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## Article

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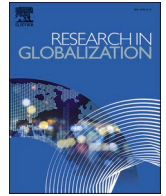
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# Delving the influence of socio-economic, demographic and migration factors on utilization of remittances in the agricultural sector in a high out-migrating region in India

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## ABSTRACT

In developing nations, remittances play a vital role in the development of the society. Remittances serve as a substantial income stream for rural households, empowering them to invest in farming activities, procure resources, and enhance their overall quality of life. This study focuses on investigating remittance utilization patterns in agriculture and how do socio-economic, demographic and migration factors influence remittance utilization patterns in agriculture in the Middle Ganga Plain region (Eastern Uttar Pradesh and Bihar) of India? The study utilizes the data from the Middle Ganga Plain (MGP) migration survey (2021) conducted by the International Institute for Population Sciences, Mumbai. With the help of bivariate analysis, the study explores the relationship between socioeconomic and migration characteristics and the utilization of remittances in the agricultural sector. The Chi-Square test validates the findings, followed by a Binomial Logistic Regression Model for further analysis. The study reveals that marginalized social groups are more inclined to use remittances for agriculture due to their active involvement in agriculture. Furthermore, households with larger landholdings demonstrate an increased likelihood of remittance utilization across all agricultural sectors. Additionally, it was observed that remittances in agriculture were more prevalent among female-headed households. Moreover, parents who are recipients of remittances tend to allocate their funds to agricultural activities. The significant positive correlation between monthly remittance receivers and total agricultural expenses underscores the importance of remittances in rural development. This study provides valuable insights into remittance utilization patterns and associated factors in the agricultural sector, highlighting the need for targeted policies and interventions to enhance the efficient and effective use of remittances in agriculture, ultimately contributing to rural economic growth and development.

## 1. Introduction

Migration is a permanent or semi-permanent relocation of individuals or groups from one region to another, driven by various determined reasons. The causes of migration are complex and multifaceted, ranging from the pursuit of peace, political stability, and development to escaping conflict and poverty. Additionally, many people migrate abroad for educational opportunities or to work and send remittances back to their families (Silva et al., 2018). Significantly, millions of people migrate yearly to boost their earnings and improve household welfare, which is a widespread phenomenon worldwide that is especially prominent in developing nations (Rajkumar, 2020). A substantial proportion of overseas migrants come from rural areas. As a

consequence of migration, it benefits both regions, as the origin region gains new skills and remittances, while the destination benefits from a plentiful supply of affordable labour. Simultaneously, the return of money and assets by migrants to their respective home regions is one of the repercussions of rural-to-urban migration (Rempel & Lobdell, 1978). International and domestic migration from rural to urban areas plays a crucial role in an economy's structural evolution, presenting both opportunities and challenges to rural economies. For example, family remittances have a significant positive effect on reducing poverty (Silva et al., 2018). As a developing country, this migration trend in India is notably pronounced, with a distinct shift from rural areas to cities.

Although labour migration is a complex phenomenon with a considerable focus on understanding its driving factors, there is a

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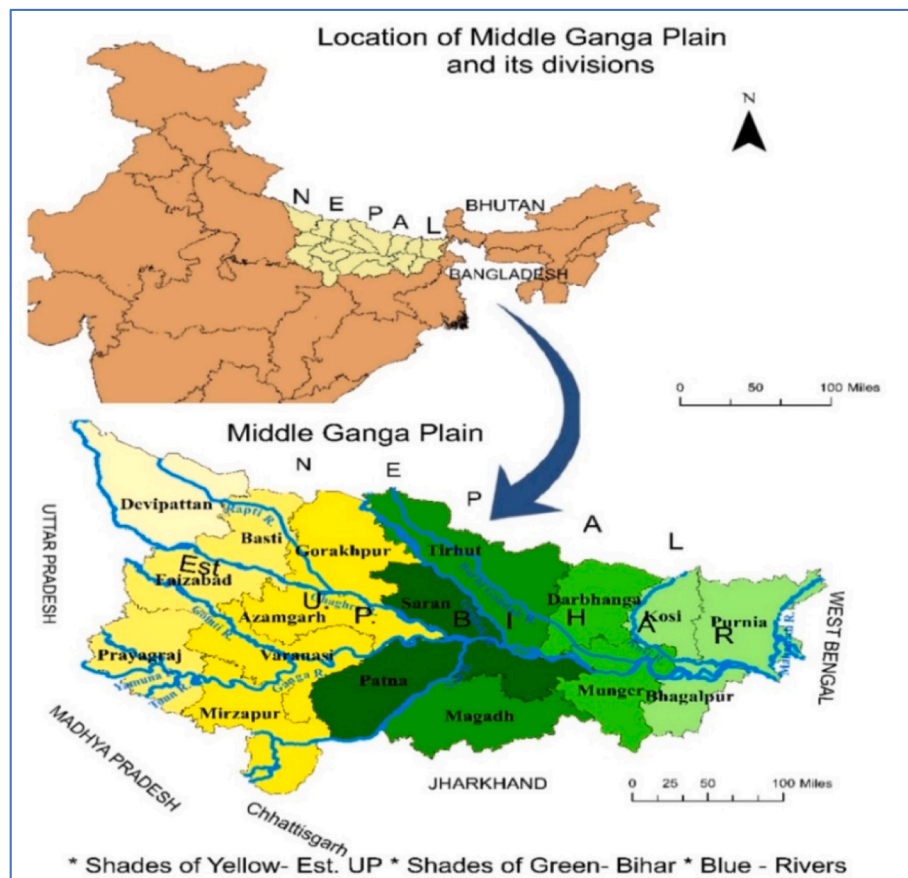
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notable lack of knowledge and practical policies regarding the impacts on individuals and the communities they leave behind (Dessalegn et al., 2023). Despite these complexities, it is recognized that remittances can play a significant role in the economic development of the source regions, especially in rural areas in this context (Hidayati, 2020). They serve as an essential source of funding, supporting livelihoods and economic activities in rural areas (Chintamani & Kulkarni, 2023). It is also evident that the quantity of migrant remittances received by developing countries has expanded dramatically over the last decade and has played an essential role in rural development in many ways (Mabrouk & Mekni, 2018). Remittances to India have increased dramatically since 1991, propelling the nation to the top of the developing world's remittance recipient list (Gupta, 2006). According to the latest World Migration Report by the United Nations, India topped the list of countries receiving remittances from abroad, with a total of \$111 billion in 2022. This amount significantly surpassed that of its nearest competitors, including Mexico (\$61.1 billion), China (\$51 billion), the Philippines (\$38.05 billion), and France (\$30.04 billion) (Ghosh, 2024). These remittances, along with other development aspects such as contributions to savings or business investments, often help grow local agricultural activities and enhance the welfare and livelihood of recipient households by providing necessities such as food, clothing, improved health and education, and human and social capital. (Xing, 2018). See (Fig. 1).

