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Impact of Artificial Intelligence on Job Displacement in Pakistan's Industrial Sector

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Abstract

This study examines the increasing impact of automation and artificial intelligence (AI) on employment patterns in Pakistan's major economic sectors, such as manufacturing, agriculture, logistics, energy, construction, and services. As labour-intensive sectors make up the backbone of Pakistan's economy, AI adoption presents opportunities for increased productivity as well as threats of large-scale job losses. The analysis finds that as much as 60% of Pakistan's workforce could be at risk of being automated, especially in repetitive and low-value tasks in the textile industry, agriculture, transportation, and office work. Sector-level vulnerabilities are noted as the research identifies new patterns in the use of AI, including smart manufacturing, precision farming, automated warehousing, and AI-based customer service. The report also assesses Pakistan's readiness to transition to these changes, highlighting a high digital and skills deficit, particularly among young people, women, and those living in rural areas. In response to these challenges, the paper suggests practical policy recommendations such as targeted reskilling programs, education reforms, vocational training expansion, and digital inclusion policies. Finally, the study highlights that AI can transform inclusive development if it is supported by active, people-oriented policymaking.

Introduction

The rapid advancement of artificial intelligence (AI) and automation is reshaping labour markets worldwide, raising concerns about potential job displacement. Globally, studies indicate that while up to 50% of job tasks may change due to automation in the coming decade, only a smaller fraction of jobs (around 5–14%) might be fully eliminated, as new roles also emerge to offset losses[1]. The disruption could be substantial. The World Economic Forum (2020)[2] projected that 85 million jobs could be displaced globally by 2025 due to AI and automation, even as 97 million new roles may be created, reflecting a major shift in the skills demanded. Developing countries are expected to face disproportionate risks because a large share of their workforce is employed in routine, low-skill jobs. The International Labour Organisation (ILO, 2021)[3] warned that regions like South Asia (including Pakistan) have almost up to 60 percent of jobs at risk from automation. This vulnerability stems from economic structures dominated by agriculture, manufacturing, and informal services, where tasks are more easily automated, and workers have limited avenues to transition into new roles.

Pakistan has a labour force of tens of millions with a large youth population, and a significant portion of workers are engaged in agriculture and low-tech industries. Agriculture alone still employs about one-third of the workforce (37.4% as of 2020-21, down from 42.3% in 2014-15)[4]. This includes many routine manual and clerical roles. One estimate by the World Economic Forum suggests that by 2030, *up to 1.2 million jobs in Pakistan could be displaced* by automation if current trends continue unchecked[5].

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[1] van Eerd, Robbert, and Jean Guo. "Jobs Will Be Very Different in 10 Years. Here's How to Prepare." World Economic Forum, January 17, 2020. https://www.weforum.org/stories/2020/01/future-of-work/.

[2] Forbes Technology Council. "The Future of Work: Embracing AI's Job Creation Potential." Forbes, March 12, 2024. https://www.forbes.com/councils/forbestechcouncil/2024/03/12/the-future-of-work-embracing-ais-job-creation-potential/.

[3] International Labour Organization. World Employment and Social Outlook 2021: The Role of Digital Labour Platforms in Transforming the World of Work. Geneva: ILO, 2021.

[4] Mushtaq, Aatekah. "How Susceptible Is Pakistan's Job Market to AI?" Musafer Human Resource Centre, Lahore University of Management Sciences (LUMS), May 11, 2023. https://mhrc.lums.edu.pk/how-susceptible-pakistans-job-market-ai.

[5] World Economic Forum. The Future of Jobs Report 2020. Geneva: World Economic Forum, 2020. https://www.weforum.org/publications/the-future-of-jobs-report-2020/.

It is important to recognise that AI is a double-edged sword. While it threatens certain jobs, it also has the potential to spur productivity, create new occupations, and contribute to economic growth. In Pakistan, emerging opportunities in the tech sector (e.g. data science, software development, AI system management) are expected to generate new jobs that did not exist before[6]. The net impact on employment will depend on how effectively Pakistan can adapt and reskill its workforce to meet the demands of an AI-enabled economy. This makes the issue of workforce preparedness and skills development central to the discussion.

The country's educational and vocational training systems have lagged behind the pace of technological change, leaving many workers ill-prepared for emerging job requirements. Pakistan Bureau of Statistics (2022)[7] noted that many young Pakistani workers *"lack the technical skills required for employment in emerging sectors"*, underscoring a misalignment between current education outcomes and industry needs. Likewise, a World Bank assessment in 2022 argued that without substantial investment in human capital and digital skills, Pakistan's workforce will struggle to gain the expertise needed to thrive in an AI-driven economy[8].

AI and Job Displacement Pakistani Perspectives

Manufacturing and Textile Sector

Manufacturing is a cornerstone of Pakistan's industrial sector, contributing around 12–13% of GDP and employing a sizeable share of the labour force. Within the manufacturing sector, the textile and apparel industry is paramount, accounting for over 60% of Pakistan's exports and approximately 40% of industrial employment, with around 2.5 million workers in textiles as of 2021[9]. This heavy reliance on labour-intensive manufacturing makes the sector one of the most closely watched in terms of
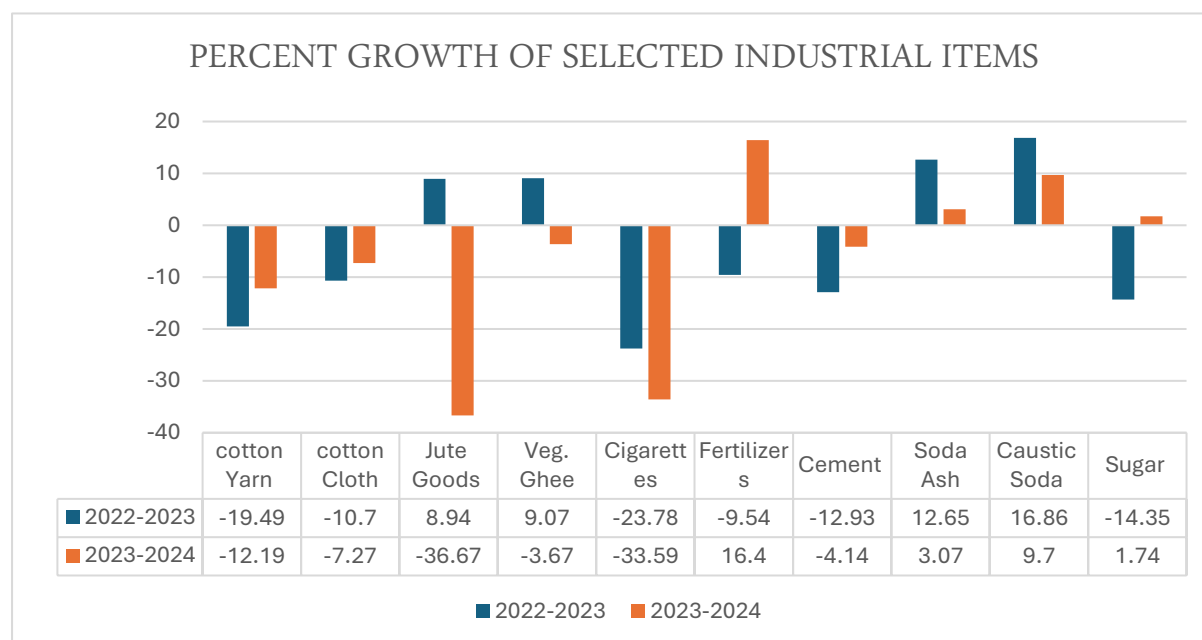
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[6] Aurora. "The Impact of AI on the Future of Work in Pakistan." Aurora, Dawn Media Group, April 27, 2023. https://aurora.dawn.com/news/1144808.

[7] Pakistan Bureau of Statistics. Labour Force Survey 2020–21. Islamabad: Government of Pakistan, 2022. https://www.pbs.gov.pk/content/labour-force-statistics.

[8] Pakistan Institute of Development Economics (PIDE). "AI and the Future of Work for Women in Pakistan." PIDE, October 6, 2023. https://pide.org.pk/research/ai-and-the-future-of-work-for-women-in-pakistan.

[9] Ahmad, M. (2025, March 11). Balancing automation and employment in textile industry. The News International. https://www.thenews.com.pk/print/1290597-balancing-automation-and-employment-in-textile-industry

automation impact. Automation technologies – such as industrial robots, AI-driven assembly lines, and computer-aided manufacturing – have begun to penetrate Pakistani factories, albeit at a slower pace compared to more developed economies. Pakistan's manufacturing industry is highly vulnerable to automation, and the introduction of robotics and AI-powered production is already reducing demand for traditional factory workers in some plants. This aligns with global patterns: repetitive and routine tasks (such as assembly, packaging, or basic machine operation) are easiest to automate. Pakistan needs a different solution to boost the industrial growth, as Pakistan's industrial Structure is already in deficit[10]. Technology progresses and becomes more affordable; Pakistan's textile sector could face significant job displacement.

