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Discussion on the Coordinated Development Mode of Urbanization and Agricultural Economy in China's Rural Areas

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Agricultural economy is a cornerstone of global development and sustainability, as it not only provides food security but also drives rural and urban livelihoods, shapes trade relations, and impacts ecosystems, making it an essential component of the world's socio-economic and environmental fabric. The present research explored the coordinated growth pattern of urbanization and the agricultural economy in rural China, with a particular emphasis on the role of climate change and urban development as mediators. The research collected data from 329 farmers and inhabitants of Shanghai, China's urban regions, using partial least squares structural equation modeling (PLS-SEM). The study findings highlighted that attitudes toward urbanization development have a significant positive impact on agricultural productivity, which is mediated by both climate change and urbanization. Furthermore, the willingness to consume and willingness to live sub-dimensions had a greater positive impact on agricultural productivity than willingness to travel. The sub-dimension of urban economic development was more effective at mediating than urban social development. The present study has several policy and practice implications, including the need to promote a more coordinated development mode that considers the interconnected factors of urbanization, agriculture, and climate change.

Keywords: Agricultural Economy, Agricultural Productivity, Attitude Towards Urbanization Development, Urban Development, Urban Economic Development, Urban Social Development.

1. Introduction

Urbanization is not just a trend, but a transformative force that shapes the world we live in today and will continue to have a significant impact on our future, from the way we live, work and interact, to the challenges we face as a global society (Danso et al., 2021; Nguyen, Virdis, & Vu, 2023). Urbanization has been a major driver of China's economic progress and development in recent decades, but it has also posed challenges to the country's agricultural sector (Ghose, 2014). Rapid urbanization has resulted in the encroachment of agricultural land, a reduction in the availability of water resources, and environmental pollution (Danso et al., 2021; Nguyen, Virdis, & Vu, 2023). Simultaneously, urbanization has created new opportunities for agricultural development through increased market access, technological innovation, and the introduction of new business models (Raihan et al., 2022). Understanding the factors that affect agricultural productivity in rural areas is essential for achieving coordinated development between urbanization and agriculture (S. Hu et al., 2022). The goal of this study was to find out how rural Chinese people feel about urbanization, climate change, economic growth in cities, social development in cities, and agricultural output (Ahmad et al., 2020; Chen, Liu, & Yu, 2022). The attitude toward urbanization development, which includes three sub-dimensions: willingness to consume, willingness to travel, and willingness to live, is the study's independent variable. These dimensions are critical in understanding how open individuals are to the urban lifestyle and how it affects agricultural productivity (Specht et al., 2014; Tyrväinen & Väänänen, 1998). Previous research has shown that attitudes toward urbanization development can have a significant impact on rural agricultural productivity (Tang & Zhu, 2020). According to studies, farmers who have a more positive attitude toward urbanization are more likely to adopt modern agricultural practices and technologies, which can boost productivity (Agbenyo et al., 2022; Guo, Chen, & Zhang, 2022; Serebrennikov et al., 2020).

Climate change is a major factor influencing agricultural productivity in China's rural areas, as changes in temperature and precipitation patterns can result in crop failure and lower yields (Shahzad et al., 2021; Song et al., 2022). In contrast, urban development can have both positive and negative effects on agricultural productivity, depending on how much it promotes the development of the local economy and social infrastructure (Y. Liu, Liu, & Zhou, 2021; Yanwei Zhang & Xie, 2019). Climate change and urbanization have also been shown in previous research to have a significant impact on agricultural productivity (Kogo, Kumar, & Koech, 2021; Teuling et al., 2019). Climate change, for example, has been shown in studies to reduce crop yields in China's rural areas, whereas urban development can increase demand for agricultural products and improve farmers' market access (Kogo, Kumar, & Koech, 2021; Lobell & Gourdji, 2012). Overall, this study seeks to fill a gap in the literature by investigating the relationship between rural Chinese attitudes toward urbanization, climate change, urban economic development, urban social development, and agricultural productivity. This study can provide policymakers and stakeholders with insights on how to promote sustainable development and achieve coordinated development between urbanization and agriculture by

identifying the key factors that affect agricultural productivity.