Remittance inflows can provide smallholder farmers with access to capital, which they can use to purchase seeds, fertilizers, and other necessary inputs for successful crop production. Previously, many studies have been carried out in several developing countries like China, Nepal, Bhutan, Philippines, and some Latin American and African countries. A study by Atamanov and van den Berg (2012) says

remittances generally result in higher crop earnings for most farmers, except those who own the most land. Another important study (Vasco et al., 2016) focused on the impact of international migration and remittances on agricultural production patterns in rural Ecuador. The study says families with members who migrated abroad tend to use remittance to purchase fertilizers to compensate for the decreased available labour due to migration. A study investigated remittances' impact on agricultural labour productivity in Sub-Saharan Africa. Using panel data from 39 countries (2000–2016), they found that remittances had a strong negative impact on agricultural labour productivity (Wonyra & Ametoglo, 2020). Another study (Ghimire & Kapri, 2020) also conducted similar research in Nepal. They tried to analyse the role of earned and unearned remittance in agricultural productivity. Their study findings show that unearned remittances improve agricultural productivity more than earned remittances. In the long term, agriculture can contribute to reducing rural poverty. However, in the short term, remittances from abroad are more effective in alleviating poverty through agricultural development in rural areas (Liu et al., 2020). At the same time, the individual and household factors like age, marital status, human capital, household size, caste, and land ownership greatly influence migration decisions and the amount of remittances sent (Pal, 2022). Agriculture is the most important economic sector of rural areas; in this context, it is important to study the role of socioeconomic, Demographic and Migration Factors of remittance utilization in agriculture in the Indian context. So, the research question arises: How do socioeconomic, demographic and migration factors influence the utilization of remittances in agricultural expenses among households in Bihar and Eastern Uttar Pradesh (Middle Ganga Plain region), considering the prevalence of various agricultural inputs starting from hiring labour, purchasing hybrid seeds, purchasing fertilizer and pesticides to



**Fig. 1.** Location Map of the Study Area.  
Map Source: MGP Migration Survey Report (2021)

purchasing tubewell?

2. Rationale of the study

Middle Ganga Plain (MGP) in this study covers Bihar and Eastern Uttar Pradesh in India. It is a vital region under the Agro-Climatic Zone in India, with 132 per cent cropping intensity (Sharma & Paithankar, 2014). Furthermore, outward migration is more prevalent in the rural regions of the country's northern and eastern states, particularly in Uttar Pradesh and Bihar(Keshri & Bhagat, 2012). Simultaneously, according to the Middle Ganga Plain (MGP) migration survey report (2021), over 57 per cent of households consist of at least one member who has migrated for employment or business purposes within the country as well as across the border (Roy et al., 2021).. The Census of India (2011) also indicates that a total of 10.11 million male out-migration have occurred in these two states. Lack of employment is the primary reason for outward migration from the vast region of Eastern Uttar Pradesh and Bihar (Samanta & Munda, 2023). So, the migrant households of this MGP region receive not only internal remittance but also international remittance. This migration trend highlights the interconnectedness between local and global dynamics, as individuals from this region contribute to the global labour force. Understanding how remittances flow into these migrant households, both from internal sources and internationally, adds a global dimension to the study. Families receiving remittances tend to have a greater agricultural output (Kapri & Ghimire, 2020). Although numerous studies have examined the impact of remittances on agricultural development in many developing countries in many ways, research in the Indian context has been relatively scarce. Likewise, most of the existing studies mainly highlighted that remittances play a vital role in enhancing agricultural development in developing countries, providing smallholder farmers with essential capital for agricultural input, and the use of this remittance can differ based on various factors such as socioeconomic, demographic characteristics of the households, migration factors etc. Consequently, remittance helps poverty reduction and rural development. Therefore, remittance has the potential to achieve sustainable development goals (SDGs) and contribute to economic growth in developing countries. Therefore, the present study examines the determinants of remittance utilization in the agricultural sector. See (Fig. 2).