PERCENT GROWTH OF SELECTED INDUSTRIAL ITEMS

	cotton Yarn	cotton Cloth	Jute Goods	Veg. Ghee	Cigarettes	Fertilizers	Cement	Soda Ash	Caustic Soda	Sugar
2022-2023	-19.49	-10.7	8.94	9.07	-23.78	-9.54	-12.93	12.65	16.86	-14.35
2023-2024	-12.19	-7.27	-36.67	-3.67	-33.59	16.4	-4.14	3.07	9.7	1.74

■ 2022-2023   ■ 2023-2024

Source: Pakistan Economic Survey[11]
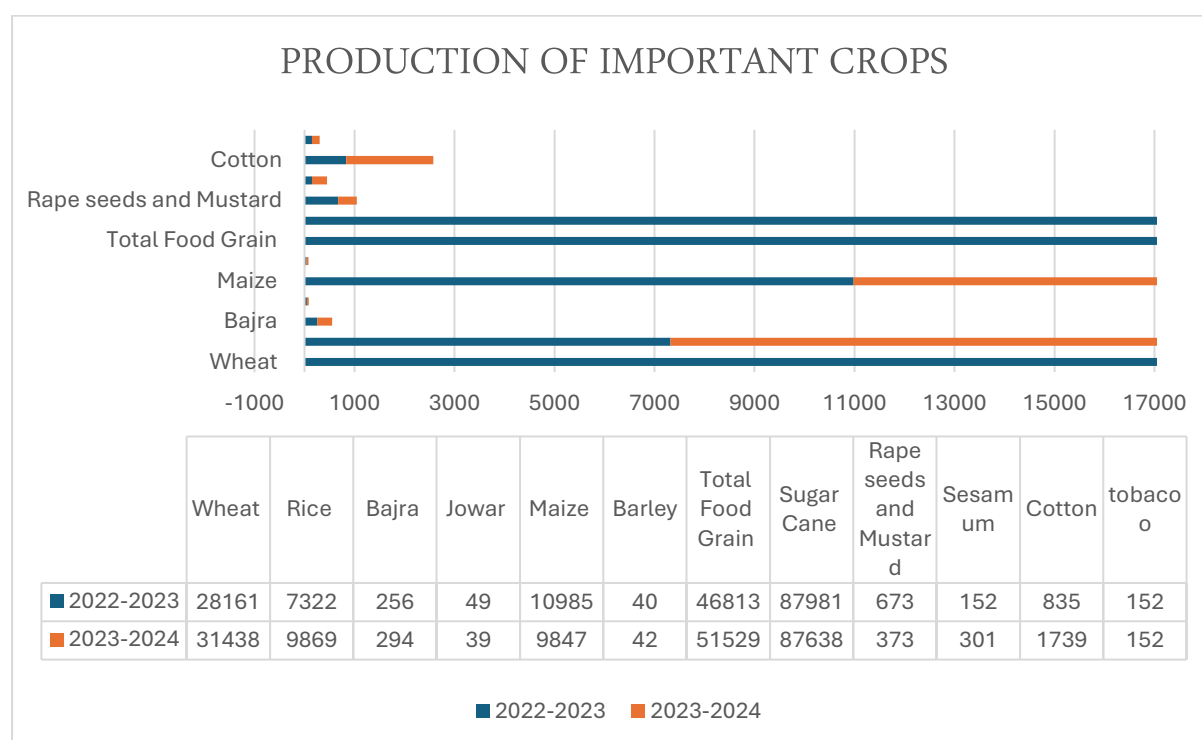
Agriculture Sector

Traditionally, agriculture in Pakistan has been labour-intensive, with modest levels of mechanisation relative to developed countries[12]. However, since 2015, there has been increasing attention on how emerging technologies—precision agriculture, Internet of

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[10] Salman., A & Choudhary., S,A., (2025). Role of Industrial Structural Output in Pakistan's Economy.

[11] https://finance.gov.pk/survey/chapter_24/3_manufacturing%20and%20mining.pdf

[12] Arif, Rimsha, and Ayleen Naushahi. "How Susceptible Is Pakistan's Job Market to AI?" Mahbub ul Haq Research Centre at LUMS, December 8, 2023. https://mhrc.lums.edu.pk/how-susceptible-pakistans-job-market-ai.

Things (IoT) devices, drones, and AI analytics—could transform this sector. *AI in agriculture* is still in early stages in Pakistan; its potential impact on labour should not be underestimated. Automation in agriculture (for instance through AI-driven farm machinery, automated irrigation, and drone-based crop monitoring) *"could reduce the need for manual labour"* in many farming tasks. Drones are being tested for automated crop spraying, irrigation systems are being outfitted with AI to optimise water use, and combine harvesters are gradually replacing harvest crews in some areas. These technologies can significantly increase efficiency and yields, which is a boon for productivity. However, they also *displace the farmers and labourers* who currently perform those jobs[13]. . For example, if an AI-powered system can manage a large irrigation network or if one drone operator can do the work of dozens of field labourers in spraying pesticide, the demand for traditional farm workers may decline.

PRODUCTION OF IMPORTANT CROPS

	Wheat	Rice	Bajra	Jowar	Maize	Barley	Total Food Grain	Sugar Cane	Rape seeds and Mustard	Sesam um	Cotton	tobaco o
2022-2023	28161	7322	256	49	10985	40	46813	87981	673	152	835	152
2023-2024	31438	9869	294	39	9847	42	51529	87638	373	301	1739	152

■ 2022-2023 ■ 2023-2024

Source: Pakistan Bureau of Statistic[14]

Logistics and Transportation

The logistics and transportation sector in Pakistan includes trucking, freight services, warehousing, shipping, and public transport – all vital for economic activity and

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[13] Akademos. "AI and Automation in Pakistan: Threat or Opportunity for Jobs?" Akademos Research, March 4, 2025. https://www.akademosresearch.com/blog/ai-and-automation-in-pakistan-threat-or-opportunity-for-jobs.

[14] https://www.pbs.gov.pk/agriculture-statistics-tables

employment. This sector has traditionally been labour-intensive: thousands of drivers, loaders, warehouse clerks, and delivery personnel keep goods and people moving across the country. With the rise of AI, however, transportation globally is on the brink of a major transformation. Technologies such as autonomous vehicles, AI route optimisation, and automated warehousing systems are expected to dramatically alter how logistics operations are carried out. While Pakistan has not yet seen widespread use of self-driving trucks or delivery drones, these innovations could become a reality in the coming decade and would have a direct impact on jobs in this sector.

According to a discussion by Amir Jahangir (2023)[15] , transportation is one of the industries that may be particularly affected by AI, second only to manufacturing. In advanced economies, self-driving truck trials are already underway, and experts predict that autonomous trucks and taxis could largely replace human drivers for long-haul routes and ride-hailing services within 10–15 years. If such technology becomes commercially viable and is adopted in Pakistan, it could put at risk the jobs of a vast number of truck drivers, bus drivers, and cab drivers. self-driving vehicles could replace human drivers in transportation once the technology matures. Pakistan has an estimated 200,000+ truck and bus drivers and countless inter-city and intra-city transport workers; even partial automation in this area could displace many of them. Similarly, the logistics industry is eyeing automation in warehousing and supply chains[16]. Large e-commerce and courier companies (both globally and in Pakistan) are investing in AI-driven sorting systems, robotic pick-and-place arms, and smart inventory management software. These tools can handle tasks that previously required teams of workers – such as sorting packages, managing stock levels, and scheduling deliveries – with greater speed and accuracy. If Pakistan's logistics firms follow suit, the demand for manual warehouse labour and even certain clerical roles could decline.

Energy Sector

Pakistan's energy sector encompasses power generation (thermal, hydro, renewables), transmission and distribution (electric grids), and the oil and gas industry.

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[15] Jahangir, A. (2023). How AI could reshape transportation in Pakistan. Aurora Magazine, Dawn Media Group. Retrieved from https://aurora.dawn.com/news/ai-transportation-pakistan
[16] Jahangir, Amir. "Stepping Into the Unknown." Aurora Magazine, July 3, 2023. https://aurora.dawn.com/news/1144808

In terms of employment, the energy sector is not as labour-intensive as agriculture or manufacturing, but it employs a significant number of engineers, technicians, line workers, and plant operators. The adoption of AI in energy globally is primarily geared towards improving efficiency, reliability, and decision-making. The impact on jobs in this sector is more about changing skill requirements than mass layoffs, but there is still a displacement risk for certain traditional roles.

