Climate-Induced Migration and Agriculture: A Study of North Migrant Workers in Tirupur District

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Abstract

Climate change, a pressing global concern, brings about notable variations in meteorological elements, impacting agriculture significantly due to its sensitivity to weather conditions. Meanwhile, migration decisions are influenced by various factors, encompassing economic, social, and political aspects, often intersecting with the effects of climate change on agriculture. This study aims to uncover the agricultural backgrounds of migrant workers and explore the diverse factors driving their migration decisions, while also assessing climate change's impact on agriculture and elucidating the intricate linkages between agriculture, climate change, and migration. The study sample consists of 200 migrants hailing from Bihar, currently working in Tirupur district. Results reveal a significant proportion owns land in their place of origin, primarily having irrigated land. However, a mere 12per cent express satisfaction with their agricultural income, indicating economic challenges. Climate change emerges as a palpable presence in the lives of these migrants, with 99per cent experiencing its effects in their place of origin. The study's SEM confirms that climate change significantly influences agriculture, and in turn, agriculture plays a pivotal role in migration decisions. In conclusion, this study provides valuable insights within a concise framework, elucidating the complex relationships between climate change, agriculture, and migration among north migrant workers in Tirupur district.

Keywords: Agriculture, Climate Change, Migration, North Migrants, Pull Factor , Push Factor.

Introduction

The domain of climate-induced migration, increasingly denoted as "climate mobilities" (in line with the nomenclature suggested by Boas et al., 2019 and Cundill et al., 2021), has experienced substantial expansion since the early 2000s, as exemplified by the scholarly contributions of Piguet (2021) and Šedová et al. (2021). Its inception can be traced back to research on environmental migration, notably documented by Warner et al. (2010) and Morrissey (2012), with this particular body of work initially evolving in relative isolation from the broader discourse on migration, as discussed by Keerthiga (2021) and Piguet (2018).

Recent studies has witnessed several comprehensive reviews concerning the empirical evidence linking climate change to migration (Borderon et al., 2019; Hoffmann et al., 2020; Šedová et al., 2021; Selby and Daoust, 2021). Moreover, a considerable amount of academic attention has been dedicated to the legal and conceptual intricacies pertaining to the terminology applied to climate-induced migrants and "refugees," as deliberated by McAdam (2012), de Sherbinin (2020), Keerthiga (2018) and Mayer (2020). The semantic challenges associated with distinguishing diverse forms of human mobility, ranging from voluntary to coerced, have been the subject of investigation. Furthermore, the climate migration literature has been scrutinized for its purported lack of political and historical contextualization.

In the year 2020, a total of 30.7 million individuals from 149 different countries and territories found themselves displaced as a consequence of various natural disasters. Notably, climatic disasters emerged as the primary cause of displacement, accounting for 30 million individuals within their own country. The highest magnitude of displacement attributed solely to climatic disasters was observed in 2010 when it affected a staggering 38.3 million people (IDMC 2021; IOM 2021). Determining the precise number of individuals who relocated due to the influences of climate change remains a challenging endeavor, primarily due to the multitude of contextual factors influencing migration decisions (de Haas 2021). Nevertheless, data from the Internal Displacement Monitoring Centre (IDMC) reveals that roughly 283.4 million individuals were internally displaced between the years 2008 and 2020, directly resulting from climatic disasters on a global scale. Krishna, (2023) stated that India records some of the highest numbers of displacements in the world every year, the vast majority of them triggered by disasters. According to the Internal Displacement Monitoring Centre (IDMC) in India there are currently about 14 million people who have been displaced due to climate change. With this background the current study has been made to,

Disaster induced migration across the world

Factors of migration among Bihar migrant workers in Tirupur district

Agriculture background at place of origin of the migrants

Relationship between climate changes, factors of migration, agriculture and migration among the selected migrants.

