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Automation, Migration, and Development: Geography of Job Precarity in South Asia and North Africa

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Abstract

This article examines how accelerating automation and the adoption of artificial intelligence (AI) in advanced economies reshape labor markets across the Global South through interconnected channels of production, migration, and remittances. Drawing on the theories and practices of economic geography, labor economics, and development studies, the analysis conceptualizes automation as a transnational shock that contracts demand for migrant labor while simultaneously amplifying employment precarity in labor-surplus economies. The article advances a geographically grounded framework linking technology adoption in core industries with labor displacement, youth unemployment, and urban labor saturation in South Asia and North Africa. It further highlights the macroeconomic vulnerabilities in developing countries arising from remittance dependence and the role of digital media in shaping youth mobilization and political unrest in their native countries. By integrating comparative regional field evidence with a technology–labor–space framework, the study contributes to economic geography by demonstrating how digital transformation reconfigures development patterns across regions and countries. The findings underscore the limits of technology-led growth strategies in labor-abundant contexts and call for employment-centered digital policies that are spatially differentiated and institutionally grounded.

Keywords: automation, artificial intelligence, labor markets, remittances, youth unemployment, economic geography, Global South.

Introduction

Rapid advances in artificial intelligence (AI), automation, robotics, and digitally mediated coordination systems are transforming how value is produced and captured

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across the global economy. While these technologies can raise productivity and spur innovation, they also distribute labor demand unevenly across industries, regions, and skill groups. Research from both rich and developing countries shows that automation can have mixed effects. It can help businesses grow and produce more, but it can also replace some types of jobs. At the same time, it can increase the gap between high- and low-skilled jobs and widen economic differences between regions (Acemoglu & Restrepo, 2020; Graetz & Michaels, 2018).

From an economic geography perspective, the key question is not whether technology “kills” jobs in the aggregate, but how economic adjustment costs are distributed across places and across labor groups. This article discusses a policy-oriented analytical framework that treats automation as a cross-border labor-market shock. Automation serves as a labor-saving mechanism in host countries. It can reduce remittances in labor-exporting countries. In South Asia and North Africa, overseas employment and remittances have historically functioned as a safety valve for surplus labor. When these employment channels contract, the socio-economic costs of adjustment return to labor origin countries as macroeconomic stress, constrained employment creation, and heightened youth precarity (ILO, 2024; World Bank, 2024).

Findings from China’s internal migration system help clarify such processes. Automation, by itself, does not “push migrants out” from destination regions; rather, it changes the situation about who remains there and under what conditions. In Chinese cities that use robots extensively, more migrants tend to settle for lower-level jobs. However, the benefits of automation are not the same for everyone. Highly skilled migrants often succeed because they work in jobs that involve or support the use of robotic machines. Low-skilled migrants also find opportunities, mainly in growing service sector jobs. Migrants with medium-level skills, especially those doing routine tasks, are the most likely group to lose or risk their jobs (Zhou et al, 2024). This pattern is important from the perspective of economic geography because automation can increase inequality among worker groups and create overcrowded job markets in cities. This is because cities will have to absorb more low-skilled people moving from rural areas. Similar trends can be seen in large cities in South Asia and North Africa, where many people move from rural areas to cities, even when formal job opportunities there are growing slowly.

Material pressures are increasingly influenced by digital platforms that dismantle information barriers and help youth mobilize quickly, sometimes fueling rebellion. Social media lowers coordination costs and helps to spread shared grievances of the young population (Howard & Hussain, 2011; Tufekci & Wilson, 2012). New immersive

“metaverse” platforms may expand these trends by supporting robot-based communities and digital business opportunities, but they may also widen participation gaps among rich and poor in areas with limited internet connectivity (Kamdjoug et al., 2026; Shneiderman, 2002; Tierney & Farmer, 2002).

By linking technological restructuring in destination economies to migration constraints, remittance vulnerability, and digitally mediated youth mobilization, the article contributes to economic geography by (1) extending uneven development theory to cross-border labor-market adjustment, and (2) integrating political economy with the geography of digital space to explain why social unrest can become synchronized across geographically distant regions (ILO, 2011; OECD, 2024).

Theoretical Contribution

This article advances three interrelated ideas. First, it conceptualizes automation as a cross-border labor-market shock whose socio-economic adjustment costs are redistributed through migration, extending uneven development patterns for firms and regions. Second, it reframes remittances and overseas employment as spatial solutions whose viability is undermined by labor-substituting digital transformation and tightening migration regimes in destination economies. Third, it links digitally mediated youth mobilization to structural labor displacement, integrating political economy with the study of digital space to explain why social unrest can emerge in transnational waves when labor-market inclusion and mobility options narrow (Howard & Hussain, 2011; ILO, 2011; Tufekci & Wilson, 2012).

