PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol x(x): xx–xx
https://doi.org/10.14719/pst.6109

HORIZON
e-Publishing Group

REVIEW ARTICLE

Labour migration in Indian agriculture: Patterns, drivers and consequences—A systematic review

Gowri Shankar R[1], Malaisamy A[1]*, Balasubramaniam M[2], Ragavan T[3], Prabakaran K[1], Balaji R[4], Arunachalam P[5] & Sivasankari B[1]

[1]Department of Agricultural Economics, Agricultural College and Research Institute, Madurai 625 104, Tamil Nadu, India

[2]Division of Agricultural Economics, ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India

[3]Department of Agronomy, Agricultural College and Research Institute, Madurai-625 104, Tamil Nadu, India

[4]Department of Agricultural and Rural Management, TNAU, Coimbatore 641 003, Tamil Nadu, India

[5]Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai 625 104, Tamil Nadu, India

*Email: malaisamy@tnau.ac.in

OPEN ACCESS

ARTICLE HISTORY

Received: 24 October 2024
Accepted: 25 February 2025

Available online
Version 1.0 : 03 April 2025

Check for updates

Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE

Gowri Shankar R, Malaisamy A, Balasubramaniam M, Ragavan T, Prabakaran K, Balaji R, Arunachalam P, Sivasankari B. Labour migration in Indian agriculture: Patterns, drivers and consequences—A systematic review . Plant Science Today (Early Access). https://doi.org/10.14719/pst.6109

Abstract

Approximately 45 % of the global population resides in rural areas, where agriculture, including livestock, accounts for 28 % of worldwide employment. Despite these notable figures, substantial structural shifts have occurred in the agricultural sector in recent decades, influencing employment and labour dynamics. Rapidly growing economies, such as India, are anticipated to witness an increasing disparity in living standards between rural and urban areas, resulting in heightened migration from rural to urban regions. In India, labour migration is significantly influenced by social structures and development patterns. Uneven development, intensified by factors like unemployment, low rural wages, agricultural challenges, insufficient industrial support, poverty, limited job opportunities and natural disasters, is the primary driver behind migration. This paper aims to provide an in-depth analysis of the current literature, presenting a systematic review and thematic analysis of the evolving landscape of agricultural labour migration. It examines the drivers, challenges and socioeconomic impacts of migration, addressing aspects like the feminization of agriculture, diverse types of agricultural migration, the role of technology and the impact of government policies on employment. The study emphasizes the importance of future policy considerations in this domain.

Keywords

agriculture; labour migration; livelihood security; PRISMA framework; rural studies

Introduction

Agriculture is a primary source of employment and revenue for rural farm households, making its development critical for rural income generation (1). In developing nations such as China and India, the agricultural sector provides livelihoods for approximately 200 million individuals, making up a significant quarter of the global workforce, second only to the services sector (2, 3). Labour is a key element of seed-to-seed development in every agricultural system. Farmers and farming scientists find it challenging to complete the food security program due to the severe labour shortage in the agricultural sector (4). Indias' agriculture sector has encountered several problems throughout the years, but one of the biggest ones in the last few years has been labour shortages (5). The rural workforce has increasingly

shifted towards urban areas, industry and the service sectors. Meanwhile, technological advancements in agriculture have led to the replacement of labour with capital (6). Furthermore, the agricultural industry faces challenges in retaining and attracting workers due to low wages, extended working hours and physically demanding tasks (7).

According to the 2011 Indian Census, approximately 450 million people were classified as migrants based on their last residence, accounting for around 37 % of the total population. This number is nearly double the 225 million internal migrants recorded in the 1991 Census (8). The Labour Force Participation Rate (LFPR) in usual status for primary and subsidiary work in India is 42.4 %. Males have a higher LFPR, with 55.5 % in rural areas and 58.3 % in urban areas, while females have a lower LFPR at 30.5 % in rural areas and 20.2 % in urban areas (9). From 1977 to 2022, agricultural participation declined across rural and urban areas. Rural male participation fell from 80.6 % to 49.1 %, while rural female participation declined from 88.1 % to 76.2 %. From Table 1, in urban areas, male participation dropped from 10.6 % to 4.7 % and female participation from 31.9 % to 11.7 %. In 2021–2022, rural females had higher agricultural participation (75.9 %) than males (51.0 %). In urban areas, agricultural participation was 11.1 % for females and 5.4 % for males. By 2022–2023, rural agricultural employment stood at 49.1 % for males and 76.2 % for females, while urban agricultural participation was 4.7 % for males and 11.7 % for females.

Table 1. Trends in agricultural employment by gender and region in India (1977–2023)

Year	Rural males (%)	Rural females (%)	Urban males (%)	Urban females (%)
1977–78	80.6	88.1	10.6	31.9
1983–84	77.5	87.5	10.3	31
1987–88	74.5	84.7	9.1	29.4
1993–94	74.1	86.2	9	24.7
1999–2000	71.4	85.4	6.6	17.7
2004–05	66.5	83.3	6.1	18.1
2009–10	62.8	79.4	6	13.9
2011–12	59.4	74.9	5.6	10.9
2017–18	55	73.2	5	11
2018–19	54.3	72.5	4.8	10.8
2019–20	53.2	71.1	4.5	10.5
2020–21	52.7	70.5	4.3	10.2
2021–22	51	75.9	5.4	11.1
2022–23	49.1	76.2	4.7	11.7

Source: Data for the years 1977–78 to 2022–23 have been sourced from the respective PLFS annual reports.

Between 2017–2018 and 2021–2022, Indias' labour force increased by 16.6 %, outpacing population growth. The Labor Force Participation Rate (LFPR) rose from 35.8 % to 38.7 % under the weekly status and from 36.9 % to 41.3 % under the usual status. In 2021–2022, male employment was distributed as 38 % in agriculture, 28 % in industry and 34 % in services, while female employment stood at 63 % in agriculture, 17 % in industry and 20 % in services. From the Table 2, female participation in agriculture increased from 23.1 % in 2017–2018 to 29.6 % in 2021–2022 (10). Despite this shift, agricultural labour share continued to decline, with rural agricultural employment decreasing by 15.5 % in 2020–2021, while non-agricultural employment rose to 39.2 % (11). Agricultural labourers are the most affected by widespread unemployment and underemployment due to the seasonal nature of farming activities. Frequent droughts, caused by monsoon failures over large areas, further reduce labour productivity and worsen economic hardships (12). Migration away from agriculture affects rural communities, individuals and global economies in various complex ways (13). The International Organization for Migration defines "a migrant as any individual who leaves their usual place of residence and travels across an international border or within a country, regardless of their legal status or whether the movement was forced or voluntary and irrespective of the length of time they stay or their motivations (14).

One important migration category is agricultural labour migration, in which unskilled labourers migrate in search of employment, frequently in the context of traditional farming methods. Migration is the term used to describe the temporary or permanent relocation of people. Globally, migration from rural to urban areas is frequent. It is a selection procedure determined by demographic, social, educational and economic variables (15). Migration had a negative impact on agricultural productivity (16). Research conducted in the Cuddalore district of Tamil Nadu revealed a significant scarcity of labour for farming tasks, negatively impacting the productivity of all crops (17). The existing studies often focus on specific regions, types of migration, or socioeconomic impacts. However, there is a notable gap in the literature concerning a comprehensive overview of agricultural labour migration. Most studies tend to address the drivers of migration, the patterns of migration, or the impacts on rural economies without providing a holistic understanding of the linkage between labour migration and farming practices at a national level. This comprehensive review synthesizes the multifaceted dynamics of agricultural labour migration concerning changing weather patterns, socioeconomic factors, technological advancements and policy responses over the past few decades. Such a review would not only contribute to filling the gap in the literature but also provide valuable insights for policymakers, researchers and practitioners seeking to address the challenges and harness the potential of agricultural labour migration for sustainable rural development in India. The conceptual framework, illustrated in Fig. 1, offers a comprehensive overview of the paper, guiding the reader through its structure and flow while addressing key research gaps.

