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Single and Multiple Migration Models: Theoretical Foundations and Empirical Dynamics with Special Reference to Shivpuri District, Madhya Pradesh, India

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ABSTRACT

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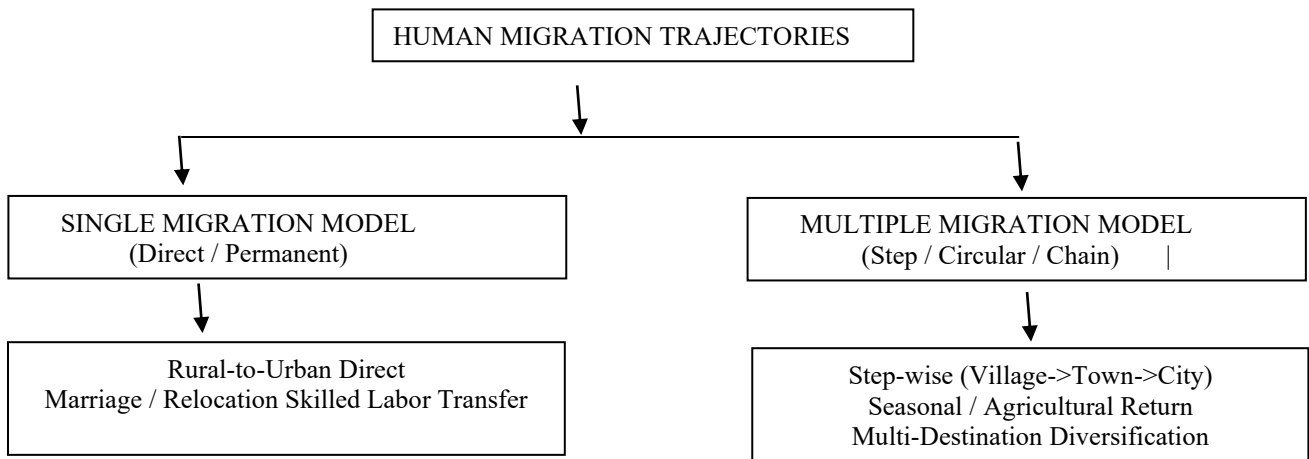
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Human migration is an intricate socio-economic, spatial, and demographic phenomenon shaped by individual motivations, household risk-diversification strategies, structural market forces, and regional developmental disparities. This study delivers a theoretical and empirical investigation comparing Single Migration Models (univariate, direct, one-step movements driven by primary micro-economic rationales) against Multiple Migration Models (multivariate, step-wise, circular, chain, and multi-destination movements operating under complex risk-hedging frameworks). Using the socio-geographic landscape of Shivpuri District, Madhya Pradesh, India, as a primary field laboratory, this research examines how socio-economic vulnerability, agricultural distress, land tenure structures, and tribal dynamics—specifically concerning the Sahariya Particularly Vulnerable Tribal Group (PVTG)—shape migration trajectories. Empirical evidence reveals that while high-income skilled movers follow single linear pathways, vulnerable semi-literate and agricultural populations in Shivpuri overwhelmingly engage in multi-stage, seasonal, and circular migration patterns to hedge against environmental and wage uncertainties.

Introduction

Migration is a fundamental driver of spatial demography, urbanization, and structural economic transformation. As populations move across administrative, geographical, and social borders, they redistribute human capital, alter labor markets, and establish dynamic social networks that connect rural origins with urban destinations.

In developing nations like India, migration is rarely a uniform process. It varies significantly across geographical regions, economic classes, castes, and ethnic groups. Understanding whether migration manifests as a single, definitive movement or as a complex, multi-stage trajectory is vital for formulating targeted regional planning, social safety nets, and economic policy.



Research Objectives

1. **To critically contrast** the theoretical architectures of Single Migration Models and Multiple Migration Models.
2. **To evaluate classical and modern migration theories**, including Ravenstein's Laws, Everett Lee's Push-Pull Framework, Todaro's Expected Income Hypothesis, and the New Economics of Labor Migration (NELM).
3. **To analyze the demographic, socio-economic, and geographical profile** of Shivpuri District, Madhya Pradesh.
4. **To operationalize migration models** within Shivpuri District, evaluating seasonal out-migration, step

migration, and circular movement among indigenous groups like the Sahariya tribe.