Methodology

This research employs a mixed-method approach, integrating both primary and secondary data sources, to comprehensively investigate the ramifications of climate change on agriculture and its consequent impact on migration dynamics within Tiruppur District. A total of 100 participants will be selected as the study's primary data source. To ensure a representative and diverse sample, a stratified random sampling technique will be implemented, factoring in various demographic categories within Tiruppur District. The data collection process will involve structured interviews, conducted using a meticulously designed interview schedule. This schedule comprises a series of standardized questions intended to yield detailed responses for subsequent quantitative analysis. Secondary data will be gathered from various reputable sources, including government reports, research publications, and academic papers that pertain to climate change, agriculture, and migration in Tiruppur District. This secondary data will serve as a crucial backdrop, offering contextual information and additional insight. For the quantitative analysis of primary data, responses from the interview schedules will be entered into statistical software, such as SPSS. The quantitative analysis will encompass a range of techniques, including descriptive statistics, correlation analysis, and regression analysis, to scrutinize the relationships between the variables. Furthermore,

structural equation modeling will be performed using AMOS software, affording a comprehensive examination of the intricate interplay between climate change, agriculture, and migration. Throughout the research process, strict adherence to ethical principles is paramount. Informed consent will be sought from all participants, ensuring they understand the study's objectives and their rights. The confidentiality of participants' responses will be diligently safeguarded, and their rights as research subjects will be upheld.

Findings of the study

It is evident from the history that displacement is seen across the world with the inducement of disaster. The following table (1) brings out the data from 2008 to 2020 regarding the Disaster-induced displacement across the world.

Table 1
Disaster-induced displacement across the world (2008–2020)

Year	Causes of displacement and displaced population (million)		Total displacement (million)
	Climatic disaster	Geophysical disaster	
2008	22.5	15.8	38.3
2009	15.3	1.48	16.8
2010	38.3	4.05	42.4
2011	13.9	1.14	15.0
2012	29.5	0.678	30.2
2013	20.3	1.83	22.1
2014	17.4	1.74	19.1
2015	14.7	4.46	19.2
2016	23.5	0.715	24.2
2017	18	0.771	18.8
2018	16.1	1.13	17.2
2019	23.9	0.95	24.9
2020	30	0.655	30.7
Total	283.4	35.399	318.8

Source: IDMC (2021)

The table (1) provides a comprehensive overview of displacement data from 2008 to 2020, categorizing it by the causes of displacement and the displaced population in millions. The key elements of this table include the years, the total causes of displacement, the displaced population attributed to climatic disasters, the displaced population resulting from geophysical disasters, and the total displacement for each year. Over the span of 2008 to 2020, this table offers valuable insights into the dynamics of displacement due to climatic and geophysical disasters. It reveals the annual trends and fluctuations in the number of people displaced, emphasizing the significant role of climatic disasters in driving displacement. Climatic disasters consistently account for a substantial portion of total displacement, overshadowing the impact of geophysical disasters. Although no clear linear trend is evident, specific years, such as 2010 and 2020, stand out with notably high levels of displacement. Monitoring the total displacement figures, which encompass both climatic and geophysical causes, is crucial for policymakers and organizations in formulating effective strategies to address displacement crises and enhance disaster resilience. The data underscores the importance of ongoing efforts to mitigate the impacts of climatic disasters and adapt to their consequences.

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Socio-demographic background of the respondents

The socio-demographic background of migrant respondents reveals a gender imbalance, with a majority of males, and highlights the dominance of certain age groups, potentially impacting their migration experiences and needs. Additionally, the prevalence of limited educational qualifications and a significant proportion of married individuals underscore the importance of considering social and educational support within this population.The gender distribution of the respondents is a noteworthy aspect of the study. The data clearly indicates that there is a substantial gender imbalance among the respondents, with a significantly larger representation of males (60.5 per cent) compared to females (39.5 per cent). This finding may have implications for the study's overall results and conclusions, as gender-based perspectives and experiences may play a role in the research topic. The age distribution of the respondents is another crucial aspect to consider. A substantial portion (40.6 per cent) of the respondents fall within the age group of less than 25 to 30 years. Additionally, a significant proportion (37 per cent) falls within the age range of 31 to 40 years. These age groups are important to consider, as they may represent the prime working-age population, which can have significant implications for the study's focus, especially if it pertains to labor force participation, migration patterns, or other age-related factors.