Materials and Methods

The systematic article searches and screening were performed by generating keyword combinations in the two databases, Scopus and Science Direct. The search was

Table 2. Changes in labor force participation and employment distribution in India (2017–2018 to 2021–2022) (in %)

Indicator	2017–2018	2021–2022	Change
Labor force growth			
LFPR (weekly status)	35.80	38.70	2.90 %
LFPR (usual status)	36.90	41.30	4.40 %
Male employment distribution			
Agriculture	39.40	38.00	-1.40 %
Industry	25.60	28.00	2.40 %
Services	35.00	34.00	-1.00 %
Female employment distribution			
Agriculture	23.10	29.60	6.50 %
Industry	16.50	17.00	0.50 %
Services	20.40	20.00	-0.40 %
Agricultural employment (rural India)	60.80	51.30	-15.50 %
Non-agricultural employment share	39.20	48.70	9.50 %

Source: Compiled by the author from various PLFS reports from 2017-2022.

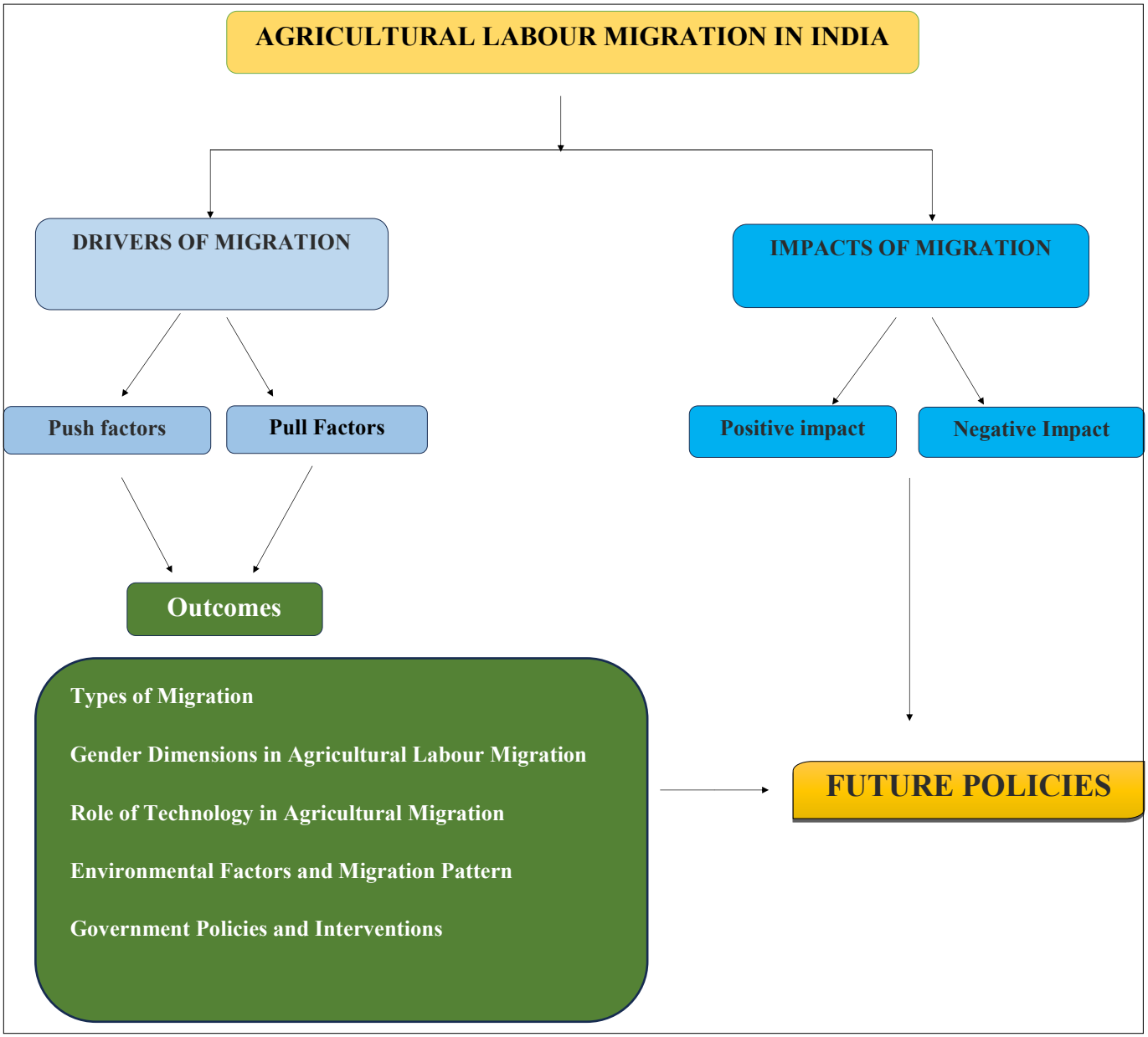

Fig. 1. Conceptual framework of the article.

done by entering the 'TITLE' and 'TITLE-ABSTRACT-KEYWORD'. Language restriction was done. Only English articles were chosen for review. The search was done by collecting peer-reviewed journal articles, excluding books and book chapters, conference papers, editorials, letters, patents, reference works, research notes and trade publications. Peer-reviewed journal articles were collected by using these databases until 2023. Table 3 provides details on the search strings used for this review.

Table 3. Strings used for searching articles.

Strings used for searching articles
"Labour" AND "Migration
"Agricultural" AND "Labour" AND "Migration"
"Agricultural" AND "Labour" AND "Migration" AND "Impacts"
"Agricultural" AND "Labour" AND "Migration AND "Gender Equity"

A list of research articles was generated based on titles and the combination of titles, abstracts and keywords containing "Labour" and "Migration." Subsequently, we refined the search using the Boolean keywords "Agricultural", "Labour" and "Migration." Its' important to note that altering search parameters can yield different outcomes. The PRISMA framework was used to generate the list of research articles. In the first phase, a research article was selected focusing on Agricultural Labour Migration, excluding conference proceedings, books, book chapters, encyclopaedias, short communications and reports. This filtering process identified 560 articles from Scopus and 455 from Science Direct without eliminating duplicates. In the second step, publications were excluded for the review articles and research papers lacking specificity related to agricultural labour migration. Then, in the third step, we narrowed the selection to include only case studies that elucidate factors and impacts of agricultural labour migration. This led to the exclusion of 542 articles from Scopus and Science Direct databases, manually deleting duplicate articles.

The next stage of screening involved reading abstracts and selecting only open-access articles. During this process, approximately 284 articles were removed based on the following criteria: lack of relevance to the research topic, insufficient methodological details, absence of empirical data, duplication, or a focus on regions or contexts outside the studys' scope. The final screening process involved a thorough review of the full-text articles, with 82 articles excluded for not meeting the predefined threshold for the systematic literature review. The inclusion criteria were based on several factors, including relevance to the research objective, methodological rigour, empirical data availability, findings clarity and alignment with the studys' geographical and thematic focus. Articles that lacked a strong theoretical foundation had insufficient data support, or did not contribute meaningfully to the research questions were excluded. Therefore, 76 articles were selected for review, including 11 articles from Google Scholar. The PRISMA framework used to screen articles is presented below in Fig. 2.

Results and Discussion

Dynamic changes of agricultural labour migration

Under their rule, the British used labour force mobilization for mining, commercial agricultural production and other administrative goals (8). The two theoretical connections may be traced back to the Lewis model of economic development with unlimited labour supplies (18) and Gunnar Myrdals' notion of "Spread and Backwash" effects (19).

Early theories of development concentrated on "surplus labour" that was restricted to the agricultural sector. Consequently, dual-economy models emerged in which the labour, money and technology transfers between industry and agriculture were the core components of developing economies' dynamics. In early discussions of development theory, the models played a crucial role (20). The models were generally built on the observation that per capita income and wages tended to be higher in industry and lower in agriculture. The gravity hypothesis of migration (21) outlined the forces of attraction and repulsion.

In contrast, migration theory demonstrated that issues like limited access to land, non-farm employment, education and essential public services act as primary drivers for rural out-migration. Additionally, factors such as drought, crop failure, large family sizes and returning migrants in the village continue to push rural households to migrate (22). According to the Human capital theory of migration, the shift from rural to urban areas occurs when urban wages are anticipated to surpass those in rural areas (23, 24). The four reasons given by the new economics labour migration theory for migrants include financial transfers to home, investments, insurance contracts and altruism and the network theory of migration, which describes the causes of migration, its effects on migrants in migrant-receiving urban and migrant-sending rural areas (25, 26). Dualistic ideologies and substantial amounts of disguised unemployment in the agriculture sector are prevalent in many emerging nations. The dynamic changes in the agricultural workforce in rural India are illustrated in Fig. 3.