This study makes several significant contributions to the existing literature on remittances and agricultural dynamics, particularly in the context of developing nations. By concentrating on the Middle Ganga Plain region in India (Eastern Uttar Pradesh and Bihar), this study provides detailed regional insights that are often underrepresented in broader analyses of remittance utilization in agriculture. This focus

enriches the understanding of dynamics and socio-economic conditions influencing remittance utilization in agriculture. This is one of the few studies that specifically examine the Middle Ganga Plain region, providing unique insights into a relatively less studied area. This regional focus in the Indian context fills a significant gap in the literature and offers a nuanced understanding of remittance dynamics and agricultural aspects. The detailed examination of remittance utilisation in the Middle Ganga Plain region provided valuable insights that can inform global strategies for leveraging remittances to improve agricultural productivity and socioeconomic development in other underrepresented and high outward migratory regions around the world.

3. Data and methodology

3.1. Study area

The Middle Ganga Plain, the focus of this study, includes two geographic regions: Eastern Uttar Pradesh and Bihar in India. These regions are subdivided into 17 administrative divisions, with Eastern Uttar Pradesh containing 8 and Bihar 9, each characterized by diverse socio-economic profiles. Based on previous research, this region is identified as the primary source of outward migration in India.

3.2. Sampling design

Middle Ganga Plain (MGP) migration survey data was used for the study, which was conducted by the Department of Migration and Urban Studies, International Institute for Population Sciences, Mumbai, in 2021. MGP has four types of migration data: internal or out-migration, international migration, seasonal migration, and potential migration. Apart from that, another type of migration data also includes return migration. For this study, the use of data is limited to remittance use in agricultural expense and its associated information. This study employed a multi-stage stratified random sampling approach. Basically, internal or outmigration and international migration data have been used in this study. This study involves a total of 4056 households, consisting of 1579 non-migrant households and 2164 migrant households. Among the migrant households, 1639 households, with 1530 for internal and 109 for international migrants, have been considered for the study. This data set contains several aspects such as household characteristics, demographic composition, migration characteristics, remittances and their utilization pattern, and various socio-economic characteristics such as education, employment, landholding, agricultural investment, irrigation, and household head characteristics.

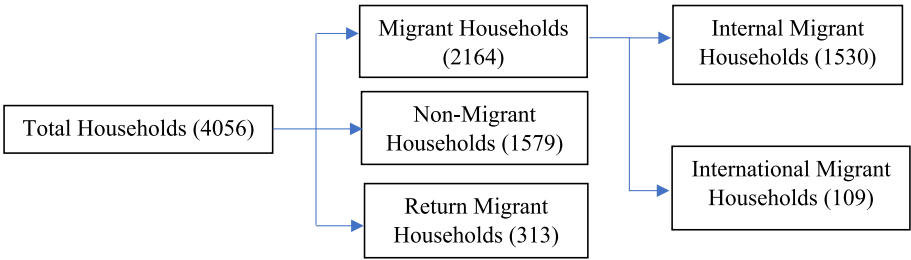


Fig. 2. Sampling Framework of the Study.

**Note:** A **Migrant** is defined as any household member who has relocated their usual place of residence to another district within India or to a different country for employment, business, or education, staying away for over a year. A **Migrant Household** refers to a household that includes at least one member who is a migrant. This individual could be an internal (out-migrant), international, or seasonal migrant. A **Non-Migrant Household** refers to a household where no member has ever relocated from their usual place of residence for employment or business purposes. A **Return Migrant Household** is any household that includes a member who has previously migrated and returned. An **International Migrant Household** refers to a household where at least one member has moved to destinations outside India for employment or business purposes, and their stay has exceeded six months. An **Out-Migrant Household** refers to a household where at least one member has migrated to other districts within India (but not internationally) for work or business for a duration exceeding one year. **Remittance** refers to the money that a household receives from its members who have migrated, over a period of at least one year.

Source: MGP Migration Survey Report (2021)

### 3.3. Methods

#### 3.3.1. Description of variables

**Dependent variable:** Both internal and international migrant households were asked four types of questions in the MGP migration survey regarding the expenditure of remittances on agricultural expenses. These questions were related to the hiring of labourers, purchase of hybrid seeds, purchase of fertilizers or pesticides, and purchase of tube wells. Multiple choice answers were there for every question, these are “1 = Fully”, “2 = Partially”, “3 = Not at all” and “9 = Not Applicable”. These options are recorded as “1/2 = 0 Yes” as respondents using remittances in agricultural sectors and “3/9 = 1 No” as respondents not using the remittances in agricultural sectors. In this way, a binary dependent variable has been created for further analysis. The choice of this binary dependent variable in this study is justified because it aligns with the research focus, facilitates analysis, and provides a straightforward interpretation. It effectively addresses the central question of whether remittances are utilized for agricultural activities.

**Independent variables:** Upon examining the current literature, the relevant information in the dataset that could potentially impact the utilization of remittances in agricultural expenses has been identified and considered as independent variables. A critical study by [Kapri and Ghimire \(2020\)](#) used significant variables such as remittance inflows, number of migrants, agricultural productivity, and other household head characteristics, including age, sex of the household head, education categories, etc. and other socio-economic characteristics of the household includes caste category, household size, family type, landholding etc. as independent variable for analysing the remittance utilization pattern in agricultural expenses. So, details of independent variables those are used in this study are given below-