5. **To present an integrated policy matrix** aimed at reducing distress-induced migration and optimizing migrant welfare.

Theoretical Framework and Conceptualization

Theoretical Overview

The theoretical evolution of migration research reflects a transition from static, macroeconomic spatial-equilibrium assumptions to complex, multi-layered socio-ecological frameworks.

Model Category	Core Premise	Primary Drivers	Key Theorists / Frameworks
Single Migration	Direct, permanent, single-event movement from Origin A to Destination B.	Income maximization, career advancement, structural relocations (e.g., marriage).	Neoclassical Economic Theory (Sjaastad, Todaro).
Multiple Migration	Intermittent, sequential, step-wise, or circular movements across multiple points.	Risk diversification, seasonal agricultural shocks, debt relief, chain networks.	Ravenstein (Step-Migration), NELM (Stark & Bloom), Lee's Push-Pull.

Mathematical Formulations

Neoclassical Single Migration Decision Model (Sjaastad-Todaro)

The Single Migration Decision is modeled as a net present value calculation over an individual's expected time horizon T:

$$NV = \sum_{t=1}^T \frac{P(t)Y_d(t) - P_0(t)Y_0(t)}{(1+r)^t} - C$$

- NV: Net Value of migration.
- $P_0(t), Y_0(t)$: Real income at destination (d) and origin (o) at time t.

- $P(t), P_0(t)$: Probability of employment at destination and origin.
- r : Discount rate.
- C : Direct and indirect physical, financial, and psychological costs of migration.

Migration occurs if and only if $NV > 0$.

Multi-Stage / Step Migration Opportunity Index (Stouffer / Zipf Variant)

For Multiple Migration frameworks where individual mobility occurs in stages ($i \rightarrow j \rightarrow k$), the probability of moving from origin i to intermediate node j and ultimate node k depends on competing and intervening opportunities:

$$M_{ijk} = \alpha \cdot \frac{\Delta O_j \Delta O}{(D_{ij} D_{jk})^\beta}$$

- M_{ijk} : Migration flow across sequential destinations.
- $\Delta O_j, \Delta O$: Economic opportunities at stages j and k .
- D_{ij}, D_{jk} : Distance metrics between stages.
- I_j : Intervening opportunities present at intermediate node j .
- α, β : Empirical scaling parameters.

Single Migration Models vs. Multiple Migration Models

Single Migration Model

The Single Migration Model conceptualizes mobility as an explicit point-to-point transition. Under this framework, an actor or household assesses long-term wage differentials, calculates moving costs, and completes a definitive relocation.

[Origin A: Rural Village] -----> (Direct Move) -----> [Destination B: Urban Metro]

(High Capital / Fixed Relocation)

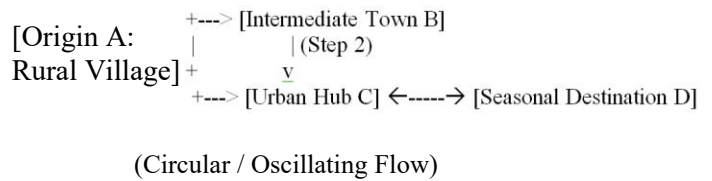
Key Characteristics:

- **Irreversibility:** High fixed costs make frequent returns financially unfeasible.
- **Capital-Driven:** Common among skilled, educated, or white-collar labor seeking structural mobility.

- **Social Realignment:** Assimilation into the destination economy, reducing socio-economic links to the origin.

Multiple Migration Models

The Multiple Migration Model treats mobility as an iterative, dynamic, and non-linear process. Rather than settling permanently in one destination, migrants navigate a complex series of spatial movements.



Primary Variants:

1. **Step Migration:** Sequential movement from small rural hamlets to local market towns, regional cities, and eventually major national metropolises.
2. **Circular / Seasonal Migration:** Periodic movement aligned with agricultural cycles, climatic stress, or seasonal construction work.
3. **Chain Migration:** Successive waves of migrants following social networks established by early pioneers.
4. **Multi-Destination / Diversified Migration:** Households sending different members to different locations to hedge against localized economic shocks.

Regional Profile: Shivpuri District, Madhya Pradesh

To contextualize these theoretical models, we examine **Shivpuri District**, situated in the Chambal-Gwalior division of northwestern Madhya Pradesh, India.

