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MODELING THE FACTORS DETERMINING THE STATUS OF ECONOMIC DEVELOPMENT IN GANGA AND YAMUNA VALLEY OF UTTARKASHI DISTRICT, UTTARAKHAND: A TISM APPROACH

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ABSTRACT

This paper presents a comprehensive model for analyzing the factors determining the status of economic development in the Ganga and Yamuna valleys of Uttarkashi district, Uttarakhand, using the Total Interpretive Structural Modeling (TISM) approach. The region is characterized by a diverse economic landscape shaped by its geographical, cultural, and environmental context. Through extensive literature review and stakeholder consultations, this study identifies key factors influencing economic development, including agricultural productivity, tourism potential, infrastructure development, environmental sustainability, education and skill development, water resource management, government policies, migration trends, hydropower potential, and cultural heritage.

Employing TISM, the paper systematically maps the relationships and hierarchies among these factors, revealing their interdependencies and identifying primary drivers of economic development. The findings highlight the importance of a holistic approach to policy formulation, emphasizing the need for integrated strategies that address the complexities of the local socio-economic environment. By providing a structured framework for understanding the dynamics of economic development in Uttarkashi, this research contributes valuable insights for policymakers, practitioners, and researchers dedicated to fostering sustainable growth in the region. The model not only aids in visualizing the interconnections between various factors but also serves as a decision-making tool for prioritizing interventions and resource allocation.

Keywords: Economic Development, Ganga Yamuna Valley, Uttarkashi District, TISM Approach, etc

OBJECTIVE: To model the factors determining the status of economic development in Ganga and Yamuna valley of Uttarkashi district, Uttarakhand.

RESEARCH QUESTION- What are the major factors determining the status of economic development in Ganga and Yamuna valley of Uttarkashi District of Uttarakhand?

1. INTRODUCTION

The Ganga and Yamuna valleys of Uttarkashi district, Uttarakhand, hold significant economic, cultural, and ecological value, making them vital areas for sustainable development initiatives in India (Majumdar & Sharma, 2021; Kumar et al., 2022; Joshi & Dutta, 2022; Tyagi et al., 2022; Kansal & Singh, 2022). Characterized by their unique geographical features and rich biodiversity, these valleys face a myriad of challenges that influence their economic development status (Negi & Bhatt, 2023; Saini, 2023; Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024; Singh & Pandey, 2024; Bhambri et al.,

2024; Kumar et al., 2024; Sati, 2024; Khanduri, 2024). Factors such as agricultural productivity, tourism potential, infrastructure development, and environmental sustainability interact in complex ways, creating a dynamic socio-economic landscape ((Majumdar & Sharma, 2021). Understanding these interrelationships is crucial for formulating effective policies that can promote balanced and sustainable growth ((Majumdar & Sharma, 2021; Kumar et al., 2022; Joshi & Dutta, 2022; Tyagi et al., 2022; Kansal & Singh, 2022; Chauhan & Dixit, 2023).

In recent years, economic development in this region has been hampered by several issues, including inadequate infrastructure, environmental degradation, and migration of skilled labor to urban areas (Pant, 2023; Rawat & Singh, 2022; Verma & Singh, 2023; Bhatt, 2023; Negi & Bhatt, 2023; Saini, 2023; Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024; Singh & Pandey, 2024; Bhambri et al., 2024; Kumar et al., 2024; Sati, 2024; Khanduri, 2024). The interplay of these factors necessitates a robust analytical framework to assess their impact and guide decision-making processes (Singh & Pandey, 2024; Bhambri et al., 2024; Kumar et al., 2024; Sati, 2024; Khanduri, 2024). This paper employs the Total Interpretive Structural Modeling (TISM) approach (Rizvi et al., 2019; Kumar & Aggarwal, 2021; Pal et al., 2022; Raut et al., 2023; Singh & Sharma, 2023), a systematic and participatory methodology that allows for the identification, analysis, and modeling of complex relationships among various factors. TISM enables stakeholders to visualize and interpret the connections between different determinants of economic development, offering a comprehensive understanding of how they influence each other (Sushil, 2017; Sangwa and Sangwan, 2018;Rizvi et al., 2019; Kumar & Aggarwal, 2021; Pal et al., 2022; Raut et al., 2023; Singh & Sharma, 2023).