- a) **Age Group:** Age groups can significantly influence the utilization of remittances in agriculture due to varying priorities, capabilities, and perspectives among different cohorts. The Age Group of the study population has been categorised as ‘Less than 30 Years’, ‘31–45 Years’, ‘46–60 Years’, and ‘More than 60 Years’.
- b) **Sex of the Household Head:** The sex of the household head can significantly influence the utilization of remittances in agriculture due to differing roles, responsibilities, priorities, and access to resources between men and women. This variable has been extracted from the study to determine the headship of the household.
- c) **Caste Category:** Caste category is another crucial aspect that plays an important role in remittance use in agriculture. Caste categories can significantly influence the utilization of remittances in agriculture, particularly in societies where caste-based hierarchies affect access to resources, opportunities, and social capital. According to data availability, this variable is further subdivided into ‘STs’, ‘SCs’, ‘OBCs’ and ‘Others.’
- d) **Education Category:** The education category of households can significantly influence the utilization of remittances in agriculture, as education levels often correlate with access to information, skills, and resources. This variable is further recorded as ‘Illiterate’, ‘Primary’, ‘Secondary’ and ‘Higher Secondary & Above’.
- e) **Landholding:** Landholding plays a crucial role in the effective utilization of remittances in the agricultural sector, as it provides the necessary resources and infrastructure for investment in farming activities. Landholding is further recorded as ‘Land Less’, ‘Less than 1 Acre’ and ‘More than 1 Acre.’
- f) **Nature of Work:** The nature of the work of a migrant plays a crucial role in determining the effective utilization of remittances in the agricultural sector, as certain skills and experiences may be more relevant and beneficial to the specific needs and demands of agricultural work. This variable further recorded as ‘Casual Wage Labour’, ‘Govt. Salaried Work’, ‘Private Salaried Work’, ‘Self-Employed’, ‘Unpaid Family Worker’.
- g) **Family Type:** The family type of a migrant also holds significant importance in the utilization of remittances in the agricultural sector, as the needs and priorities of a migrant’s family can influence the allocation of funds towards agricultural investments and development. According to the need of the study and availability of data this variable also recorded as ‘Nuclear’ and ‘Joint/Extended’.
- h) **Family Size:** Here, family size means the total number of family members in a household. The size of a migrant household holds a crucial role in effectively utilizing remittances in the agricultural sector, as larger families may require more significant investments to meet their needs and achieve sustainable agricultural growth. In comparison, smaller families may have more flexibility in resource allocation. This variable is also recorded in three subcategories, these are ‘Single’ ‘2–5 Members’, and ‘6 & More Members’.
- i) **Frequency of Remittance:** The frequency of remittance inflows is an important factor that affects the utilization of remittances in the agricultural sector. Further, this variable is subdivided into ‘Monthly’, ‘Quarterly’, ‘Half Yearly /Yearly’ and ‘When Required’.
- j) **Remittance Receiver:** The role of the remittance recipient in utilizing remittances for agricultural development is also crucial. This variable is categorised as ‘Parents’, ‘Wife’, and ‘Others’.
- k) **Migration Duration:** The migration duration can affect the remittance sender’s ability to maintain a consistent level of support for their family’s agricultural activities. ‘Less than 5 Years’, ‘5–10 Years’ and ‘More than 10 years’ are the subcategories of this variable.

#### 3.3.2. Analytical model

A bivariate model was used to examine the relationship between different socio-economic and migration characteristics of migrants and various agricultural expenses that were paid using the money sent back by those migrants as remittance. The purpose of this analysis was to understand how the characteristics of the migrants were related to the agricultural expenses that were being paid using their remittance money. Bivariate analysis serves as an initial exploration of relationships between individual variables without considering the influence of other factors. The Chi-Square test has been adopted for the validity check. Further, the binomial Logistic Regression Model has been used for this study. Logistic regression modelling is a suitable method for analyzing the relationship between multiple independent variables (such as socio-economic, demographic and migration characteristics) and a binary outcome variable. It allows for controlling the effects of confounding variables and quantifying the impact of each predictor variable on the likelihood of specific outcomes. In this study, using a binomial logistic regression model enables us to investigate how different socio-economic, demographic and migration characteristics of migrants influence the likelihood of remittance utilization in agriculture. Stata 14.1 software tool has been used for data analysis.

## 4. Results

Determining the background characteristics of the study population is crucial because the variation of sociodemographic characteristics between individuals who participate and those who do not in population-based studies can introduce bias and diminish the applicability of any research results ([Vo et al., 2023](#)). Therefore, relevant socioeconomic, demographic and migration characteristics which can influence the utilization of remittances have been selected for the present study. [Table 1](#) provides a brief background characteristic of the study population.

In terms of age distribution, the majority of migrants fall within the age range of 46–60 years (31.91 %), followed by those aged less than 30 years (24.28 %), 31–45 years (25.16 %), and more than 60 years (18.64 %). Regarding the sex of the household head, a higher proportion of households are headed by females (61.3 %) compared to males (38.7 %). Caste category distribution reveals that a significant portion of migrants belong to Other Backward Classes (OBCs) (55.19 %), followed by



