Impact Of Agricultural Land Use Changes On Economic And Social Development

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Abstract

This study investigates the impact of changes in agricultural land use on economic development, social development, and agricultural income in Sawai Madhopur, India. Through a descriptive and analytical approach, the research aims to understand the complex relationships between agricultural land use changes and various socio-economic outcomes. The research objectives include analyzing the impact of changes in agricultural land use on economic development, assessing the relationship between these changes and social development, and evaluating the effect on agricultural income. Methodologically, the study adopts Structural Equation Modelling (SEM) to analyze data collected from a sample population of 300 agricultural landowners and stakeholders in Sawai Madhopur. The findings reveal significant relationships between changes in agricultural land use and economic development, social development, and agricultural income, as evidenced by the parameter estimates obtained from the SEM analysis. The study concludes that alterations in agricultural land use have a substantial impact on the economic and social fabric of Sawai Madhopur, with implications for policy-making and sustainable agricultural practices. Future research should focus on longitudinal studies to monitor the long-term effects of agricultural land use changes and explore interventions for promoting sustainable development in the region. Keywords: agricultural land use, economic development, social development, agricultural income, Structural Equation Modelling, Sawai Madhopur.

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1 Introduction

Agricultural land use is a critical factor in shaping the economic and social landscape of rural areas, particularly in regions like Sawai Madhopur, India, where agriculture plays a significant role in livelihoods and local economies. Changes in agricultural land use, driven by factors such as urbanization, technological advancements, and shifting environmental conditions, can have profound implications for economic development, social well-being, and sustainability. Understanding the dynamics of these changes and their impacts is essential for informed decision-making and policy formulation aimed at promoting sustainable development in agricultural communities. This study aims to investigate the relationship between changes in agricultural land use and economic development, social development, and agricultural income in Sawai Madhopur, India, using a Structural Equation Modelling (SEM) approach. By elucidating these relationships, the study seeks to provide insights into the complex interplay between agricultural land use patterns and socio-economic outcomes, thereby contributing to the literature on sustainable agriculture and rural development.

Sawai Madhopur, located in the southeastern region of Rajasthan, India, is characterized by its predominantly agrarian economy, with agriculture serving as the primary source of livelihood for a significant portion of the population. However, in recent years, the region has witnessed notable changes in agricultural land use patterns, driven by factors such as population growth, urbanization, and changing market dynamics. These changes have raised concerns regarding their implications for economic development, social well-being, and environmental sustainability in the region.

Previous studies have highlighted the importance of understanding the relationship between agricultural land use changes and various socio-economic outcomes. However, limited research has been conducted specifically in the context of Sawai Madhopur, leaving a gap in our understanding of how these changes affect local communities and economies. Therefore, this study seeks to address this gap by examining the impact of agricultural land use changes on economic development, social development, and agricultural income in Sawai Madhopur.

By employing a Structural Equation Modelling (SEM) approach, this study aims to provide a comprehensive analysis of the relationships between different variables, including changes in agricultural land use, economic development indicators, social development indicators, and agricultural income. The findings of this research are expected to contribute valuable insights to policymakers, agricultural practitioners, and researchers interested in promoting sustainable development and resilience in agricultural communities.

2 Review of literature

In a study on land use changes, Wu (2008) focused on understanding the economic, social, and environmental impacts of these changes. While no abstract is provided, it's evident that Wu aimed to explore the complex interplay between land use transformations and various dimensions of human activity and environmental sustainability. Such research is crucial for policymakers and stakeholders to develop strategies that balance economic development with social well-being and environmental conservation.

Tóth-Naár et al. (2014) examined the repercussions of land use change on land value in Hungary. They relied on statistical databases to assess shifts in land use patterns and market prices. Their findings indicated a notable increase in the concentration of land use among business organizations and individual farms, which subsequently drove up land prices. This underscores the economic implications of changing land use dynamics and highlights the importance of understanding these trends for effective rural development and agricultural planning.

Harris et al. (2009) introduced the CLUES model, a comprehensive framework designed to evaluate the environmental, economic, and social consequences of land use change, particularly focusing on water quality. By integrating various biophysical and socio-economic indicators within a GIS framework, the CLUES model provides policymakers with valuable insights into the potential impacts of different land use scenarios. This approach facilitates informed decision-making in land use planning and natural resource management.