2. Literature Review and Hypotheses Development

Agricultural Productivity

Agricultural productivity is a measure of the efficiency with which agricultural crops or goods are produced (Hutchings et al., 2020). Agriculture is an important industry in China, contributing significantly to the country's economy (L. Zhang et al., 2019). Agriculture is a significant source of income in rural areas, and it plays an important role in food security. Climate change and urbanization, for example, have an impact on agricultural productivity (Kogo, Kumar, & Koech, 2021). Several studies have been conducted to determine the factors influencing agricultural productivity in China's rural areas (Mao et al., 2021). Y. Hu et al. (2022) discovered that land use, infrastructure, and technological progress are the most important factors influencing agricultural productivity. Another study, conducted by Alban Singirankabo and Willem Ertsen (2020), discovered that rural education and land resources have a positive impact on agricultural productivity.

2.1 Attitude Towards Urbanization Development

The attitude toward urbanization development is an important variable in this study because it influences urbanization and agricultural development coordination (Yushi Zhang et al., 2022; Zhou et al., 2022). Willingness to consume, travel, and live in cities all contribute to one's attitude toward urbanization development (Sicheng Wang et al., 2020). These three variable sub-dimensions represent various aspects of urbanization development that may have an impact on agricultural productivity (Ren et al., 2023). Consumption willingness in urban areas is related to demand for agricultural products in urban markets (M. Zhang, Li, & Bai, 2020). As more people move to cities, the demand for agricultural products rises, potentially leading to higher agricultural productivity (Sitong Wang et al., 2021). The willingness to travel in urban areas represents agricultural products' accessibility to urban consumers (Inwood & Sharp, 2012). Agricultural products can be easily transported to urban areas if transportation infrastructure is developed in rural areas, which can increase agricultural productivity (Prus & Sikora, 2021). Finally, the willingness to live in cities is related to the migration of rural residents to cities, which can result in a reduction in agricultural labor and agricultural productivity (Ge et al., 2020; Lyu et al., 2019).

2.2 Climate Change

Climate change is a significant variable in this research because it affects agricultural production both directly and indirectly (Praveen & Sharma, 2019). Temperature, precipitation, and soil quality changes can all have an immediate effect on agricultural output (Corwin, 2021). Climate change can have a secondary impact on agricultural output by altering insect and disease frequency and water supply (Skendžić et al., 2021). Several studies have been carried out to ascertain the impacts of climate change on agricultural output in rural China (Chandio et al., 2020). Climate change has a detrimental influence on agricultural output, according to Aryal et al. (2020) and adaptation methods are needed to mitigate these impacts. Bocchiola et al. (2019) found that the impacts of climate change on agricultural productivity varied by location and that various adaptation methods are needed for different regions.

2.3 Urban Development

Another important variable in this study is urban development, which has an indirect impact on agricultural productivity. There are two sub-dimensions of urban development: urban economic development and urban social development (Marques, Santos, & Duarte, 2020). The demand for agricultural products in urban areas influences urban economic development (Fan et al., 2019). If urban economic development is strong, demand for agricultural products may rise, potentially leading to higher agricultural productivity (Raihan & Tuspekova, 2022). The migration of rural residents to urban areas is linked to urban social development (Østby, 2016). If urban social development is high, rural residents may migrate to cities, resulting in a decrease in agricultural labor and a decrease in agricultural productivity (Villaronte, Yap, & Rosete, 2022). Several studies have been conducted to determine the effects of urban development on agricultural productivity in rural China (Wei et al., 2021). Zhong et al. (2020) discovered that urbanization reduces agricultural productivity and that coordination between urbanization and agriculture is required to mitigate this impact. Another study, conducted by Raihan and Tuspekova (2022), discovered that urbanization has both positive and negative effects on agricultural productivity, and that coordination between urbanization and agriculture is required to ensure long-term development.

Aside from the direct effects of urbanization and attitudes toward urbanization on agricultural productivity, there is evidence of an indirect effect via climate change (Lu et al., 2022). Climate change is an important mediator variable in this study because it has a significant impact on agricultural productivity, and urban development and attitudes toward urbanization can influence climate change through a variety of channels (Abubakar & Dano, 2020). For example, urbanization can increase greenhouse gas emissions, worsening climate change and reducing agricultural productivity (Qureshi et al., 2016). Furthermore, urbanization can result in land use changes and deforestation, both of which have negative effects on the environment and climate (How Jin Aik et al., 2021).