By modeling the factors determining the status of economic development in the Ganga and Yamuna valleys, this research aims to provide valuable insights that can inform policymakers and practitioners. The study not only emphasizes the importance of an integrated approach to economic planning but also highlights the necessity of involving local communities and stakeholders in the decision-making process. Through this investigation, the paper seeks to contribute to the broader discourse on sustainable development in Himalayan regions, ultimately fostering a more resilient and prosperous future for the Uttarkashi district.

In summary, this paper outlines the critical factors affecting economic development in the Ganga and Yamuna valleys and presents a structured framework using TISM to analyze their interconnections. The findings are expected to pave the way for more targeted interventions that can harness the region's potential while addressing its challenges effectively (Rizvi et al., 2019; Kumar & Aggarwal, 2021; Pal et al., 2022; Raut et al., 2023; Singh & Sharma, 2023)

2. LITERATURE REVIEW

The economic development of Uttarkashi, a district shaped by the Ganga and Yamuna rivers, depends on multiple socio-economic and environmental factors. Studies highlight the crucial role of infrastructure, agriculture, and tourism. According to (Sharma et al., 2021), tourism in Uttarakhand, including the religious and eco-tourism sectors, significantly contributes to the local economy, but faces challenges from inadequate infrastructure and disaster vulnerability. Micro-enterprises and agricultural productivity are also key, but these sectors are constrained by the region's topography and lack of investment (Thakur et al., 2020).

Studies emphasize that infrastructure, particularly road networks, and sustainable development programs are essential to fostering economic growth. According to Singh and Joshi (2020), investments in education and healthcare are necessary to improve living standards and promote long-term economic growth. Environmental factors, including natural disasters, limit agricultural and tourism opportunities, highlighting the need for a comprehensive development strategy that considers the region's ecological sensitivity (Kumar et al., 2019).

The TISM (Total Interpretive Structural Modeling) methodology helps in understanding the hierarchical structure and interrelationships of these factors, identifying tourism, agriculture, and infrastructure as the most influential drivers of economic development. Further research by Gupta et al. (2022) suggests that focusing on sustainable tourism and improving transportation infrastructure could alleviate some of these challenges.

3. IDENTIFICATION OF FACTORS

The status of economic development in the Ganga and Yamuna valley of Uttarkashi district, Uttarakhand, is influenced by a variety of factors that impact the region's overall progress. Here are ten key factors:

i. AGRICULTURE AND HORTICULTURE PRODUCTIVITY

Agriculture remains the primary livelihood source in the region. However, the mountainous terrain and limited irrigation facilities affect crop yields (Negi & Bhatt, 2023; Saini, 2023; Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024).

Horticulture, including apples, pears, and walnuts, holds potential but requires better infrastructure and market access for sustainable economic development.

ii. TOURISM AND PILGRIMAGE

The valleys are home to significant pilgrimage destinations such as Gangotri and Yamunotri, drawing a large influx of tourists (Kansal & Singh, 2022; Chauhan & Dixit, 2023; Chaudhary & Negi, 2023). Seasonal tourism has a direct impact on local economies by generating employment opportunities and income through hotels, transportation, and local crafts.

iii. INFRASTRUCTURE DEVELOPMENT

The development of roads, transportation, and communication infrastructure is crucial for connecting remote areas to markets, schools, and health services (Majumdar & Sharma, 2021; Kumar et al., 2022). Poor infrastructure hampers accessibility, limiting trade, tourism, and overall development.

iv. EDUCATION AND SKILL DEVELOPMENT

Limited access to quality education and vocational training hinders the region's ability to build a skilled workforce (Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024; Singh & Pandey, 2024; Bhambri et al., 2024). The development of educational institutions and skill enhancement programs are necessary for the population to engage in diverse economic activities beyond agriculture.

v. ENVIRONMENTAL CONSERVATION AND DISASTER MANAGEMENT

The region is prone to natural disasters like landslides, floods, and earthquakes, which severely impact economic stability (Chauhan & Dixit, 2023; Chaudhary & Negi, 2023; Kumar & Thakur, 2023; Sharma & Bhatnagar, 2023; Pant, 2023). Environmental conservation efforts, along with effective disaster management plans, are crucial for sustaining economic activities and protecting livelihoods.