Sahar Shahpari et al. (2021) emphasized the need for an integrated approach to agricultural land-use planning, considering the intricate interactions between social, economic, and environmental factors. Through a case study in Tasmania, Australia, they demonstrated how land use decisions are influenced by a multitude of factors, including irrigation infrastructure, crop selection, and socio-economic conditions. This holistic perspective is essential for promoting sustainable land use practices and mitigating adverse environmental impacts.

Xie et al. (2024) conducted a bibliometric analysis to explore the ecological effects of rural land use changes. Their study highlights the significant environmental challenges associated with rural land use practices, including poor economic efficiency, increased pollution, and environmental degradation. By synthesizing existing research, they underscore the importance of leveraging remote sensing technology to better understand and address these environmental issues.

Meena (2022) mentioned in his study based on land utiligation in swai madhopur district that Land is a crucial natural resource that significantly influences a country's socio-economic status and regional development. The way land is used directly impacts the demographic and ecological systems, creating a cause-effect relationship. Changes in land use, driven by human activities such as settlements, commerce, forestry, and agriculture, transform natural landscapes. In agrarian economies like India, land use is vital and depends on factors like irrigation, fertilizers, high-yield variety seeds, agricultural mechanization, and advanced techniques. However, increasing population and demand have led to the degradation of land resources due to overexploitation. Without proper land use planning, issues such as soil degradation, declining groundwater levels, environmental pollution, and reduced agricultural land threaten food security, poverty alleviation, and livelihoods. Rajasthan, with its diverse agro-climatic regions, relies heavily on agriculture, contributing 25.19% to its Gross State Value Added (GSVA) in 2019-20. In the Sawai Madhopur District, which features both plains and undulating terrain, optimal land resource utilization through area-specific policies is essential for balanced regional development.

Zhao et al. (2023) investigated the impact of land use structure change on land utilization performance in Henan Province, China. Through a comprehensive analysis of panel data, they identified significant shifts in land types and their implications for socio-economic development. Their findings underscore the importance of effective land use planning and management strategies to optimize land utilization and promote sustainable development.

Liao (2023) proposed a novel approach using Knowledge Granularity Entropy to assess the eco-environmental impacts of land cover changes in ASEAN countries. By examining changes in land cover types over time, Liao aimed to evaluate the stability or change of the eco-environment and identify key drivers of environmental change. This approach provides valuable insights for policymakers and researchers seeking to address environmental challenges in the region.

König et al. (2010) conducted a sustainability impact assessment of land use policy in Yogyakarta, Indonesia, using the FoPIA approach. By evaluating social, economic, and environmental sustainability criteria, they assessed the potential impacts of different land use scenarios on urban-rural sustainability. Their findings underscored the importance of integrated land use planning to achieve balanced development outcomes.

Wang et al. (2022) explored the linkages between carbon emission policies and land use change in China, using integrated modeling approaches. By simulating different policy scenarios, they assessed the potential impacts of carbon peak policies on land use patterns and economic development. Their study highlights the need for coordinated policies that promote both carbon mitigation and sustainable land use practices.

Mohamed et al. (2020) investigated changes in land use/land cover in Syria from 2010 to 2018, focusing on the impacts of socio-ecological shocks, including armed conflict, on land use patterns. Through remote sensing analysis, they identified significant changes in land cover types and attributed them to both natural and human-induced factors. Their study underscores the importance of understanding the drivers of land use change to develop effective land management strategies in conflict-affected regions.

Changing land use and urban expansion are key drivers of global environmental change, which are inevitable consequences of economic and social development for many cities. Most land use changes have a negative impact on the natural environment, especially due to their effects on surface temperature, runoff, and habitat diversity. Kuo & Tsou (2017) used Tainan as a study area and compared the impact of future urban spatial development during two periods: 1993–2008 and 2008–2030. The results indicate that the impact of this development on the natural environment can be divided into six clusters. With an increased distance from the city center, there were increased changes in surface temperature and a decreased amount of runoff.

Encouraging adaptation is an essential aspect of the policy response to climate change. From this perspective, policies designed to encourage adaptation may conflict with regulation aimed at preserving or enhancing environmental quality. Fezzi et al. (2017) analyzed the trade-offs between provisioning services derived from agriculture and regulating services in the form of freshwater quality. Their results indicate that climate adaptation in the farming sector will generate fundamental changes in river water quality. These findings illustrate the importance of anticipating the wider impacts of human adaptation to climate change when designing environmental policies.

