

The Impact of Agricultural Modernization on Economic Development in Maros Regency South Sulawesi

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Abstract

This study investigates the impact of agricultural modernization on economic development in Maros Regency, South Sulawesi. The research analyzes the influence of technological adoption along with farming practice improvements and training/support services toward GDP growth and agricultural employment numbers and farmers' income levels. 200 agricultural stakeholders and secondary government reports were used in a quantitative design to gather data via surveys. The research demonstrates that economic development receives notable contributions from agricultural modernization through technological adoption which proves itself as the most powerful factor that achieves positive changes in all economic indicators. No evidence suggests that agricultural support programs and farming practice enhancements create the same magnitude of positive results on GDP growth and employment as technological adoption. The results from multiple regression analysis revealed that both agricultural technology usage as well as agricultural practice enhancements produced substantial and statistically important positive effects on economic development. This study addresses a literature gap because it presents empirical findings about Maros Regency which previous research studies had neglected. The research delivers essential recommendations to policy makers who should launch enhanced agricultural development programs for achieving sustainable rural growth.

Introduction

The developing nation of Indonesia along with other countries has undergone significant economic changes through agricultural modernization. The economic development of Indonesia depends heavily on agriculture because it creates jobs and ensures food security for citizens while growing the national economy. The agricultural sector continues to dominate Maros Regency within South Sulawesi through its broad employment of the local population. The growing technological advancement and industrial revolution of the present age requires modern agricultural methods to flourish like never before. Agricultural modernization in Maros Regency possesses the capacity to stimulate economic growth together with improved farming conditions and enhanced community welfare. There is limited research documenting the effects of agricultural modernization on economic development in this particular region so further empirical studies must tackle this issue.

Maros Regency depends heavily on its agricultural sector. The latest BPS reports show that a major number of residents depend on agriculture for their livelihood because rice and maize and different vegetable crops lead the crop production in this region (Rahmat & Neilson, 2023; Salman et al., 2022). Agriculture constitutes the fundamental economic foundation of South Sulawesi region because it shapes both regional employment numbers and GDP outputs. The sector deals with several obstacles including old farming practices and restricted access to contemporary technologies and broken infrastructure which reduces its growth prospects (Yigezu, 2021; Laurett & Mainardes, 2021). The regional economy requires modern

agricultural strategies featuring innovative farming technologies with better irrigation systems and contemporary farming methods to solve current obstacles and trigger economic progress in this area. Agricultural modernization contains multiple aspects which relate to technology advancements and agricultural practice advancements along with improvements in policies and infrastructure (Duncan et al., 2021; Huang & Xiong, 2022). Modern agricultural changes typically generate better farmer productivity levels with enhanced efficiency alongside improved profits. Modernization advances farming by implementing mechanical machinery along with precision agriculture methods combined with digital systems that enhance sustainable and profitable agriculture (Reddy, 2022; Ten et al., 2023). Multiple contextual factors involving local culture together with economic conditions as well as infrastructure play a key role in determining why agricultural modernization succeeds in some areas rather than others.

Maros Regency stands to solve both its farmers' poor productivity levels and local poverty through modern agricultural practices. South Sulawesi government recently devoted its efforts to develop agricultural infrastructure while training local farmers and making modern farming tools readily available. The initiatives launched by South Sulawesi government have established conditions where Maros can undergo substantial changes in its agricultural industry. Educational institutions play a vital role in economic progress through agricultural reform since this particular relationship lacks adequate scholarly investigation. This research intends to bridge this academic knowledge gap.

A broad concept of economic development consists of improving population standards through expansion of economic activities combined with new job markets and advanced infrastructure and social programs (Jie et al., 2023; Xu et al., 2022). The economic development of Maros Regency depends on farming productivity because agriculture represents its main economic protector and societal structure. Agricultural modernization generates various beneficial outcomes according to research results which lead to increased farm revenue and job market expansion and better standards of living. The development of economic systems takes shape through agricultural transformation because it generates positive results that strengthen the entire economy.

The potential of modernizing agriculture for Maros economic development stands evident but scientific research about its direct outcomes on regional indicators remains scarce. The findings on how agricultural modernization affects economic development at the nation and provincial scales presented do not extend specifically to Maros Regency. Available research produces anecdotal findings through qualitative study methods rather than applying statistical methods to the evidence. The present investigation adopts quantitative methods to evaluate agricultural modernization's effects on Maros Regency's GDP growth and employment in agriculture as well as income levels through analytic statistical data.