In India, Bihar, Uttar Pradesh and Rajasthan, agricultural productivity is extremely low and non-agricultural sector growth is primitive, resulting in a significant rate of rural migration (27). The shift in labour trends negatively impacts the increase in migrant workers in Punjab, especially in the agriculture industry. Because of the planting patterns' monoculture, the state has become heavily dependent on migrant labourers for various agricultural tasks. Punjab is facing several socioeconomic issues as a result of this influx of foreign labour, both seasonal and permanent (28). Labour migration, which has become a reality in India, like many other developing countries, is one of the significant socioeconomic problems in the country. As a socioeconomic group, the male working population is the most affected by migration (29). The dynamic changes in the agricultural workforce in urban India are illustrated in Fig. 4.

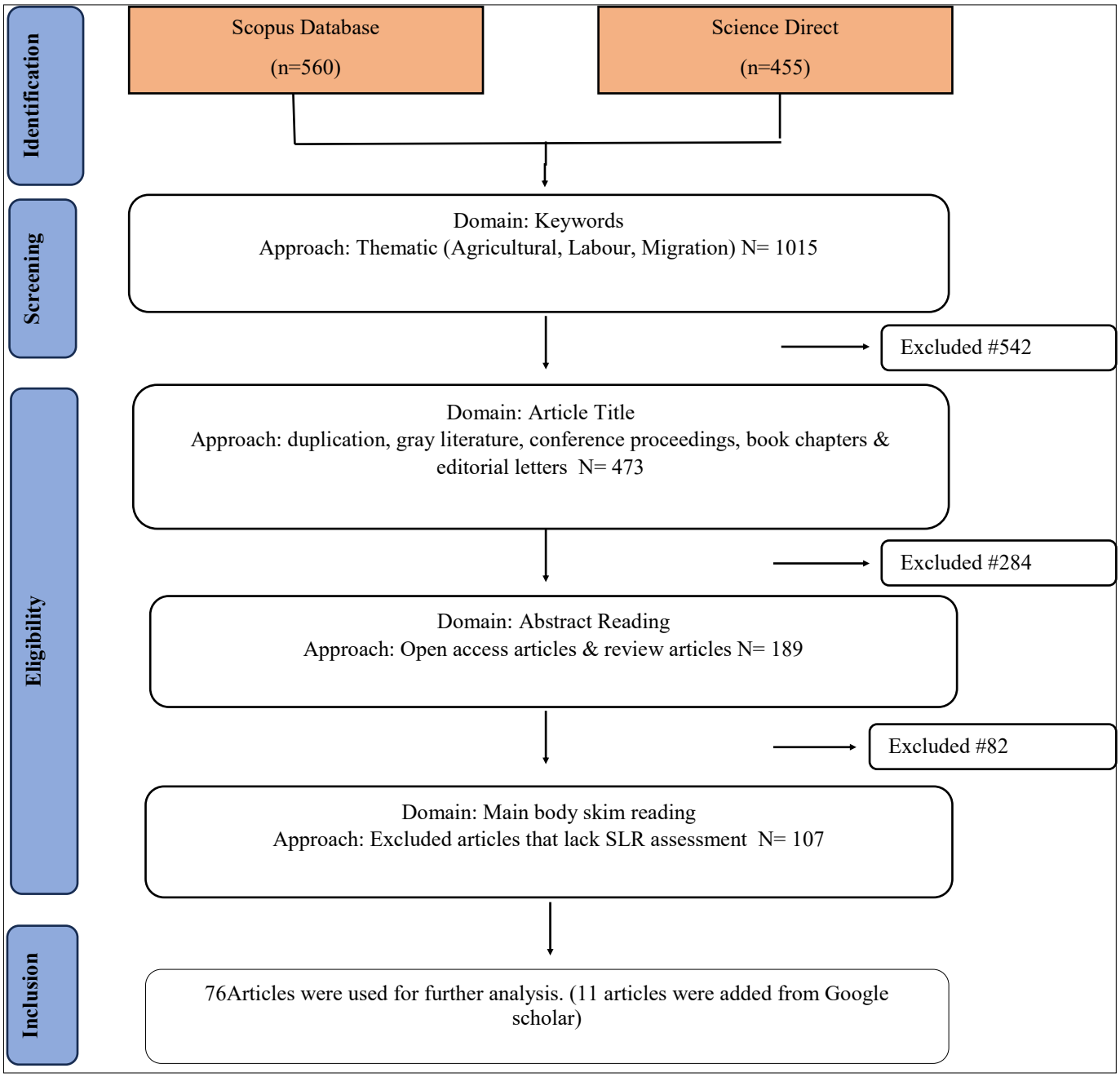

Fig. 2. PRISMA diagram showing the systematic screening process Source: Modified method from (82) and (83).

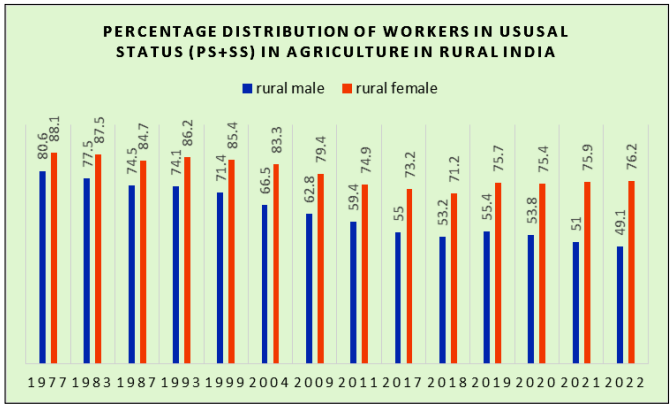

Fig. 3. Percentage distribution of workers in usual status (Principal status + Subsidiary activity status (ps+ss)) in Agriculture in Rural India .Source: Compiled by the author from various PLFS reports from 1977-2022.

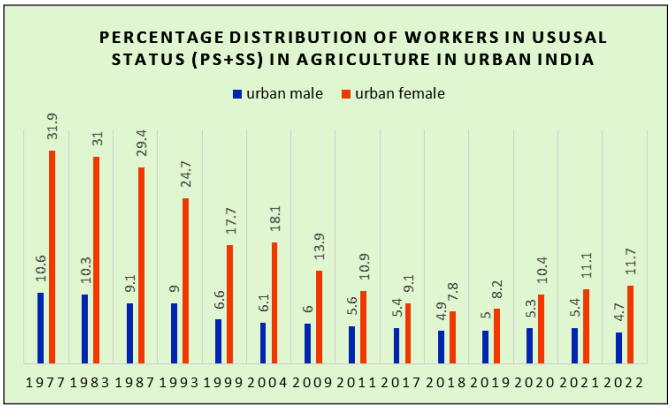

Fig. 4. Percentage distribution of workers in usual status (Principal status + Subsidiary activity status (ps+ss)) in Agriculture in Urban India. Source: Compiled by the author from various PLFS reports from 1977-2022.

Drivers of agricultural labour migration in India

Two substantial factors contribute to rural migration, which is known as "growth pull" (demand pull) and "crowding out" (supply push) impacts. The destination location has a faster growth rate under the "growth pull" effect due to growing capital stock, the introduction of new technology, structural adjustments in the production sector, or any other growth-inducing factors. High employ-

ment elasticity characterizes this type of expansion, whether it is in the core or peripheral sectors. If the 'growth pull' effect is to be effective, the quality of growth must guarantee wage differentials. Alternatively, when there is a surplus of the labour force, migration has the "crowding out" effect, where the wage rate is falling because of abundant supply.

Push factors

Social structures and development patterns significantly shape labour migration in India. Uneven development, poverty, the landholding system, fragmented land, limited job opportunities, large family sizes and natural disasters drive migration. Issues such as a high land-man ratio, the caste system, lawlessness and exploitation in native places contribute to the breakdown of traditional socioeconomic relations in rural areas, prompting individuals to seek better employment and income in more prosperous regions (28, 30). Lack of essential facilities like quality educational institutions, health centres, sufficient agricultural land and alternative job opportunities also contribute to migration. The consequences of labour migration include an increased labour supply, decreased wage rates, heightened social tension, crime, drug-related issues and cultural changes (31).