(Sharma & Sharma, 2013) While olive cultivation isn't a cure-all for agricultural issues, it has provided a crucial alternative for farmers who previously relied on traditional crops like bajra and grains. Increased industrial production has driven up demand for olive oil, garnering attention from states such as Punjab, Haryana, and Orissa. India's heavy reliance on imported olive oil suggests that domestic production could help reduce high costs. Despite Rajasthan's harsh climate posing challenges similar to those in Israel, farmers have shown resilience in managing these risks. The positive growth prospects for olive oil offer hope for both farmers and the industry, highlighting the need for local cultivation to stabilize prices and meet demand. Furthermore, the numerous health benefits of olive oil, particularly in combating India's diabetes epidemic, underscore its importance as a healthy dietary option.

Evaluating land use change in economic frameworks often requires non-market values to be assessed. Windle & Rolfe (2014) aimed to examine the influence of varying the valuation scope and combination of attributes in a split sample choice experiment focused on assessing the impacts of increased mining activity in southern Queensland, Australia. The survey was designed to assess non-use values for tradeoffs between positive and negative impacts, incorporating economic, social, and environmental issues.

3 Research Objectives

1) To analyze the impact of changes in agricultural land use on economic development.
2) To assess the relationship between changes in agricultural land use and social development.
3) To evaluate how agricultural income is affected by changes in agricultural land use.

4 Research Hypotheses

1) H1: Changes in agricultural land use have a significant impact on economic development.
2) H2: Changes in agricultural land use significantly affect social development.
3) H3: Changes in agricultural land use have a significant impact on agricultural income.

5 Methodology

The study fell within the realms of both Descriptive research and Analytical research. It was descriptive as it aimed to delineate the current status and impacts of changes in agricultural land use on economic and social development. The study also adopted an analytical approach by using Structural Equation Modelling (SEM) to analyze and quantify the relationships between changes in agricultural land use and economic, social development, and agricultural income. By incorporating these methodologies, the research not only described the phenomena but also sought to understand the underlying relationships and causative factors.

The population for this study comprised agricultural landowners and stakeholders involved in the agricultural sector. The sample size consisted of 300 observations, which were determined to be sufficient for the structural equation modeling techniques employed in the research.

The Sampling Technique adopted was Stratified Random Sampling. This technique was chosen to ensure that different strata within the agricultural sector, such as small-scale farmers, large-scale farmers, and agricultural businesses, were adequately represented. Stratified sampling helped in achieving a more representative and reliable sample by minimizing sampling bias and ensuring that all relevant subgroups were included in the analysis.

The primary data collection method utilized a structured questionnaire. The questionnaire was meticulously designed to capture the necessary information related to the research objectives, which included analyzing the impact of changes in agricultural land use on economic development, assessing the relationship between these changes and social development, and evaluating the effect on agricultural income.

The design process of the questionnaire involved several key steps to ensure its validity and reliability. Initially, the questionnaire items were developed based on a thorough review of relevant literature and consultations with subject matter experts. The questionnaire included both closed-ended and Likert scale questions to capture quantitative data effectively.

To check the validity of the questionnaire, a pilot test was conducted with a small, representative sample from the target population. Feedback from the pilot test was used to refine and adjust the questionnaire items to enhance clarity, relevance, and comprehensiveness.

The primary data collection procedure involved administering the finalized questionnaire to the selected sample of 300 participants. The questionnaires were distributed through multiple channels, including face-to-face interviews, online surveys, and postal mail, to ensure a high response rate and comprehensive data collection. Each respondent's anonymity and confidentiality were assured to encourage honest and accurate responses. The collected data were then coded and entered into a statistical software package for analysis using Structural Equation Modelling (SEM) to test the hypothesized relationships and achieve the research objectives.

