

# The Role of Rice Cultivation Techniques, Farm Management and Natural Resources on Agricultural Development in Indonesia: Moderating Role of Government Support

**Apiaty Kamaluddin**

Faculty of Agriculture,  
Universitas Pepabri Makassar, Indonesia  
Email: [apiatyamin53@gmail.com](mailto:apiatyamin53@gmail.com)

Agricultural development is crucial for global economic growth and warrants the researcher's attention. This article examines the influence of rice cultivation techniques, farm management, and natural resources on agricultural development in Indonesia. This study investigates the moderating effect of government support on rice cultivation techniques, farm management, natural resources, and agricultural development in Indonesia. The researchers employed a survey questionnaire to collect primary data from the chosen participants. The researchers used smart-PLS to analyse the relationship between variables. The study findings indicate that rice cultivation techniques, farm management, and natural resources play a beneficial role in promoting agricultural development in Indonesia. The findings suggest that government support plays a significant role in moderating the relationship between rice cultivation techniques, natural resources, and agricultural development in Indonesia. The study provides guidance to policymakers on policies aimed at improving agricultural development through the implementation of effective rice cultivation techniques, farm management, and the sustainable use of natural resources.

**Keywords:** Rice cultivation techniques, farm management, natural resources, government support, agricultural development.

## 1. Introduction

In recent decades, the global community has encountered various challenges, with the sustainability of the agriculture sector being particularly significant. The agriculture sector is confronted with significant challenges such as climate change, natural resource depletion, and inadequate agricultural technologies. The challenges faced by the agriculture industry hinder its ability to meet the growing global food demand. Agriculture plays a vital role in the economic development of every nation. Agriculture plays a dual role in a country's economy by providing sustenance for its population and fostering interdependence with other industries. The stability of a country's agriculture sector is considered crucial for its overall social, political, and economic stability. In contrast, individuals in developing countries who depend on agriculture as their primary source of income tend to have lower socioeconomic status compared to those employed in alternative sectors of the economy. In many countries, a significant portion of the population living in poverty is comprised of individuals engaged in agricultural activities. Consequently, the agricultural sector has experienced enhanced overall performance. Improving the agriculture sector is crucial due to its role in generating employment opportunities for local inhabitants. Agriculture is commonly considered to be the primary economic sector in developing countries. According to [Tudi et al. \(2021\)](#), the agricultural sector contributes to approximately 30–60% of the total gross domestic product (GDP) and employs approximately 70% of the total workforce. Agriculture in developing nations exhibits a significant labour force in comparison to other industries. Agriculture serves as the primary employment sector in most developing nations. The farm owner often finds it necessary to hire additional labourers to effectively

manage the cultivation of the land and the care of the cattle ([Qaim, 2020](#)). Work opportunities in the agricultural sector are diversifying beyond traditional farming to include areas such as agriculture processing, advertising, and packaging. Improvements in the agricultural sector have the potential to significantly reduce unemployment rates in emerging nations.

Addressing hunger, poverty, and ensuring the sustainability of agricultural and food systems pose significant challenges in the present era. Ensuring the provision of clean and fresh food for future generations is a significant priority, particularly in light of the increasing global population ([Basso & Antle, 2020](#)). Global food production is outpacing both population growth and per capita consumption. The global population is projected to surpass 10 billion individuals by 2050, representing 34% growth compared to the current population ([Griesche & Baeumner, 2020](#)). The developing world is projected to contribute significantly to the overall increase in global population. Natural resources, farmers' abilities, farm management, agriculture technologies, and government support are just a few of the variables that can make or break the agriculture industry ([Alizamir, Irvani, & Mamani, 2019](#); [Klerkx & Jansen, 2010](#); [Koochafkan, Altieri, & Gimenez, 2012](#); [Singh et al., 2017](#); [Wright & Annes, 2016](#)). This study focuses on the impact of cultivation techniques, farm management practices, and natural resources on the development of agriculture. The study also examined the moderating effect of government support.