According to the gravitation theory of migration, people tend to move from areas with limited opportunities to those with better prospects and the physical distance between their origin and destination affects the rate of rural out-migration. The primary reasons for the substantial influx of rural migrants into urban areas stem from unfavourable conditions in rural regions, including high unemployment, low wages, small landholdings, inadequate infrastructure and poverty (12). Factors like household size, total asset value, networking influence, proximity to commercial banks and susceptibility to floods significantly influence migration patterns (16). The major push factors for agricultural labour migration are shown in Fig. 5. The introduction of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in 2005 has led people to shift from agricultural employment to social welfare programs due to the higher wages offered (4).

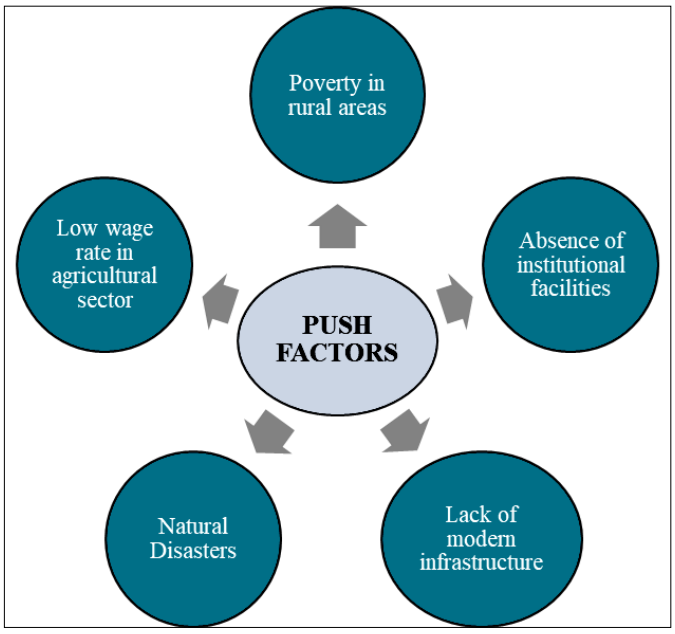

Fig. 5. Push factors influencing the agricultural labour migration.

Pull factors

The choice to migrate from household agriculture is influenced by various factors, including the appeal of higher wages in non-farm local jobs, limited earnings, high unemployment rates, job insecurity, dissatisfaction with work, extended working hours, unfavourable working conditions, the seasonal nature of work, challenges in settling debts and the employment prospects provided by programs like MGNREGA (32). On the flip side, the availability of jobs, attractive wages and satisfactory work conditions encourage migration to urban areas. Additionally, growing infrastructure, improved civic amenities and better facilities further enhance the appeal of urban migration (12).

The primary labour source for the construction sector in cities is rural labourers, who are drawn to these jobs because of high wages (15). Factors influencing male out-migration include land per capita, number of family members, family income excluding remittances, educational status and caste (27). Availability of jobs at the destination, hope of getting a job at the destination, higher wages at the destination, employment information, flexible working hours at the destination, skill development, ambitions, city connections and relatives, attractiveness of city life and bustling social life/urban comfort are also factors that influence migration (33). The primary pull factors for agricultural labour migration are shown in Fig. 6.

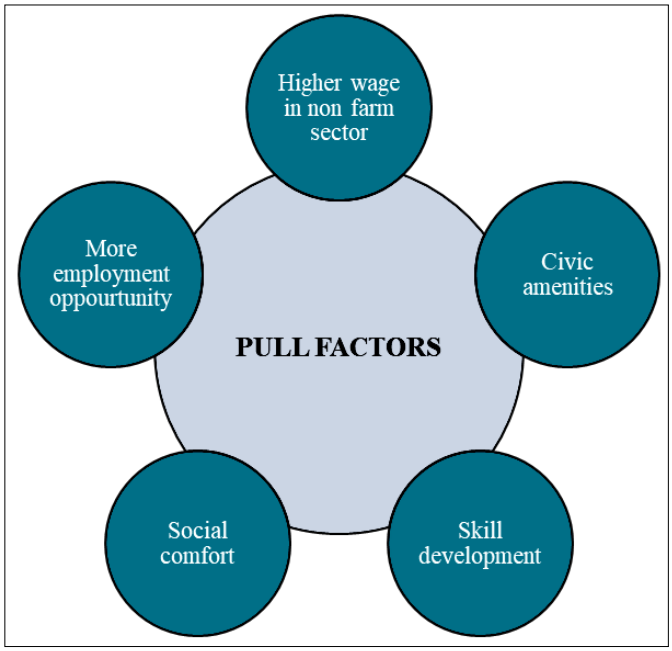

Fig. 6. Pull factors influencing the agricultural labour migration.

Challenges faced by migrants in India

Most farmers depend on agriculture for their livelihood. As a labour-intensive industry, migration heavily affects agriculture (34). When labourers migrate from farming, it can significantly reduce the income from crops at their original homes (16). The income migrants earn at their new location depends on their job type, how long they work and their attributes, such as education level, skills and experience. However, most migrant workers have low personal

endowments. They often end up in irregular or casual jobs in the informal sector, which typically pay very low wages (35).

Access to basic amenities is another major challenge for agricultural migrants. Those who move to urban centres often struggle to access nutritious food, adequate employment, social protection, housing and water and sanitation facilities. Health disparities among migrant agricultural workers result in avoidable illnesses and fatalities. These individuals frequently encounter difficulty accessing sufficient restrooms, laundry facilities and other essential sanitary amenities (36). Moreover, agricultural migrants often face policy challenges and mistreatment, which were made worse by the COVID-19 pandemic.

Socioeconomic impacts of migration from rural areas

When workers in India move from one region to another, it can significantly impact the economy. This is especially true when people move from the countryside to cities. One of the main effects of this migration is that the workers often send money back to their families. This money, known as remittances, can make up a large part of a familys' income, helping to raise their earnings and reduce poverty. The funds can be used in many ways, such as for healthcare, education, or even to start a small business, which can help the local economy in the areas where the workers came from (10). However, migration can also lead to a shortage of workers in the areas where people are moving, especially in farming. This could potentially harm food security and agricultural production. But on the bright side, the decrease in available workers might lead to higher wages for those who stay behind, which could improve their standard of living. Furthermore, when migrants return to their home regions, they often bring back new ideas, skills and experiences that can benefit the local economy (37).

Positive impacts

Migration has significantly improved the income levels of labourers in India. After migrating, these labourers, who mainly belong to marginalized communities, have seen an increase in their income. This has not only improved their standard of living but also helped them become more included in the economy and society (15). The remittances help supplement their families' income back home, reducing poverty in rural areas (38). Research conducted in the Bundelkhand region of central India revealed that elements such as education, farming experience and access to extension services play a crucial role in enhancing the productivity of farm households with migrant members. The remittances from migration serve as supplementary income for the households of origin, contributing to reducing poverty in rural areas (39, 40). The average annual income of households with migrant members was about 2.5 times higher than that of non-migrants (41). Better income and employment opportunities were the main reasons for migration. For example, in Punjab, after migration, 63 % of the migrants could earn between ₹20000 to ₹50000 per annum and 34 % earned more than ₹50000 per annum (28). The average yearly income of households with members who migrated is about 2.5 times higher than that of households without migrants. This shows that migration can significantly improve the financial situation of these households (41). Additionally, the size of a family and the education level of its members positively influence the decision to migrate (27). This means that larger families and those with more education are more likely to have members who migrate. Migration also positively affects agricultural investment, technology spillover and productivity. The happiness of families increases when they receive remittances from migrants. Theres' also an increased focus on childrens' education, especially for girls. These families also reported increased consumption of cereals, pulses, vegetables and milk (42). After shifting from agriculture to other non-farm occupations, the income generated increased compared to before the shift. There was also an increase in employment generation after the change (43).

Negative impacts

A surplus of agricultural labour and limited job opportunities primarily cause rural unemployment. This leads to low income, low purchasing power for most rural people and weak connections between rural and urban areas (44).

Labour mobility from the agriculture sector aims to get better wages to improve workers' welfare. Labour reallocation from the traditional industry to the modern sector is needed for increased economic growth. However, the demand of the contemporary industry sector for high-skilled workers forces low-skilled workers to be out of the labour market (45). A person moving to a non-agriculture industry is unlikely to receive the average income of that sector immediately. Migrants often start with low-paying jobs, holding only briefly (46).