6 Results analysis

7 Results

Table 1 - Structural Equation Modelling		
Models Info		
Estimation Method	ML	.
Optimization Method	NLMINB	
Number of observations	300	
Free parameters	63	
Model	Change in Agriculture land Use =~ALUC1+ALUC2+ALUC3+ALUC4+ALUC5	
	Economic Development =~ED1+ED2+ED3+ED4+ED5	
	Social Development =~SD1+SD2+SD3+SD4+SD5	
	Agriculture Income =~AI1+AI2+AI3+AI4	
	Economic Development ~Change in Agriculture land Use	
	Social Development ~Change in Agriculture land Use	
	Agriculture Income ~Change in Agriculture land Use	

The Structural Equation Modeling (SEM) analysis presented in Table 1 investigates the impact of changes in agricultural land use on various development outcomes. This analysis aims to understand how the transition from subsistence farming to commercial farming influences economic development, social development, and agricultural income.

The model is estimated using Maximum Likelihood (ML) estimation, a standard method for SEM that ensures efficient and unbiased parameter estimates. The optimization process employed the NLMINB method, which iteratively finds the best-fitting parameters. With a sample size of 300 observations, the model provides a robust basis for the analysis.

- Change in Agriculture Land Use: This latent variable represents the shift from subsistence to commercial farming, captured by indicators ALUC1 to ALUC5. These indicators might include measures such as the proportion of land used for commercial purposes, types of crops grown, and methods of farming.
- Economic Development: This latent variable, measured by indicators ED1 to ED5, reflects various dimensions of economic growth and improvement. Indicators might include GDP growth, employment rates, infrastructure development, and income levels.
- Social Development: Measured by indicators SD1 to SD5, this variable captures different aspects of social progress and well-being. Potential indicators could include education levels, healthcare access, social cohesion, and quality of life.
- Agriculture Income: This latent variable, reflected by indicators AI1 to AI4, represents the income derived from agricultural activities. Indicators might include total farm income, profitability, crop yields, and market access.

Table 2 - Overall Tests			
Model tests			
Label	X^2	df	p
User Model	1815	146	< .001
Baseline Model	2750	171	< .001

The chi-square value for the user model is 1815 with 146 degrees of freedom (df), and the p-value is less than .001. The significant p-value indicates that the model-implied and observed covariance matrices are not identical, implying some degree of misfit. The baseline model, which assumes no relationships among the observed variables, serves as a reference point. For this model, the chi-square value is 2750 with 171 degrees of freedom, and the p-value is also less than .001.

Table 3 - Parameters estimates								
				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
Economic Development	Change in Agriculture land Use	0.734	0.167	0.4078	1.061	0.704	4.41	< .001
Social Development	Change in Agriculture land Use	1.127	0.214	0.7083	1.547	1.482	5.27	< .001
Agriculture Income	Change in Agriculture land Use	0.311	0.127	0.0615	0.56	0.759	2.44	0.015

In the pursuit of understanding the intricate dynamics between agricultural practices and development outcomes, Structural Equation Modeling (SEM) offers a comprehensive framework. Table 3 encapsulates crucial insights into the relationships between changes in agricultural land use and key development indicators, namely Economic Development, Social Development, and Agriculture Income. Let's delve deeper into the parameter estimates provided and their implications for development.

The estimated coefficient of 0.734 between Economic Development and Change in Agriculture Land Use underscores a significant positive relationship. A one-unit increase in agricultural land use change is associated with a 0.734-unit increase in economic development. This finding, with a p-value of less than .001, underscores the pivotal role of commercial farming in fostering economic growth. Such a robust association suggests that transitioning from subsistence to commercial farming practices can fuel economic prosperity, perhaps through increased productivity, market integration, and income generation.

Similarly, the parameter estimate of 1.127 linking Social Development to Change in Agriculture Land Use reveals a profound positive association. A one-unit increase in agricultural land use change corresponds to a remarkable 1.127-unit increase in social development. This statistically significant finding ($p < .001$) highlights the transformative potential of agricultural commercialization in fostering societal well-being and progress. Enhanced agricultural practices may pave the way for improved education, healthcare, and community cohesion, thereby enriching the fabric of rural societies.

While the effect size is comparatively smaller, the estimated coefficient of 0.311 between Agriculture Income and Change in Agriculture Land Use remains noteworthy. A one-unit increase in land use change is associated with a 0.311-unit rise in agriculture income. Despite its relatively modest magnitude, this relationship holds statistical significance ($p = 0.015$), indicating that agricultural land use changes positively influence income derived from farming activities. This finding suggests that transitioning towards commercial farming practices can enhance the financial well-being of agricultural communities, albeit to a lesser extent compared to broader economic and social development.