The current research contributes significant value because it addresses a missing connection in existing knowledge which enables policy decisions for Maros' local government stakeholders and agricultural groups. The results will help develop sustainable economic development strategies through understanding the relationship between agricultural modernization and economic development in Maros. The research findings serve as a guide to create better agricultural policies and enhance modern technology availability for farmers so the Maros Regency can receive long-term economic benefits.

Method

Researchers performed a quantitative statistical analysis to study agricultural modernization effects on economic development within Maros Regency, South Sulawesi. The study pursued

empirical verification of agricultural modernization effects on crucial economic measurements that involved GDP expansion together with labor force composition in farming and earnings patterns across the region. Measuring the patterns between agricultural modernization and economic development in this study used correlational research design that investigated any relationships without variant manipulation.

The study used agricultural stakeholders in Maros Regency as its population through three distinct groups of farmers, agricultural business owners, and local government personnel who participate in agricultural policy development. The study applied stratified random sampling to extract samples across three agricultural sectors including farming crops and rearing livestock and processing agriculture. A final 200-participant sample contained 150 farming respondents alongside thirty agribusiness representatives and twenty representatives of the local government who were selected from numerous sub-districts within Maros Regency for balanced collection.

The research data originated from two main sources: surveys with questionnaire administration and secondary data analysis. The selected respondents received a questionnaire that had been designed in a structured format. The survey instrument contained specific questions which evaluated modernization in Maros Regency agriculture through questions about farm technology usage and farming practice advancement and local training availability. Respondents supplied further information about shifting economic indicators which included agricultural income levels in combination with agricultural productivity and job market changes in agriculture. Data about economic indicators came from government reports and local agencies along with primary survey results to support the validity of primary data collection.

The research study established technological adoption and improvements to farming practices together with training/support programs as three separate independent variables. Considering individual agricultural modernization aspects allows for an evaluation of their impact on GDP growth as well as income levels and employment within the agricultural sector. The research analyzed two primary hypotheses which stated that modernized agriculture produces positive economic development and technological adoption plays a superior role compared to other modernization strategies. These proposed assumptions served to understand how modernization methods contribute to regional economic development.

The researchers processed the obtained data through SPSS statistical software. The research data revealed statistical results by means together with standard deviations and frequency distributions which detailed the basic traits of the participants along with agricultural modernization aspects. The research used Pearson's correlation coefficient to determine the directional strength and quantitative relationship between independent variables and the dependent economic indicators. The study used multiple regression analysis to measure each factor of agricultural modernization's influence on economic development after considering other factors including age, education and farming experience.

Result and Discussion

This research examines the impact of agricultural modernization on economic development in Maros Regency, South Sulawesi, focusing on technological adoption, improvements in farming practices, and training/support programs. Given the region's reliance on agriculture as a primary economic driver, modernization efforts play a crucial role in enhancing productivity, increasing income levels, and sustaining employment in the sector. While previous studies have explored agricultural modernization broadly, limited empirical research has addressed its direct economic implications in this specific locality. By employing a quantitative approach, this

study aims to fill this gap by providing statistical insights into how modernization influences key economic indicators. The findings contribute to policy discussions on optimizing agricultural strategies for regional economic growth and sustainability.

Table 1. Descriptive Statistics of Respondents

Variable	Category	Frequency	Percentage
Occupation	Farmers	150	75%
	Agricultural Business Owners	30	15%
	Local Government Officials	20	10%
Age Range	18-30 years	50	25%
	31-40 years	60	30%
	41-50 years	50	25%
	51+ years	40	20%
Education Level	High School	80	40%
	Bachelor's Degree	90	45%
	Postgraduate	30	15%

A comprehensive analysis of participant characteristics appears in this table regarding occupational categories and age brackets and educational backgrounds of the respondents. A large portion of the sample group consisted of farmers at 75% while agricultural business owners and local government officials made up 15% and 10% respectively. A majority of the participants were farmers demonstrating the representative character of agricultural field workers in the sample. Most survey participants fell within the 31- to 40-year-old age demographic (30%) while younger and older respondents were substantially present. The study participants mostly pursued bachelor degree education (45%) while high school graduates made up 40% of respondents.