In the oil and gas industry, AI and automation are being used for tasks like seismic data analysis (to find oil), drilling automation, and even robotic inspections of pipelines. Pakistan's oil & gas sector is relatively smaller in employment terms, but as companies modernise, they may rely more on AI-driven analysis and IoT sensors, potentially affecting geologists, surveyors, and field technicians who did traditional monitoring. However, these changes often shift jobs rather than eliminate them – workers might need to transition from manual monitoring roles to supervising automated systems or analysing AI-generated insights.
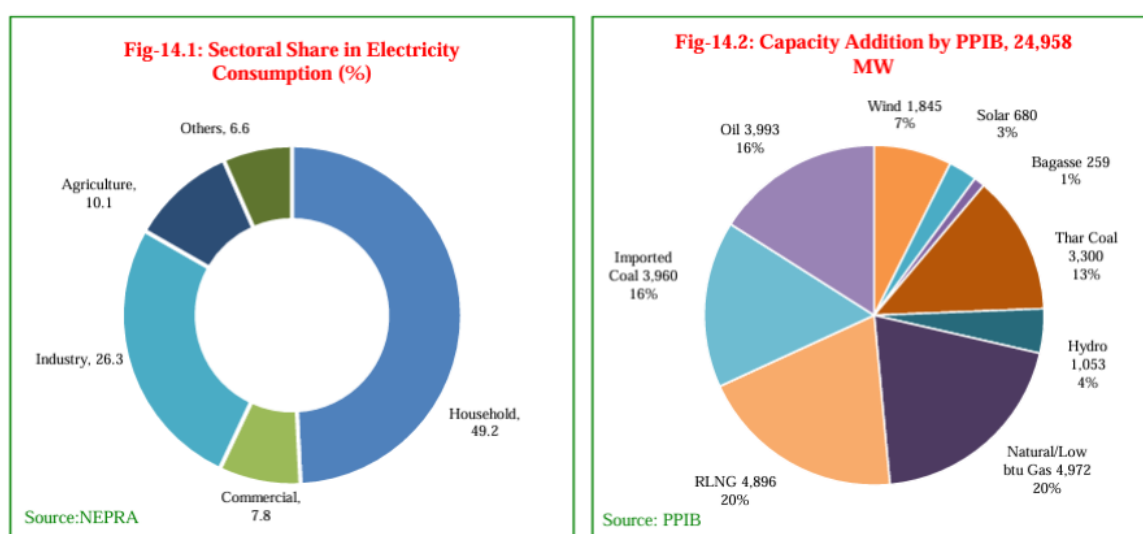
Source: Pakistan Economic Survey[17]

Services Sector (Including IT and BPO)

The services sector in Pakistan is broad, covering everything from wholesale/retail trade and hospitality to banking, education, healthcare, and IT-enabled services. It constitutes the largest share of Pakistan's GDP and has grown to employ the plurality

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[17] https://finance.gov.pk/survey/chapter_24/14_energy.pdf

of workers[18]. The impact of AI on services is heterogeneous – some service jobs are highly susceptible to automation, while others may actually grow in importance.

- **Customer Service and Call Centers:** These are significant employers, especially in urban areas and in business process outsourcing (BPO) companies that serve overseas clients. AI in the form of chatbots and virtual assistants is rapidly advancing. Banks, telcos, and e-commerce companies in Pakistan have begun deploying AI chatbots for customer support. Globally, call center automation threatens to replace a large number of human agents with AI that can handle routine inquiries. In Pakistan, which has a budding call center industry and many customer support jobs, this trend is notable chatbots and other AI-powered tools could replace human operators in call centers for many standard queries. This suggests that thousands of entry-level customer service jobs (often taken by college graduates with good English skills) might be at risk if companies fully embrace these technologies. However, some literature notes that AI will handle simple issues while humans may still be needed for complex, high-empathy interactions, potentially upgrading the nature of customer service work rather than eliminating it entirely.

- **Financial Services:** Banks and financial institutions are adopting AI for tasks like fraud detection, credit scoring, and even automated customer advising (robo-advisors). While the financial sector in Pakistan is not as high-tech as in some countries, leading banks have IT departments exploring AI solutions. This could impact jobs such as credit analysts, loan officers, and administrative staff. On the other hand, as services become more digital, new roles in fintech, digital marketing, and data analysis are emerging in finance.

- **Retail and E-commerce:** The retail sector still primarily consists of brick-and-mortar stores and informal markets in Pakistan, employing a vast number of shopkeepers, sales staff, and support workers. AI's immediate impact here is limited by the traditional retail structure. Yet, modern retail chains and supermarkets are experimenting with self-checkout kiosks and AI-driven inventory systems. E-commerce, a growing segment, uses algorithms for personalised marketing and could, in the future, use robotic warehousing. So, while retail as a whole may not see a sudden AI takeover in

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[18] Arif, Rimsha, and Ayleen Naushahi. "How Susceptible Is Pakistan's Job Market to AI?" Mahbub ul Haq Research Centre, LUMS, December 8, 2023. https://mhrc.lums.edu.pk/how-susceptible-pakistans-job-market-ai.
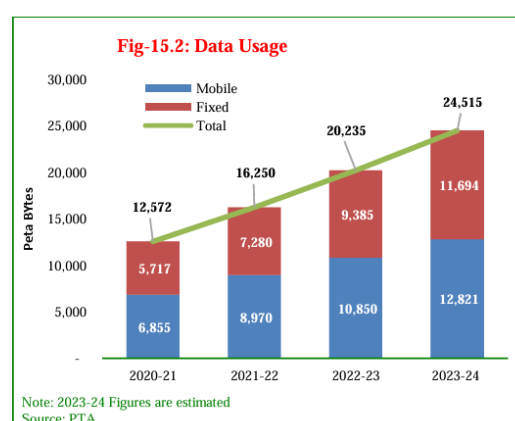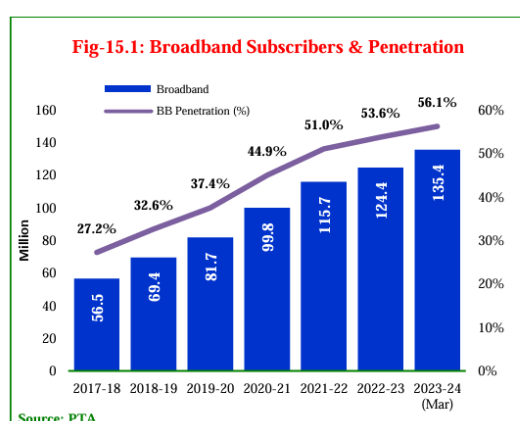
Pakistan, the gradual shift towards organised retail and e-commerce means automation of certain roles (cashiers, inventory clerks) is plausible in the next decade

- **Information Technology (IT) and Software:** Interestingly, this is one service sub-sector where AI is more of a job creator than a displacer in Pakistan. The rise of AI has increased demand for IT professionals who can develop and maintain AI systems. Pakistan's IT industry has been expanding, and many companies and startups are specialising in AI, data analytics, and machine learning solutions. As noted earlier, new jobs in data science, AI development, and related fields are on the rise. The challenge is ensuring enough Pakistanis have the advanced skills to fill these roles, rather than the jobs going to those outside the country. Currently, Pakistan faces a shortage of highly skilled AI engineers, which educational institutions are trying to address by launching specialised programs. Thus, in IT and software, AI is a boon for employment potential – but only for those with the requisite expertise.

- **Gig Economy and Freelancing:** Pakistan is one of the top countries for online freelancing. Many Pakistani freelancers work in fields like content writing, graphic design, digital marketing, and software development for international clients. AI is beginning to affect these areas as well. A*pproximately 17% of jobs in Pakistan are susceptible to automation"* and specifically mentions graphic design, illustration, animation, and content writing as roles already seeing replacement by AI tools. Platforms like Fiverr have even created new categories for AI-assisted services, acknowledging that freelancers are now using AI to deliver work[19]

- **Administrative and Clerical Work:** Across various service industries (government offices, corporate firms, universities, etc.), there are numerous administrative support roles – secretaries, data entry clerks, accountants, HR assistants. These roles are very susceptible to software automation and AI. South Asian studies indicate that women, in particular, are overrepresented in such entry-level clerical jobs. 1 out of every 5 females in [clerical] jobs is likely to lose it due to AI automation in the coming years[20]. This is significant for Pakistan, where female labour force participation is

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[19] Anwar, S. (2024). Gig economy and AI: Pakistani freelancers at the crossroads. Pakistan Institute of Development Economics (PIDE) Discussion Paper, Islamabad.
[20] Anwar, Saba. "AI and the Future of Work for Women in Pakistan." Pakistan Institute of Development Economics, August 2024. https://pide.org.pk/research/ai-and-the-future-of-work-for-women-in-pakistan/.

already low (and often concentrated in education, healthcare, or clerical roles). Automation of tasks like scheduling, bookkeeping (with AI-driven accounting software), and record-keeping can reduce the need for these roles. Conversely, jobs that require social intelligence, decision-making, and creativity (often higher up the ladder) may grow. The PIDE study suggests that while entry-level jobs for women might decline, AI could open up more decision-making or analytical roles if women are equipped with the right skills[21]. This highlights an important point: AI's impact within the service sector can exacerbate inequalities unless there are efforts to help those workers move into the more resilient job categories.