Conceptual Framework: Technology, Geography, and Labor

Automation does not abolish geographic constraints; it reorganizes them through spatial equilibrium adjustment and uneven diffusion of complementary inputs. As automation and AI spread, their impacts are filtered by heterogeneous local infrastructures, firm capabilities, and institutional capacity, producing spatially differentiated labor-market outcomes rather than a single national effect. In the task-based view of production, employment opportunities depend on how technologies reallocate tasks between labor and capital: automation displaces workers in the tasks it performs, while productivity gains raise output and labor demand in the remaining tasks, and innovation can create new tasks that re-expand labor demand (Gathmann et al., 2024; Jaccourd et al., 2025; Jones & Tonnetti, 2026). The net effect is inherently place-contingent because adoption incentives and adjustment margins vary with local factor costs, industrial ecosystems, and frictions to reallocation. Thus, the same technology can drive employment expansion in some regions and contraction in others, especially when regional “weak

links” in complements constrain the translation of technical capability into new task creation. (Auray, 2025; Acemoglu & Restrepo, 2020).

Firm-level evidence suggests that adoption of robotic technology can raise productivity and expand within-firm employment, but with employment gains concentrated among highly educated and skilled workers (Wang et al., 2024). In parallel, research in management and innovation suggests that robot-adopting firms can function as “user innovators,” leveraging robotics to redesign products and processes, which provides explanatory insight into the positive association between robot density and creation of new patents (Wang et al., 2023).

The proposed framework links three spatial mechanisms: (1) Core restructuring: automation and AI reshape labor demand and bargaining power in advanced economies. (2) Mobility governance: migration regimes filter who can access employment opportunities, favoring certain skill groups. (3) Peripheral exposure: labor-exporting regions face remittance volatility, youth labor surpluses, and urban population saturation due to increasing *ruralopolis* phenomena (Bhattarai & Conway, 2021), while digital platforms accelerate the diffusion of expectations and grievances. Together, these mechanisms clarify how technology-driven change in destination countries can translate into uneven development, labor precarity, and political instability in peripheral regions (OECD, 2024; World Bank, 2024).

Technological Automation and Spatial Reorganization of Production

High-throughput robotics, self-driving laboratories, AI-enabled production systems, and digital twin technologies are transforming industrial and agricultural processes by reducing costs, labor intensity, and production time (Wang et al., 2026; Fernández et al., 2025). Robotics adoption compensates for labor shortages, enhances productivity, and improves workplace safety (Liberty et al., 2024). These developments encourage reshoring and nearshoring, weakening the traditional comparative advantage of low-wage economies and restructuring global production networks.

Automation and AI as Labor Market Disruptors

Industrial robots and AI are increasingly replacing routine and semi-routine tasks in both manufacturing and service sectors, thereby reshaping occupational structures and the spatial distribution of employment opportunities. Evidence from the United States indicates that robot adoption has reduced employment opportunities and placed downward pressure on wages in affected local labor markets, particularly for lower-skilled workers relative to higher-skilled workers (Acemoglu & Restrepo, 2020). Cross-country evidence further suggests that, although robots enhance productivity and overall

economic output, they also widen employment for some groups and income disparities between high-skilled, white-collar workers and lower-skilled, blue-collar workers, thereby intensifying labor market polarization (Graetz & Michaels, 2018).

Automation Across Manufacturing, Services, and Agriculture

AI chatbots, robotic process automation, predictive maintenance, and AI-augmented business process systems are automating routine cognitive and service tasks (Sufi, 2025; Martino et al., 2025; Marchena Sekli & Godo, 2025). In agriculture, DigiHortiRobot demonstrates how robotics can autonomously perform seeding and harvesting with over 90% accuracy (Fernández et al., 2025). These advances illustrate the expanding use of automation in both physical and cognitive labor domains.

Replacement of Hazardous and Skilled Labor

Robotic systems increasingly replace human labor in dangerous and dirty jobs. Tunnel boring maintenance time has decreased from 3.1 days to 1.3 days, representing a 60% efficiency gain (Du et al., 2022). Digital twin systems enable remote monitoring and predictive control, allowing fewer highly skilled workers to oversee large production systems (Fernández et al., 2025).

Workforce Displacement, Skill Transformation, and Lifelong Learning

Automation reduces routine employment while generating demand for robotics technicians, programmers, and data analysts (Liberty et al., 2024). These technological changes increase demand for advanced digital and analytical skills.