**Table 1**  
Socio-economic and Migration Characteristics of Study Population.

Background Characteristics		Total (%)	No. of Migrants
Age Category	Less than 30 Years	24.28	356
	31- 45Years	25.16	367
	46–60 Years	31.91	558
	More than 60 Years	18.64	345
Sex of the Household Head	Male	38.7	686
	Female	61.3	940
Caste Category	STs	2.4	36
	SCs	23.19	418
	OBCs	55.19	880
	Others	19.22	295
Education Category	Illiterate	58.05	938
	Primary	13.77	233
	Secondary	20.19	322
	Higher Secondary & Above	7.98	136
Land Holding	Land Less	55.8	719
	Less than 1 Acre	30.04	512
	More than 1 Acre	14.16	328
Nature of Work	Casual Wage Labour	48.22	476
	Govt. Salaried Work	3.26	30
	Private Salaried Work	44.99	970
	Self-Employed	3.4	133
	Unpaid Family Worker	0.13	9
Family Type	Nuclear	60.29	885
	Joint/extended	39.71	744
Family Size	Single	5.11	65
	2–5 Members	68.43	1,035
	6 and More Members	26.46	526
Frequency of Remittance	Monthly	63.99	884
	Quarterly	22.79	311
	Half Yearly /Yearly	5.37	89
	When required	7.85	118
Remittance Receiver	Parents	36.83	562
	Wife	58.44	759
	Others	4.72	80
Migration Duration	Less than 5 Years	32.49	535
	5–10 Years	35.22	587
	More than 10 Years	32.29	499

Scheduled Castes (SCs) (23.19 %), Others (19.22 %), and Scheduled Tribes (STs) (2.4 %). In terms of education, the majority of migrants are illiterate (58.05 %), while smaller proportions have completed primary (13.77 %), secondary (20.19 %), or higher secondary education and above (7.98 %). Landholding patterns show that a considerable proportion of migrants have no land (55.8 %), while others own less than 1 acre (30.04 %) or more than 1 acre (14.16 %). Regarding employment, a significant portion of migrants are engaged in private salaried work (44.99 %), followed by casual wage labour (48.22 %), self-employment (3.4 %), government salaried work (3.26 %), and unpaid family work (0.13 %). Nuclear families constitute the majority (60.29 %), and remittances are primarily sent monthly (63.99 %), with wives being the most common receivers (58.44 %). Migration duration is fairly evenly distributed, with approximately one-third of migrants having been away for less than 5 years (32.49 %), 5–10 years (35.22 %), and more than 10 years (32.29 %).

Remittances play an important role in increasing overall well-being and promoting economic growth at both the individual and community levels(Ghosh Dastidar, 2017). The efficient use of remittances is determined by the receivers’ unique needs and ambitions and the larger context of the receiving community. Table 2 indicates detailed information about remittance utilization in various sectors according to the migration types as well as region-wise in the Middle Ganga Plain. The analysis further revealed that medical expenses have the highest share of remittance expenses, around 63 %, followed by daily needs, including food, around 60 %, and education of the children, about 56 %. Social ceremonies, such as festivals and gifts to relatives, have a percentage of 51.5 % while paying dowry has a percentage of 45.6 %. Loan repayment

**Table 2**  
Pattern of Utilization of Remittances in Various Sectors in Bihar, Eastern UP (Middle Ganga Plain).

Bihar		Est. UP	MGP	OM	IM
Household and Other Expenditure	%	%	%	%	%
Daily need and expenses (including food)	62.0	55.9	60.5	60.3	63.5
Medical/Health care expenses	65.4	57.0	63.2	63.1	65.3
Education of children	56.8	53.6	56.0	55.3	66.7
Social ceremonies	53.0	47.5	51.5	50.9	62.5
Paying dowry	47.9	38.9	45.6	44.4	62.5
Loan repayment	44.6	35.4	42.3	41.6	54.2
<b>Investment</b>					
Construction of new house	55.7	34.1	50.2	48.9	70.1
Repair/Maintenance of house	56.0	36.7	51.0	49.8	69.1
Purchasing of land	31.7	19.8	28.7	28.6	30.5
Purchasing of ornaments	39.7	23.1	35.4	35.2	39.2
Leasing in the land (taking on REHAN)	30.5	17.4	27.1	27.3	25.8
Investment in buying livestock	33.7	18.8	29.9	30.2	25.0
<b>Other Household Purchases</b>					
Motorcycle	24.9	22.7	24.4	24.0	30.9
Television	21.7	22.0	21.7	21.7	22.1
Fridge/Washing Machine	19.2	16.4	18.5	18.6	16.5
Mobile/Camera	38.9	25.1	35.4	35.5	34.4
<b>Agriculture Expenses</b>					
Hire laborer	27.5	33.3	29.0	29.5	21.9
Purchase hybrid seeds	24.4	30.7	26.0	26.6	16.7
Purchase fertilizer/pesticides	22.8	30.2	24.7	25.3	16.5
Purchase tube well	23.6	19.4	22.5	22.5	21.9
Total(n)	777	862	1,639	1530	109

Source: Middle Ganga Plain (MGP) Migration Survey Report (2021).  
Note:  
The Rehan system means that individuals pledge their land for a defined duration, and they must repay the borrowed funds to regain ownership of their land. OM defines Out migration or Internal Migration within the country, and IM defines International Migration across the border.  
Answers on utilization of remittance were multiple choice.

accounts for 42.3 %. For investment, the highest percentage is spent on constructing a new house at 50.2 %, followed by repair/maintenance of the house at 51 %. Purchasing of ornaments and investing in buying livestock are also listed under this category. Other household purchases include a motorcycle, television, fridge/washing machine, and mobile/camera, with the highest percentage spent on a motorcycle at 24.4 %. Under agriculture, hiring a labourer has the highest percentage at 29 %, followed by purchasing hybrid seeds at 26 %. Purchasing fertilizers/pesticides and tube wells are also expenses listed under this category.