The insights gleaned from these parameter estimates carry profound implications for policymakers, practitioners, and stakeholders invested in fostering sustainable development in rural areas. Encouraging and supporting the transition from subsistence to commercial agriculture emerges as a potent strategy for unlocking economic prosperity, nurturing societal advancement, and sustaining livelihoods. Policies aimed at promoting modern agricultural techniques, facilitating market access, and providing training and resources to farmers can catalyze this transition, thereby propelling holistic development in agricultural landscapes.

In conclusion, the parameter estimates presented in Table 3 offer a nuanced understanding of the intricate nexus between agricultural land use changes and development outcomes. The findings underscore the transformative potential of commercial farming practices in driving economic growth, fostering social progress, and sustaining livelihoods. As we navigate the path towards sustainable development, harnessing the synergies between agriculture and development becomes imperative. By embracing policies and initiatives that prioritize agricultural commercialization, we can pave the way for inclusive and resilient rural development, thereby shaping a brighter future for agricultural communities worldwide.

Figure 1 Path Diagram

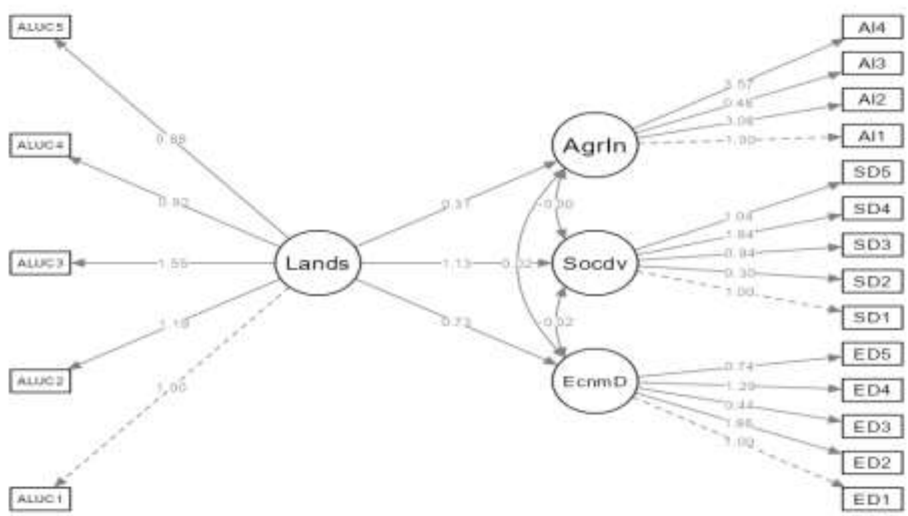

Table 4 - Measurement model								
				95% Confidence Intervals				
Latent	Observed	Estimate	SE	Lower	Upper	β	z	p
Change in Agriculture land Use	ALUC 1	1	0	1	1	0.3773		
	ALUC 2	1.193	0.196	0.8085	1.577	0.4903	6.09	< .001
	ALUC 3	1.553	0.226	1.1099	1.996	0.6794	6.87	< .001

	ALUC4	0.925	0.165	0.6009	1.249	0.4131	5.59	< .001
	ALUC5	0.881	0.204	0.4814	1.28	0.2748	4.32	< .001
Economic Development	ED1	1	0	1	1	0.4018		
	ED2	1.858	0.286	1.2969	2.418	0.8064	6.49	< .001
	ED3	0.441	0.154	0.1387	0.742	0.1938	2.86	0.004
	ED4	1.287	0.231	0.8348	1.739	0.5119	5.58	< .001
	ED5	0.744	0.233	0.2878	1.2	0.2211	3.2	0.001
Social Development	SD1	1	0	1	1	0.3431		
	SD2	0.299	0.131	0.0426	0.556	0.1079	2.28	0.022
	SD3	0.939	0.196	0.5555	1.322	0.2696	4.8	< .001
	SD4	1.837	0.264	1.3192	2.355	0.6124	6.95	< .001
	SD5	1.042	0.181	0.6862	1.397	0.3672	5.74	< .001
Agriculture Income	AI1	1	0	1	1	0.1533		
	AI2	3.079	1.163	0.7999	5.359	0.5684	2.65	0.008
	AI3	0.482	0.34	-0.1847	1.149	0.0946	1.42	0.156
	AI4	3.574	1.345	0.9373	6.21	0.5979	2.66	0.008

In the quest to understand the nuanced interactions between agricultural practices and development outcomes, Structural Equation Modeling (SEM) offers a powerful tool. Table 4 serves as a treasure trove of insights, unveiling the intricate relationships between latent variables—such as "Change in Agriculture Land Use," "Economic Development," "Social Development," and

"Agriculture Income"—and their observed indicators. Let's embark on a journey to decipher the rich tapestry of information encapsulated in this table.