## 2. Aims and Objectives

Over the course of time, various industries across the globe are undergoing a process of modernization. Certain industries, such as agriculture, exert significant influences on the nation. Agriculture serves the dual purpose of

meeting the nutritional requirements of a population while also making significant contributions to a nation's economy. The performance of the agriculture industry is contingent upon the integration of contemporary technologies in cultivation practises, which serve to enhance its overall efficacy. In the present study, [Hu et al. \(2019\)](#) examined the interrelationship between various cultivation methods, rice growth, and development. The investigation focused on examining the relationship within the population of China. The study utilised a quantitative approach. A sample was collected consisting of quantitative data from fragrant rice cultivars with a growth period ranging from 111 to 114 days. The sample data utilised in this study was collected from a plantation in the year 2017. To investigate the aforementioned relationship, the analysis methods outlined in Statistics 8.1 were utilised.

The analysis results indicate that various rice cultivation methods, such as direct seeding and transplanting, significantly influence both the growth and development of rice. [Lakhia et al. \(2018\)](#) investigated contemporary plant cultivation technologies in modern agriculture. The study also examined the controlled environment. The study conducted a review of existing literature. The review findings indicate that modern cultivation technologies significantly impact contemporary agriculture. Moreover, the implementation of advanced plant cultivation technologies leads to a revolution in the agricultural industry and subsequently enhances production. In light of the growing global food demand, it is imperative to embrace innovative methods of crop cultivation to not only sustain agriculture but also meet the nutritional requirements. Food varies globally. Certain practises or preferences may be favoured in developed economies, while they may not be as preferred or applicable in developing economies.

Several factors contribute to this phenomenon, including resource availability and land and water-related concerns. Mushrooms are highly regarded as a popular food item worldwide. The high demand for this product significantly impacts the agriculture sector. [Higgins et al. \(2017\)](#) conducted research on mushroom cultivation. The study also examined and compared different cultivation technologies. The study focused on developing economies. The study conducted a review of the existing literature. The extracted results from the review were subsequently combined to compare various cultivation methodologies in terms of cost, required resources, and overall performance. Mushroom farming in underdeveloped countries presents both challenges and opportunities. Two significant challenges faced in impoverished regions include issues related to spore production as well as post-harvest transportation and storage. The decided hypothesis is as under:

**H1:** *Cultivation techniques have an association with agriculture development.*

The performance of the agriculture sector depends on various factors, including land type, farmers' skills, farm management, cultivation techniques, and related factors. Farm management is a crucial determinant that exercises

control over other factors. Existing literature suggests a strong connection between farm management and agricultural development. [Said Mohamed et al. \(2021\)](#) investigated the impact of smart farming on agriculture management, specifically focusing on the role of farm management. The study also examined the utilisation of contemporary farming technologies to enhance agricultural productivity. This study focused on the implementation of a novel smart farming approach worldwide between 2019 and 2021. The study findings suggest that smart farming has a significant impact on the agriculture industry. The integration of modern technologies such as artificial intelligence, the Internet of Things, and mobile Internet has the potential to revolutionise contemporary farming practices. This can lead to increased productivity and reduced human intervention in agricultural processes.

Additionally, the study suggests that the global community should embrace contemporary agricultural technologies, especially in developing nations, in order to meet the demand for food. [Rose et al. \(2019\)](#) investigated the role of integrated farm management in sustainable agriculture. The study also examined knowledge exchange and policy. The study utilised interview data from farms as a representative sample. Interviews were conducted with a sample size of 78 farmers from various farming groups. The study findings suggest that integrated farming significantly impacts the agricultural industry. Integrated farming involves the utilisation of modern agricultural technologies, leading to enhanced food production.