Migration can decrease the amount of labour in farming, which can lower agricultural production (1). However, the money sent back home by migrant workers can be used for labour and non-labour inputs in farming to make up for any labour losses. But if this money isn't invested in agriculture, migration can harm farm production, mainly when farming is based on subsistence and has low investment returns. Increased emigration from the village reduces the chance that village residents have to worry about having enough food, eating less preferred food, or limiting their portion size (37). Migrant households did not invest remittances in productive farm assets but allocated funds for material inputs and cattle feed. In migrant families, a more significant percentage of land was left fallow and the number of livestock was also lower. The workload of farm women was higher in migrant households than in non-migrant households due to the additional burden of non-household and non-farm work in the absence of male members migrants (47). The cost of harvesting wheat, planting paddy and the annual rates of a permanent labourers' contract significantly decreased due to labour migration. However, this also led to an increase in crime, drug problems and cultural invasion (41).

Gender dimensions in agricultural labour migration-'Feminization of Agriculture'

In 2021–2022, women comprised 41.1 % of all agricultural workers. As a result, plans for agricultural growth must prioritize both genders (10). In the Indian sociocultural context, men are freer than women when migrating to Indian society for better employment prospects. A survey from the Institute for Human Development, New Delhi, says men labour out-migration led to 70 % of women farming. In South Asia, men are increasingly moving away from agricultural employment towards non-farm agriculture, leaving women to do more housework and agricultural activities (48). The so-called "feminization of agriculture" occurs when women who remain in the villages due to male out-migration take on a significant part in various farm tasks.

Additionally, it has strengthened the female migrant household members' ability to make decisions about various activities (3). The decline in male migration rates has been more significant than that of female migration rates, particularly between 1981 and 1991, reflecting a period of jobless growth in India (49). Despite a higher economic growth rate in India during the 1991-to-2001-decade, migration rates remained relatively stable compared to the previous decade (50). Compared to migrant residences, a more significant proportion of women work in domestic and agricultural activities in non-migrant households. Compared to non-migrant residences, women in migrant households devote 38–42 hours per week to agriculture and 36–46 hours per week to domestic tasks. The difference implies that women in homes with migrants are less likely to engage in labour-intensive agricultural employment (51).

Womens' increased representation in agricultural decision-making has occasionally been associated with this feminization process in agriculture. However, the ability of the women who remain in agriculture to make decisions is not inevitably enhanced by the departure of men from this field (52). Furthermore, as seen in Karnataka, womens' growing participation has improved their influence in agricultural decision-making; however, males should still approve "final" decisions even if they remain outside (53). Womens' access to adaptation strategies depends more on their marital status (54). Adaptation to climate change poses challenges for women, particularly widows and divorcees, in acquiring land due to cultural and legal complexities. Climate change disproportionately affects women due to their limited ability to adapt to agricultural water management. As men typically migrate for work, women are left to tend to crops for household subsistence in their absence (3).

Women are crucial in reducing migration and ensuring household food and nutrition security through both production and consumption. However, despite their contributions, they continue to face agricultural discrimination, particularly in wages and employment status. Policymakers must consider the wage disparity to support and encourage both male and female farmers (35).

Environmental factors and migration pattern

Agriculture, a key sector for employing rural workers, is heavily affected by weather-related shocks such as floods, drought or extreme heat (55). Less rainfall and unusually high temperatures increase the number of people moving out the most (56). Climate change could have significant economic effects on the rural labour market in less developed countries. Climate change is causing big problems for the labour market, affecting peoples' livelihoods, job opportunities and living conditions. This is especially true for resources, areas sensitive to climate and places that often experience extreme weather. Changes in temperature and rainfall are affecting farming. At the same time, rising sea levels could force communities to relocate and render agricultural land too salty in countries like Bangladesh, Egypt and Papua New Guinea (57). Droughts and unusually high temperatures increase the number of people moving out, leading to a significant shift in labour supply from farming (58). The IPCC highlights the impact of climate change on farming production and food security, forcing people to leave rural areas to look for better conditions (59). Environmental factors like drought, soil erosion and climate change contribute to farming migration, creating challenges for food security and livelihoods (60).

Short-term environmental disruptions can be addressed through temporary migration, while persistent and long-term ecological challenges threaten peoples' livelihoods, necessitating permanent and long-distance migration (61). Individuals adapt to climate shocks instead of migrating in certain instances, underscoring their social and economic ties to their current location (62).

Types of migration

Peoples' migrant status is categorized based on the duration of migration. It is considered temporary if the individual states that they have left their place of enumeration for less than six months in pursuit of a livelihood. On the other hand, it is classified as permanent if the person has relocated to the place of enumeration and has been residing there for more than six months (63).

Seasonal versus Permanent migration

Under British rule, the British organized the labour force for activities like commercial crop production, mining and administrative tasks. Post-Independence, the Indian government embraced a mixed economy approach via five-year plans. Unfortunately, due to flawed agricultural development policies, theres' a growing regional imbalance, resulting in an uptick in seasonal migration among agrarian labourers (15). Early farming relied on seasonal migration for agricultural work, with labourers moving between rural areas and cities based on farming seasons. However, adopting high-yield crops and modern farming techniques reduced the need for seasonal labour, prompting a shift to permanent migration, especially from rural to urban areas (64). Unlike permanent migration, temporary labour migration entails shorter periods of movement, where migrant workers return to their village and regular household after working elsewhere for a specific duration (65). In the long run, migration occurs for better income standards and living conditions.

Shorter-term migrants, such as seasonal farmworkers, travel for short periods to plant or harvest farm products (29). For short-term migration, Scheduled Caste and Scheduled Tribe households, who are more likely to be poor, tend to migrate. Distress is the leading cause of unequal income distribution among the social group (66). The wage gap between rural and urban areas varies yearly due to crop cycles. Seasonal migration is a primary method people in India and Bangladesh use to diversify income and deal with seasonality (37). Seasonal migration for rural manual work is one way for poor households in eastern India to seek income and welfare (64). In rural areas, temporary and seasonal migration is highest among illiterates and mobility decreases with increasing education. Its' well recognized that the poorest people migrate for survival within the country and this mobility is generally in the form of short-term migration, even if the capacity to afford a move is lower among the poor (67).

Inter-State migration

People are increasingly moving from rural to urban areas, with a significant 38 % migration rate, highlighting the trend of individuals seeking employment in cities. Moreover, there is notable urban-to-urban migration among inter-state migrants, accounting for 27 % and evenly distributed between males and females, as per the 2001 Census data (68)**.** Sociocultural factors, particularly language, play a crucial role in influencing inter-state migration in India, leading to the identification of specific migration corridors for such movements (69). The research suggests climate-induced migration within the countrys' borders is more likely due to migration costs and legal barriers, particularly in agricultural states. Drought frequency significantly increases inter-state migration in these regions, particularly in rural-to-rural scenarios (70). Drought frequency significantly increases inter-state migration in these regions, particularly in rural-to-rural scenarios (71).

The analysis reveals that the inter-state out-migration rate is elastic, with a negative correlation (-0.775) to per capita net state domestic agricultural product. This indicates that a decrease in the value of agricultural output due to weather variations leads to an increase in the out-migration rate. Crop-wise examination demonstrates that a 1 % decline in rice (wheat) yield corresponds to a nearly 2 % (1 %) rise in the out-migration rate within a state (69). Furthermore, the major migration corridors in northwestern India were identified based on data from the 55th round of the NSS in 1999–2000. States with the highest numbers of inter-state out-migrants include Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra and Karnataka, reflecting the significant impact of migration trends in these regions (71).

Intra-state migration

District-level analysis has been conducted for three distinct categories of migrants – inter-district, intra-district and total in-migrants within a district. It is reasonable to anticipate that certain climatic factors, especially rainfall, can impact agricultural performance within a district, consequently influencing peoples' mobility (69). The sensitivity of agriculture to weather conditions and the growing susceptibility of crop yields to extreme weather events and evolving climatic patterns are expected to contribute to an increased pace of rural-to-rural and rural-to-urban migration. In the case of rural-to-rural intra-district migration among males, the trend appears to stem from individuals migrating from areas characterized by low agricultural productivity to less densely populated regions with new developmental activities underway (72).