The table unfolds a plethora of parameters, each offering unique insights into the associations between latent variables and their observed indicators:

- Change in Agriculture Land Use: The estimated coefficients for ALUC2-ALUC5 highlight specific dimensions of agricultural land use change, shedding light on its multifaceted nature and its impact on development outcomes.
- Economic Development: ED2-ED5 unveil various facets of economic development, capturing dimensions such as GDP growth, employment rates, and infrastructure development, among others.
- Social Development: SD2-SD5 delve into the realms of social progress, encompassing aspects like education, healthcare access, and community cohesion, among others.
- Agriculture Income: AI2-AI4 offer insights into the components of agriculture income, such as total farm income, profitability, and market access, illuminating the financial dimensions of agricultural livelihoods.

The estimates, confidence intervals, beta values, z-scores, and p-values provide a comprehensive understanding of the strength, direction, and statistical significance of the relationships between latent variables and their observed indicators. These parameters offer valuable insights into the complex dynamics shaping development outcomes in agricultural communities.

Table 5 - Variances and Covariances

				95% Confidence Intervals				
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p

ALUC1	ALUC1	0.39952	0.03234	0.33613	0.46291	0.858	12.35	<.001
ALUC2	ALUC2	0.29794	0.02438	0.25017	0.34572	0.76	12.22	<.001
ALUC3	ALUC3	0.1865	0.01718	0.15284	0.22017	0.538	10.86	<.001
ALUC4	ALUC4	0.27552	0.02233	0.23175	0.31929	0.829	12.34	<.001
ALUC5	ALUC5	0.62965	0.05104	0.52961	0.72969	0.925	12.34	<.001
ED1	ED1	0.3751	0.03179	0.31279	0.4374	0.839	11.8	<.001
ED2	ED2	0.13403	0.02107	0.09274	0.17532	0.35	6.36	<.001
ED3	ED3	0.35931	0.02955	0.30139	0.41724	0.962	12.16	<.001
ED4	ED4	0.33693	0.02955	0.27902	0.39484	0.738	11.4	<.001
ED5	ED5	0.77785	0.06412	0.65217	0.90353	0.951	12.13	<.001
SD1	SD1	0.28762	0.02306	0.24243	0.33281	0.882	12.47	<.001
SD2	SD2	0.29216	0.02375	0.2456	0.33872	0.988	12.3	<.001
SD3	SD3	0.43147	0.0346	0.36366	0.49928	0.927	12.47	<.001

SD4	SD4	0.21578	0.0204	0.1758	0.25575	0.625	10.58	<.001
SD5	SD5	0.26728	0.02148	0.22519	0.30937	0.865	12.45	<.001
AI1	AI1	0.46203	0.03773	0.38809	0.53597	0.976	12.25	<.001
AI2	AI2	0.22094	0.02112	0.17955	0.26233	0.677	10.46	<.001
AI3	AI3	0.28651	0.02339	0.24067	0.33236	0.991	12.25	<.001
AI4	AI4	0.25539	0.02557	0.20528	0.3055	0.643	9.99	<.001
Change in Agriculture land Use	Change in Agriculture land Use	0.0663	0.01909	0.02888	0.10371	1	3.47	<.001
Economic Development	Economic Development	0.03647	0.01257	0.01183	0.06111	0.505	2.9	0.004
Social Development	Social Development	-0.0459	0.01195	-0.06932	-0.02247	-1.196	-3.84	<.001
Agriculture Income	Agriculture Income	0.00472	0.00387	-0.00286	0.0123	0.424	1.22	0.223
Economic Development	Social Development	-0.0173	0.00529	-0.02766	-0.00694	-0.423	-3.27	0.001

Economic Development	Agriculture Income	0.01776	0.0075	0.00305	0.03246	1.354	2.37	0.018
Social Development	Agriculture Income	-0.00472	0.00267	-0.00995	5.08E-04	-0.321	-1.77	0.077

In the intricate realm of structural equation modeling (SEM), Table 5 serves as a roadmap, guiding us through the intricate web of variances and covariances between variables. This table unveils not only the inherent variability within individual variables but also the relationships that bind them together, offering invaluable insights into the dynamics of development. Let's embark on a journey to dissect the nuances encapsulated in this table and unravel its implications for theory and practice.