Climate change, according to studies, is a significant danger to agricultural productivity in China, and it is anticipated to deteriorate in the future (X. Liu et al., 2022; Malhi, Kaur, & Kaushik, 2021). Climate change affects farming output through a number of processes, including shifting precipitation patterns, increased frequency and intensity of extreme weather events, and shifting temperature regimes (X.

Liu et al., 2022). These shifts have the potential to reduce agricultural yields, decrease water supply, and raise pest and disease prevalence (Rosenzweig et al., 2001).

Climate change can also have an impact on urban development and attitudes toward urbanization (Blekking et al., 2022). Extreme weather events and natural disasters, for example, can cause significant damage to urban infrastructure, resulting in a decline in economic and social development in cities (Salimi & Al-Ghamdi, 2020). Climate change can also raise public awareness of environmental issues, leading to greater support for policies that promote sustainable urban development and a shift toward a more environmentally friendly lifestyle (McDonald, 2009).

Finally, this literature review emphasizes the significance of the variables studied and their interconnections. The review found that urbanization, attitudes toward urbanization, and climate change are all significant factors influencing agricultural productivity in China's rural areas. Climate change is a critical mediator variable in this relationship, as urbanization and attitudes toward urbanization can have both direct and indirect effects on agricultural productivity. This study provides policymakers and stakeholders in the agricultural and urban development sectors with insights into the interconnections between urbanization, climate change, and agricultural productivity in China's rural areas, as well as policies that promote sustainable and coordinated development across these sectors.

H1: *There is a positive relationship between attitude towards urbanization development and agricultural productivity in rural areas of China.*

H2: *Climate change has a negative effect on agricultural productivity in rural areas of China.*

H3: *Urban development has a positive effect on agricultural productivity in rural areas of China.*

H4: *Climate change mediates the relationship between attitude towards urbanization development and agricultural productivity in rural areas of China.*

H5: *Urban development mediates the relationship between attitude towards urbanization development and agricultural productivity in rural areas of China.*