Moreover, the study suggests that global adoption of modern farming technologies, particularly in developing economies, is necessary to meet the growing demand for food. [Sarker et al. \(2019\)](#) investigated the use of digital agriculture in promoting sustainable farm management. The study conducted a review of the relevant literature. The study used articles published in 2006 as a representative sample. The chosen time period spans from 2012 to 2018. The articles were obtained from various research engines, such as Google Scholar, Sage, and Taylor & Francis. The findings suggest that digital agriculture significantly impacts the practice of sustainable farm management. Additionally, the study suggests that global adoption of digital agriculture could improve agricultural productivity and meet food demands. The decided hypothesis is as under:

**H2:** *Farm management has an association with agriculture development.*

The availability of natural resources significantly impacts the agricultural sector's outcomes in any given country. Every nation strives to optimise the utilisation of its natural resources in order to achieve maximum productivity. [Lu, Bai, Li, and Wang \(2019\)](#) investigated the interconnections between climate change, natural resources (specifically water resources), and agriculture. The research was carried out on the agricultural sector in China. The findings suggest a significant impact of climate change on global natural resources. Natural resources are diminishing over time. The depletion of natural resources has a negative impact on global agriculture.

Additionally, the study suggests that global efforts should be made to address the negative impacts of climate change in order to mitigate the depletion of natural resources and increase agricultural production to meet food demands. [Jiang et al. \(2017\)](#) investigated the sustainability of natural resources (i.e., waters), in relation to agriculture, focusing on grain production, trade, and consumption. The research was carried out in the agricultural sector in China. The study examined the period of tenure between 2004 and 2013. The findings indicate a significant correlation between agriculture and the sustainability of natural resources.

As a result, sustainable management of natural resources leads to increased grain production in order to meet the growing global food demand. Additionally, the study suggests that global efforts should be made to regulate the sustainable use of natural resources in order to enhance agricultural production and meet the growing demand for food. [Aghapour Sabbaghi, Nazari, Araghinejad, and Soufizadeh \(2020\)](#) examined the economic impact of climate change on natural resources, specifically water and agriculture. The research was carried out on the agricultural sector in Iran. The findings suggest that climate change significantly impacts natural resources (i.e., waters) and agriculture in terms of their economic implications. Additionally, the study suggests that global attention should be directed towards addressing the economic implications of climate change and its detrimental effects. The decided hypothesis is as under:

**H3:** *Natural resources have an association with agricultural development.*

The implementation of contemporary cultivation methods is regarded as a crucial element in the prosperity of a nation's agricultural industry. The divergence in the agricultural industries' outcomes between the two economies can be attributed to the varying levels of adoption of contemporary technologies, specifically in cultivation techniques. Despite the implementation of modern technologies, the agricultural industry often fails to achieve the desired levels of productivity. Government support moderates the relationship between factors in this context. [Kim, Kim, Suh, and ZHENG \(2016\)](#) examined the relationship between service innovation, R&D activities, and the support system in the context of moderation. The study also examined the influence of government support as a moderating factor. The study examined the relationship within the Korean population. The study utilised a quantitative approach.

The quantitative data of 54831 companies was taken as a sample. The study used the simple random sampling technique. The selected data collection was carried out through questionnaires. For the examination of the aforementioned relationship, the MR analysis approach was employed. The results extracted after analysis proposed that service innovation has a nexus with R&D activities as well as a support system. Further, government support moderates the nexus aimed at service innovation and R&D activities as well as the support system. Similarly, [Saber and Hamdan \(2019\)](#) checked the nexus aimed at entrepreneurship and economic growth.

The study also explored the moderating effect of government support. The relationship was investigated in the population of GCC economies. The quantitative approach was adopted in the study. A sample consisting of quantitative data from a 10-year period was collected. The study employed simple random sampling. The chosen date falls within the period from 2016 to 2015. To examine the relationship mentioned above, the study utilised the Smart-PLS analysis approach. The results of the analysis suggest a relationship between entrepreneurship and economic growth. Moreover, government assistance plays a crucial role in fostering the connection between entrepreneurship and economic growth. The decided hypothesis is as under:

**H4:** *Government support moderates the nexus aimed at cultivation techniques and agriculture development.*

Effective farm management is crucial for the overall success and sustainability of the agriculture sector. Despite effective farm management, the agricultural sector often fails to achieve improved performance. Various factors contribute to this phenomenon, including government policies pertaining to agriculture and the proficiency of farmers. Government support affects this relationship by acting as a moderator. [Seow, Choong, and Ramayah \(2021\)](#) examined the relationship between enterprise business performance and the tourism industry within the context of moderation. The study also examined how government support influences the relationship between variables as well as how innovative practice mediates this relationship. The study examined the relationship within the Malaysian population. The study employed a quantitative approach. A sample of 278 businesses was collected for quantitative data analysis. The study employed the quota sampling technique. Data collection was conducted using questionnaires.

To analyse the relationship mentioned above, we utilised the PLS-SEM analysis approaches. The analysis results suggest a correlation between enterprise business performance and the tourism industry. Additionally, the government provides support for both traditional and innovative practises that facilitate the connection between enterprise business performance and the tourism industry. [Kim, Oh, Park, and Joo \(2018\)](#) examined the relationship between perceived value and intentions to adopt electric vehicles. The study also examined how government support and environmental traits moderate the effects. The study examined the relationship within the Korean population. The study employed a quantitative approach. A sample of 285 drivers was used to collect quantitative data. The study employed simple random sampling. Data collection was conducted using questionnaires. To analyse the relationship mentioned above, ML regression analysis methods were used. The analysis results suggest a relationship between perceived value and intentions to adopt electric vehicles.

Additionally, the relationship between perceived value and intentions to adopt electric vehicles is influenced by government support and environmental characteristics. The decided hypothesis is as under:

**H5:** *Government support moderates the nexus aimed at farm management and agriculture development.*

The presence of ample natural resources does not ensure agricultural prosperity. Farmers often fail to effectively utilise resources, resulting in suboptimal output. In this scenario, the government provides support to professionals in the agriculture sector to assist farmers, aiming to enhance the performance of the agriculture sector by serving as mediators. Tse et al. (2021) examined the relationship between moderation and the nexus of research and development (R&D) and innovation. The study also examined how government support and entry mode influence the relationship in question. The study examined the relationship within the population of multinational enterprise (MNE) subsidiaries. The study employed a quantitative approach. A sample of 524 firms was used to collect quantitative data. The study employed random sampling. Data collection was conducted using questionnaires. To analyse the relationship mentioned above, regression analysis methods were utilised. The analysis results suggest a correlation between research and development (R&D) and innovation.

Additionally, the relationship between research and development (R&D) and innovation is influenced by government support and the mode of entry into the market. Yang and Liu (2023) examined the relationship between SDGs, financial knowledge, investment strategies, and organisational profitability. The study also examined the influence of government support as a moderator. The study examined the relationship within the Chinese population. The study employed a quantitative approach. A sample of 540 employees was used to collect quantitative data. The study employed a simple random sampling method. The data collection was conducted using questionnaires. To analyse the relationship mentioned above, we utilised Smart-PLS analysis methods. The analysis revealed a significant relationship between SDGs, financial knowledge, investment strategies, and organisational profitability. Government support and entry modes play a moderating role in the relationship between sustainable development goals (SDGs), financial knowledge, investment strategies, and organisational profitability. The decided hypothesis is as under:

**H6:** *Government support moderates the nexus aimed at natural resources and agriculture development.*

### 3. Research Significance

The present study aims to: 1) elucidate the significance of agricultural development in addressing global food demand; 2) contribute to the existing literature on food agriculture development, with a specific focus on Indonesia; 3) enhance the understanding of professionals in the agriculture industry regarding the sector's requirements; and 4) identify the necessary measures to achieve sustainability. Lastly, it aims to provide insights to professional.