Fig-15.1: Broadband Subscribers & Penetration

Fig-15.2: Data Usage

Note: 2023-24 Figures are estimated
Source: PTA

Source: Pakistan Economic Survey[22]

Methodology

This research uses a qualitative-dominant mixed-methods design with a structured review of literature accompanied by sector-wise economic indicator analysis to evaluate the effect of artificial intelligence (AI) on employment displacement in Pakistan. The study is based on a wide range of secondary data sources, such as official reports of the Pakistan Bureau of Statistics, Pakistan Economic Survey (2022–2023), World Bank Development Indicators, International Labour Organisation (ILO) reports, and pertinent white papers of the World Economic Forum. These sources were chosen for their credibility, national applicability, and frequency of citation in the available literature. A thematic synthesis was conducted through reading more than 50 documents and reports, which shed light on trends in adopting AI, the risk of

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[21] Pakistan Institute of Development Economics (PIDE). (2023). **The future of work and technological innovation in Pakistan**. PIDE Working Papers. Retrieved from http://pide.org.pk/future-of-work-2023

[22] https://finance.gov.pk/survey/chapter_24/15_information%20technology.pdf

automating the workforce, skills misalignment, and preparedness in institutions. The research employs a comparative analytical approach that examines Pakistan's major economic sectors—i.e., textiles, agriculture, logistics, construction, automotive, pharmaceuticals, and services—on five pivotal dimensions: labour productivity, operational efficiency, labour intensity and risk of displacement, level of technological integration, and international competitiveness. The preparedness of each sector for AI integration was measured by aligning existing inefficiencies against possible advantages of AI implementation. Although this research is not based on primary data in the form of interviews, questionnaires, or focus groups, it makes up for this shortcoming by making use of credible and triangulated secondary data derived from internationally reputed sources. This weakness in using non-stakeholder voices directly is recognised as a limitation, yet the thickness and scope of the literature review make the outcomes empirically validated as well as contextual. Overall, this methodological approach allows for a comprehensive understanding of AI's transformative impact on employment within Pakistan's industrial structure and provides a strong evidence base for the policy recommendations proposed.

Theoretical and analytical Framework

To enhance the analytical strength of this research and minimise impressionistic comparison concerns, the study uses a comparative descriptive framework designed to gauge sectoral vulnerability, preparedness, and prospect for artificial intelligence (AI) uptake in Pakistan. Though not directly based on any prevailing global models such as Frey and Osborne's task-based vulnerability model or McKinsey's automation scenarios, this research draws upon analogous principles by finding critical structural dimensions across industries—i.e., labour productivity, operational efficiency, labour intensity and displacement risk, degree of technological integration, and export competitiveness. These dimensions were chosen due to their frequency in automation-readiness literature and their applicability in the Pakistani context. The model allows for a systematic and uniform comparison across industries like textiles, agriculture, construction, automotive, pharmaceuticals, and services. Each industry was compared against this multi-dimensional prism based on data drawn from economic surveys, labour reports, and technology readiness studies, thus adding empirical significance to the findings arrived at. For example, the argument that clothing is subject to more direct AI influence than medicine is not founded on gut

instinct, but on quantifiable measures like labour intensity, current automation levels, and industry reliance on low-skilled activities. While the structure is not taken from a single recognised model, it is based on commonly accepted measures for evaluating automation risk and has been modified to mirror the particular economic, technological, and human capital environment of Pakistan. The method supplies a logical framework for cross-sectoral comparison while maintaining the optionality necessary to adapt to the industrial diversity of the country.
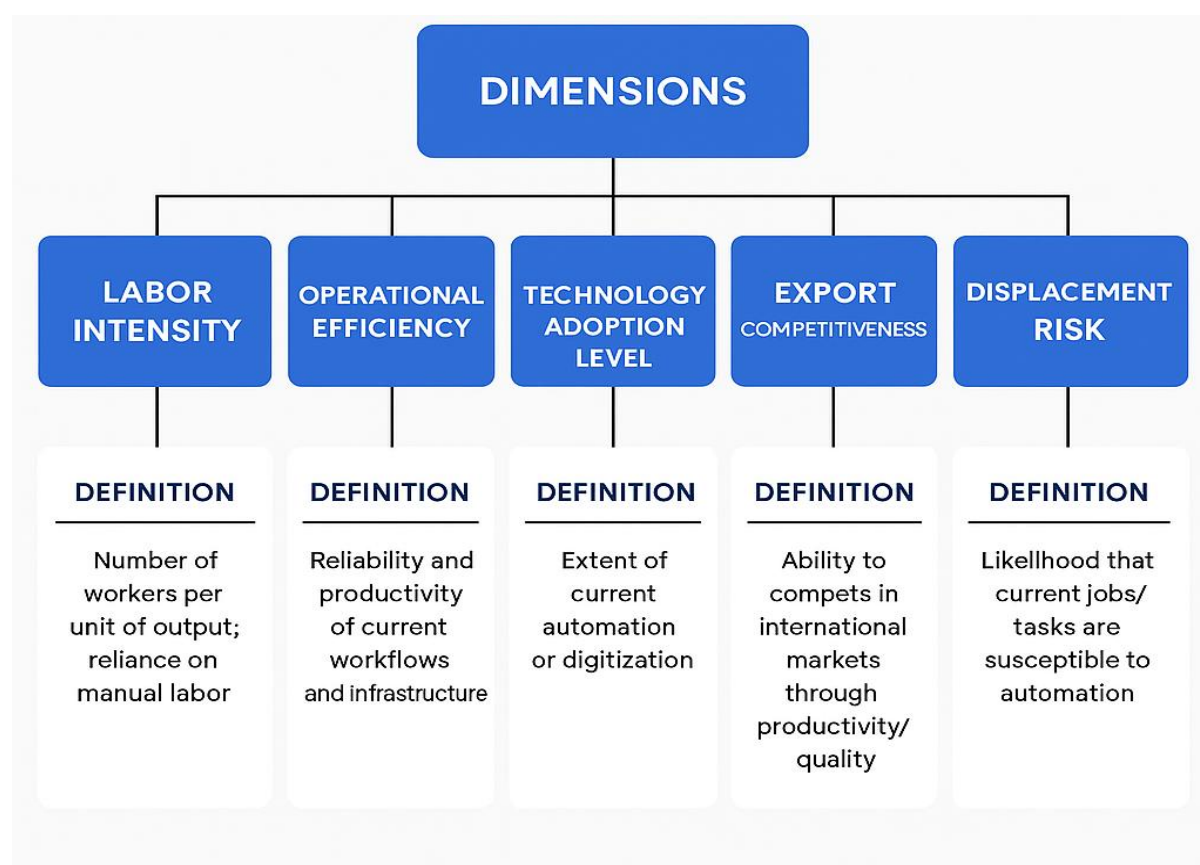
Where AI is needed in Pakistan's Industrial Sector

Pakistan's economy relies on a few key industrial sectors that are critical for growth, exports, and employment. However, sectors such as Textile & Apparel, Automotive Manufacturing, Pharmaceuticals, Agriculture (including Agro processing), and Construction & Real Estate suffer from various inefficiencies. These range from low labour productivity and outdated processes to high accident rates and lagging technological adoption. Integrating Artificial Intelligence (AI) and automation can

address many of these issues by optimising operations, improving safety, and boosting productivity. Comparison tables and sector-specific overviews are provided to highlight where AI-driven solutions could have the most impact.