vi. HYDROPOWER POTENTIAL

Uttarkashi district has significant hydropower potential due to the presence of perennial rivers like the Ganga and Yamuna. Properly harnessing this resource through environmentally sustainable hydropower projects can provide energy security and economic growth to the region (Majumdar & Sharma, 2021; Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024; Singh & Pandey, 2024; Bhambri et al., 2024; Kumar et al., 2024).

vii. WATER RESOURCES AND IRRIGATION

The availability of water from the Ganga and Yamuna rivers is a major factor for agriculture and domestic use (Rawat & Singh, 2022; Verma & Singh, 2023; Bhatt, 2023; Negi & Bhatt, 2023; Saini, 2023; Mittal et al., 2024; Devi & Ara, 2024; Joshi & Nag, 2024; Singh & Pandey, 2024). However, inadequate irrigation facilities limit agricultural productivity. Investment in irrigation infrastructure could enhance farming yields and contribute to the economic growth of the valley.

viii. FORESTRY AND BIODIVERSITY

The forests in the region offer a variety of resources such as medicinal plants, timber, and other forest products, which can be sustainably utilized for economic gain. However, deforestation and overexploitation of resources pose threats to long-term ecological balance and economic stability (Chaudhary & Negi, 2023; Kumar & Thakur, 2023; Sharma & Bhatnagar, 2023; Pant, 2023; Rawat & Singh, 2022; Verma & Singh, 2023; Bhatt, 2023).

ix. GOVERNMENT SCHEMES AND POLICY SUPPORT

The effectiveness of government initiatives like the Pradhan Mantri Gram Sadak Yojana (PMGSY) for road connectivity, National Rural Employment Guarantee Act (NREGA) for rural employment, and others plays a critical role in determining the pace of development in the valleys (Kumar et al., 2022; Joshi & Dutta, 2022; Tyagi et al., 2022; Khanduri, 2024). Policy interventions aimed at promoting sustainable agriculture, tourism, and infrastructure can foster economic progress.

x. MIGRATION AND POPULATION DYNAMICS

A significant portion of the population migrates to cities in search of better employment opportunities, leading to depopulation in the valleys. This migration trend results in labor shortages for agriculture and local industries (Kansal & Singh, 2022; Chauhan & Dixit, 2023;). Reversing this trend requires creating local employment opportunities, promoting entrepreneurship, and enhancing rural livelihoods.

These factors, collectively, play a vital role in shaping the economic development status of the Ganga and Yamuna valley in Uttarkashi district. Addressing the challenges and leveraging opportunities in these areas can help in promoting balanced and sustainable development.

4. RESEARCH METHODOLOGY

Total Interpretive Structural Modelling (TISM) is a systems-based methodology (Sushil, 2017; Sangwa and Sangwan, 2018;Rizvi et al., 2019; Kumar & Aggarwal, 2021; Pal et al., 2022; Raut et al., 2023; Singh & Sharma, 2023) used to identify and analyze the complex relationships between various elements in a system. Originally derived from Interpretive Structural Modeling (ISM), TISM extends its predecessor by adding an interpretive aspect that enhances the depth of understanding of the relationships among factors (Sushil, 2017; Sangwa and Sangwan, 2018;Rizvi et al., 2019; Kumar & Aggarwal, 2021; Pal et al., 2022; Raut et al., 2023; Singh & Sharma, 2023). It helps in building a hierarchical structure of interactions, which is particularly useful for problems that involve a high degree of interdependence among elements (Raut et al., 2023).