Table 3 presents the percentage distribution of agricultural expenses farmers incur in relation to different background characteristics. The agricultural expenses are categorized into four types: hiring labour, purchasing hybrid seeds, purchasing fertilizer/pesticides, and purchasing a tube well. Use of remittance in different categories of agricultural expenses represents on the basis of various socio-economic, demographic and migration characteristics. The background characteristics include age categories, such as less than 30 years, 31–45 years, 46–60 years, and more than 60 years. For instance, farmers under 30 years old spend their remittances in agricultural expenses on hiring labour, purchasing hybrid seeds and purchasing fertilizer/pesticides around 44 %, further 46 % on purchasing a tube well. The total agricultural expenses incurred by this age category is 52.44 %. The age group of more than 60 years has the highest proportion of remittance expense in every agricultural sub-category. For the age category of more than 31 – 45 years, 56.58 % of them spent their remittance as agricultural expenses on hiring labour, around 54 % on purchasing hybrid seeds, 54 % on purchasing fertilizer/pesticides, and 49 % on purchasing a tube well. The total agricultural expenses incurred by this age category is 63.13 %. Households headed by females have higher expenses with around 61 % related to farming activities compared to males, with

**Table 3**

Utilization of Remittances in Different Agricultural Sectors by Socio-economic and Demographic Characteristics.

Background Characteristics	Hiring Labour	Purchasing Hybrid Seeds	Purchasing Fertilizer/Pesticides	Purchasing Tube Well	Total Agricultural Expenses
<b>Age Category</b>					
<30 Years	160 (44.61 %)	159 (44.67 %)	159 (44.8 %)	157 (46.78 %)	185 (52.44 %)
31–45 Years	209 (56.58 %)	213 (54.38 %)	221 (54.52 %)	179 (49.5 %)	237 (63.13 %)
46–60 Years	306 (51.89 %)	327 (54.72 %)	315 (53.09 %)	255 (45.21 %)	356 (60.74 %)
> 60 Years	196 (52.26)	202 (55.14 %)	202 (55.1 %)	149 (48.02 %)	221 (64.07 %)
<b>Sex of the Household Head</b>					
Male	363 (49.33 %)	372 (50.97 %)	363 (49.75 %)	281 (41.97 %)	415 (57.81 %)
Female	508 (52.66 %)	529 (53.1 %)	524 (53.11 %)	459 (50.49 %)	584 (61.29 %)
<b>Caste Category</b>					
STs	19 (47.05 %)	21 (49.04 %)	20 (48.34 %)	16 (37.86 %)	22 (51.6 %)
SCs	248 (55.86 %)	241 (52.86 %)	327 (52.37 %)	200 (46.78 %)	268 (59.81 %)
OBCs	473 (53.05 %)	497 (55.51 %)	493 (55.06 %)	416 (49.61 %)	554 (62.78 %)
Others	133 (41.15 %)	144 (42.12 %)	139 (41.73 %)	110 (41.48 %)	157 (52.34 %)
<b>Education Category</b>					
Illiterate	509 (50.76 %)	521 (50.48 %)	513 (50.12 %)	437 (46.37 %)	558 (60.06 %)
Primary	128 (54.16 %)	132 (58.38 %)	130 (57.29 %)	112 (51.74 %)	146 (63.24 %)
Secondary	164 (52.72 %)	176 (52.93 %)	176 (53.45 %)	132 (45.57 %)	186 (57.38 %)
Higher Secondary & Above	72 (46.3 %)	74 (51.78 %)	70 (49.24 %)	61 (48.35 %)	81 (58.28 %)
<b>Land Holding</b>					
Land Less	340 (41.84 %)	322 (38.99 %)	318 (38.79 %)	302 (40.14 %)	376 (47.54 %)
Less than 1 Acre	323 (65.33 %)	354 (73.05 %)	351 (72.9 %)	278 (61.59 %)	387 (79.94 %)
More than 1 Acre	210 (58.61 %)	227 (59.79 %)	220 (57.65 %)	162 (43.83 %)	238 (65.47 %)
<b>Family Type</b>					
Nuclear	450 (49.65 %)	463 (49.81 %)	459 (49.69 %)	412 (47.53 %)	517 (57.5 %)
Joint/extended	423 (53.73 %)	440 (55.75 %)	430 (54.78 %)	330 (46.46 %)	484 (63.32 %)

Note: Row percentages were considered, and the answers for these agricultural expenses were multiple choice.

percentages around 57 %. The OBCs are the highest remittance users in different agricultural sectors, with around 62 %, whereas STs are the lowest, with around 51.6 %. In terms of the education category, migrants with primary have the highest expenses in all categories with around 63.24 %, while those with higher secondary have the lowest expenses with around 57.38 %. Regarding land holding, households with less than 1 acre have the highest expenses in all categories at 79.94 %, while those with landless have the lowest expenses at around 47.54 %. In terms of family type, households in joint or extended families have higher expenses than those in joint or extended families in all categories.

Various factors related to migration significantly impact the utilization of remittances in the agricultural sector. Table 4 highlights that households receiving remittances half-yearly or yearly exhibit the highest engagement in agricultural expenses at approximately 65 %, followed closely by those receiving remittances monthly at 64.09 %. This engagement is notably lower for households receiving remittances on an as-needed basis. Additionally, households receiving remittances from other household members show a higher propensity (64.2 %) to spend on agricultural expenses compared to those receiving remittances from parents or spouses. Lastly, migrants with a migration duration of more than 10 years have a higher likelihood (around 64 %) of using

remittances for agricultural expenses, compared to those with a migration duration of 5–10 years (nearly 61 %) and less than 5 years (54.93 %).