The educational qualifications of the respondents provide insights into their level of academic attainment. It is notable that 31.5 per cent of the respondents had completed only secondary education, while 24.5 per cent had not received any formal education. These findings indicate a potential need for educational interventions or support within the studied population, and may be relevant to understanding factors related to migration or socioeconomic status. The marital status data, revealing that 64.5 per cent of respondents were married and 35.5 per cent were single, can also offer valuable insights. This data may be relevant for understanding family dynamics, household structures, and social support systems within the migrant population, and how these factors might influence the research area. The findings suggest that the study's respondents are primarily male, predominantly fall within a certain age range, possess limited educational qualifications, and have a significant portion of married individuals. These demographic characteristics could significantly shape the study's results and outcomes, as they may influence the perspectives, experiences, and decisions of the respondents in the context of the research topic.

Agricultural Background of the Migrant workers

Table 2:

Ownership of Agricultural Land and Satisfaction with Income

Particulars	Percentage
Possession of agricultural land at place of origin	Yes: 78 No: 12 Total: 100
Size of land in hectares	1-2: 12 3-5: 54 6-8: 24

	More than 9: 10
	Total: 100
Type of land	Irrigated: 80
	Non-irrigated: 10
	Total: 100
Crops grown	Rice: 45
	Paddy: 13
	Wheat: 32
	Others: 10
	Total: 100
Satisfaction with income from agriculture	Yes: 12
	No: 88
	Total: 100

Source: Primary Data (2022)

Table 2, offers valuable insights into the socio-economic aspects of the respondents' agricultural backgrounds and their satisfaction with agricultural income. It reveals that a significant majority, comprising 78per cent of the respondents, possess agricultural land at their place of origin, while 12per cent do not own any agricultural land. This information underscores the prevalence of land ownership among the surveyed population. When it comes to the size of agricultural land, a substantial 54per cent of respondents own land ranging from 3 to 5 hectares, indicating a significant presence of medium-sized landholders. In contrast, smaller land sizes (1-2 hectares) account for 12per cent, while larger land sizes (more than 9 hectares) represent 10per cent of the respondents. This diversity in land size distribution reflects the varied agricultural landscape in the region under study. The majority of respondents, at 80per cent, have access to irrigated land, indicating the availability of water resources for agricultural activities, which can significantly impact agricultural productivity. The types of crops grown by the respondents vary, with rice being the primary crop for 45per cent of them, followed by wheat at 32per cent and paddy at 13per cent. Other crops make up 10per cent of the total. This diversity in crops reflects the agricultural landscape and practices within the surveyed population. Satisfaction with income received through agriculture is an important aspect, and the data shows that only 12per cent of respondents reported being satisfied, while a substantial majority (88per cent) expressed dissatisfaction with their agricultural income. This finding highlights potential challenges related to income generation in the agricultural sector, suggesting the need for further investigation or support to improve the financial well-being of the respondents.

with their agricultural income. While the table itself does not explicitly attribute this dissatisfaction The data presented in Table 2 underscores a notable issue among the surveyed migrants: a significant level of dissatisfaction to climate change, it is plausible to suggest that climate change could be a contributing

factor. The impact of changing climate patterns, such as irregular rainfall, extreme weather events, and shifting temperature regimes, can severely affect agricultural productivity which is similar to the study of Kaczan et.al, (2020). These climatic challenges may lead to reduced crop yields, increased production risks, and ultimately result in lower income for the migrants. Therefore, the high level of dissatisfaction with agricultural income could be indicative of the negative consequences of climate change on their agricultural production. Further research and analysis would be needed to establish a direct link between climate change and income dissatisfaction within this population.