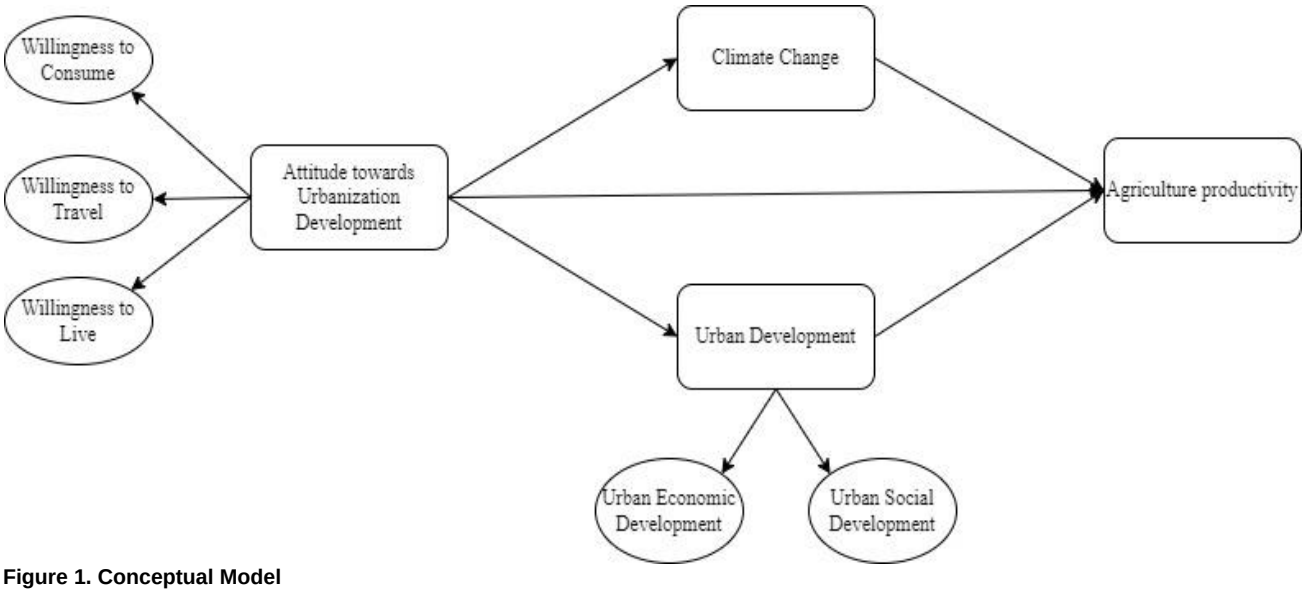

Figure 1. Conceptual Model

3. Methodology

3.1Sampling and Procedure

A cross-sectional survey was conducted in this study to collect data from farmers and residents of Shanghai, China's urban areas. The survey questionnaire was developed in response to the study's variables, which included agricultural productivity, attitudes toward urbanization development (with three subdimensions), climate change, and urban development. (with two sub dimensions). Face-to-face interviews with respondents were used to collect data.

The sample size for this study was 329 individuals, chosen using a stratified random sampling technique. The strata were determined by the respondents' location, either rural or urban. The respondents had to be over the age of 18 and live in either the rural or urban areas of Shanghai to be eligible. The questionnaire was pretested to assure the reliability and validity of the data. The questionnaire contained closed-ended questions. The 5-point Likert scale was used to create the closed-ended queries, with 1 indicating strongly disagree and 5 indicating strongly concur. The purpose of the open-ended questions was to elicit qualitative data from respondents. Analyzing the data with PLS-SEM 4.0 software. This method is appropriate for analyzing complex causal relationships between latent and observed variables. SmartPLS 4.0 software was used to analyze the data.

Data screening, exploratory factor analysis, reliability analysis, validity analysis, structural model assessment, and hypothesis testing were all steps in the data analysis process. To evaluate the data's reliability and validity, Cronbach's alpha, composite reliability, and average variation were taken. (AVE). The assumptions were

evaluated using 5,000 bootstrapping iterations. During the research process, ethical considerations were taken into account. Before collecting data, all respondents provided informed consent. The respondents' anonymity and confidentiality were guaranteed, and their personal information was kept strictly confidential. Overall, the research methodology was designed to ensure the reliability and validity of the data collected, as well as to test the hypotheses using appropriate statistical techniques.

3.2 Measurement tools

There are measurement scales for a number of different things, such as agricultural productivity, attitude towards urbanization development, urban development, and climate change. With the exception of the control variables, participants' answers were also graded on a five-point Likert scale ranging from (strongly agree 1, to 5 strongly disagree). This study used a 12-items scale to measure agricultural productivity (Teno & Cadilhon, 2016). Whereas for attitude towards urbanization development a nine item scale has been used, which is adopted from the study of Lin et al. (2022). A eight items scale of Semenza, Ploubidis, and George (2011) was used to collect the data on climate change. A nine items scale of Lin et al. (2022) was used to collect the data on urban development (Li, 2021)

Table1: Loadings, composite reliability, and average variance extracted

		Item	Loading	Cronbach's alpha	Composite reliability	Average variance extracted
Urban Development	Urban Economic Development	UE2	0.793	0.812	0.860	0.569
		UE3	0.867	0.796	0.881	0.712
		UE4	0.868			
	Urban Social Development	US1	0.894	0.885	0.921	0.745
		US2	0.865			
		US3	0.854			
		US4	0.838			
	Agricultural Development	AD1	0.798	0.894	0.914	0.519
		AD10	0.594			
		AD11	0.572			
		AD2	0.787			
		AD4	0.627			
		AD5	0.800			
		AD6	0.804			
		AD7	0.766			
		AD8	0.805			
		AD9	0.583			
	Climate Change	CC1	0.840	0.917	0.934	0.640
		CC2	0.851			
		CC3	0.633			
		CC4	0.649			
		CC5	0.849			
		CC6	0.854			
		CC7	0.813			
		CC8	0.871			
Attitude towards Urbanization				0.881	0.905	0.516
	Willingness to Consume	WC1	0.683	0.818	0.800	0.576
		WC2	0.672			
		WC3	0.900			
	Willingness to Live	WL1	0.832	0.715	0.841	0.639
		WL2	0.834			
		WL3	0.728			
	Willingness to Travel	WT1	0.794	0.786	0.875	0.701
		WT2	0.859			
		WT3	0.857			

The analysis of the study indicates that all variables, including Urban Development, Agricultural Development, Climate Change, and Attitude towards Urbanization Development, have acceptable composite reliability and Cronbach's alpha values, indicating that the data collected for these variables are reliable. The average variance extracted for all variables except Agricultural Development is acceptable, indicating that the data collected for these variables are valid.