Table 5 visualises the effects of various socio-economic, demographic and migration characteristics of migrants on remittance utilization patterns in the agricultural sector, such as hiring labour, purchasing hybrid seeds, purchasing fertilizer/pesticides, and purchasing a tube well. The table presents the odds ratios (OR) and confidence intervals (CI) for each category of independent variables (age, caste, family type, sex of household head, education category, landholding, migration duration, and frequency of remittance) concerning the reference category for each variable. The age category of migrant agricultural households is significantly associated with total agricultural expenses. Compared to respondents below the age of 30, those in the age range of 31–45 years have 1.3 times higher agricultural expenses. However, the confidence interval (CI) suggests that this result is not statistically significant. However, for individuals aged 46–60 and those above 60 years, the agricultural expenses are more pronounced, with respective increases of 1.47 and 1.67 times, and the latter is statistically significant. Caste categories also play a role in influencing total agricultural expenses. Scheduled Castes (SCs) show a particularly strong

**Table 4**

Utilization of Remittances in Different Agricultural Expenses by Migration Characteristics.

Background Characteristics	Hiring Labour	Purchasing Hybrid Seeds	Purchasing of Fertilizer/Pesticides	Purchasing Tube Well	Total Agricultural Expenses
<b>Frequency of Remittance</b>					
Monthly	506 (56.75 %)	524 (56.41 %)	518 (55.81 %)	451 (51.94 %)	573 (64.09 %)
Quarterly	164 (50.64 %)	164 (50.1 %)	165 (50.94 %)	128 (45.53 %)	190 (61.3 %)
Half Yearly /Yearly	59 (57.68 %)	57 (60.35 %)	54 (59.19 %)	47 (53.03 %)	63 (64.62 %)
When required	50 (38.15 %)	66 (54.77 %)	62 (53.39 %)	35 (39.15 %)	68 (55.69 %)
<b>Remittance Receiver</b>					
Parents	323 (52.15 %)	337 (55.00 %)	330 (54.14 %)	260 (47.7 %)	368 (62.4 %)
Wife	419 (54.4 %)	433 (54.34 %)	426 (54.14 %)	369 (50.02 %)	480 (62.5 %)
Others	36 (57.07 %)	40 (58.87 %)	42 (60.4 %)	31 (52.78 %)	45 (64.2 %)
<b>Migration Duration</b>					
Less than 5 Years	274 (49.43 %)	275 (48.47 %)	270 (47.67 %)	222 (42.34 %)	307 (54.93 %)
5–10 Years	305 (49.90 %)	321 (53.07 %)	315 (52.67 %)	268 (49.76 %)	360 (61.32 %)
More than 10 Years	290 (55.09 %)	303 (55.41 %)	300 (55.22 %)	248 (49.42 %)	330 (63.72 %)

Note: Row percentages were taken into account, and the answers for these agricultural expenses were multiple-choice.

**Table 5**

Effect of Socio-economic, Demographic and Migration Characteristics on Utilization of Remittance for Agriculture Expenses: Evidence from Logistic Regression Analysis.

Background Characteristics	Total Agricultural Expenses
	OR [CI]
<b>Age Category</b>	
<30®	
31–45	1.30 [0.91–1.84]
46–60 Years	1.47 [0.98–2.21]
More than 60 Years	1.67 [1.01–2.74] *
<b>Caste Category</b>	
Others®	
STs	1.82 [0.77–4.33]
SCs	2.06 [1.41–3.03] ***
OBCs	1.61 [1.15–2.25] **
<b>Family Type</b>	
Nuclear®	
Joint/extended	0.98 [0.74–1.30]
<b>Sex of HH head</b>	
Male®	
Female	1.62 [1.13–2.33] **
<b>Education Category</b>	
Illiterate®	
Primary	1.14 [0.80–1.62]
Secondary	0.98 [0.71–1.37]
Higher Secondary & Above	1.13[0.69–1.86]
<b>Landholding</b>	
Land Less®	
Less than 1 Acre	4.21 [3.13–5.65] ***
More than 1 Acre	4.51 [3.10–6.56] ***
<b>Migration Duration</b>	
Less than 5 Years®	
5–10 Years	1.01 [0.76–1.36]
More than 10 Years	1.22 [0.88–1.68]
<b>Frequency of Remittance</b>	
When required®	
Monthly	1.66 [1.08–2.56] *
Quarterly	1.31 [0.82–2.11]
Half Yearly /Yearly	1.81 [0.97–3.40]
<b>Remittance Receivers</b>	
Others®	
Parent	1.89 [1.12–3.20] *
Wife	1.64 [0.98–2.75]

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ , ®= Reference category.

Note: Agriculture expenses include hiring labour, purchasing hybrid seeds, purchasing fertilizer and pesticides, and purchasing tubewell.

relationship among different caste groups, with 2.06 times higher expenses than the reference group (Others). Scheduled Tribes (STs) and Other Backward Classes (OBCs) also demonstrate increased expenses, which are not statistically significant. The type of family structure (nuclear or joint/extended) does not appear to significantly impact total agricultural expenses. The odds ratio of 0.98 suggests no substantial difference in expenses between nuclear and joint/extended families. The gender of the household head is a significant factor influencing agricultural expenses. Female-headed households exhibit 1.62 times higher expenses compared to male-headed households. This statistically significant result indicates a gender-based difference in agricultural spending patterns. The education level of the household head does not show a clear pattern of influence on agricultural expenses. The odds ratios for different education categories (illiterate, primary, secondary, and higher secondary and above) are close to 1, indicating that education level may not be a decisive factor in determining agricultural expenses. The size of the landholding has a substantial impact on total agricultural expenses. Households with less than 1 acre or more than 1 acre of land exhibit significantly higher remittance expenses, with odds ratios of 4.21 and 4.51, respectively. The odds ratio for Landholding is significant for all the dependent variables with a p-value less than 0.001. These findings suggest that landholding size is a crucial determinant of agricultural expenditure. The duration of migration does not appear to have a significant effect on remittances on total agricultural expenses.