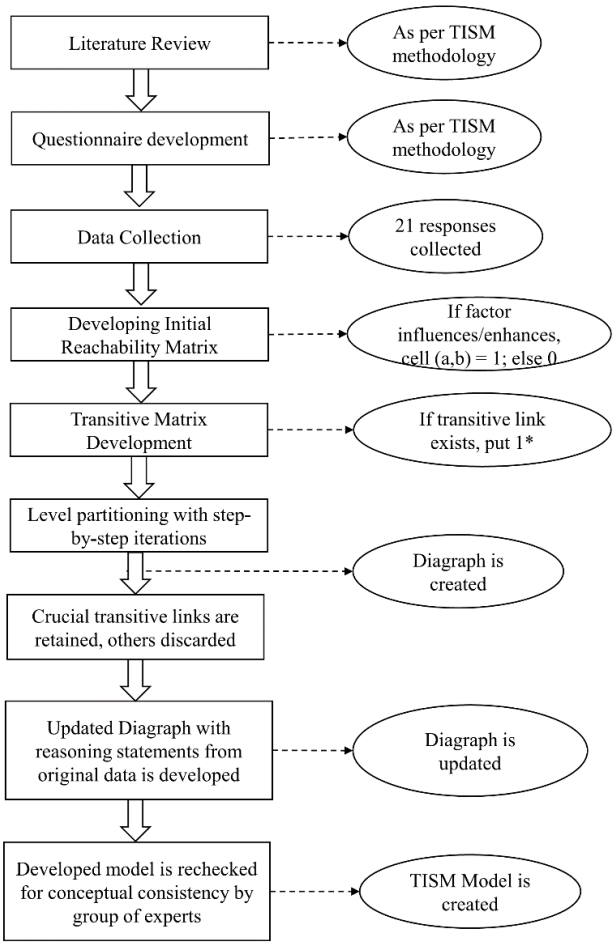

Figure 1: Flow of TISM Model

Interpretive structural modeling (ISM) proves invaluable in dissecting complex scenarios where multiple elements are intricately interconnected (Rizvi et al., 2019). The TISM process involves several steps:

i. Identification of key factors through literature review.
ii. Establishment of contextual relationships between factors.
iii. Interpretation of relationships to understand influence or enhancement.
iv. Conducting pair-wise comparisons to determine relationships.
v. Formulating a reachability matrix based on comparisons and checking transitivity.
vi. Partitioning factors into hierarchical levels.
vii. Construction of a diagraph based on relationships.
viii. Transformation of the diagraph into an interaction matrix, refining transitive links.
ix. Development of TISM based on connective logic and interpretive insights, establishing directive links between nodes.

This approach allows for a comprehensive mapping of complex relationships, eliciting managerial insights and facilitating a deeper understanding of qualitative research. following tables provided for reachability matrix and deciding the levels of factors that influence the purchase intention of buyers for handicraft.

Table 1: List of variables and their codes for TISM modeling

S. No.	Variable Code	Variables
1	1	**Agriculture and Horticulture Productivity**
2	2	**Tourism and Pilgrimage**
3	3	**Infrastructure Development**
4	4	**Education and Skill Development**
5	5	**Environmental Conservation and Disaster Management**
6	6	**Hydropower Potential**
7	7	**Water Resources and Irrigation**
8	8	**Forestry and Biodiversity**
9	9	**Government Schemes and Policy Support**
10	10	**Migration and Population Dynamics**

5. ANALYSIS AND RESULTS

TISM Model

Table 2: Reachability Matrix

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
B1	1	1	1	0	0	0	0	0	0	0
B2	0	1	0	0	0	0	0	0	0	0
B3	0	1	1	0	0	0	0	0	0	0
B4	0	0	0	1	1	0	0	0	0	1
B5	0	0	1	1	1	0	1	0	0	1
B6	0	0	0	0	0	1	0	0	1	1
B7	0	1	1	1	0	0	1	0	0	0
B8	0	0	0	0	0	1	0	1	1	0
B9	0	0	1	0	0	1	0	0	1	0
B10	0	0	0	0	0	0	0	0	0	1

Table 3: Reachability Matrix with transitivity

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
B1	1	1	1	0	0	0	0	0	0	0
B2	0	1	0	0	0	0	0	0	0	0
B3	0	1	1	0	0	0	0	0	0	0
B4	0	1*	1*	1	1	0	1*	0	0	1
B5	0	1*	1	1	1	0	1	0	0	1
B6	0	1*	1*	0	0	1	0	0	1	1
B7	0	1	1	1	1*	0	1	0	0	1*
B8	0	1*	1*	0	0	1	0	1	1	1*
B9	0	1*	1	0	0	1	0	0	1	1*
B10	0	0	0	0	0	0	0	0	0	1