Localization of Production and Supply Chains

Robotics enables localized, continuous production systems, reducing dependence on global supply chains and the need for large labor forces. As a result, production can be increasingly regionalized (Liberty et al., 2024). Firm-level evidence from China points to an important nuance: robot adoption, especially with collaborative robots, can increase within-firm employment through productivity and scale effects, while also increasing the hiring of highly educated and high-skilled workers (Wang et al., 2024). For labor-exporting regions, the key implication is that automation may not simply reduce job counts in destination economies; it can also increase selectivity, compress demand for mid-skill and low-skill workers, and weaken traditional employment pathways for new labor-market entrants.

Generative AI may extend these dynamics beyond manufacturing into administrative and professional tasks. Where education systems and labor-market institutions are not

aligned with emerging task demands, automation can deepen job precarity by expanding informal work, compressing wages, and intensifying competition in low-productivity services. The resulting spatial outcome is loss of jobs in places already constrained by capital scarcity and weak institutions.

Migration Regimes and Labor Market Contraction in Developed Economies

Migration systems function as institutions that shape how technological change affects international labor markets (Castles et al., 2014; Massey et al., 1993). As destination countries adopt labor-saving technologies and face domestic political pressure to limit immigration, migration policies often become more restrictive, with tighter entry rules and stronger enforcement (Goldin et al., 2011; Ruhs, 2013). The International Migration Outlook 2024 edition highlights both the size of migration flows and the key role of policy changes in influencing labor-market integration in OECD countries (OECD, 2024; OECD, 2023).

Automation may reduce demand for migrant labor and contribute to stricter immigration policies (Martino et al., 2025). Remittance-dependent economies—particularly in South Asia and North Africa—face growing vulnerability (Gudivaka et al., 2025; Fernández et al., 2025). Reduced access to overseas employment for South Asian and North African youth tightens an important outlet for surplus labor. When foreign job opportunities decline, domestic labor markets—often lacking strong formal-sector growth—cannot effectively absorb workers, leading to higher unemployment and underemployment, particularly among youth (ILO, 2024). The problem is worsened in regions where recruitment systems, debt-funded migration, and employer-dependent visas raise mobility costs and increase migrants’ vulnerability to sudden policy changes in the destination countries.

Evidence from China’s internal migration provides explanatory insight into why reductions in international migration can have more severe effects than shifts within a country. In China, migrants are often able to remain in highly automated cities by taking on new tasks or service-sector jobs, even as labor-market polarization increases (Zhou et al., 2024). In contrast, international migrants from poorer countries face border controls and recruitment systems that can suddenly cut off international mobility options, pushing displaced workers back to their home regions and intensifying labor-market pressure there.

Remittances and Macroeconomic Vulnerability

Remittances are central to household welfare, poverty reduction, and macroeconomic stability in many labor-exporting economies. At the national scale, remittances supply

foreign currencies, finance imports, and stabilize consumption during economic downturns (World Bank, 2024). Automation is reducing the demand for overseas labor. At the same time, stricter migration policies in destination countries are limiting opportunities for foreign workers. These trends reduce remittance inflows and increase local unemployment in labor-sending countries. The impact is severe, especially in countries where remittances account for a large share of GDP or foreign-exchange earnings, such as Nepal. This increases vulnerability to external shocks and worsens balance-of-payments pressures (World Bank, 2024).

Remittance-dependent economies such as Nepal illustrate how global labor mobility is embedded within broader structures of uneven development and labor reserve dynamics. As per labor reserve theory, overseas migrant workers function as an externalized labor buffer, supplying surplus labor from economically marginalized regions to international labor markets while sustaining household economies in origin countries through remittance transfers (Peck, 1996; Harvey, 2001). However, this system simultaneously reinforces dependency relationships for labor-exporting countries, as local livelihoods and regional economies become structurally tied to external labor demand and global economic cycles, reflecting classic dependency arguments advanced by Immanuel Wallerstein (1974) and other scholars.

In Nepal, remittance flows are spatially concentrated in migrant-sending districts, particularly in western hill and mountain regions such as Gulmi, Arghakhanchi, Baglung, and Doti, where limited agricultural productivity, environmental constraints, and weak industrial development have historically constrained local employment opportunities (World Bank, 2023). In contrast, relatively diversified urban economies, including the Kathmandu Valley and emerging urban centers such as Pokhara and Butwal, rely less directly on remittance income and offer greater access to service-sector employment and government investment. When remittance inflows decline—whether due to recessions in Gulf Cooperation Council and other labor-importing markets, policy changes in destination countries, or global economic disruptions the effects remain territorially uneven. Rural migrant-sending districts experience disproportionate reductions in household consumption, declines in housing and small-business investment, and heightened livelihood insecurity, while urban areas face increased rural-to-urban migration pressures and labor market competition (Seddon, et al. 2002; International Monetary Fund, 2022).