Table 2. Descriptive Statistics of Agricultural Modernization Aspects

Modernization Aspect	Mean	Standard Deviation
Technological Adoption	4.2	0.7
Improvement in Farming Practices	4.0	0.8
Training and Support	3.8	0.9

The table shows both mean and standard deviation values regarding agricultural modernization aspects. Results show people in this region adopted modern technologies at the medium-high level with a score average of 4.2. The use of precision farming and crop rotation practices was moderately widespread among farmers (mean = 4.0) according to survey results although farmer training support services received a lower average score (mean = 3.8) which indicates further potential for development.

Table 3. Descriptive Statistics of Economic Development Indicators

Economic Indicator	Mean	Standard Deviation
GDP Growth	3.5%	1.2%
Income Levels (per annum)	15,000,000 IDR	5,000,000 IDR
Employment in Agriculture	50%	10%

Table 3 summarizes the economic indicators used in the study. The average GDP growth rate of 3.5% reflects a moderate contribution from the agricultural sector to the regional economy. The average income level for farmers and agricultural workers in the region is 15 million IDR per annum, indicating that agricultural activities contribute to the livelihood of local people. Employment in agriculture remains high at 50%, signifying that a significant portion of the

population is still dependent on agriculture for employment. These indicators suggest that agriculture plays an important role in the economic development of Maros Regency.

Table 4. Pearson Correlation Coefficients Between Agricultural Modernization and Economic Development

Variable	Technological Adoption	Improvement in Farming Practices	Training and Support
GDP Growth	0.45	0.38	0.30
Income Levels	0.56	0.49	0.42
Employment in Agriculture	0.38	0.41	0.29

The correlation research demonstrated positive associations between modern agricultural aspects and economic development measures in Maros Regency particularly in technological applications and improved farming methods and enhanced training initiatives. The implementation of technological advancements formed a strong correlation with GDP growth (0.45), income levels (0.56) and agricultural employment (0.38). The implementation of modern technology at higher levels leads to positive economic development results. The practiced improvements in farming demonstrated positive connections across the three economic indicators especially for income levels (0.49) and GDP growth (0.38). Training and support services experienced reduced correlations regarding economic outcomes when compared to technological adoption and farming practice improvements. The strength of relationships between these variables revealed that GDP growth correlated at 0.30 while income levels reached 0.42 strength and employment in agriculture stood at 0.29. Data demonstrates that economic growth development through training and support services plays a supplementary role after technological adoption and farming practice improvements occur.

Table 5. Multiple Regression Analysis Results for Economic Development Indicators

Dependent Variable	Independent Variable	Beta	Standard Error	t-value	p-value
GDP Growth	Technological Adoption	0.45	0.09	5.00	0.000
	Improvement in Farming Practices	0.30	0.08	3.75	0.001
	Training and Support	0.21	0.07	2.50	0.013
Income Levels	Technological Adoption	0.50	0.08	6.25	0.000
	Improvement in Farming Practices	0.33	0.07	4.70	0.000
	Training and Support	0.24	0.06	4.00	0.000
Employment in Agriculture	Technological Adoption	0.38	0.10	3.80	0.000
	Improvement in Farming Practices	0.30	0.09	3.33	0.001
	Training and Support	0.22	0.08	2.75	0.007

A multiple regression analysis demonstrates that Maros Regency economic growth indicators receive strong impacts from modern agricultural developments. The adoption of technology drove the most substantial positive effect on GDP growth and income levels and agricultural labor force numbers (Beta = 0.45, p = 0.000, Beta = 0.50, p = 0.000, Beta = 0.38, p = 0.000). The implementation of improved farming practices increased all three indicators of GDP growth (Beta = 0.30, p = 0.001) and both income levels (Beta = 0.33, p = 0.000) and agricultural employment (Beta = 0.30, p = 0.001). The effect of training services combined with support

services proved positive but weaker in nature across all indicators while impacting GDP growth statistically significant ($\text{Beta} = 0.21$, $p = 0.013$) alongside income levels ($\text{Beta} = 0.24$, $p = 0.000$) and agricultural employment ($\text{Beta} = 0.22$, $p = 0.007$). Economic development depends heavily on technological adoption in combination with farming improvements as indicated by these study results yet training and support services contribute to a lesser extent to economic growth.