KPI / Sector	Textile & Apparel	Automotive Manufacturing	Pharmaceuticals	Agriculture & Agro-processing	Construction & Real Estate
Labour Productivity (*Output per worker*)	**Moderate:** Higher than agriculture but below global benchmarks; reliant on semi-skilled labour. Factory output per hour is decent, but below other manufacturing industries	**Moderate-High:** Assembly lines and some automation yield relatively high output per worker in manufacturing. However, overall output is constrained by import-dependent production halts	**High (value-added):** Pharma is capital and skill-intensive. each worker contributes significant value. Production processes are automated to a degree, so output per employee is relatively high	**Low:** One of the lowest productivity levels. Huge workforce yields comparatively low output Traditional farming methods and small landholdings limit output.	**Very Low:** Lowest productivity of all output per construction worker per hour is only about one-quarter of that in manufacturing Manual methods and delays lead to meagre output per worker. Real estate services likewise have low efficiency in processes.
Operational Efficiency (*Process reliability, waste, downtime*)	**Mixed:** Fragmented supply chains and energy outages lower efficiency. Outdated machinery and manual quality inspection cause waste and slowdowns. High input costs further reduce efficiency .	**Inefficient Supply Chain:** Strong assembly capabilities but heavily import-dependent. Regulated import of parts led to component shortages and factory shutdowns Low local parts content and production planning issues create downtime.	**Moderate:** Quality control and compliance processes are cumbersome. Frequent raw material shortages cause production stops R&D and testing cycles are long, and many firms operate below capacity due to limited export orders.	**Poor:** Inefficient water use, low mechanisation, and high post-harvest losses are persistent The sector faces huge waste and highly variable yields. Lack of cold storage and agro-processing means much output is wasted instead of reaching markets.	**Low:** Construction projects commonly suffer delays and cost overruns due to archaic project management. On-site work is often disorganised with frequent rework. The industry has seen only ~1% annual productivity improvement over decades, indicating very slow operational progress. Real estate transactions are also inefficient, with poor transparency and slow bureaucratic processes.

Labour Intensity (*Jobs per output & displacement risk*)	**Very High:** Millions employed in textiles many in low-skill jobs. Automation here could displace a large number of workers, a high social risk. However, AI can also augment workers to increase output without immediate layoffs.	**Medium:** The auto industry workforce is sizable but smaller than textiles. Many jobs are skilled Robots and AI could replace some repetitive assembly tasks, but much of the workforce can be reskilled to supervise automated systems. Displacement risk is moderate.	**Low-Medium:** Pharmaceuticals employ a relatively small, skilled workforce AI adoption might eliminate some manual roles, but overall job displacement risk is low – workers can be retrained for higher-value tasks	**Very High:** About 37% of Pakistan's labour force works in agriculture, mostly in manual, subsistence farming. This sector is extremely labour-intensive. Mechanisation and AI-driven automation could affect millions of rural jobs.	**High:** Construction relies on armies of unskilled workers (masons, labourers). Labour-to-output ratio is high (many workers per project). AI and robotics (e.g. robotic bricklayers, AI-guided machinery) could **reduce** the need for manual labour in repetitive or dangerous tasks. This raises job displacement concerns for low-skilled workers, although new jobs can emerge.
Workplace Accidents (*Frequency & severity*)	**Moderate:** Industrial accidents occur Textile factories often have outdated safety easures. Overall, manufacturing is among sectors with high accident rates in Pakistan. conditions are better than construction. Recent	**Moderate:** Automotive plants have heavy machinery and welding, but adherence to industrial safety can mitigate ccidents. Manufacturing in general sees a significant share of workplace injuries. Still, auto factories likely have	**Low:** Pharmaceutical manufacturing is usually in controlled, clean environments with strict safety. Accident rates here are relatively low; main risks are chemical exposure or lab mishaps, which are infrequent.	**High:** Farming has many unreported accidents from tractor rollovers to pesticide poisoning. Agriculture accounts for 42% of reported work injuries. Many farmers lack protective equipment, and field work exposes them to weather,	**Very High:** Construction is **the most dangerous** sector. It has the second-highest injury rate and it's *increasing* . Falls from heights, equipment ccidents, and structural collapses are common on sites. Globally, construction is considered a high-risk industry, and Pakistan is no exception. Poor safety culture and informal worksites worsen the problem.

	Textiles	Automotive	Pharmaceuticals	Agriculture	Construction
	efforts aim to improve this.	fewer accidents than informal sectors.		chemicals, and machinery accidents.	
Tech Adoption & Automation (*Current level of mechanisation / AI use*)	**Low-Medium:** Some large textile mills have modern looms and even basic automation, but overall Industry 4.0 adoption is limited. Many processes are manual or semi-automatic. Data analytics for supply chain or AI for pattern design is nascent. The sector relies on cheap labour rather than advanced tech,	**Medium:** The automotive sector has begun adopting automation but is behind global leaders. Local car assembly is done with some robotic assistance in welding/painting, but many steps are manual. AI use is not widespread yet. The industry is aware of global trends but constrained by scale and investment.	**Medium:** Pharmaceuticals use automated filling, mixing, and packaging to maintain precision. Lab information systems and data analytics are present in big firms. However, cutting-edge AI is only just emerging. Many firms still operate with legacy equipment and minimal AI in production.	**Low:** Technology adoption on farms is very low. Pakistan's agriculture is often cited for low mechanisation as a key barrier Small farmers use traditional tools; use of AI, IoT, or precision agriculture is rare, though some large farms have begun using tractor GPS guidance and satellite imagery..	**Low:** Construction methods remain traditional – brick-and-mortar with little prefabrication or robotics. Project planning might use basic software, but AI-based schedule optimisation or 3D printed construction is virtually absent. The real estate segment has only recently seen digital platforms for listings; advanced analytics are not common. Overall, the sector lags in adopting modern equipment and digital tools.
Export Competitiveness (*Global trade performance*)	**High importance, Mixed performance:** Textiles are Pakistan's largest export earner, notably yarn, fabric, and garments. However,	**Low (domestic-focused):** Pakistan's auto industry mostly serves local demand under high import tariffs. Exports are negligible	**Low (untapped potential):** Pharma exports are relatively small. The industry mostly caters domestically with generic drugs. Globally,	**Medium:** Agriculture is a significant export segment Pakistan is among top rice exporters. Yet, export value-added is low	**Very Low (non-export):** Construction and real estate are domestically oriented. They contribute to GDP and employment but not directly to exports. Pakistani construction firms rarely win projects

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competitiveness is eroding – global demand is shifting and rivals offer lower costs or better technology. Pakistan's textile exports fell ~12.4% in 2023 amid energy and raw material crises	Pakistani-made vehicles or parts are not significant in global markets. Thus, global competitiveness is low. To change this, the industry would need massive quality and efficiency improvements to meet international standards and find niche export markets	Pakistan's pharma has a minor footprint compared to India or China. However, there is potential if quality, consistency, and R&D improve. AI-driven drug development and process automation could enable Pakistani pharma firms to compete in generic medicines and halal pharmaceuticals in regional markets, but this is a longer-term prospect.	mostly raw or lightly processed goods. Issues like inconsistent quality and not meeting phyto-sanitary standards hurt competitiveness. For instance, Pakistan's basmati rice struggles to fetch top prices due to quality variations. AI can enhance competitiveness by improving yields and quality and optimising supply chains thereby boosting agro-exports.	abroad, partly due to technology gaps. Global competitiveness is not about exporting construction services, but about adopting global best practices. By using AI to build faster and smarter, local firms could become competitive enough to participate in international projects in the

Sector-by-Sector Overview and AI Applications

Textile & Apparel

The textile and apparel sector is the backbone of Pakistan's exports, contributing about 60% of total export earnings and employing 40% of industrial labour[23]. Despite its importance, it faces numerous inefficiencies. Many textile mills operate with outdated machinery, leading to lower output and frequent breakdowns. Energy shortages and high tariffs have caused production costs to spike, and in 2022–23 the sector saw a significant decline due to global demand slowdown, floods destroying cotton crops, and import/export hurdles[24].

Labour productivity is moderate but lags behind that of competing countries. Pakistan largely relies on cheap labour rather than advanced automation, especially in garment stitching and finishing. This labour-intensive approach also raises quality variation and error rates.

Automotive Manufacturing

Pakistan's automotive industry – encompassing car, motorcycle, tractor, and parts manufacturing – holds about 4% of GDP and around 15% of large-scale manufacturing output[25]. It has grown behind high import tariffs and saw a boom until the recent crises. Inefficiencies in this sector are largely linked to its structure: manufacturers import kits and components to assemble locally. In FY2023, auto production plummeted by 42% due to import restrictions on these kits, exposing the vulnerability of the supply chain[26] The sector's operational efficiency is hampered by low localisation of parts and outdated processes at some plants. Labour productivity is relatively higher than in textiles or construction, given the use of assembly lines, but still below world standards

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[23] Finance Division, Government of Pakistan. (2023). Trade and Payments. In Pakistan Economic Survey 2022-23 (Chapter 8). https://www.finance.gov.pk/survey/chapters_23/08_Trade_and_Payments.pdf

[24] Finance Division, Government of Pakistan. (2023). Manufacturing and Mining. In Pakistan Economic Survey 2022-23 (Chapter 3). https://www.finance.gov.pk/survey/chapters_23/03_Manufacturing_and_Mining.pdf

[25] Finance Division, Government of Pakistan. (2023). Manufacturing and Mining. In Pakistan Economic Survey 2022-23 (Chapter 3). https://www.finance.gov.pk/survey/chapters_23/03_Manufacturing_and_Mining.pdf

[26] Finance Division, Government of Pakistan. (2023). Manufacturing and Mining. In Pakistan Economic Survey 2022-23 (Chapter 3). https://www.finance.gov.pk/survey/chapters_23/03_Manufacturing_and_Mining.pdf

automation levels are modest and many processes remain manual or semi-automatic (e.g. parts inspection, certain assembly tasks).