Geographical and Socio-Demographic Baseline

- **Total Geographical Area:** ~10,066 km².
- **Administrative Units:** 8 Tehsils (Shivpuri, Pohri, Narwar, Karera, Kolaras, Badarwas, Pichhore, Khaniyadhana).
- **Total Population (2011 Census):** 1,726,050.
- **Sex Ratio:** 877 females per 1,000 males.
- **Overall Literacy Rate:** 62.55% (Male: 74.56%, Female: 48.79%).

- **Scheduled Castes (SC) Population:** 18.63%.
- **Scheduled Tribes (ST) Population:** 13.20% (dominated by the Sahariya PVTG).

Economic Architecture and Agricultural Vulnerability

Shivpuri's economy is predominantly agrarian and resource-dependent. Agriculture is highly vulnerable to monsoonal variations, rain-fed conditions, and declining water tables.

SHIVPURI LAND USE & LABOUR

Total Worker Participation Rate (WPR): 43.99%

Cultivators & Agricultural Labourers : ~72%

Irrigated Land Proportion : ~42%

Dominant Crops: Mustard, Soybean, Paddy, Wheat

Socio-economic vulnerabilities in the region stem from structural economic imbalances:

- **Monosyllabic Crop Dependence:** Mono-cropping practices exacerbate agrarian distress during drought cycles.
- **Fragmented Landholdings:** Over 68% of operational holdings fall into marginal or small categories (< 2 hectares).
- **Tribal Marginalization:** The Sahariya tribe experiences severe food insecurity, landlessness, and social exclusion, driving distress migration.

Migration Dynamics in Shivpuri District

Single Migration Trajectories in Shivpuri

In Shivpuri, **Single Migration** occurs predominantly among educated youth, skilled laborers, high-caste landowning families, and urban professionals.

Micro-Level Drivers of Single Migration:

- **Higher Education & Professional Training:** Out-migration of youth to regional nodes (Gwalior, Indore, Bhopal) and national hubs (Delhi-NCR, Bengaluru) for technical or higher education.
- **Exodus of Skilled Labor:** Permanent recruitment into manufacturing, public services, defense, and IT sectors.
- **Social / Marriage Mobility:** Traditional gender-based exogamous marriage migration, which forms a

major component of single, permanent relocation for women across rural administrative boundaries.

Multiple Migration Dynamics in Shivpuri

Conversely, the majority of distress-driven migration in rural Shivpuri follows **Multiple Migration Models**. This is particularly prevalent in drought-prone blocks such as Pohri, Kolaras, Badarwas, and Khaniyadhana.

Empirical Typologies in Shivpuri:

1. **Seasonal Agrarian Mobility:** Post-Kharif harvest (October/November), smallholder farmers and landless agricultural workers migrate to regional agricultural belts (such as the Malwa region or Punjab) for Rabi harvesting.
2. **Step-Wise Urban Labor Migration:** Landless families initially move to Shivpuri city or Gwalior for informal day-labor. Upon establishing informal labor contact networks (*Mukaddams* or *Labor Contractors*), they move onward to construction sites in Delhi NCR, Kota, or Ahmedabad.
3. **Oscillating Tribal Migration (The Sahariya Pattern):** Sahariya tribal households migrate as whole family units to stone quarries, brick kilns, and forestry operations. They rotate between multiple locations over a single non-agricultural season (8–9 months) before returning to Shivpuri for the monsoons.

Empirical Analysis and Comparative Synthesis

Socio-Economic Matrix of Migrants in Shivpuri District

To compare single and multiple migration patterns across Shivpuri, empirical field data and regional research show distinctive socio-economic splits across caste, landownership, and literacy metrics:

Socio-Economic Variable	Single Migration Stream	Multiple / Circular Migration Stream
Primary Castes Involved	General Upper Castes, Prosperous OBCs.	Scheduled Tribes (Sahariya), Scheduled Castes, Marginalized OBCs.