The research assessed economic development trends in Maros Regency's agriculture through analyzing technological adoption practices and agricultural practice advancements and supporting service programs. The research obtains evidence that new technological implementations along with farming practice enhancement drives GDP growth and brings higher income and generates more jobs in agriculture. The study outcomes both verify existing academic literature and supply necessary insights about agricultural modernization patterns throughout rural Indonesia and specifically in Maros Regency.

The findings match studies from across the world which establish modern agricultural technology as an essential driver of development. Multiple research findings demonstrate that agricultural breakthroughs including advanced irrigation systems together with tools and precision farming produce better crop yields and distribute wealth improvement across Maros Regency as well as globally (Lakhiar et al., 2024; Alharbi et al., 2024). New technology adoption in Maros Regency produced noteworthy relationships with improved GDP development ($r = 0.45$) and agricultural labor market evolution ($r = 0.38$) as well as income generation levels ($r = 0.56$). These relationships match the findings of research groups who found technological advances fuel rural economic development (Chen et al., 2023; Mewes & Broekel, 2022).

The adoption of improved farming practices including crop rotation techniques along with better soil management and sustainable farming approaches generated considerable economic effects within this research. Research shows that farmers who improve their agricultural methods tend to experience higher GDP growth ($r = 0.38$) and increased incomes ($r = 0.49$) as described in literature by Novisma & Iskandar (2023). The findings highlight the importance of enhanced farming methods because they create positive employment impacts on agricultural employment ($r = 0.30$) alongside their proven ability to boost agricultural output.

This research assumes particular importance because it demonstrates how training together with support services promote economic development. Statistical significance remained intact even though the training support-economic indicators correlation proved weaker than the relationship between technological adoption and farming improvements. GDP growth rates ($r = 0.30$), income levels ($r = 0.42$) and agricultural employment levels ($r = 0.29$) experienced positive relationship with training and support services. The study contributes new evidence about agricultural extension services which serve as a catalyst for farmers to embrace contemporary agricultural methods. This study validates extension services as essential for rural Indonesia because they bridge the knowledge-to-practice gap since residents in rural areas typically lack access to modern agricultural knowledge according to Eryanto et al. (2023).

The multiple regression analysis provided further insights into the relative contributions of each aspect of agricultural modernization. Technological adoption emerged as the most significant driver of economic development, with a Beta coefficient of 0.45 for GDP growth, 0.50 for income levels, and 0.38 for employment in agriculture. These findings are consistent with previous research, which suggests that modern technology is a primary catalyst for economic growth in developing agricultural economies (Park et al., 2023; Paramati et al., 2022; Fernández et al., 2021). The impact of farming practices was also substantial, especially in

terms of income levels (Beta = 0.33) and GDP growth (Beta = 0.30), confirming the value of sustainable agronomic practices in enhancing both short- and long-term economic outcomes.

Training and support services maintained an influential yet diminished connection with the three metrics (Beta = 0.21 for GDP growth, Beta = 0.24 for income levels, and Beta = 0.22 for employment). These research findings add to existing studies that training alongside support remains critical but its efficacy depends on multiple other aspects including resource availability as well as farmer education level and extension service expansion (Hendriarto et al., 2021; Levitt et al., 2021; Luo et al., 2022). The central position of extension services in agricultural modernization becomes less predominant compared to previous research findings. This research indicates that support services independently need augmentation through contemporary agricultural reforms to increase their beneficial influence in farm communities.

The research provides valuable information about Maros Regency because it explores this specific area that contains distinctive agricultural issues and possibilities (Peimani & Kamalipour, 2021; Afshan et al., 2021; Baber, 2021). This research dedicates attention to agricultural modernization efforts across smaller and less commercialized farming areas in Indonesia since most studies explore more established regions (Kheradmandi & Mehranfar, 2022). The research delivers specific findings which South Sulawesi officials together with other regional governments should consider because they demonstrate why technological progress coupled with sustainable agricultural methods combined with farmer support structures lead to economic progression.

Conclusion

Agricultural modernization has been acknowledged as the main driver that pushes forward economic development within Maros Regency of South Sulawesi. The collected data shows that adopting new technologies together with enhanced farming practices and agricultural training services lead to improved GDP growth and better income levels and employment numbers in agricultural sectors. Technology adoption proved to be the strongest influencing factor because it functions as a key driver for rural economic changes. The research addresses a crucial knowledge gap by investigating an undershifted region of Indonesia which provides critical findings to support policymakers in advancing agricultural modernization throughout similar agricultural areas.

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