Pharmaceuticals

The pharmaceutical sector in Pakistan is relatively small but vital for public health. It produces generic medicines, some vaccines, and medical supplies, contributing only modestly to GDP and exports (pharma and chemicals exports were about $1.07 billion in 9 months of FY2023)[27]. Inefficiencies in pharma manufacturing and distribution have become evident in recent years – firms faced raw material shortages when import payments were restricted, and price controls made certain drugs unprofitable to produce, leading to occasional medicine shortages. Operationally, many pharma companies still use older production technology and processes, which can be improved. The sector is highly regulated, which means any process inefficiency (in quality testing or compliance paperwork) can delay time-to-market. Labour productivity in pharma is high in value-added terms – a small number of skilled workers can produce a large volume of drugs – but there is room to improve throughput and reduce human error.

Agriculture & Agro-Processing

Agriculture is Pakistan's largest employer and a major contributor to GDP[28]. It also provides raw materials for industries and exports. Despite its importance, agriculture is plagued by low productivity and efficiency. Yields per hectare for major crops (wheat, cotton, sugarcane) are well below global averages due to factors like outdated farming practices, low mechanisation, poor quality seeds, and inefficient irrigation[29]. The sector also suffers huge post-harvest losses – a significant portion of fruits and vegetables rot before reaching markets due to inadequate storage and transportation. Farming is labour-intensive; millions of smallholder farmers rely on manual labour and animal

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[27] Finance Division, Government of Pakistan. (2023). Trade and Payments. In Pakistan Economic Survey 2022-23 (Chapter 8). https://www.finance.gov.pk/survey/chapters_23/08_Trade_and_Payments.pdf

[28] Finance Division, Government of Pakistan. (2023). Agriculture. In Pakistan Economic Survey 2022-23 (Chapter 2). https://www.finance.gov.pk/survey/chapters_23/02_Agriculture.pdf

[29] Food and Agriculture Organization. (2023). Agricultural mechanization for smallholder farmers in Pakistan: Results of a multistakeholder policy dialogue. https://openknowledge.fao.org/bitstreams/0369bd1a-11de-4d1c-9838-ae9f6eda312a/download

power, which is both slow and prone to drudgery. The result is low labour productivity and high labour intensity. Additionally, agriculture faces safety and health risks – pesticide exposure and farm accidents contribute to a high share of workplace injuries[30].

Climate volatility (floods, droughts) further exacerbates inefficiencies by causing unexpected output losses. Agro-processing is closely linked; inefficiencies in agriculture feed into those industries as well.

Construction & Real Estate

The construction and real estate sector in Pakistan are a key part of the economy, fuelling infrastructure development and urbanisation. Construction (buildings, roads, dams, etc.) contributes roughly 2–3% of GDP[31] and employs many workers (often informally). Real estate activities (buying, selling, renting property) are part of the service economy and closely tied to construction. This sector is notorious for inefficiencies and safety issues. Construction projects frequently run over time and budget due to factors such as poor planning, obsolete project management practices, and on-site work inefficiencies. Labour productivity is the lowest among the sectors compared here[32]– A construction worker's output per hour is only a fraction of that of a manufacturing worker. Real estate, on the other hand, suffers from inefficiencies like lack of transparent data and slow processes. It doesn't directly have the safety issues of construction, but the two are linked (e.g. unsafe buildings are a real estate concern too).

AI and Automation: Transforming Key Economic Sectors in Pakistan

Automation and AI can be a game-saver in the textile sector. Predictive maintenance through AI prevents downtime in weaving and spinning equipment, addressing

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[30] Noman, M., Mujahid, N., & Fatima, A. (2021). The assessment of occupational injuries of workers in Pakistan. Safety and Health at Work, 12(4), 452–461. https://doi.org/10.1016/j.shaw.2021.06.001

[31] Pakistan Credit Rating Agency. (2023). Construction. https://www.pacra.com/view/storage/app/Construction%20-%20PACRA%20Research%20-%20Mar%2723_1680249473.pdf

[32] Asian Productivity Organization. (2023). Productivity in Pakistan: Estimates, Bottlenecks, and The Way Forward. https://www.apo-tokyo.org/wp-content/uploads/2023/07/Productivity-in-Pakistan.pdf

operating inefficiencies. Computer vision applications enable automated inspection of fabrics at a faster pace than the human eye, hence enhancing quality while saving on waste. In clothing production, sewbots perform repetitive stitching operations, though this presents job displacement hazards in a highly labour-intensive industry. AI-based design software and augmented reality help designers in pattern-making and fashion forecasting. Moreover, AI streamlines the textile supply chain by forecasting fashion trends, inventory, and streamlining export logistics. Through big data analysis of orders and worldwide pricing trends, AI enables textile companies to quickly adjust to market conditions. Such technologies are critical for Pakistan to compete on the international level because other competing countries are quickly embracing such technologies. Overall, AI enhances textile sector productivity, reduces costs, and fosters innovation. AI provides several avenues to enhance car manufacturing. Robotics and AI-driven assembly lines enhance the accuracy and efficiency of welding, painting, and assembling, and minimise faults and scrap. Predictive analytics enhance supply chain management by projecting demand for vehicles and spare parts, while AI simulations enhance the ability to withstand supply chain breaks. Machine vision provides quality control, ensuring locally produced parts meet global standards. Artificially intelligent design software also accelerates and optimises vehicle development. While automation will cut down conventional assembly work, it opens up new avenues in robot repair, AI system management, and high-tech manufacturing positions. In the end, AI-based innovations can reduce costs of production, increase product quality, and unlock export potential for Pakistan's automobile sector.

AI has revolutionary potential in Pakistan's pharmaceutical industry, right from drug formulation and production to quality control and delivery. Local firms produce mostly generics, while AI can streamline formulations and redeploy existing compounds. AI-based process controls ensure accurate manufacturing conditions, enhancing batch uniformity and yield. For quality control, image analysis rapidly identifies faults in pills and syringes. Supply chain prediction software avoids medicine shortages or overstocking by foretelling demand by region. AI also assists in the analysis of healthcare data from hospitals and pharmacies and inform production planning. In terms of regulation, AI can automate quality documents for drug registration. AI adoption poses little job displacement but generates knowledge jobs in data science and bioinformatics. The net effect is a more effective, compliant, and competitive pharmaceutical industry with export growth prospects.

Artificial intelligence and new technologies such as drones and IoT sensors are transforming agriculture with precision farming. Predictive analytics based on weather, soil, and satellite information predict pests or water stress so that proactive action can be taken. AI-powered smart irrigation systems enhance water use in a water-deficient nation such as Pakistan. Drones track crop health over large fields, detecting localised problems for targeted treatment. Autonomous tractors and robotic harvesters minimise labour requirements while enhancing precision in operations such as seeding and harvesting. AI also increases agro-processing through sorting produce for export and domestic markets according to quality. Supply chain platforms link farmers to markets, predict prices, and advise on harvest timing. Although job displacement threats are present, AI can complement farmers' decision-making and redirect labour to more skilled positions. The ultimate outcome is higher yields, farm incomes, food security, and export competitiveness.

AI and automation bring significant efficiency and safety benefits to construction and real estate. By marrying AI and Building Information Modelling (BIM), project schedules, resource utilisation, and designs can be optimised from vast datasets. On the ground, drones scan from the air and track construction progress, while robotic equipment tackles toxic or redundant tasks. Wearable AI safety devices warn workers of hazardous conditions, avoiding accidents. In real estate, AI enhances property pricing by analysing sales data and enhances customer service through chatbots. Recommendation systems can effectively pair buyers with properties, while AI-powered smart building management systems maximise energy efficiency. All these reduce costs, accelerate construction, enhance safety for workers, and introduce transparency in real estate transactions, which all together transform the industry and align it with international standards.