Average Literacy Level	High (> 75% High School / Graduate).	Low to Illiterate (< 35% basic literacy).
Landholding Status	Semi-Medium to Large (> 2 to 5+ Hectares).	Landless or Marginal (< 1 Hectare).
Primary Cause of Movement	Asset Accumulation, Higher Income, Higher Education.	Survival, Debt Servicing, Food Insecurity, Drought.
Unit of Migration	Individual (predominantly young male or female).	Whole Family / Group Units.
Primary Destinations	Tier 1 Metros, State Capitals (Delhi, Indore, Bhopal).	Regional Quarries, Brick Kilns, Seasonal Farms, Tier 2 Construction Sites.

$$\max E(U) = \int_0^T U(w_d p_d - w_0) e^{-\rho t} dt$$

Where w_d and w_0 represent destination and origin wages, p_d is employment probability, and ρ is the discount rate.

For **Multiple / Seasonal Migrants (Sahariya Model)**, movement is dictated by a **Survival Constraint Equation**:

$$Migrate \Leftrightarrow Y_{farm} + Y_{forest} < C_{subsistence} + D_{debt}$$

Where Y_{farm} is agricultural yield,

Y_{forest} is Non-Timber Forest Produce (NTFP) collection income,

$C_{subsistence}$ is basic household consumption needs, and D_{debt} represents informal high-interest loan repayments owed to local moneylenders.

Empirical Comparative Equations

Expected Income vs. Survival Thresholds

For **Single Migrants**, the destination choice follows Todaro's Expected Utility Function:

Policy Framework and Intervention Matrix

To address the challenges of distress migration while facilitating productive mobility, an integrated policy matrix is required.

INTEGRATED POLICY FRAMEWORK

PREVENTATIVE IN-SITU POLICIES
(Reducing Distress Migration)
Irrigation Expansion & Water Harvesting
Forest Rights Act (FRA) & NTFP Support
Year-Round MGNREGA Rural Employment

MIGRANT PROTECTION POLICIES
(Managing Circular Flows)
Portable Social Security (PDS / Ayushman)
Contractor Registration & Minimum Wages
On-Site Mobile Schools & Healthcare

Specific Interventions for Shivpuri District

Portability of Social Entitlements

One Nation One Ration Card (ONORC): Ensure functional portability of subsidized food grains for

migrating families, particularly the Sahariya tribe, to prevent malnutrition while away from origin villages.

Healthcare Coverage: Extend Ayushman Bharat health insurance access across state and district borders for migratory workers in hazardous sectors like stone quarries and construction.

Enhancing Rural Infrastructure and In-Situ Opportunity

Water Management Infrastructure: Expand check-dams and rainwater harvesting in drought-prone tehsils (Pohri, Kolaras, Badarwas) to enable multi-cropping and reduce non-monsoon agricultural displacement.

NTFP Value Addition: Establish processing centers for Minor Forest Produce (such as *Chironji*, *Gond*, *Tendu* leaves) to provide sustainable local livelihoods for tribal communities.

Formalizing Migration Networks

Migrant Resource Centers (MRCs): Establish dedicated labor registration and welfare booths at major transit hubs (Shivpuri Railway Station, Gwalior Bus Terminal) to register outgoing labor contractors (*Mukaddams*) and ensure compliance with the **Inter-State Migrant Workmen Act**.

Mobile Education Units: Deploy seasonal schools at major destination sites (brick kilns and quarry clusters) to prevent educational disruption for children of migrating families.

In conclusion, this comparative analysis demonstrates that human mobility cannot be explained by a single universal theory. While **Single Migration Models** effectively capture income-maximizing, permanent moves driven by high educational and socio-economic capital, **Multiple Migration Models** better explain the survival-oriented, multi-destination, circular mobility typical of socio-economically vulnerable populations.

In **Shivpuri District, Madhya Pradesh**, these dynamics are split along class, caste, and ecological fault lines. Higher-income and skilled cohorts follow single, linear paths toward urban economic centers. Meanwhile, landless marginal farmers and indigenous communities—most notably the **Sahariya tribe**—rely on multiple, seasonal, and step-wise migration strategies to offset agricultural shocks, repay informal debt, and ensure basic household survival.

Effective policy interventions must move beyond attempting to prevent migration altogether. Instead, governments should adopt a dual strategy: strengthening in-situ economic opportunities to reduce distress mobility while safeguarding the legal, social, and

physical security of circular migrants across their migration pathways.

Author Contributions

Shailendra Rawal: Investigation, formal analysis, writing—original draft. S. S. Gautam: Validation, methodology, writing—reviewing. Virendra Upadhyay:—Formal analysis, writing—review and editing. Nupur Pandya: Investigation, writing—reviewing

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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