Role of technology in agricultural migration

The demand for labour and skills in agriculture is impacted by the further digital revolution (automation, artificial intelligence and information and communications technology) (73). According to the notion of induced innovation, labour is replaced by mechanical power or labour-saving technology as wages and labour scarcity rise. However, the widespread adoption of labour-saving technologies raises major equity concerns and may result in labour displacement (74). The mechanization of agriculture has led to the migration of unskilled labour from agricultural sectors to manufacturing, altering national economic structures (65). Tractors, tillers and combine harvesters are examples of labour-augmentation technology that negatively impacts labour use and causes labour displacement. When tractor inventories increase, the demand for manual labour in agriculture decreases, often reducing migration rates as fewer workers are needed in rural areas. This can result in a more stable rural workforce, as mechanization minimizes the reliance on seasonal or migratory labour, which traditionally occurs due to agricultural labour shortages during peak seasons (75).

Technical advancements in the agriculture sector have led to a reduction in family labour and an increase in the use of hired labour (76). However, mechanization in agriculture reduces labour hours and costs while enhancing production efficiency and precision. It also creates employment opportunities across various sectors, including manufacturing, servicing and distribution. Labour shortages during peak seasons, caused by factors like the National Rural Employment Guarantee Act and urban construction demand, are driving increased mechanization in farming (51). The labour force has shifted from agriculture to more profitable non-farm sectors due to urbanization, expanding literacy, greater demand for non-food goods and services and agricultural modernization and commercialization (44).

Government policies and interventions

In India, labour laws and regulations are enacted along with social protection policies, which are carried out at the federal, state and local levels of government. These initiatives aim to improve the lives of migrants by providing a safety net, assisting with risk management and enhancing living conditions. One example is a substantial workfare program in India, which recruited workers from rural areas during the agricultural off-season (77). The program significantly impacted by reducing seasonal migration to cities, helping to narrow the income disparity between rural and urban areas. Indias' extensive rural employment program

aims to increase rural incomes to replace temporary migration and informal insurance (42). Various programs, including the National Food for Work Program (NFFWP), Crash Scheme for Rural Employment (CSRE), National Rural Employment Jawahar Gram Samridhi Yojana (JGSY) and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), fall under the umbrella of the Employment Guarantee Act (4).

The seasonal movement of agricultural labourers is on the rise due to growing regional disparities. An inclusive growth strategy aims to integrate women, marginalized groups, castes, tribes and economically disadvantaged groups into the mainstream economy (15). The rate of decrease in the proportion of labour employed in agriculture can also be influenced by institutional and structural factors (78). In addition to initiatives like MGNREGA, government investments in training and skill development programs like the National Skill Development Corporation (NSDC) and Agriculture Skill Council of India (ASCI) can aid in the retention of distressed migrants and deter the creation of slums. Planning urban development is essential to fostering opportunity for migrants, maintaining resource balance and maximizing the demographic dividend. A demographic crisis could result from unregulated migration if it is not appropriately managed (66).

Mitigating the issue of rural-urban migration would greatly benefit from the efficient implementation of rural development programs, especially the MGNERGA (79). These unforeseen and severe weather factors frequently result in farmers losing crops, endangering their livelihoods and food security and pushing already-stressed areas farther into poverty and misery (80). Climate risks must be managed to protect farmers' well-being and address the growing human and economic concerns about increasingly extreme weather conditions. The Consultative Group for International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (CIMMYT–CCAFS) and the International Maize and Wheat Improvement Centre are attempting to tackle the issue by developing the concept of climate-smart villages (CSVs) in partnership with national and international stakeholders (35).

Future policies

Improved agricultural methods and mitigation techniques, including crop diversification, can help ensure household food and income and lower the male out-migration rate. But, knowledge, financial sustainability and scalability are necessary to implement these strategies effectively. Adoption can be facilitated by offering services and practical training. For effective climate adaptation and resilience, women in agriculture must be empowered and given access to resources, knowledge and decision-making positions (31).

In India, efforts are focused on improving rural economies through small-scale businesses, agriculture and education and addressing infrastructure and health requirements to reduce rural-urban migration. Additional strategies include boosting rural tourism, broadening the economy and enhancing services. Under the direction of a socioeconomic analysis of the effects of migration, efficient government programs, decentralized urban amenities and population management are essential (81). While some amenities may be insufficient, infrastructure is critical in fostering agricultural and rural development. Rural communities gain from improved market accessibility, information diffusion and input-output flow efficiency that comes with infrastructure access. Infrastructure is recognized by development economists such as Paul Rosenstein Rodan, Ragnar Nurkse and Albert Hirschman as "social overhead capital," which is essential for economic advancement (47). MOUs between states help to raise agricultural labourers' standards (48). Another issue that needs policy attention is the feminization of the agriculture sector. Men are migrating in large numbers, which means that women, who are inadequate for these new tasks, bear the brunt of the workload and responsibilities. A socio-political framework is, therefore, desperately needed so that women can be empowered with the necessary knowledge, abilities and tools to carry out this new role more effectively (1). To help agricultural labourers escape from the debt cycle, rural financial institutions should meet their needs for both consumption and production expenses (12). Policy implications include creating labour societies or self-help groups to assist migrant workers, setting up training programs to increase womens' capacity, emphasizing girls' education more and developing rural infrastructure (27). According to (81), the most effective way to deal with the labour shortage is to have an MGNREGA workforce in agriculture.

Conclusion

From 1977 to 2022, labourers in agricultural participation have declined across rural and urban areas. The responsiveness of agriculture to weather conditions and the rising susceptibility of crop yields to extreme weather events and evolving climate patterns are expected to intensify rural-to-rural and rural-to-urban migration. Two primary factors contribute to labour migration, which are known as "demand pull" or "supply push". Push factors such as uneven development, poverty, landholding system, fragmentation of land, lack of job opportunities, large family size and natural disasters are the main reasons for migration. Factors attracting individuals from rural areas to urban centres include evolving lifestyles and introducing a new dimension related to amenities, as people seek controlled environments in response to challenging climates. Another well-established factor contributing to increased migration is the growing educational achievements, which can facilitate movement based on network effects and geographical considerations. Labour-saving technology, such as mechanization, causes labour displacement. Female participation in agriculture has increased due to male labour outmigration.

The positive outcomes of agricultural labour migration are evident in the improved standard of living, as remittances from migration contribute to the income of households in the sending areas. This alleviates poverty in rural regions and positively influences agricultural invest-

ment, technology transfer and productivity. On the flip side, the downside is observed in the modern industry sectors' demand for highly skilled workers, leading to the exclusion of low-skilled workers from the labour market. Individuals transitioning to non-agricultural sectors may not immediately attain the average income of that sector. Typically, the initial job secured by a migrant post-migration tends to be low-paying and of relatively short duration, leading to decreased agricultural production in rural areas. To narrow the income disparity between rural and urban regions government had implemented many programs in India that brought in workers from rural areas during the agricultural off-season, which had a considerable effect on discouraging seasonal migration to cities.

Limitations

The limitation of solely relying on databases such as Scopus and ScienceDirect to collect articles on agricultural labour migration is a notable constraint in this review. While these databases are reputable sources for scholarly literature, restricting the search to only these platforms may result in overlooking relevant studies published in other databases or non-peer-reviewed sources. Agricultural labour migration is a multifaceted and complex phenomenon influenced by various socioeconomic, environmental and policy factors. Therefore, limiting the search to specific databases may inadvertently omit valuable insights from interdisciplinary or niche journals, government reports, grey literature and local publications that could contribute to a more comprehensive understanding of the topic. Furthermore, the choice of keywords for the search strategy may also introduce biases and overlook studies that use different terminology or focus on specific aspects of agricultural labour migration not captured by the selected keywords. This limitation could result in a skewed representation of the existing literature and may impact the breadth and depth of the reviews' findings.

Acknowledgements

The authors acknowledge and are grateful to the University Grants Commission, Government of India, New Delhi, for funding this research study through the UGC NET fellowship. The authors acknowledge and are grateful for periodic labour force survey reports from the government of India used in the study.

Authors' contributions

GSR was responsible for designing the study, collecting articles, developing the protocol, and drafting the initial manuscript. MA, BM, RT, PK, BR, AP and SB contributed and revised the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: There is no conflict of interest between the authors.