### 4. Structure of Review

This study aims to address literature gaps related to the model consisting of variables such as cultivation techniques, farm management, natural resources, and agriculture development, with a specific focus on the

moderating effect of government support in Indonesia. These gaps have not been extensively explored in recent research. 1) Higgins et al. (2017) and Lakhier et al. (2018) investigated the relationship between cultivation techniques and agricultural development. In addition, they examined the impact of factors such as farm management, natural resources, and government support on this relationship in Indonesia, 2) Rose et al. (2019) and Sarker et al. (2019) investigated the relationship between farm management and agriculture development. In addition to this, they examined the impact of cultivation techniques, natural resources, and government support as moderating factors in Indonesia. 3) Lu, Bai, Li, and Wang (2019) investigated the relationship between natural resources and agricultural development, specifically examining the impact of cultivation techniques, farm management, and government support as moderating factors in Indonesia, 4) Kim, Kim, Suh, and ZHENG (2016), Saberi and Hamdan (2019), and Seow, Choong, and Ramayah (2021) have examined the moderating effect of government support in various contexts. In addition, government support is also used as a moderating variable in the context of cultivation techniques, farm management, natural resources, and agriculture development, specifically in Indonesia.

### 5. Research Method

This article examines the influence of rice cultivation techniques, farm management, and natural resources on agricultural development in Indonesia. It also explores the moderating effect of government support on these factors. The researchers employed a survey questionnaire to collect primary data from the chosen participants. The questionnaire used in this study was derived from previous literature. The cultivation techniques section consisted of five questions (Ammatillah, Sutardi, Aminah, & Nurmalinga, 2022), the farm management section had six questions (Takeuchi-Storm et al., 2019), the natural resources section included five items (Grilli & Notaro, 2019), the government support section comprised of four questions (Zulu-Chisanga, Chabala, & Mandawa-Bray, 2021), and the agricultural development section consisted of five questions (Kustepeli, Gulcan, Yercan, & Yildirim, 2023).

The primary data for this study was collected from Indonesian farmers. The farmers were selected using a simple random sampling method. The surveys were administered to farmers through in-person visits. Out of the 534 surveys sent by the researchers, only 290 valid responses were received, indicating a response rate of approximately 54.31%. Additionally, the researchers used smart-PLS to analyse the relationship between variables. Smart-PLS is a statistical tool commonly employed for analysing primary data. It is particularly effective when dealing with larger data sets and intricate frameworks (Hair, Howard, & Nitzl, 2020). The study employed three predictors, namely cultivation techniques (CT), farm management (FM), and natural resources (NR). Additionally, the study incorporated a moderating construct called government support (GS) and a predictive construct known as agricultural development (AD). The constructs are depicted in Figure 1.



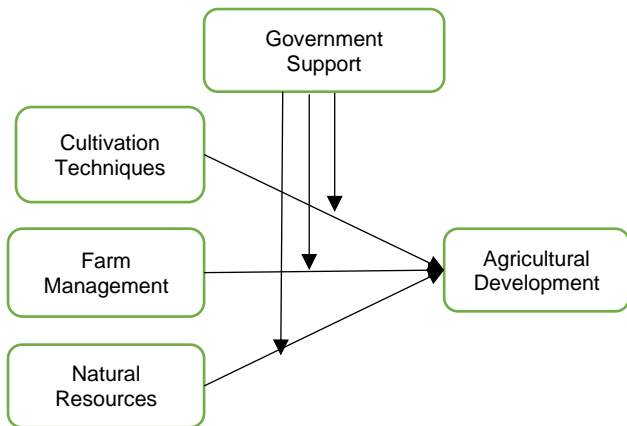


Figure 1: Research framework

## 6. Results

### 6.1 Research Findings

This study investigates the convergent validity of items by examining their correlation. The examination involves the use of average variance extracted (AVE) and factor loadings, both of which indicate values higher than 0.50. Furthermore, the study also assessed the construct's reliability using composite reliability (CR) and Alpha. The findings revealed that the obtained values exceeded the threshold of 0.70. The results suggest a strong correlation among the items. The outcomes are presented in Table 1.