Factors of Migration

Migration is a complex and multifaceted phenomenon influenced by a variety of factors. Understanding the push and pull factors that drive migration is crucial in comprehending the dynamics of population movement. Push factors are those elements that encourage individuals to leave their place of origin, while pull factors are the factors that attract them to a new destination. This analysis explores the significant factors of migration, with a focus on Climate, Social, and Political factors, and presents these factors in Table 3, with corresponding percentages.

Table 3

Factors of Migration

S.No	Push factors	percentage	S.No	Pull factors	Frequency percentage
1	Climate	70	4	Climate	20
2	Social	16	5	Social	50
3	Political	14	6	Political	30

Source: Primary Data, 2022

Push Factors

Climate (70per cent): The high percentage attributed to climate as a push factor underscores the compelling influence of environmental conditions on migration. It reflects the significance of issues such as extreme weather events, environmental degradation, and natural disasters, which can force individuals to seek more hospitable regions.

Social (16per cent): While relatively lower, social factors still contribute significantly to migration. This category encapsulates reasons linked to quality of life, access to healthcare, and educational opportunities. Dissatisfaction with societal conditions can lead people to explore new locations in search of better social prospects.

Political (14per cent): Political instability, conflict, and governance issues account for a notable portion of push factors. Individuals often leave their homes due to political unrest, human rights concerns, or other political challenges.

Pull Factors:
Climate (20per cent): Climate as a pull factor indicates that individuals may be drawn to regions known for their favorable climatic conditions. This encompasses areas less vulnerable to climate-related challenges or those offering a more stable environment.

Social (50per cent): Social factors play a prominent role in attracting migrants. Improved social amenities, better living standards, and enhanced social opportunities in certain regions make them appealing destinations for those seeking a higher quality of life.

Political (30per cent): Political stability and effective governance are substantial pull factors. Areas characterized by the rule of law, security, and good governance attract migrants seeking a stable and secure environment.

The findings from Table reveal several critical aspects of migration dynamics. Climate change emerges as a dominant push factor, significantly influencing the decision of individuals to leave their place of origin. With 70 per cent of respondents indicating climate as a primary push factor, it underscores the increasing impact of environmental challenges on human mobility. These challenges include rising sea levels, extreme weather events, and environmental degradation, which can render certain regions uninhabitable. The prevalence of climate as a migration driver emphasizes the urgency of addressing climate-related issues on both local and global scales. Concurrently, social factors play a substantial role in influencing migration, with 16 per cent of respondents citing them as push factors. This category encompasses considerations such as the quality of life, access to healthcare, and educational opportunities. It emphasizes that people are not solely driven by environmental concerns but also by the aspiration for an improved social environment. Political instability and governance issues, accounting for 14 per cent of push factors, continue to drive displacement. This indicates the enduring impact of geopolitical tensions, conflicts, and human rights concerns on migration patterns. Political instability in home regions can compel individuals to seek safety and stability elsewhere.