Ethical issues: None

References

1. Maharjan A, Bauer S, Knerr B. Migration for labour and its impact on farm production in Nepal. Kathmandu, Nepal: Centre for the Study of Labour and Mobility; 2013.
2. Organization for Economic Co-operation and Development (OECD), Food and Agriculture Organization of the United Nations (FAO). OECD-FAO Agricultural Outlook 2021-2030 [Internet]. Paris: OECD Publishing; 2021 [cited 2025 Feb 20]. https://doi.org/10.1787/19428846-en
3. Jain V, Tewathia N, Barik K. Gender-differentiated labor and adaptation effects of climate change in rural areas: A systematic literature review. Gender Issues. 2023;40(2):168-84. https://doi.org/10.1007/s12147-023-09310-8
4. Vaishnavi P, Manisankar G. Labour scarcity in agriculture: A review. Pharma Innov J. 2022;11(4):2087-90.
5. Federation of Indian Chambers of Commerce and Industry (FICCI). Accelerating growth of Indian agriculture: micro irrigation an efficient solution [Internet]. New Delhi: FICCI; 2015 [cited 2025 Feb 20]. Available from: http://ficci.in/spdocument/20550/FICCI-agri-Report %2009-03-2015.pdf
6. Alvarez-Cuadrado F, Poschke M. Structural change out of agriculture: labor push versus labour pull. Am Econ J Macroecon. 2011;3(3):127-58. https://doi.org/10.1257/mac.3.3.127
7. Malanski PD, Dedieu B, Schiavi S. Mapping the research domains on work in agriculture: a bibliometric review from Scopus database. J Rural Stud. 2021 ;81:305-14. https://doi.org/10.1016/j.jrurstud.2020.10.050
8. Lusome R, Bhagat RB. Trends and patterns of internal migration in India, 1971–2001. In: Annual Conference of the Indian Association for the Study of Population (IASP); 2006 Sep 7–9; Thiruvananthapuram, India
9. Ministry of Statistics and Programme Implementation (MOSPI). Annual report: periodic labour force survey (PLFS) 2023–24 [Internet]. New Delhi: MOSPI; 2024 [cited 2025 Feb 20]. https://www.mospi.gov.in/annual-report-periodic-labour-force-survey-plfs-2023-24
10. Chand R. Changes in labour force and employment: evidence from PLFS data. Indian J Labour Econ. 2023 ;66(3):645-60. https://doi.org/10.1007/s41027-023-00457-2
11. Office of the Registrar General & Census Commissioner, India. Census tables [Internet]. New Delhi: Ministry of Home Affairs; 2025 [cited 2025 Feb 20]. https://censusindia.gov.in/census.website/data/census-tables
12. Rambabu B. Economic conditions of agricultural labourers: a case study in Nellore district in Andhra Pradesh. i-Manag J Manag. 2014 ;9(2):40.
13. Kapri K, Ghimire S. Migration, remittance and agricultural productivity: evidence from the Nepal Living Standard Survey. World Dev Perspect. 2020 ;19:100198. https://doi.org/10.1016/j.wdp.2020.100198.
14. International Organization for Migration (IOM). Global migration trends factsheet 2015 [Internet]. Geneva: IOM; 2016 [cited 2025 Feb 20]. https://publications.iom.int/books/global-migration-trends-factsheet-2015
15. Doddamani KN. A study on migration of agriculture labourers from Hyderabad Karnataka area to Maharashtra. IOSR J Humanit Soc Sci. 2014;19:68-71.
16. Islam B, Guha P. Impact of occupational migration of unskilled labourer from domestic agriculture on farm business income in source households of Assam, India. Int J Soc Econ. 2020;47(12):1561-76. https://doi.org/10.1108/IJSE-05-2020-0296.
17. Agasty MP, Patra RN. Migration, labor supply, wages and agriculture: A case study in rural Odisha. Migration. 2014 ;4(16):94-109.

18. Lewis WA. Economic development with unlimited supplies of labour. Manchester School. 1954;22(2):139-91 : https://la.utexas.edu/users/hcleaver/368/368lewistable.pdf
19. Myrdal G. Economic theory and under-developed regions. London: Gerald Duckworth; 1957.
20. Ranis G, Fei JC. A theory of economic development. Am Econ Rev. 1961;51(4):533-65. https://www.jstor.org/stable/1812785
21. Ravenstein EG. The laws of migration. J R Stat Soc. 1889;52 (2):241-305. https://doi.org/10.2307/2979333.
22. Lee ES. A theory of migration. Demography. 1966 ;3(1):47-57 [cited 2025 Feb 20]. https://wrap.warwick.ac.uk/36568
23. Harris JR, Todaro MP. Migration, unemployment and development: a two-sector analysis. Am Econ Rev. 1970 ;60(1):126-42. https://www.jstor.org/stable/1807860
24. Espíndola AL, Silveira JJ, Penna TJ. A Harris-Todaro agent-based model to rural-urban migration. Braz J Phys. 2006;36:603-9. https://doi.org/10.1590/S0103-97332006000500002
25. Stark O, Bloom DE. The new economics of labor migration. Am Econ Rev. 1985;75(2):173-8. https://doi.org/10.1007/s12143-010-9077-2
26. Taylor JE, Wyatt TJ. The shadow value of migrant remittances, income and inequality in a household-farm economy. J Dev Stud. 1996;32(6):899-912. https://doi.org/10.1080/00220389608422445
27. Singh NP, Singh RP, Kumar R, Padaria RN, Singh A, Varghese N. Labour migration in Indo-Gangetic plains: determinants and impacts on socioeconomic welfare. Agric Econ Res Rev. 2011;24:449-58. https://doi.org/10.22004/ag.econ.119396
28. Kaur B, Singh JM, Garg BR, Singh J, Singh S. Causes and impact of labour migration: a case study of Punjab agriculture. Agric Econ Res Rev. 2011;24:459-66. https://doi.org/10.22004/ag.econ.119397
29. Dakua T. Labour migration. Thematics J Geogr. 2018;3(2). https://doi.org/10.1080/21632324.2015.1022967
30. Jorgenson DW. Surplus agricultural labour and the development of a dual economy. Oxf Econ Pap. 1967;19(3):288-312. https://doi.org/10.1093/oxfordjournals.oep.a041051
31. Sriram V, Deering K, Wright P. Good practices for integrating gender equality and womens' empowerment in climate-smart agriculture programmes. 2019; https://doi.org/10.5555/20210277371
32. Paris T, Singh A, Luis J, Hossain M. Labour out-migration, livelihood of rice farming households and women left behind: a case study in Eastern Uttar Pradesh. Econ Polit Wkly. 2005;18:2522-9. https://www.jstor.org/stable/4416781
33. Sundaravaradarajan KR, Sivakumar P, Jahanmohan KR. Determination of key correlates of agricultural labour migration in less resource-endowed areas of Tamil Nadu. Agric Econ Res Rev. 2011;24:467-72. https://doi.org/10.22004/ag.econ.119401
34. Bhagat T, Singh GC. Causes and impact of agricultural labour migration: a case study of Ranchi district. IJFMR Int J Multidiscip Res. 5(1):1-8.
35. Agarwal T, Goel PA, Gartaula H, Rai M, Bijarniya D, Rahut DB, Jat ML. Gendered impacts of climate-smart agriculture on household food security and labor migration: insights from Bihar, India. Int J Clim Chang Strateg Manag. 2022;14(1):1-9. https://doi.org/10.1108/IJCCSM-01-2020-0004
36. Caxaj CS, Weiler AM, Martyniuk J. Housing conditions and health implications for migrant agricultural workers in Canada: a scoping review. Can J Nurs Res. 2024;56(1):16-28. https://doi.org/10.1177/08445621231203086
37. Akram AA, Chowdhury S, Mobarak AM. Effects of emigration on rural labor markets. National Bureau of Economic Research; 2017 Oct 16. https://doi.org/10.3386/w23929
38. Taylor JE, Lopez-Feldman A. Does migration make rural households more productive? Evidence from Mexico. In: Migration, transfers and economic decision making among agricultural households. Routledge; 2020. p. 68-90.
39. Tuladhar R, Sapkota C, Adhikari N. Effects of migration and remittance income on Nepals' agriculture yield. Manila: Asian Development Bank; 2014.
40. Anuja AR, Kar A, Kumar P, Jha GK, Burman RR, Singh KN, Shivaswamy GP. Pattern and implications of labour migration on technical efficiency of farm households: A study in Bundelkhand region of central India. Indian J Agric Sci. 2020;90(10):1877-82. https://doi.org/10.56093/ijas.v90i10.107888
41. Bhandari G, Reddy BV. Impact of out-migration on agriculture and women workload: An economic analysis of hilly regions of Uttarakhand, India. Indian J Agric Econ. 2015;70(3):396-404. https://doi.org/10.22004/ag.econ.230218.
42. Selod H, Shilpi F. Rural-urban migration in developing countries: Lessons from the literature. Reg Sci Urban Econ. 2021 ;91:103713. https://doi.org/10.1016/j.regsciurbeco.2021.103713
43. Radhakrishnan P, Murugan PP. To measure the impact of shift from agriculture to other non-farm occupations: An analysis in Coimbatore district of Tamil Nadu. Int J Agric. 2018 ;8(1):69-72. ISSN (E): 2321-0087.
44. Pundir RS, Singh K. Rural-urban linkages and socioeconomic development: a case study of two villages in Gujarat. Anand: Institute of Rural Management; 2001.
45. Pratiwi ED, Ashar K, Syafitri W. Intersectoral labour mobility in Indonesia. 23rd Asian Forum of Business Education (AFBE 2019); 2020.
46. Larson D, Mundlak Y. On the intersectoral migration of agricultural labor. Econ Dev Cult Change. 1997 ;45(2):295-319. https://doi.org/10.1086/452275
47. Bhatia MS. Rural infrastructure and growth in agriculture. Econ Polit Wkly. 1999 Mar 27;A43-8.
48. Saini S, Burman RR, Padaria RN, Mahra GS, Bishnoi S, Aditya K, Nithyashree ML, Mallick S, Mukherjee S, Padhan SR. Mapping the research trends of migration behavior in agricultural households: A bibliometric analysis. Front Sustain Food Syst. 2023;7:1241716.
49. Sivaramakrishnan K. Migration from and within Asia. Int Semin Nucl War Planet Emerg. 2005;45-65.
50. Deshingkar P, Akter S. Migration and human development in India. New Delhi: United Nations Development Programme; 2009. https://doi.org/10.3389/fsufs.2023.1241716
51. Sarkar DE, Roy DE, Chattopadhyay KS. Effect of farm mechanization on agricultural growth and comparative economics of labour and machinery in West Bengal. Agro-Econ Res Centre Visva -Bharati Shantiniketan Study. 2013 Jul 18;(175).
52. Pattnaik I, Lahiri-Dutt K, Lockie S, Pritchard B. The feminization of agriculture or the feminization of agrarian distress? Tracking the trajectory of women in agriculture in India. J Asia Pac Econ. 2018 ;23 (1):138-55. https://doi.org/10.1080/13547860.2017.1394569
53. Goudappa SB, Surekha S, Reddy BS. Participation of farm women in decision-making process on agricultural operations in Yadgir district of Karnataka. Indian Res J Ext Educ. 2012;1:138-43.
54. Van Aelst K, Holvoet N. Intersections of gender and marital status in accessing climate change adaptation: Evidence from rural Tanzania. World Dev. 2016;79:40-50. https://doi.org/10.1016/j.worlddev.2015.11.003
55. Chowdhury JR, Parida Y, Agarwal P. How floods affect rural employment in India: A gender analysis. Int J Disaster Risk Reduct. 2022;73:102881. https://doi.org/10.1016/j.ijdrr.2022.102881