Table 4: Partitioning the Reachability Matrix into different levels

Variables	Reachability Set	Antecedent Set	Intersection Set	Level
a) Iteration 1				
B1	1,2,3	1	1	
B2	2	1,2,3,4,5,6,7,8,9	2	I
B3	2,3	1,3,4,5,6,7,8,9	3	
B4	2,3,4,5,7,10	4,5,7	4,5,7	
B5	2,3,4,5,7,10	4,5,7	4,5,7	
B6	2,3,6,9,10	6,8,9	6,9	
B7	2,3,4,5,7,10	4,5,7	4,5,7	
B8	2,3,6,8,9,10	8	8	
B9	2,3,6,9	6,8,9	6,9	
B10	10	4,5,6,7,8,10	10	II
b) Iteration 2				
H1	1,3	1	1	

B3	3	1,3,4,5,6,7,8,9	3	III
B4	3,4,5,7	4,5,7	4,5,7	
B5	3,4,5,7	4,5,7	4,5,7	
B6	3,6,9	6,8,9	6,9	
B7	3,4,5,7	4,5,7	4,5,7	
B8	3,6,8,9	8	8	
B9	3,6,9	6,8,9	6,9	
c) Iteration 3				
B1	1	1	1	IV
B4	4,5,7	4,5,7	4,5,7	V
B5	4,5,7	4,5,7	4,5,7	V
B6	6,9	6,8,9	6,9	VI
B7	4,5,7	4,5,7	4,5,7	V
B8	6,8,9	8	8	
B9	6,9	6,8,9	6,9	VI
d) Iteration 4				
B8	8	8	8	VII

Table 5: List of variables and their levels in TISM

S. No.	Variable Code	Variables	Level in TISM
1	2	Tourism and Pilgrimage	I
2	10	Migration and Population Dynamics	II
3	3	Infrastructure Development	III
4	1	Agriculture and Horticulture Productivity	IV
5	4	Education and Skill Development	V
6	5	Environmental Conservation and Disaster Management	V
7	7	Water Resources and Irrigation	V
8	6	Hydropower Potential	VI
9	9	Government Schemes and Policy Support	VI
10	8	Government Schemes and Policy Support	VII

6. DIAGRAPH

Figure 2 given below provides for the diagraph of the above TISM Model.

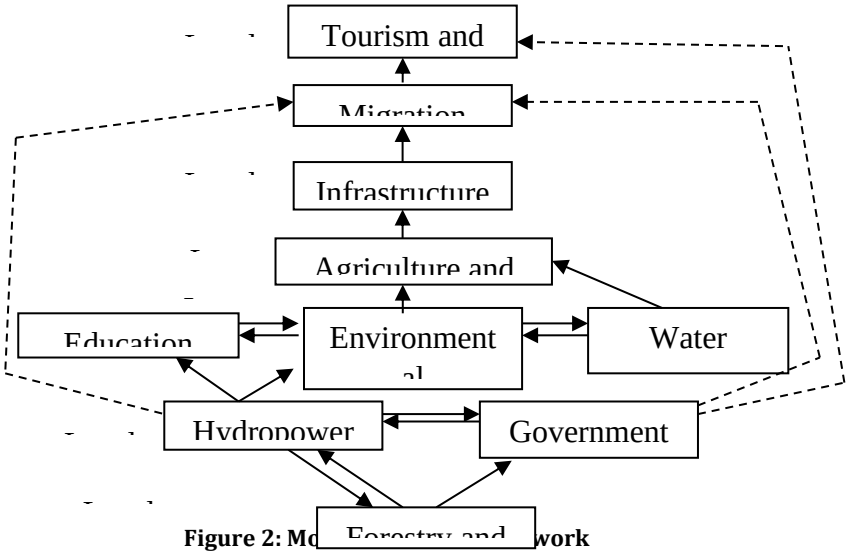

Figure 2: Mo work

7. DISCUSSION

It can be seen from Figure 2 **Level VII** consists of variable 8 namely Forestry and Biodiversity (8), which affects Hydropower Potential (6) level VI and gets affected by it; Government Schemes and Policy Support (9) also affects

Hydropower Potential (6) level VI and gets affected by it. Forestry and Biodiversity (8) also affects Government Schemes and Policy Support.