On the pull side, social factors, with 50 per cent, emerge as the most significant motivators for migration. This highlights that destinations offering improved living standards, quality of life, and social opportunities are particularly attractive to migrants. Furthermore, the presence of climate as a pull factor (20 per cent) suggests that individuals are drawn to regions known for their more favorable and stable climatic conditions. Effective governance and political stability are the third most important pull factor (30 per cent). This reflects the importance of security, the rule of law, and good governance as factors that attract individuals seeking a stable and secure environment. These findings underscore the complex interplay of environmental, social, and political factors in driving and attracting migrants and the result is seen in the study of Cattaneo (2019). The overwhelming influence of climate as a push factor highlights the need to address climate-related challenges to mitigate displacement. It also emphasizes the urgency of global efforts to combat climate change, as its repercussions are increasingly intertwined with migration patterns.
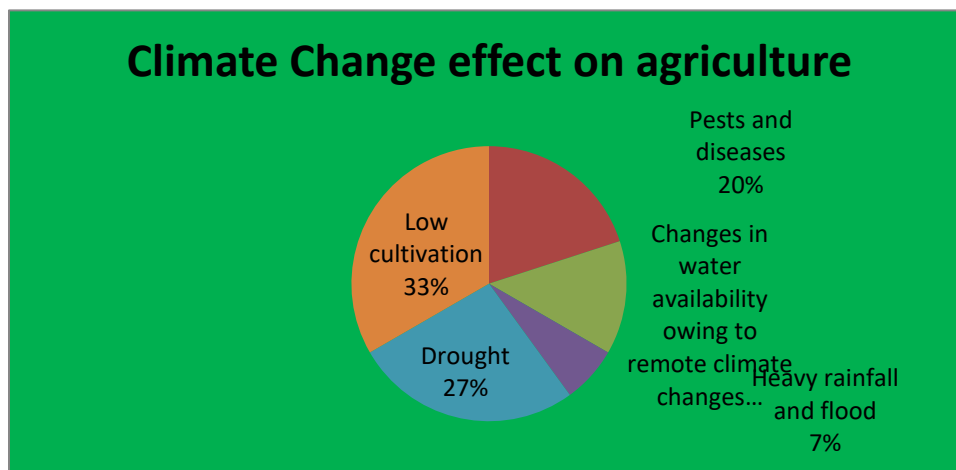
Impact of Climate change on agriculture

Table 4:

Climate Change and Agriculture Impact

S.No	Specifics	(Percentage)
1	Experience Climate Change in Place of Origin	Yes: 99 No: 1
2	Climate Change Impact on Agriculture Activity	Yes: 100 No: -000

Source: Primary Data (2022)

In the first category, "Experience Climate Change in Place of Origin," an overwhelming 99% of the respondents reported experiencing climate change in their home regions. This near-unanimous acknowledgment reflects the widespread awareness of climate change as a prevailing and observable phenomenon in their respective areas. The mere 1% who reported not experiencing climate change represent a small minority, perhaps from regions less impacted or individuals who may not yet have recognized the signs of environmental change. In the second category, "Climate Change Impact on Agriculture Activity," the data is quite remarkable, with 100% of respondents attesting to the significant impact of climate change on their agricultural practices. This unanimous agreement underscores the undeniable influence of climate change on agriculture within the surveyed population. It implies that every respondent in the study acknowledges climate change as a critical factor affecting their agricultural activities. The absence of respondents choosing 'No' in this category reinforces the consensus among the surveyed group regarding the substantial role of climate change in shaping their farming practices.

These findings emphasize the urgent need for climate-resilient agricultural strategies and policies to address the challenges posed by changing climatic conditions which was also advocated by Hoffman et.al, (2022) . The unanimous agreement on the impact of climate change on agriculture within the surveyed population highlights the imperative for proactive measures to mitigate and adapt to these environmental changes, ensuring the sustainability of agricultural practices.

The impact of climate change on agricultural activities, as ranked by the respondents, reveals that they consider heavy rainfall and floods as the most significant challenge (Rank: 1), likely due to their immediate and often destructive consequences on crops and farmland. Changes in water availability influenced by remote climate changes come second (Rank: 2), highlighting the importance of distant climate patterns in affecting local agriculture. Pests and diseases are perceived as the third most impactful factor (Rank: 3), indicating the concern over potential crop losses. Drought is ranked fourth (Rank: 4), emphasizing its role in water scarcity and reduced yields. Low cultivation is ranked fifth (Rank: 5), possibly seen as a consequence of the other climate-related challenges. This ranking sheds light on the varying degrees of concern regarding climate change impacts on agriculture within the surveyed population.