56. Baronchelli A, Ricciuti R. Temperature shocks, rice production and migration in Vietnamese households. Ecol Econ. 2022;193:107301. https://doi.org/10.1016/j.ecolecon.2021.107301

57. Maitra P, Tagat A. Labour supply responses to rainfall shocks. Available at SSRN 3449144. 2019. https://doi.org/10.1111/rode.13079

58. Chowdhury M, Wadood SN. Internal and forced migration and economic development in South Asia. In: Migration in South Asia: IMISCOE Regional Reader. Cham: Springer International Publishing; 2023;29. p. 17-35. https://doi.org/10.1007/978-3-031-34194-6

59. IPCC. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press; 2014. p. 1–32.

60. Jha PK. Agricultural labour in India. New Delhi: Vikas Publishing House; 1997.

61. Jennings JA, Gray CL. Climate variability and human migration in the Netherlands, 1865–1937. Popul Environ. 2015;36:255-78. https://doi.org/10.1007/s11111-014-0218-z

62. Koubi V, Spilker G, Schaffer L, Bernauer T. Environmental stressors and migration: Evidence from Vietnam. World Dev. 2016;79:197-210. https://doi.org/10.1016/j.worlddev.2015.11.016

63. Kavi Kumar KS, Viswanathan B. Influence of weather on temporary and permanent migration in rural India. Clim Change Econ. 2013 ;4(02):1350007.

64. Rogaly B. Who goes? Who stays back? Seasonal migration and staying put among rural manual workers in Eastern India. J Int Dev. 2003;15(5):623-32. https://doi.org/10.1002/jid.1020

65. Katseli LT, Lucas RE, Xenogiani T. Effects of migration on sending countries: what do we know? Paris: Organisation for Economic Co-operation and Development; 2006. https://doi.org/10.1787/18151949

66. Handral AR, Anbukkani P, Kumar P. Internal labour migration in India: Recent trends and patterns. Ann Agric Res. 2018;39(2):1-8.

67. Kundu A, Sarangi N. Migration, employment status and poverty: An analysis across urban centres. Econ Polit Wkly. 2007;27:299-306. https://www.jstor.org/stable/4419187

68. Das KC, Saha S. Inter-state migration and regional disparities in India. Pop Asso Am Ann Meet; 2013. https://doi.org/10.21203/rs.3.rs-915554/v1

69. Viswanathan B, Kumar KK. Weather, agriculture and rural migration: Evidence from state and district level migration in India. Environ Dev Econ. 2015;20(4):469-92. https://doi.org/10.1017/S1355770X1500008X

70. Marchiori L, Maystadt JF, Schumacher I. The impact of weather anomalies on migration in sub-Saharan Africa. J Environ Econ Manag. 2012;63(3):355-74. https://doi.org/10.1016/j.jeem.2012.02.001

71. Dallmann I, Millock K. Climate variability and inter-state migration in India. CESifo Econ Stud. 2017 ;63(4):560-94. https://doi.org/10.1093/cesifo/ifx014

72. Nam CB, Serow WJ, Sly DF, editors. International handbook on internal migration. New York: Greenwood Press; 1990.

73. Christiaensen L, Rutledge Z, Taylor JE. The future of work in agri-food. Food Policy. 2021;99:101963. https://doi.org/10.1016/j.foodpol.2020.101963

74. Roy A. Structural change and labour productivity trend in the non-agricultural sector: a study of Asia. Eur J Comp Econ. 2022;19(2):227-49. https://ejce.liuc.it/articles/ejce013.pdf

75. Raut K. Changes in demand for agricultural labour: results of a resurvey of a village in Maharashtra, India. Geographien Südasiens. 2016;5:1-15.

76. Narayanamoorthy A, Jyotishi A, Deshpande RS. Agricultural growth and migration: Search for new evidence. Indian J Agric Econ. 1999;54(3):402-11.

77. Imbert C, Papp J. Short-term migration and rural workfare programs: Evidence from India. J Eur Econ Assoc. 2014.

78. Ramsey AF, Sonoda T, Ko M. Intersectoral labour migration and agriculture in the United States and Japan. Agric Econ. 2023;54(3):364-81.

79. Jayaraman TK. Seasonal migration of tribal labour: An irrigation project in Gujarat. Econ Polit Wkly. 1979;1727-32.

80. Choithani C, van Duijne RJ, Nijman J. Changing livelihoods at Indias' rural–urban transition. World Dev. 2021;146:105617. https://doi.org/10.1016/j.worlddev.2021.105617

81. Prasad S. MGNREGA: A strategy to overcome labour shortage in agriculture. Int J Agric Ext. 2014;2(1):57-64. https://journals.esciencepress.net/index.php/IJAE/article/view/656

82. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int J Surg. 2010;8(5):336-41.

83. Mengist W, Soromessa T. Assessment of forest ecosystem service research trends and methodological approaches at global level: a meta-analysis. Environ Syst Res. 2019;8(1):22.