Level VI comprises of Hydropower Potential (6), and Government Schemes and Policy Support (9). Hydropower Potential (6) affects Government Schemes and Policy Support (9) and Government Schemes and Policy Support (9) affects Hydropower Potential (6). Government Schemes and Policy Support (9) also affects Tourism and Pilgrimage (2) level 1 and Migration and Population (10) level II. On the other hand Hydropower Potential (6) affects Migration and Population (10) level II. It also affects Education and Skill Development (4) level V and Environmental Conservation and Disaster Management (5) level V.

Level V consists of Education and Skill Development (4), Environmental Conservation and Disaster Management (5), and lack of easy fundraising process (7). Education and Skill Development (4) casts impact on Environmental Conservation and Disaster Management (5) and vice-versa. Similarly, there is a two way relationship between Environmental Conservation and Disaster Management (5) and Water Resources and Irrigation (7) and they both affect each other mutually. Environmental Conservation and Disaster Management (5) also impacts Agriculture and Horticulture Productivity (1) level IV in rural areas for innovation and investment.

Level IV comprises of Agriculture and Horticulture Productivity (1) and it affects Infrastructure Development (3) III. It gets affected by Environmental Conservation and Disaster Management (5) and Water Resources and Irrigation (7) level V.

Level III consists of Infrastructure Development (3) and it affects lack of Migration and Population (10) level II and gets affected by Agriculture and Horticulture Productivity (1) level IV.

Level II comprises of Migration and Population (10). It affects Tourism and Pilgrimage (2) level I and gets impacted by Government Schemes and Policy Support (9) VI and Hydropower Potential (6) level VI.

Level I consist of Tourism and Pilgrimage (2) and gets impacted by Migration and Population (10) level II and Government Schemes and Policy Support (9) VI.

8. IMPLICATIONS

8.1 PRACTICAL IMPLICATIONS

The findings of this study, which utilizes the Total Interpretive Structural Modeling (TISM) approach to analyze the factors influencing economic development in the Ganga and Yamuna valleys of Uttarkashi district, present several practical implications for policymakers and stakeholders. Firstly, the identification of interdependent factors allows for integrated policy formulation that addresses multiple aspects of development, ensuring that initiatives in areas like infrastructure, agriculture, and tourism work synergistically rather than in isolation. Furthermore, prioritizing interventions based on their influence on economic growth can lead to more effective resource allocation, ultimately enhancing developmental outcomes. Engaging local communities in the decision-making process fosters ownership and capacity building, empowering stakeholders to actively contribute to sustainable development efforts. Additionally, the TISM framework facilitates the establishment of monitoring and evaluation mechanisms, enabling stakeholders to assess the effectiveness of implemented strategies and adapt to evolving challenges. By promoting public-private partnerships and raising awareness about regional issues, the study's insights can drive collaborative efforts towards a more resilient and prosperous future for Uttarkashi district. Overall, the practical implications emphasize the need for a holistic approach to economic development that aligns with the unique characteristics and needs of the Ganga and Yamuna valleys.

8.2 THEORETICAL IMPLICATIONS

The theoretical implications of this study extend the understanding of economic development dynamics within the Ganga and Yamuna valleys of Uttarkashi district by employing the Total Interpretive Structural Modeling (TISM) approach, which emphasizes the interconnectedness of various development factors. This research contributes to the literature by illustrating how traditional economic development theories can be enriched through a systems thinking perspective, highlighting the complexity and interdependencies among agricultural productivity, tourism, infrastructure, and environmental sustainability. The use of TISM not only provides a structured framework for analyzing these relationships but also offers a nuanced understanding of how contextual factors shape economic outcomes in a specific regional setting. By demonstrating the applicability of TISM in regional development studies, this paper invites further exploration of its use in diverse contexts, potentially leading to more comprehensive models that incorporate social, cultural, and environmental dimensions. Ultimately, the findings underscore the need for interdisciplinary approaches

in economic development theory, paving the way for future research that integrates various theoretical frameworks to address the challenges and opportunities unique to Himalayan regions like Uttarkashi.