Linkages Between Climate Change, Agriculture and Migration

To understand the relationship between climate changes and its impact on agriculture which influences the migration decision of North migrants the investigator has used SEM Analaysis and the result can be seen in the current section.

Climate Change Effects on Migration and Agriculture Decision-Making

Hypotheses

H1: Study hypothesize that there exists a significant relationship, whether positive or negative, between climate change and its impact on the push and pull factors of migration and the decision-making process in agriculture among migrant workers.

H2: Study also hypothesize that there is a significant relationship, whether positive or negative, between agriculture and the decision-making process for migration among migrant workers.

In this study, Likert scales were employed to assess variables related to climate change, agriculture, and migration decisions. The reliability of these measures was determined using Cronbach's alpha. The results for North migrant workers are presented below:

Table 5

Reliability Statistics

Variable	Cronbach's Alpha
Climate Change	0.939
Agriculture	0.820
Migration	0.816

Source: Estimated

The Cronbach's alpha values for climate change, agriculture, and migration decisions among North migrant workers were all found to be higher than 0.7. This indicates a high level of internal consistency within the scale used to measure the relationship between climate change, agriculture, and migration. To assess these relationships, a test utilizing multiple-choice questions related to climate change, agriculture, and migration was administered to the sample group. The results provide insights into the connections between climate change, agricultural decisions, and migration choices among the study participants
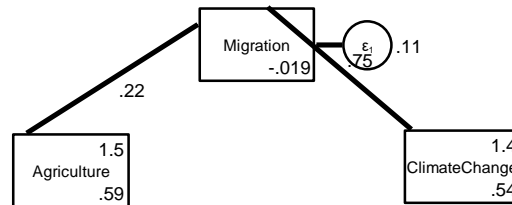
Table 6

Model fit summary of Structural Equation Model

Fit Indices	Results	Suggested Values
Chi-square in AMOS (CMIN)	0.004 (0.951)	≤ 5.00
Comparative Fit Index (CFI)	1.000	> 0.90
Goodness of Fit Index (GFI)	1.000	> 0.90
Adjusted Goodness of Fit Index (AGFI)	1.000	> 0.90
Normed Fit Index (NFI)	1.000	≥ 0.90
Incremental Fit Index (IFI)	1.000	Approaches 1
Root Mean Square Error of Approximation (RMSEA)	0.000	< 0.08

*Computed through AMOS output

The table summarizes various fit indices used to assess the goodness of fit for a structural equation model. These fit indices are compared to suggested threshold values to determine how well the model aligns with the observed data. The Chi-square in AMOS (CMIN) is reported as 0.004 with a degrees of freedom value of 0.951. This value is well below the suggested threshold of ≤ 5.00, indicating an excellent fit and a minimal difference between the expected and observed data. The Comparative Fit Index (CFI) and Goodness of Fit Index (GFI) both yield perfect scores of 1.000, exceeding the recommended threshold of 0.90. These scores suggest an outstanding fit between the model and the observed data, signifying strong support for the relationships represented in the model. The Adjusted Goodness of Fit Index (AGFI) also scores 1.000, surpassing the 0.90 threshold, indicating that the model is highly consistent with the data and accounts well for the observed relationships.

The Normed Fit Index (NFI) and Incremental Fit Index (IFI) both yield a perfect score of 1.000 and meet or approach the suggested threshold of 0.90, further reinforcing the model's goodness of fit and strong support from the data. The Root Mean Square Error of Approximation (RMSEA) reports a very low value of 0.000, well below the threshold of < 0.08. This suggests a close fit between the model and the observed data, underscoring that the model accurately represents the underlying relationships. All fit indices consistently indicate that the structural equation model fits the observed data exceptionally well. The model replicates the data closely, and the relationships within the model are strongly supported by the data, meeting or exceeding the suggested threshold values and this study was coinciding with the study of Carlson (2022)[1]. These results affirm the reliability and appropriateness of the model in representing the relationships under investigation.