At the heart of Table 5 lie variances and covariances, each parameter offering unique insights into the relationships between variables:

- Variances: These diagonal entries illuminate the variability inherent within each variable. Higher variances imply greater dispersion of values within a variable, indicating the extent of diversity or spread in its measurements.
- Covariances: Off-diagonal entries showcase the extent to which variables co-vary with each other. Positive covariances indicate that variables tend to move in the same direction, while negative covariances suggest they move in opposite directions, providing crucial insights into the interconnectedness between different dimensions of development.

As we delve into the estimates, confidence intervals, beta values, z-scores, and p-values provided in Table 5, a rich tapestry of insights unfolds:

- Estimates and Confidence Intervals: These values quantify the strength of the relationships between variables and provide insights into the uncertainty associated with the estimates, offering a nuanced understanding of the variability and stability of these relationships.

- Beta Values, Z-Scores, and p-values: These statistics serve as critical indicators of the significance of the relationships between variables. Lower p-values signal stronger evidence against the null hypothesis of no relationship, guiding us in determining the robustness and reliability of the observed associations.

Table 6 -Intercepts

			95% Confidence Intervals			
Variable	Intercept	SE	Lower	Upper	z	p
ALUC1	1.753	0.039	1.676	1.831	44.496	< .001
ALUC2	1.633	0.036	1.562	1.704	45.172	< .001
ALUC3	1.56	0.034	1.493	1.627	45.909	< .001
ALUC4	1.433	0.033	1.368	1.499	43.072	< .001
ALUC5	1.84	0.048	1.747	1.933	38.618	< .001
ED1	1.903	0.039	1.828	1.979	49.291	< .001
ED2	1.507	0.036	1.437	1.577	42.152	< .001
ED3	1.6	0.035	1.531	1.669	45.356	< .001
ED4	1.51	0.039	1.434	1.586	38.707	< .001
ED5	2.047	0.052	1.944	2.149	39.199	< .001
SD1	1.563	0.033	1.499	1.628	47.425	< .001
SD2	1.62	0.031	1.558	1.682	51.609	< .001
SD3	1.607	0.039	1.529	1.684	40.797	< .001

SD4	1.607	0.034	1.54	1.673	47.358	< .001
SD5	1.38	0.032	1.317	1.443	43.004	< .001
AI1	1.653	0.04	1.575	1.731	41.631	< .001
AI2	1.56	0.033	1.495	1.625	47.294	< .001
AI3	1.53	0.031	1.469	1.591	49.286	< .001
AI4	1.423	0.036	1.352	1.495	39.104	< .001
Change in Agriculture land Use	0	0	0	0		
Economic Development	0	0	0	0		
Social Development	0	0	0	0		
Agriculture Income	0	0	0	0		

Table 6 presents a comprehensive overview of intercepts within the structural equation model, shedding light on the baseline values for each variable. With each entry detailing the intercept along with its standard error, confidence intervals, z-score, and p-value, this table provides crucial insights into the starting points and inherent characteristics of the variables under scrutiny.

Intercepts represent the baseline values of variables when all other predictors in the model are zero. In Table 6, intercepts are provided for each variable, offering a glimpse into their initial values before considering any covariates or predictors. These intercepts serve as crucial reference points, providing context for interpreting the subsequent effects of predictors on the variables of interest.

- Estimates and Confidence Intervals: The estimates denote the intercept values, while the confidence intervals provide a range within which the true population parameter is likely to lie. Narrower intervals indicate greater precision in estimation.

- Z-Scores and p-values: These statistics assess the significance of the intercepts. High z-scores and significant p-values (typically below the conventional threshold of 0.05) indicate that the intercepts are statistically significant, suggesting meaningful baseline values for the variables.