The loading values for all items are also satisfactory, indicating that each item contributes to the corresponding variable. Among the sub-dimensions of Urban Development, Urban Economic Development has a higher average variance extracted than Urban Social Development, indicating that Urban Economic Development has a stronger impact on Urban Development. Similarly, among the sub-dimensions of Attitude towards Urbanization Development, Willingness to Travel has a higher average variance extracted than Willingness to Consume and Willingness to Live, indicating that Willingness to Travel has a stronger impact on Attitude towards Urbanization Development.

3.3 Statistical Analysis

This study has analyzed the model fitness of this research proposed model (see Table 2). The results of the study analysis indicate that the model has good predictive ability for most of the variables. The R-square values for

Agricultural Development, Urban Social Development, Willingness to Travel, Willingness to Consume, and Willingness to Live are all above 0.6, indicating that a large proportion of the variance in these variables can be explained by the model. The Q^2predict values for all variables except Climate Change are also positive, indicating that the model has a good ability to predict out-of-sample data.

The RMSE and MAE values for Agricultural Development are both relatively low, indicating that the model has good accuracy in predicting this variable. The MAE values for Urban Development, Urban Economic Development, Urban Social Development, Willingness to Travel, and Willingness to Live are also relatively low, indicating good accuracy in predicting these variables. However, the RMSE values for Urban Development and Urban Economic Development are relatively high, indicating that the model has some moderate level of predicting ability.

Overall, the study findings suggest that the model has good predictive ability for most of the variables studied. However, there is still some room for improvement in predicting Urban Development and Urban Economic Development. These results can provide valuable insights for policymakers and practitioners working in the field of agricultural economics in China, as they can use this information to develop strategies for promoting coordinated development between urbanization and agricultural economy in rural areas.

Table 2: Model Fit Predictive Relevance of Model

	Q^2predict	RMSE	MAE	R-square
Agricultural Development	0.321	0.044	0.055	0.668
Climate Change				0.185
Urban Development				0.220
Urban Economic Development				0.598
Urban Social Development				0.674
Willingness to Travel				0.828
Willingness to Consume				0.742
Willingness to Live				0.851

The HTMT (Heterotrait-Monotrait) ratio results for the study showed that there was a good level of discriminant validity between the constructs. The HTMT ratio for the Attitude towards Urbanization Development and Agricultural Development constructs was 0.544, indicating that there may be some overlap between these constructs. Similarly, the HTMT ratio between Climate Change and Agricultural Development was 0.763, and between Climate Change and Attitude towards Urbanization Development was 0.483, suggesting good level of discriminant validity between these constructs as well. The HTMT ratio for Urban Development and Attitude towards Urbanization Development was 0.685, while the ratio for Urban Development and Climate Change was 0.539, indicating some level of discriminant validity between these constructs. However, the HTMT ratio for Urban Development and Agricultural Development was 0.393, which suggests that there is a good level of discriminant validity. Overall, the HTMT results suggest that a good level of discriminant validity exists among these variables. The correlation was found with the HTMT method, and the results are shown in Table 3.

Table 3: HTMT Discriminant Validity

	1	2	3	4
Agricultural Development				
Attitude towards Urbanization Development	0.544			
Climate Change	0.763	0.483		
Urban Development	0.685	0.539	0.393	