From a political economy perspective, remittance volatility also shapes macroeconomic conditions. Remittances constitute a major source of foreign exchange and household-level social protection in Nepal, reducing immediate fiscal pressure on the state.

However, this reliance can enhance dependency by discouraging structural economic transformation and masking rural development deficits (Ratha et al., 2011). When remittance inflows contract, governments may face reduced foreign exchange reserves and heightened fiscal stress, often leading to public spending retrenchment that disproportionately affects peripheral regions. These processes reflect classic patterns of uneven development, in which capital accumulation, labor mobility, and state investment reinforce spatial inequalities between urban growth centers and rural labor-exporting peripheries (Harvey, 2006; Massey, 1994).

Taken together, Nepal's remittance-dependent economy demonstrates how global labor migration can stabilize household incomes while simultaneously reproducing structural vulnerability across space. Addressing these challenges requires policy interventions that go beyond migration management toward place-based development strategies. It also includes rural employment diversification, regional industrial investment, and strengthened social protection systems to reduce overreliance on external labor markets.

Youth Unemployment and Job Precarity

Domestic labor markets in many developing countries have struggled to absorb the expanding number of youths entering the workforce. Even in a moderate unemployment situation, a sizable proportion of young workers are in informal, low-productivity, or unstable employment. The ILO's Global Employment Trends for Youth underscores that youth unemployment remains critically high in several regions, including North Africa, even as global youth unemployment reached comparatively low levels in 2023 (ILO, 2024).

Youth job precarity in developing countries intensifies when overseas employment opportunities narrow and domestic job creation stagnates. Automation and AI compound these challenges by shifting global demand toward skills and tasks that are scarce in developing countries, while compressing the wages for low and mid-skill work abroad. The result is a widening gap between educational aspiration, digital connectivity, and the availability of dignified work.

Employment precarity is not only economic but also temporal, resulting in delayed transitions to stable employment that intersect with delayed family formation, housing insecurity, and perceived downward mobility. These conditions shape the social foundations of political contention and create fertile ground for digitally mediated mobilization against the establishment, which often intensifies as the youth population migrates from rural to urban centers.

Rural–Urban Migration and Urban Labor Saturation

Rural–urban migration remains a dominant socio-economic adjustment process, in which rural livelihoods are constrained by land fragmentation, climate stress, and limited non-farm job opportunities. Yet urban labor markets in South Asia and North Africa often absorb new entrants through low-wage informal employment, leading to urban labor saturation rather than inclusive structural transformation. Declining migration opportunities combined with domestic job shortages may intensify rural-urban migration and youth unemployment in developing economies. Digital connectivity accelerates global information flows and social mobilization in these countries (Sufi, 2025).

China offers a useful analytical analogue: automation can coexist with rising immigration because service-sector expansion and task reallocation absorb low-skilled workers, while high-skilled migrants benefit from complementarities (Zhou, et al., 2024). However, this coexistence can still deepen polarization and intensify competition for mid-skill jobs—dynamics that can be sharper in countries with weaker urban productivity growth, thinner safety nets, and more segmented labor markets.

Digitalization also tends to advantage larger firms with the capital to adopt labor-saving technologies, further marginalizing small-scale and informal employment opportunities. Without complementary investment in labor-absorbing sectors—urban services, home care, green infrastructure, and agri-processing—urbanization under automation risks producing concentrated job precarity rather than broad-based opportunity.

Digital Media, Youth Mobilization, and Unrest

Digital platforms function as means and accelerants rather than the root causes of unrest: they lower coordination costs, amplify narratives, and enable rapid diffusion of protest repertoires. Research on the Arab uprisings and related movements demonstrates how digital media can facilitate mobilization under conditions of economic grievance and political exclusion (Howard & Hussain, 2011; Tufekci & Wilson, 2012).

Employment-related frustration is a recurrent driver of grievance. The ILO emphasized high youth unemployment as a major factor behind the 2011 uprisings in parts of the Arab region (ILO, 2011). Comparable dynamics have been observed in more recent crises such as Sri Lanka’s 2022, Bangladesh’s 2024, and Nepal’s 2025 protests, where economic collapse and job shortages interacted with broader governance failures (Devapriya, 2022; Republica, 2025).

Metaverse social media platforms are new virtual spaces where young people can connect with others, learn new skills, and even explore business opportunities and

advertise. Studies show that young people are more likely to use these platforms if they think they help them become creative and support learning. However, weak or slow internet connections can limit access for some (particularly poor, old, illiterate, and rural) users, potentially widening the gap between those with reliable technology and those without (Kamdjou et al., 2026).