Table 1: Convergent validity

Constructs	Items	Loadings	Alpha	CR	AVE
Agricultural Development	AD1	0.695	0.774	0.845	0.526
	AD2	0.652			
	AD3	0.609			
	AD4	0.783			
	AD5	0.859			
Cultivation Techniques	CT1	0.880	0.858	0.907	0.714
	CT2	0.647			
	CT3	0.907			
	CT5	0.916			
	CT4	0.916			
Farm Management	FM1	0.888	0.898	0.922	0.667
	FM2	0.676			
	FM3	0.754			
	FM4	0.925			
	FM5	0.756			
	FM6	0.871			
Government Support	GS1	0.827	0.901	0.931	0.773
	GS2	0.937			
	GS3	0.805			
	GS4	0.939			
Natural Resources	NR2	0.921	0.785	0.873	0.698
	NR4	0.858			
	NR5	0.713			
	NR3	0.921			
	NR1	0.858			

This study investigates the discriminant validity of variables and their correlations. The Heterotrait Monotrait (HTMT) ratio is used for examination. The results indicate that the HTMT ratio values are below 0.90. The results suggest a low correlation among the variables. The outcomes are presented in Table 2.

Table 2: Discriminant validity

	AD	CT	FM	GS	NR
AD					
CT	0.861				
FM	0.675	0.768			
GS	0.455	0.320	0.249		
NR	0.874	0.668	0.498	0.732	

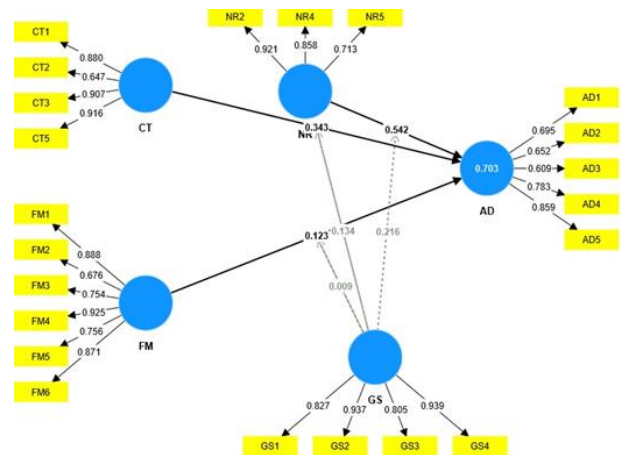


Figure 2: Measurement assessment model

The findings indicate that rice cultivation techniques, farm management, and natural resources positively influence agricultural development in Indonesia, supporting hypotheses H1, H2, and H3. The results of the study suggest that government support plays a significant role in moderating the relationship between rice cultivation techniques, natural resources, and agricultural development in Indonesia. This finding supports hypotheses H4 and H6. The nexus mentioned can be found in Table 3.

Table 3: Path analysis

Relationships	Beta	Standard deviation	T statistics	P values
CT -> AD	0.343	0.055	6.281	0.000
FM -> AD	0.123	0.046	2.649	0.008
GS -> AD	0.092	0.043	2.132	0.033
NR -> AD	0.542	0.044	12.231	0.000
GS x NR -> AD	0.216	0.046	4.660	0.000
GS x CT -> AD	0.134	0.049	2.718	0.007
GS x FM -> AD	0.009	0.050	0.185	0.853