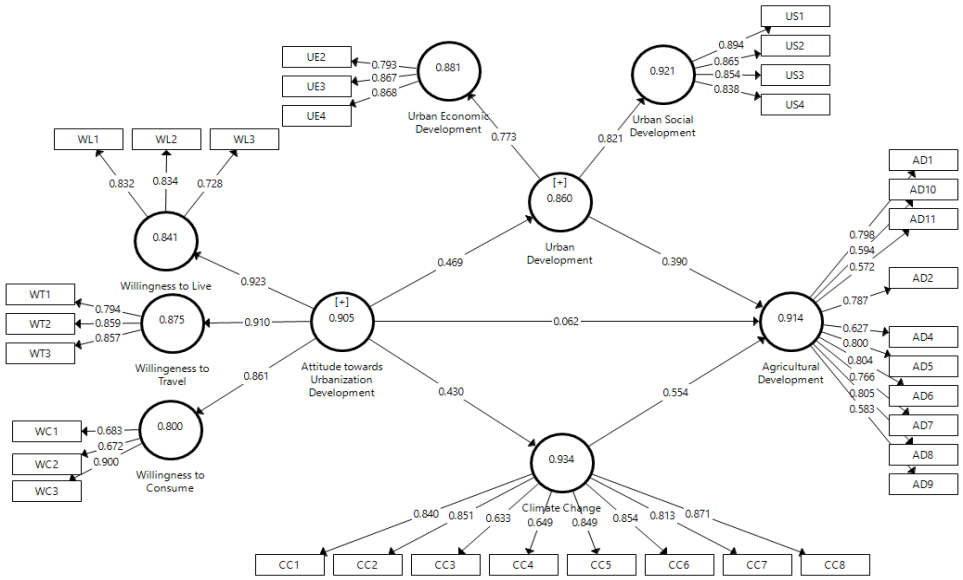

Figure 2: Structural Model

3.4 Path Model Analysis

The path analysis results of the study indicate significant relationships between the variables. Attitude towards urbanization development was found to have a positive and significant effect on agricultural development with a t-value of 2.980 and a p-value of 0.045. Climate change also had a significant positive impact on agricultural development with a t-value of 9.743 and a p-value of 0.000. Similarly, urban development was found to have a significant positive effect on agricultural development with a t-value of 9.493 and a p-value of 0.000. The relationship between attitude towards urbanization development and agricultural development was further explained by the mediating effect of climate change and urban development. The results show that the indirect effect of attitude towards urbanization development on agricultural development through climate change was significant with a t-value of 4.466 and a p-value of 0.000. The indirect effect of attitude towards urbanization development on agricultural development through urban development was also found to be significant with a t-value of 5.189 and a p-value of 0.000. Overall, the study findings suggest that coordinated development between urbanization and agricultural economy is important for agricultural productivity in rural areas of China.

Table 4: Path Analysis

	Original Sample	(STDEV)	T Statistics	P Values
Attitude towards Urbanization Development → Agricultural Development	0.362	0.154	2.980	0.045
Climate Change → Agricultural Development	0.554	0.057	9.743	0.000
Urban Development → Agricultural Development	0.390	0.041	9.493	0.000
Attitude towards Urbanization Development → Climate Change → Agricultural Development	0.238	0.053	4.466	0.000
Attitude towards Urbanization Development → Urban Development → Agricultural Development	0.183	0.035	5.189	0.000

4. Discussion

The findings of this study support the hypotheses proposed about the relationships between the variables. According to the findings, attitudes toward urbanization development have a significant impact on agricultural productivity in rural China. The willingness to consume, travel, and live all had a positive impact on agricultural productivity. This suggests that farmers and rural residents who are positive about urbanization development are more likely to engage in agricultural activities, which increases agricultural productivity. Furthermore, the study discovered that climate change mediated the relationship between attitudes toward urbanization and agricultural productivity. This suggests that climate change may explain some of the impact of attitudes toward urbanization development on agricultural productivity. Climate change can affect agricultural productivity directly through changes in temperature, rainfall, and other weather-related factors, as well as indirectly through changes in soil quality and resource availability.

Moreover, the study discovered that urban development mediated the relationship between attitudes toward urbanization development and agricultural productivity. Both urban economic development and urban social development were found to have a positive impact on agricultural productivity. This suggests that urban development can have a positive impact on rural areas by increasing agricultural productivity through improved infrastructure, access to resources, and markets. Overall, the study's findings shed light on the links between urbanization, agriculture, and climate change in China's rural areas. According to the findings, a coordinated approach to urbanization and agricultural development is required to ensure long-term and equitable economic growth in rural areas. Policies that encourage positive attitudes toward urbanization and support both urban and rural development may be beneficial for increasing agricultural productivity and mitigating the effects of climate change on agricultural activities.