Ranking of Sectors by AI Integration Impact

Considering the above analysis of inefficiencies and the criteria of economic impact, labour considerations, global competitiveness, and productivity gains, we rank the five sectors in terms of urgency and potential benefit of AI-driven solutions:

1. **Textile & Apparel *First*:** This sector is the lifeblood of Pakistan's economy (major export share and large workforce) and is under intense pressure to modernise. AI adoption here promises an immediate economic impact, improving export quality and reducing

costs in a sector that has seen recent declines. While it's very labour-intensive (raising job displacement concerns), the risk of *not* adopting technology is loss of global market share (and thus potential job losses anyway). AI can boost productivity and operational efficiency significantly through automation of quality control, predictive maintenance, and supply chain optimisation. Given textiles' pivotal role in trade, any efficiency gains translate quickly into better global competitiveness and export earnings. Therefore, textiles rank first for AI integration need, with a focus on augmenting the workforce to manage displacement risks.

2. **Agriculture (including Agro processing)** *Second*: Agriculture's sheer scale and low productivity make it a prime candidate for AI intervention. Even modest improvements here yield large gains in GDP and rural incomes. AI can directly address inefficiencies and significantly increase productivity and efficiency. The *immediate economic impact* could be huge in terms of food output and potentially reducing imports of food items. This sector also has a clear path to improving global competitiveness: better quality and consistent supply of crops will boost agricultural exports. The reason it's ranked second and not first is the challenge of implementation – adoption among millions of small farmers will take time, and there's a high job displacement risk if mechanisation isn't managed carefully. However, AI in agriculture can be introduced in a way that complements farmers rather than outright replacing them in the near term. Considering all factors, agriculture is extremely important for AI integration, nearly on par with textiles, given the transformative potential for Pakistan's economy and the large population it affects.

3. **Construction & Real Estate** *Third*: This sector ranks high because of its acute inefficiencies and safety issues. Labour productivity is abysmally low and accident rates are high, so the potential gains from AI are very significant. The immediate economic impact of making construction more efficient would be seen in faster infrastructure development and cost savings on projects, which can stimulate further investment. While construction doesn't directly boost exports, it is an enabler for the whole economy efficient construction lowers costs for all industries' expansion. The job displacement potential here is a concern, as many low-skilled jobs could be automated; however, the sector also suffers from project delays due to skilled labour shortages and could benefit from automation filling that gap. Also, improved safety through AI is a direct social benefit (potentially saving many lives). Because AI and automation in construction can drastically reduce waste and delays, the sector's operational efficiency could increase

sharply. Thus, construction is ranked third: its transformation via AI would yield broad economic benefits and address critical inefficiencies, albeit with careful handling of workforce transitions.

4. **Automotive Manufacturing *Fourth*:** The auto industry stands to gain from AI in terms of better efficiency and possibly moving towards exports, but its overall size in the economy is smaller than the above sectors. The immediate impact of AI adoption in auto manufacturing would be moderate – it would certainly help with consistent production (avoiding crises like the CKD import issue by improving supply chain planning and could save costs with automation, but this sector is not as large a share of GDP as textiles or agriculture. Productivity gains from AI would solidify the industry's base and potentially lower vehicle prices for consumers. The job displacement risk is moderate and manageable since the workforce can be upskilled. In terms of global competitiveness, Pakistan's auto sector has a long way to go; AI could be a catalyst for eventually meeting export-grade quality and cost levels, but structural issues also need addressing. We rank automotive fourth because it is somewhat intermediate – it definitely benefits from AI, but the scale of benefits (in employment or export earnings) is less immediate than the top three sectors. Nonetheless, as Pakistan aims to modernise its industry, automotive cannot be ignored AI could be key to developing an internationally competitive engineering sector over time.

5. **Pharmaceuticals *Fifth*:** The pharmaceutical sector, while important for self-sufficiency in medicines, is ranked last in terms of AI integration priority from an economic perspective. This is mainly because of its relatively small share in GDP and exports and its already higher baseline of automation compared to, say, agriculture. The immediate economic impact of AI in pharma is not as large or visible on the macro scale improvements would primarily ensure consistent drug supply and possibly reduce import of certain high-tech medicines by enabling local innovation. There is substantial potential to increase efficiency, but these gains affect a sector that is a minor part of the overall labour force and export basket. Global competitiveness could be improved if AI helps Pakistan produce high-quality drugs for export, but capturing significant market share would require time and regulatory alignment in addition to AI. On the positive side, pharma has low job displacement risk and can have high impact on public welfare. However, in a ranking focused on economic and productivity criteria, pharma comes fifth because other sectors offer larger immediate returns on AI investment. It should

still be a focus for modernisation, but its transformation, while beneficial, will not move the economic needle as much as the others in the short term.

Scenario Modelling: Contrasting AI Adoption Futures

To prepare policymakers, we outline alternative trajectories for Pakistan's labour market based on how rapidly AI is adopted and when supportive policies are implemented. A **high-adoption** scenario assumes rapid digitalisation – firms quickly integrate AI and automation – while a **low-adoption** scenario envisions a gradual, labour-intensive path where technology diffuses slowly. In each, we contrast **proactive (early)** versus **reactive (delayed)** policy interventions. These stylised futures highlight trade-offs in sectoral displacement, productivity, and job creation under different policy regimes:

Scenario	Description	Productivity Outcome	Employment Impact	Strategic Insight	References (APA Style)
High AI Adoption + Early Intervention	Rapid AI adoption with proactive policies (e.g., infrastructure, reskilling); boosts productivity and creates high-skill jobs while minimising displacement risks.	High (â‰ˆ1.5% growth/year; ~7% GDP boost in 10 years)	Net positive with policy-led transition to high-skill roles	Best-case scenario; requires investment in upskilling and safety nets	IMF (2023)[33]; WEF (2020)[34]; Acemoglu & Johnson (2021)[35]; Batool et al. (2025)[36]
High AI Adoption +	Rapid AI adoption but without supportive policies; leads to job losses among low-	High but uneven (benefits capital	Net negative; high displace	Most disruptive; calls for urgent	CGD (2023)[37]; UNCTAD (2023)[38]

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[33] International Monetary Fund (IMF). Harnessing AI for Inclusive Growth: Policy Implications for Developing Economies. IMF Working Paper WP/23/201. Washington, DC: IMF, 2023.

[34] World Economic Forum (WEF). The Future of Jobs Report 2020. Geneva: WEF, 2020.

[35] Acemoglu, Daron, and Simon Johnson. Power and Progress: Our Thousand-Year Struggle Over Technology and Prosperity. New York: PublicAffairs, 2023.

[36] Batool, Ayesha, Hassan M. Khan, and Syed Ali. "Technology and Labour: Automation Risks in Pakistan's Informal Economy." Lahore Journal of Economics 30, no. 1 (2025): 35–64.

[37] Center for Global Development (CGD). "Three Reasons Why AI May Widen Global Inequality." Accessed April 2025. https://www.cgdev.org/blog/three-reasons-why-ai-may-widen-global-inequality.

[38] United Nations Conference on Trade and Development (UNCTAD). Technology and Inequality: How the Digital Divide Shapes Development. Geneva: UNCTAD, 2023.

Delayed Intervention	skilled workers, rising inequality, and uneven growth.	and skilled labour)	ment, underemployment	policy correction	
Low AI Adoption + Early Intervention	Slow AI diffusion with proactive policy groundwork; gradual productivity improvement, stable employment, and potential long-term readiness.	Moderate (steady growth via foundational reforms)	Stable; low displacement, moderate new job creation	Low-risk preparation; delays gains but builds resilience	UNDP (2022)[39]; World Bank (2023)[40]; ILO (2021)[41]
Low AI Adoption + Delayed Intervention	Slow AI adoption and reactive policies; minimal productivity gains, persistence of low-skill jobs, economic stagnation, and increasing global marginalisation.	Low (limited innovation or sectoral growth)	Stagnant; vulnerable to external shocks	Worst-case scenario; shows urgency of proactive AI policy	CGD (2023)[42]

Data Limitations and Modeling Challenges

Any assessment of AI's job impact in Pakistan must acknowledge serious data constraints. First, Pakistan's **informal economy** is enormous: ~72% of workers operate informally (76% rural, 68% urban)[43]. These workers (e.g. home-based artisans, casual day labourers, many agricultural and service providers) fall outside formal labour surveys. National statistics largely cover formal enterprises: indeed, one study notes "national labour statistics only encompass the formal labour sector,"

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[39] United Nations Development Programme (UNDP). AI and Digital Transformation in Developing Economies. New York: UNDP, 2022.

[40] World Bank. Automation and Agricultural Transformation: A Policy Guide for Emerging Markets. Washington, DC: World Bank, 2023.

[41] ☐ International Labour Organization (ILO). World Employment and Social Outlook: The Role of Digital Labour Platforms in Transforming the World of Work. Geneva: ILO, 2021.

[42] Center for Global Development (CGD). "Three Reasons Why AI May Widen Global Inequality." Accessed April 2025. https://www.cgdev.org/blog/three-reasons-why-ai-may-widen-global-inequality.