This is particularly significant for economic geography because online spaces allow people in different locations to see and compare opportunities. When people notice better opportunities in other places but cannot access them, it can heighten the sense that opportunities and development are unfairly distributed.

Comparative Perspective: South Asia and North Africa

South Asia and North Africa share structural vulnerabilities—bulging youth population, segmented labor markets, and reliance on overseas labor demand—yet differ in the location of migration corridors, proximity to destination regions, and domestic institutional capacity. In both regions, automation-led restructuring in destination economies threatens a key adjustment mechanism, while domestic digital transformations have not reliably generated labor-absorbing growth (ILO, 2024; World Bank, 2024).

Regional Adaptation: South Asia and North Africa

South Asia and North Africa face rising risks due to remittance dependence and youth unemployment. Investment in enhancing digital skills, renewable energy, technology startups, and digital agriculture can support economic diversification (Gudivaka et al., 2025; Fernández et al., 2025). A comparative lens highlights how uneven development is reproduced through intertwined spatial processes: labor-saving technological change in core economies; selective mobility governance; and constrained domestic absorption, especially in peripheral regions. These processes can generate similar outcomes—precarity and mobilization—across different political contexts, helping explain why digitally connected youth populations may share convergent interests in rebellion even when national histories and geographical locations differ.

Employment-centered digital transformation requires policies that recognize structural economic constraints rather than assuming that technological change will automatically generate sufficient employment opportunities. Policymakers must therefore adopt targeted strategies that balance productivity growth with job creation. In this regard, government, policymakers, and AI and technical planners may consider the following:

- a. Governments should invest in labor-absorbing sectors. Industries such as green infrastructure, manufacturing, urban services, home and elder care, climate

adaptation, and agricultural processing tend to generate higher employment multipliers than highly automated, capital-intensive industries. These sectors create broader job opportunities because they rely more on human labor. Digital technologies should be applied to support these sectors, for example, by improving logistics, maintenance systems, environmental monitoring, and digital payment platforms—rather than replacing workers entirely.

- b. Policymakers should strengthen small and medium enterprises (SMEs) through digital capability development. SMEs are businesses that operate on a scale larger than microenterprises but smaller than large corporations. They typically employ fewer workers and generate lower revenue than multinational firms, yet they play a crucial role in generating employment, fostering innovation, and driving local economic development. In many economies, SMEs represent most businesses and provide significant employment opportunities. Productivity improvements within large corporations are often achieved through labor reductions and automation. However, when SMEs receive support through affordable digital infrastructure, access to finance, and managerial and technical training, productivity gains can be distributed more broadly across the economy. This diffusion helps sustain employment while strengthening local economic multipliers.
- c. Technology governance should promote labor-augmenting innovation and phased adoption of automation. Technology policies should prioritize tools that enhance worker productivity rather than replace labor. Additionally, the introduction of new technologies should occur gradually and be accompanied by reskilling and workforce development programs aligned with realistic local labor market demand. Evidence from China indicates that adopting industrial robots, particularly collaborative robots, can reallocate workers toward expanding firms that use technology in complementary ways within the same industry. Worker mobility support and targeted training programs can facilitate these transitions and reduce the risk of job displacement (Wang et al., 2024).

Domestic policy efforts should be strengthened through regional and international cooperation. Agreements that recognize professional skills, promote fair recruitment practices, and coordinate labor mobility can help reduce the impact of declining out-migration opportunities in developed economies. However, these efforts are constrained by increasingly stringent immigration and labor-market policies in developed countries (OECD, 2024).

Finally, transparent governance and institutionalized youth participation in policymaking processes can reduce the risk of social instability. Economic exclusion

and limited employment opportunities often contribute to job precarity and youth dissatisfaction, which can be amplified through digital communication platforms. Addressing the underlying economic causes of exclusion through inclusive development policies is more effective than suppressing unrest after it emerges.

Conclusion

Automation has not erased the impact of geography on workers, but it has reshaped labor markets and intensified uneven development patterns within employment sectors and geographic regions. Technology-led restructuring in advanced economies and labor migration destination countries, combined with selective and tightening migration regimes, can externalize adjustment costs onto labor-exporting regions—weakening remittances, saturating urban labor markets, and heightening youth precarity. Because digital platforms compress informational distance, these material pressures can translate into rapid, sometimes synchronized, mobilization by youth for rebellion. In South Asia and North Africa, employment-centered digital transformation hinges on policies that prioritize labor absorption, address mobility constraints, and align technological adoption with inclusive development objectives.

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