The results are not statistically significant. Households receiving remittances monthly show a 1.66 times increase in expenses compared to those who receive remittances only when required. This result is statistically significant, indicating that the frequency of remittance notably impacts agricultural spending patterns. Finally, the individuals receiving remittances also influence agricultural expenses. Specifically, households with parents are the recipients demonstrating a significant expense increase, with an odds ratio of 1.89. In contrast, when the wife is the receiver, the increase is 1.64 times, but this result is not statistically significant. This suggests that the recipient of remittances within the household has a varying impact on agricultural spending.

## 5. Discussion

In the context of economic development and modernization, the emigration of labour from the agricultural sector has been a defining trait, evident throughout the historical progression of developed countries and currently observed in developing nations (Rozelle et al., 1999). The theory of New Economics of Labour Migration (NELM) also says migration can trigger a process of development that reduces production and investment limitations experienced by households in imperfect market conditions while establishing connections that lead to income growth in developing countries (Taylor, 1999). Therefore, remittances play a constructive role in fostering economic growth by positively influencing consumption, savings, and investment (Meyer & Shera, 2017). Concurrently, the utilization of remittances cannot be evenly distributed across all sectors, and multiple factors can impact how remittances are utilized. Overall, this paper finds a significant impact of various socio-economic, demographic, and migration characteristics in remittance utilization on different agricultural expenses. The vast majority of agricultural households, accounting for approximately 86.4 %, operate small farm sizes of less than 2 ha. These farmers predominantly belong to socially marginalized groups such as SCs, STs and OBCs (Rao, 2017). Due to the high level of engagement in the agricultural sector among marginalized social groups, the probability of using remittances is likely higher in these categories. However, our study finding also shows that with increasing landholding size of the households, the likelihood of remittance use is also higher in every agricultural sector. The migration of adult men is strongly linked to an increase in the ability of left-behind women to make decisions (Hadi, 2001). Though men are more likely than women to make decisions on farms, this dynamic shifts when there is short-term migration in the household, increasing the likelihood of women making decisions on farms (Chandrasekhar et al., 2022). Similarly, a study in Mexico found that remittances received by female household members were more likely to be invested in agriculture than remittances received by male household members (Salvador et al., 1995). The present study findings show that this statement is true because, from the study, it can be seen that there is a positive relationship between the remittance utilization in agricultural sectors and households with female headship. The phenomenon of feminization of agriculture in the Middle Ganga Plain region in India can be attributed to various factors. While it is evident that this trend is occurring, it is crucial to consider other contributing elements, such as land ownership, decision-making processes, and access to agricultural resources. Understanding these additional aspects could provide further insights into the processes driving the feminization of agriculture in the region. Simultaneously, in the remittance receiver category, it can be seen that parents are more likely to invest remittances in agricultural sectors, which supports a study that talks about remittance receivers who are parents may use remittances to support the agricultural activities of their children, who may have greater expertise and knowledge of agriculture (Khandker et al., 2013). Based on the findings of this present study, it is evident that left-behind wives do not solely influence the feminization of agriculture; rather, left-behind parents, especially mothers of migrants, also play a significant role. As mentioned earlier, this is further reinforced by the female-headed households, which have a



higher prevalence of utilization of remittances in the agricultural sectors in the Middle Ganga Plain region. Similarly, there is a significant positive result between the monthly remittance receivers and total agricultural expenses. So, it can be said that when the frequency of remittance is monthly, the chance of remittance utilization in the agricultural sector is also higher. At the same time, the relationship between landholding and remittance utilization in agriculture is complex and may depend on a range of factors, including land ownership, landlessness, land fragmentation, and livelihood diversification.

## 6. Conclusion

In conclusion, the utilization of remittances in the agricultural sector is influenced by various socio-economic, demographic, and migration characteristics of migrants in the Middle Ganga Plain. However, compared to other expenditure categories like investments and household purchases, the percentage of remittance utilization in agriculture is relatively low (Roy et al., 2021); the study showed that age, caste, family type, sex of household head, education category, landholding, frequency of remittance, and remittance receivers have significant effects on remittance utilization in agriculture. Older respondents and households with more landholding were found to have a higher likelihood of utilizing remittances for hiring labour and purchasing inputs such as hybrid seeds, fertilizers, and pesticides. Additionally, female-headed households and households belonging to lower caste categories were more likely to utilize remittances in every agricultural sector. The study provides valuable insights into the remittance utilization patterns in the agricultural sector. It highlights the need for targeted policies and interventions to promote efficient and effective use of remittances in agriculture in the Indian context, such as providing financial education and training to remittance receivers and farmers, especially to the less landholding households and marginalized social groups, can help them make informed decisions about how to invest their remittances in the agricultural sector, which will accelerate the overall household economic development. The study findings show that female-headed households are more inclined to use remittance in agriculture, so strengthened support for female farmers through dedicated agricultural extension services, access to credit, and empowerment programs could be done, and policies should focus on ensuring women have equal access to resources and decision-making processes in agriculture and utilization of remittance in it.

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## CRediT authorship contribution statement

**Samrat Sarkar:** Writing – original draft, Methodology, Formal analysis, Conceptualization. **Reshmi R.S.:** Methodology, Supervision, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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