8.3 RESEARCH IMPLICATIONS

The research implications of this study are significant, as they provide a foundational framework for future investigations into the economic development of the Ganga and Yamuna valleys in Uttarkashi district and similar regions. By employing the Total Interpretive Structural Modeling (TISM) approach, this research not only identifies critical factors influencing economic growth but also illustrates how these factors interconnect, highlighting the need for a holistic view in economic analysis. Future researchers can build upon this model to explore specific elements in greater detail, such as the role of cultural heritage or community resilience in driving economic outcomes. Additionally, this study opens avenues for longitudinal research to assess the impact of various development interventions over time, thereby contributing to a deeper understanding of dynamic socio-economic processes. The findings also encourage interdisciplinary collaboration among scholars from fields such as environmental science, sociology, and urban planning, fostering comprehensive research that addresses the multi-faceted challenges of regional development. Ultimately, this study underscores the importance of tailored research methodologies in capturing the complexities of local contexts, paving the way for evidence-based policy recommendations that can effectively promote sustainable economic development in Uttarkashi and beyond.

8.4 SOCIAL IMPLICATIONS

The social implications of this study are profound, as they highlight the intricate relationship between economic development and the well-being of local communities in the Ganga and Yamuna valleys of Uttarkashi district. By employing the Total Interpretive Structural Modeling (TISM) approach, this research reveals how various economic factors, such as agricultural practices, tourism, and infrastructure development, directly impact social dynamics, including community cohesion, migration patterns, and quality of life. The findings emphasize the necessity of incorporating social considerations into economic planning, ensuring that development initiatives are not only economically viable but also socially equitable and inclusive. Engaging local stakeholders in the decision-making process fosters a sense of ownership and empowerment, enhancing community resilience and promoting sustainable livelihoods. Furthermore, this study underscores the importance of cultural heritage and traditional practices in shaping local identities, suggesting that preserving these elements can enhance social capital and contribute to overall community development. By illuminating these connections, the research advocates for a balanced approach to economic development that prioritizes social well-being, ultimately leading to a more harmonious and prosperous society in Uttarkashi district.

9. LIMITATIONS

This study, while providing valuable insights into the factors influencing economic development in the Ganga and Yamuna valleys of Uttarkashi district, has several limitations that should be acknowledged. Firstly, the reliance on the Total Interpretive Structural Modeling (TISM) approach, while beneficial for understanding interdependencies among factors, may not capture the full complexity of dynamic socio-economic systems, as it simplifies relationships into a structured model. Additionally, the qualitative data gathered through stakeholder interviews may be subject to biases, as responses can vary based on personal perspectives and experiences. The study's geographical focus on Uttarkashi limits the generalizability of its findings to other regions with different socio-economic contexts. Furthermore, while the research identifies key factors, it may not exhaustively address all potential influences, such as political and institutional frameworks, that could affect economic development. Lastly, the temporal aspect of the analysis may not account for long-term changes in socio-economic conditions, as the data is primarily cross-sectional. Acknowledging these limitations provides a framework for future research to build upon, encouraging more comprehensive studies that can address these gaps and further explore the complexities of economic development in similar contexts.

10. CONCLUSION

The present study applied the Total Interpretive Structural Modeling (TISM) approach to model the factors influencing economic development in the Ganga and Yamuna Valley of Uttarkashi District, Uttarakhand. Through the analysis, critical factors such as infrastructure development, agricultural productivity, tourism potential, education levels, and access to healthcare were identified as key determinants in shaping the economic landscape of the region. Among these, infrastructure and tourism emerged as the most pivotal drivers due to the region's geographical and cultural significance.

The hierarchical structure developed through TISM highlights the interdependencies among these factors, providing a systematic understanding of how foundational elements like infrastructure and education fuel the broader economic activities, including tourism and agriculture. These findings reinforce the need for policymakers to focus on infrastructure enhancement and sustainable tourism development to foster balanced economic growth.

Moreover, the study acknowledges the challenges faced by the valley, such as geographic isolation, limited access to modern technologies, and vulnerability to natural disasters, which impede economic progress. Addressing these challenges requires collaborative efforts between local communities, government authorities, and private enterprises.

In conclusion, the economic development of the Ganga and Yamuna Valley is a multifaceted process driven by a combination of social, economic, and environmental factors. This TISM-based analysis provides valuable insights for formulating targeted strategies to enhance the region's economic prospects while preserving its unique cultural and environmental heritage. Future research could explore further quantification of these relationships and the inclusion of additional variables such as climate change impacts and global market integration to develop a more comprehensive model.

CONFLICT OF INTERESTS

None.

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