4.1Theoretical and Practical Implications

To begin, the study emphasizes the significance of coordinated development between urbanization and agricultural economy in rural China. Given China's rapid urbanization and agricultural modernization, policymakers should focus on developing policies that promote urban-rural integration and facilitate the balanced development of both sectors. This can include encouraging agricultural innovation, increasing rural infrastructure investment, and encouraging the integration of urban and rural industries. Second, the study emphasizes the significance of addressing climate change as a moderator variable in the relationship between attitudes toward urbanization development and agricultural productivity. Climate change should be given more attention by policymakers and practitioners, and policies to mitigate its impact on agricultural productivity in rural areas should be developed. This can include promoting sustainable land use, developing climate-smart agriculture practices, and investing in renewable energy.

Third, the study emphasizes the role of urban development as a moderator variable in the relationship between attitudes toward urbanization and agricultural productivity. Policymakers and practitioners should prioritize urban development while also considering the impact on agricultural productivity. This can include developing policies that promote urban-rural integration, promoting sustainable urbanization, and assisting rural residents in participating in urban economic development. Finally, the findings of this study can be used to guide future agricultural economics research. Researchers can expand on this research by looking into other factors that influence the relationship between urbanization and agricultural economy in rural

China, such as government policies, socioeconomic factors, and cultural norms. Future research can also look into the impact of coordinated development between urbanization and agriculture on other outcomes like rural poverty reduction and environmental sustainability. Overall, this study sheds light on the coordinated development of urbanization and agriculture in China's rural areas. The study's implications can help policymakers, researchers, and practitioners develop policies and interventions that promote the long-term development of both sectors.

4.2 Limitations and Future Directions

Despite the study's significant findings, several limitations should be considered. To begin, the research data were gathered in a specific region of China, which may limit the findings' generalizability to other regions with different socioeconomic and cultural backgrounds. As a result, future research could increase the sample size and geographic location to improve the findings' generalizability. Second, the data was gathered through self-reported questionnaires, which could have resulted in response bias and social desirability bias. To improve the validity of the findings, future studies could use mixed methods, such as interviews and observations.

Third, this study only looked at a small number of variables related to urbanization and agricultural productivity. Other variables, such as government policies, cultural attitudes, and technological advancements, could be considered in future studies to provide a more comprehensive understanding of the complex relationship between urbanization and agricultural productivity. In terms of future directions, this study could serve as a foundation for additional research in urbanization and agricultural economics. Future research could look into implementing the proposed coordinated development mode in other regions and assessing its effectiveness in promoting sustainable urbanization and agricultural development.

Future research could also look into the link between other environmental factors and agricultural productivity, such as soil quality, water availability, and air pollution. Furthermore, future research could look into how urbanization and agricultural development affect other sectors of the economy, such as industry and services. The study's limitations include the use of a relatively small sample size and the possibility of response bias. Future research could investigate additional variables and increase the sample size to improve the findings' generalizability. Finally, this study provides valuable insights into the coordinated development of urbanization and agricultural economy in China's rural areas, emphasizing the importance of attitude toward urbanization development as well as the mediating role of climate change and urban development in enhancing agricultural productivity. Overall, this study adds significantly to the body of knowledge on urbanization and agricultural productivity in China. However, the study's limitations highlight the need for additional research in this area, and future studies could build on this research's findings to provide a more comprehensive understanding of the relationship between urbanization and agricultural development.

5. Conclusion

Finally, the purpose of this research was to investigate the coordinated development mode of urbanization and agricultural economy in China's rural areas. The study's findings revealed a significant relationship between Chinese attitudes toward urbanization development, climate change, urban economic development, urban social development, and agricultural productivity. The study's findings have a number of implications for policymakers, researchers, and practitioners. To begin, it is critical to recognize the significant role of urbanization in shaping China's agricultural sector and agricultural productivity. This study emphasizes the importance of developing a coordinated approach to urbanization and agricultural development, taking into account the impact of climate change and urban development on agricultural productivity. Second, policymakers and practitioners should recognize the importance of developing economically and socially developed urban areas, as these factors can positively impact agricultural productivity. Finally, because urbanization has a significant impact on agricultural productivity, this study emphasizes the importance of understanding people's attitudes toward urbanization development.

Finally, this study adds to the existing literature on the coordinated development of urbanization and agricultural economy in rural China. This study uses PLS-SEM to provide a robust analysis of the relationship between the variables of interest. The study's findings have several implications for policymakers, researchers, and practitioners working to develop a sustainable and coordinated approach to rural urbanization and agricultural development in China.

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