[43] https://pssr.org.pk/issues/v5/3/measurement-and-determinants-of-informal-employment-evidence-from-pakistan.pdf#:~:text=developing%20countries,for%20a%20detailed%20discussion%20of

excluding most women and informal workers (untitled). In practice this means conventional data (like the Labour Force Survey) misses the bulk of the workforce, so any model relying on occupation-level data (e.g. O*NET-style task exposure) will undercount at-risk workers[44].

Second, **labour market statistics are underdeveloped**. Surveys are infrequent and often limited in scope. Pakistan's provincial diversity means one region's data may not apply elsewhere. For example, infrastructure and access vary wildly: only **15% of Balochistan's population** has internet (versus ~46% nationally)[45], and many districts (especially in Balochistan and Khyber Pakhtunkhwa) have "very low digital development". Such regional divides imply that some provinces could remain largely unaffected by AI for years, while others (e.g. Islamabad, big cities) advance rapidly. Without granular subnational data on sectors, skills, and connectivity, it is difficult to estimate province-by-province impacts[46].

Third, **digital literacy and infrastructure disparities** distort projections. As the ILO notes, poor electricity, connectivity, and institutional support in low/middle-income countries will "widen the digital divide" and leave large populations behind. In Pakistan, urban centers may readily adopt AI, but rural/remote areas often lack even basic broadband. Moreover, vulnerable groups – informal workers, women, rural youth – typically lack access to training or technology. These factors mean that simple extrapolations (e.g. applying global automation rates) can be misleading: they assume all workers are equally traceable and that infrastructure is homogeneous, neither of which hold true[47].

Given these gaps, analysts often resort to **proxy indicators and mixed methods**. For instance, rather than raw employment data, models might use sectoral productivity

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[44] Asna Afzal, "Pakistan, the WTO, and Labor Reform," Boston College International and Comparative Law Review 29, no. 1 (2006): 107–122, https://lira.bc.edu/files/pdf?fileid=d04c1364-974a-48b9-9615-8050a2310f4f

[45] Samra Hamid, "Bridging the Digital Divide in Balochistan," World Geostrategic Insights, September 18, 2024, https://www.wgi.world/bridging-the-digital-divide-in-balochistan/

[46] Mehr Shah, "The Deplorable State of Pakistan's Digital Divide," Business Recorder, September 19, 2024, https://www.brecorder.com/news/40322876.:contentReference{index=6}

[47] International Labour Organization, Changing Demand for Skills in Digital Economies and Societies (Geneva: ILO, 2021), https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_emp/@ifp_skills/documents/publication/wcms_831372.pdf

growth or mobile phone penetration as proxies for AI readiness. Case studies and expert surveys can fill in the blanks where hard data are missing[48]. Household surveys (like the STEP survey) may be leveraged to infer occupational tasks indirectly. Development bodies recommend supplementing sparse data with qualitative insights and scenario exercises. For example, UNDP emphasises the need for universal Internet access and digital literacy programs to even begin harnessing AI. In practice, credible modelling of Pakistan's AI impact may combine international benchmarks with locally calibrated assumptions (e.g. adjusting exposure rates downward to reflect high informality).

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[48] Waseema Batool et al., "The Impact of AI on Employment in Pakistan: A Study on Job Displacement," Journal of Management Horizons 6, no. 1 (2025): 490–510, https://www.researchgate.net/publication/390058450_THE_IMPACT_OF_AI_ON_EMPLOYMENT_IN_PAKISTAN_A_STUDY_ON_JOB_DISPLACEMENT.:contentReference{index=11}

Sector	Contribution to Economy	Current Inefficiencies	AI Applications & Benefits
Textile & Apparel	60% of export earnings, 40% of industrial employment	Outdated machinery, frequent breakdowns, high labour intensity, energy shortages, high production costs, significant output decline (-16%)	Predictive maintenance, automated fabric inspection, sewbots for stitching, AI-driven design software, supply chain optimisation, increased productivity, enhanced global competitiveness
Automotive	4% GDP, 15% large-scale manufacturing output	Import-dependent production causing vulnerability (42% decline FY2023), low localisation, moderate automation, low operational efficiency	Robotics for assembly, predictive supply chain analytics, AI-driven quality control, design and simulation tools, improved efficiency, reduced downtime, higher quality products, potential for international competitiveness
Pharmaceuticals	Modest GDP and exports (~$1.07 billion exports FY2023)	Raw material shortages, price controls, outdated production processes, delays due to regulatory compliance	Drug formulation optimisation, process automation, AI-driven quality control, predictive demand forecasting, efficient resource management, improved quality compliance, enhanced global competitiveness, minimal job displacement risk
Agriculture & Agro-processing	37.4% employment, ~22.9% GDP	Low productivity, low mechanisation, high post-harvest losses, labour-intensive, frequent workplace injuries, vulnerable to climate variations	Precision agriculture (predictive analytics, AI-driven irrigation), drones for crop monitoring, autonomous machinery, optimised agro-processing, supply chain efficiency, enhanced productivity, reduced

			resource waste, increased export competitiveness, manageable labour displacement
Construction & Real Estate	2–3% GDP, large informal employment sector	Very low labour productivity, frequent delays, high costs overruns, highest accident rates, inefficient real estate processes (low transparency)	AI-driven project management (BIM, predictive scheduling), robotic equipment, drones for inspections, AI safety systems, real estate market analytics, smart building management, improved operational efficiency, significant reduction in accidents, better investment attraction, potential labour displacement managed by new skilled roles

Conclusion and Policy Recommendation

The development of artificial intelligence in Pakistan is paradoxical: the promise to release productivity and world competitiveness, and the concurrent danger of mass displacement of jobs—especially in low-skilled and labour-intensive sectors. This study reveals that AI adoption, unless strategically planned for, could actually worsen unemployment, inequality, and social instability. The industries examined textiles, agriculture, logistics, energy, services, automobile, pharmaceuticals, and construction exhibit different degrees of vulnerability and preparedness. Textile and agribusiness are at the greatest risk, considering their size of employment and productivity level, while services and IT hold scope for new job creation. Construction and real estate, being inefficient and accident-prone, could gain hugely from AI-driven change if proper workforce shifts are ensured.

The most pressing takeout is closing Pakistan's skills gap. As 91% of youth lack basic digital skills and millions work in informal labour, Pakistan has to act swiftly on education reform, vocational education, and digital inclusion. Policy attention should change from reactionary mitigation to forward-thinking capacity building, infusing AI literacy, establishing reskilling pipelines, and making rural and marginalised groups non-expendables.

AI is not necessarily a danger but a device. If the right policies and institutional readiness are in place, Pakistan can leverage AI to update its industries, generate high-value employment, and lower its industrial inefficiencies. The study emphasises that the future of work in Pakistan will be determined not only by the speed of AI uptake but by how inclusive and wise that transition is. Following Policy recommendations government may adopt to implement AI in the identified sectors

- Leverage the NAVTTC and TEVTA centre network to provide 6–12 month reskilling courses in domains such as AI-driven machinery operation, data entry, and digital freelancing. Collaborate with the private sector to co-design curricula and ensure internships or placements.
- Scale up DigiSkills.pk to incorporate AI-driven career counselling and Urdu and regional language modules to make it accessible. Embed mobile learning modes (SMS/WhatsApp-based learning) for workers with intermittent internet access.

- Provide training vouchers (PKR 10,000–30,000) to the unemployed or low-income beneficiaries that can be used at registered public or private training institutes. Participation in short-term technical courses driven by the market demand would be encouraged through this.

- To mitigate the impact, experts recommend strategies like *"semi-automation"* and workforce upskilling. Rather than immediately pursuing full automation, firms can adopt technologies that augment worker productivity.

- Begin digital literacy and coding basics from Grade 8 onwards in all public schools. Leverage the installed computer labs under the CERP/IT board schemes and upskill existing teachers through short certification modules.

- Deploy solar-powered mobile skill labs—vans with laptops, internet, and trainers—to provide digital skills and rudimentary AI awareness training in rural locations. The labs can be moved from village to village and small town to small town on a weekly basis.

- Collaborate with technology firms such as Systems Ltd., Microsoft, or Huawei to organise AI and machine learning bootcamps in major cities. Emphasise hands-on tools such as Python, Power BI, and TensorFlow, and leverage these as pipelines for IT industry talent.

- Use community centres or girls' schools after school hours to organise female-oriented digital skills training, particularly in low-income or conservative areas. Offer transport allowances and childcare assistance to enhance participation.

- Create a basic job-matching mobile application that matches newly trained workers with gig and freelance jobs (locally and internationally). Incorporate verified DigiSkills or TVET certifications for trust and simple hiring.

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