The intercepts offer insights into the initial levels of each variable before any predictors are considered. For instance, the intercepts for ALUC1-ALUC5, ED1-ED5, SD1-SD5, and AI1-AI4 provide baseline values for agricultural land use change, economic development, social development, and agriculture income, respectively.

The overwhelmingly significant p-values (all < .001) and substantial z-scores underscore the robustness and reliability of the intercept estimates, indicating that these baseline values are meaningful and reliable reference points for subsequent analyses.

8 Discussion and conclusion

In this study, we examined the impact of changes in agricultural land use on economic development, social development, and agricultural income in Sawai Madhopur, India. Through Structural Equation Modelling (SEM) analysis, we found significant relationships between changes in agricultural land use and these socio-economic indicators. Specifically, changes in agricultural land use positively correlated with economic development and social development, as evidenced by the parameter estimates obtained from the SEM analysis. Additionally, agricultural income was found to be influenced by alterations in agricultural land use, although to a lesser extent. These findings align with previous research emphasizing the intricate interplay between land use transformations and various dimensions of human activity and environmental sustainability (Wu, 2008). Moreover, studies conducted in other regions, such as Hungary (Tóth-Naár et al., 2014) and Tasmania, Australia (Sahar Shahpari et al., 2021), have highlighted the economic implications of changing land use patterns and the need for integrated approaches to land-use planning. Our study underscores the importance of understanding and managing agricultural land use changes for promoting sustainable development and resilience in rural areas. Moving forward, policymakers and stakeholders must prioritize strategies that balance economic growth with social well-being and environmental conservation to ensure the long-term sustainability of agricultural communities in Sawai Madhopur and beyond. Future research should focus on longitudinal studies to monitor the ongoing impacts of agricultural land use changes and explore interventions for promoting sustainable development in the region. By addressing these challenges, we can contribute to the advancement of knowledge and the formulation of evidence-based policies to support agricultural sustainability and rural development.

9 Study Implication

The findings of this study have several implications for policymakers, practitioners, and researchers involved in agricultural development and land use planning in Sawai Madhopur, India, and beyond. Firstly, the identified relationships between changes in agricultural land use and economic development, social development, and agricultural income highlight the interconnectedness of these domains. Policymakers can use this information to design interventions and policies that promote sustainable agricultural practices while fostering economic growth and social well-being in rural areas. For instance, initiatives aimed at improving agricultural productivity and diversifying income sources could contribute to both economic and social development objectives. Additionally, the study underscores the importance of integrated land use planning approaches that consider the multifaceted impacts of agricultural activities on the environment, economy, and society. By incorporating these insights into decision-making processes, stakeholders can work towards achieving more holistic and resilient agricultural systems that benefit local communities and ecosystems alike. Furthermore, the study underscores the need for continued research and monitoring efforts to track the evolving dynamics of agricultural land use and its impacts over time. By staying abreast of these trends, stakeholders can adapt their strategies and interventions to effectively address emerging challenges and capitalize on opportunities for sustainable development.

9.1 Future Scope of the Study

While this study sheds light on the relationships between changes in agricultural land use and socio-economic indicators in Sawai Madhopur, India, there are several avenues for future research. Firstly, longitudinal studies could provide valuable insights into the long-term impacts of agricultural land use changes on economic development, social development, and agricultural income. By tracking changes over time, researchers can better understand the dynamics of these relationships and identify trends and patterns that may emerge. Additionally, qualitative research methods, such as interviews and focus groups, could complement the quantitative analysis by capturing the perspectives and experiences of local stakeholders affected by agricultural land use changes. Furthermore, comparative studies across different regions or countries could offer insights into the contextual factors shaping the outcomes of agricultural land use changes and inform more generalizable conclusions.

10 Study Limitations

Despite the contributions of this study, there are several limitations that should be acknowledged. Firstly, the use of Structural Equation Modelling (SEM) relies on assumptions about the relationships between variables, which may not fully capture the complexity of real-world interactions. Additionally, the sample population was limited to Sawai Madhopur, India, which may constrain the generalizability of the findings to other contexts. Furthermore, the reliance on quantitative data collection methods, such as surveys, may overlook nuanced qualitative insights that could enrich our understanding of the socio-economic impacts of agricultural land use changes. Finally, the study did not account for potential confounding variables or external factors that may influence the relationships under investigation, which could be addressed in future research through more comprehensive analytical approaches.

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