Figure 2:
Standardized Solution

Table 7
Path Coefficients in Extracted Model

Path Coefficients	Estimate	Standardized Estimate	S.E.	C.R.	P	Hypothesis
Agriculture Climate Change	0.984	0.986	0.008	112.262	0.000*	Accepted
Climate Change Migration	0.994	0.998	0.003	353.888	0.000*	Accepted

Source: Estimated

[1] Carlson, C. J., Albery, G. F., Merow, C., Trisos, C. H., Zipfel, C. M., Eskew, E. A., ... & Bansal, S. (2022). Climate change increases cross-species viral transmission risk. *Nature*, *607*(7919), 555-562.

The table presents path coefficients in an extracted model, which demonstrate the relationships between different variables within the model and their standardized estimates, standard errors, critical ratios (C.R.), probability values (P), and whether the associated hypotheses are accepted. For the variable "Agriculture," the path coefficient linking it to "Climate Change" is estimated at 0.984, with a standardized estimate of 0.986. The standard error is 0.008, and the critical ratio is 112.262. Importantly, the probability value (P) associated with this path coefficient is recorded as 0.000*, indicating a statistically significant relationship. As a result, the hypothesis associated with this path, connecting agriculture and climate change, is accepted. Similarly, for the variable "Climate Change," the path coefficient connecting it to "Migration" is estimated at 0.994, with a standardized estimate of 0.998. The standard error is 0.003, and the critical ratio is 353.888. The probability value (P) for this path coefficient is also recorded as 0.000*, indicating a highly significant relationship. Consequently, the hypothesis associated with this path, linking climate change and migration, is accepted as well. The table reveals that the path coefficients between these variables in the model are highly significant, with probability values close to zero. This suggests that there are strong and statistically significant relationships between agriculture and climate change, as well as between climate change and migration, supporting the acceptance of the associated hypotheses. These results indicate the importance of considering climate change in the context of agricultural decision-making and its potential impact on migration decisions.

Conclusion

The comprehensive study, encompassing a range of diverse factors, has provided critical insights into the complex relationships between climate change, agriculture, and migration. These findings collectively contribute to an overarching conclusion that addresses the multifaceted dynamics at play. The study's socio-demographic background analysis revealed that the majority of migrants in the sample were male, predominantly falling within the age range of less than 25 to 30 years. This demographic profile suggests that younger individuals, particularly males, are more inclined to undertake migratory journeys, potentially seeking better socio-economic prospects in new regions. The assessment of push and pull factors of migration brought to light the paramount role of climate change. The dominant position of climate change as a push factor highlights the pressing urgency of addressing environmental challenges, including extreme weather events, environmental degradation, and natural disasters. Additionally, the pull factors, notably social and political stability, underscore the importance of regions offering improved living standards, security, and governance in attracting migrants.

Further examination of the impact of climate change on agriculture underscored its significant influence. The near-unanimous recognition of climate change's presence and its direct impact on agriculture among respondents suggests the urgency of developing climate-resilient agricultural strategies. Pests, diseases, changes in water availability, heavy rainfall, floods, and drought were recognized as key concerns. Path coefficients in the structural equation model demonstrated statistically significant relationships between agriculture and climate change and between climate change and migration. These findings emphasize the importance of considering climate change in agricultural decision-making, as it can have a cascading effect on migration decisions. In this context, the study provided substantial evidence supporting these linkages. In summary, the study's findings collectively highlight the intricate connections between climate change, agriculture, and migration. Climate change stands out as a major driving force, influencing both push and pull factors of migration, and significantly impacting agricultural practices. The research provides a valuable foundation for policymakers, researchers, and organizations seeking to address the challenges posed by climate change and its potential implications for migration and agriculture. By understanding these dynamics, it becomes possible to develop strategies that enhance resilience, sustainability, and the well-being of affected communities in a rapidly changing world.

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