, but much of this recovery came from people taking up any available work, often in informal jobs that offer low pay and no job security. It is not an indication of healthy labour market.

Automation has begun reshaping many job sectors in India, especially in manufacturing, IT, retail and agriculture. While machines and software replace routine roles, they

have not yet caused a sharp rise in overall unemployment. Instead, a gradual shift is seen towards gig, informal or self-employed jobs that offer less stability. Joblessness may be decreasing on official figures but underemployment and precarious low-quality work remain common.

Policy Recommendations

To reduce unemployment and bridge the skill gap caused by automation, the following policy actions are recommended:

1. **Update Education Curricula:** Schools and colleges should regularly update their course content to match current industry needs, including digital skills, data analysis, and technical training.
2. **Promote Vocational and Skill-Based Training:** Programs like PMKVY and NSDC should be expanded to provide hands-on training in high-demand sectors like electronics, logistics, and AI.
3. **Strengthen Industry-Academia Partnerships:** Companies should work closely with universities and technical institutes to design job-ready courses and offer apprenticeships or internships.
4. **Improve Access in Rural Areas:** Set up training centers and digital learning platforms in rural and semi-urban regions to help bridge the urban-rural skill gap.
5. **Encourage Lifelong Learning:** Create more flexible online and evening courses so that working people can learn new skills without leaving their jobs.
6. **Provide Career Counseling:** Students and job seekers should receive proper guidance on which careers are growing and what skills are needed.
7. **Support Startups and Innovation:** Offer financial support and mentoring to small businesses and startups that can create new kinds of jobs, especially in tech and green sectors.
8. **Focus on Inclusive Growth:** Special programs should support women, the elderly, and differently-abled individuals to learn and work in automated industries.

Conclusion

Automation is changing the job market in India at a fast pace. While it is helping industries become more efficient and productive, it is also creating new challenges, especially for workers who do not have the right skills. Many people-especially young graduates-are unable to find jobs because their education does not match what companies need. Others lose jobs as machines take over routine tasks. This leads to unemployment, underemployment, and rising inequality in the country.

The problem is not that there are too few jobs, but that people do not have the right skills for the available jobs. This skill mismatch, if not addressed, can slow down India's economic growth and leave many behind. To make the most of automation, India needs to prepare its workforce for the future by focusing on education, training, and technology-based job creation.

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