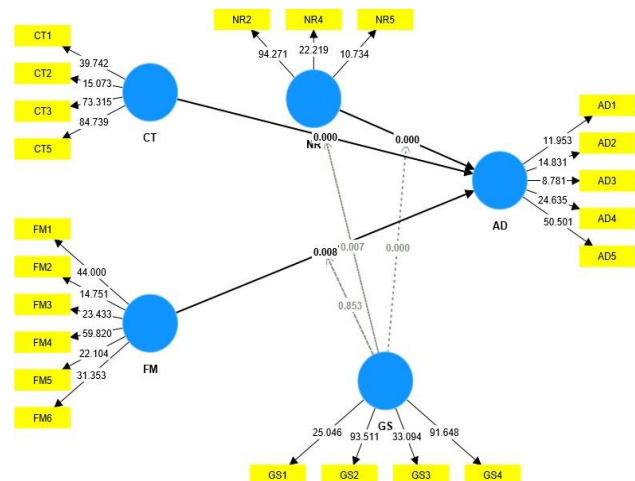


Figure 3: Structural assessment model

## 7. Findings

The study reveals that agricultural development is significantly influenced by cultivation techniques, farm management practices, and the availability of natural resources. According to Irvan and Yuliarmi (2019) research, cultivation techniques play a crucial role in agricultural development by offering various advantages that contribute to enhanced production and sustainability. One significant advantage is evident in the domain of soil

health. Crop rotation and no-till farming are effective strategies for preserving soil moisture and maintaining organic matter levels (Rusinamhodzi, 2020). This promotes nutrient-rich soils, which create optimal conditions for plant growth. In addition, farmers can utilise precision agriculture techniques, such as GPS and remote sensing, to accurately apply inputs. This practice decreases waste and mitigates environmental consequences.

These methods enhance resource efficiency by optimising agricultural yields and reducing the ecological impact of agriculture. Cultivation methods contribute to the resilience and diversification of agricultural systems. Intercropping and agroforestry techniques mitigate the risks associated with monoculture by enhancing biodiversity and simultaneously enhancing overall yield. Diversification can enhance the resilience of agricultural systems against climate disasters and market crashes. The implementation of modern irrigation methods, such as drip irrigation and precision watering systems, can significantly enhance water efficiency. Kamaludin, Narmaditya, Wibowo, and Febrianto (2021) found that these methods effectively reduce water wastage and alleviate strain on water resources in regions facing water scarcity. This is achieved by directly supplying water to the root zone.

The study's findings indicate that effective farm management is a crucial factor in achieving successful outcomes in agricultural development. According to Mariyono (2019), farm management encompasses a range of actions and decisions that collectively aim to optimise resources, increase productivity, and ensure the long-term sustainability of farming activities. Efficient resource allocation is a key benefit of effective farm management. Farmers can optimise resource allocation, such as seeds, fertiliser, and water, by employing strategic planning, budgeting, and decision-making techniques to minimise waste and maximise production. Increasing the supply of products in the market contributes to improving food security and increasing financial incentives for farmers. Zhai, Martínez, Beltran, and Martínez (2020) found that effective farming management promotes environmental responsibility.

Likewise, Otieno, Zingore, Chemining'wa, and Gachene (2020) and Jowett et al. (2022) emphasise the importance of ecological balance and sustainability. They highlight the implementation of techniques such as conservation tillage, integrated pest management, and agro-ecological approaches as means to achieve these goals. These initiatives promote environmentally sustainable practices in the agriculture industry, aiming to mitigate soil erosion, minimise chemical runoff, and reduce greenhouse gas emissions.

The utilisation of natural resources is a crucial factor in the growth of agriculture, playing a significant role in enhancing the sustainability and productivity of the industry. Irvan and Yuliarmi (2019) research supports the statement that soil fertility is a fundamental natural resource that directly impacts plant growth and agricultural productivity. Crop yields rely on nutrient

uptake, water retention, and root development, which are facilitated by fertile and well-structured soils (Rusinamhodzi, 2020).

Water resources play a vital role in agriculture, as highlighted by Kamaludin, Narmaditya, Wibowo, and Febrianto (2021). Therefore, it is imperative to ensure their sustainable management. Adequate irrigation is crucial in arid regions or during periods of drought to ensure that crops receive the necessary moisture. This statement holds true when wise water conservation practices are implemented. The utilisation of natural resources is a crucial factor in the growth of agriculture, playing a significant role in enhancing the sustainability and productivity of the industry. Irvan and Yuliarmi (2019) research supports the claim that soil fertility is a fundamental natural resource that directly influences agricultural productivity and plant growth. Fertile and well-structured soils facilitate root development, nutrient intake, and water retention, all of which affect crop yields (Rusinamhodzi, 2020). According to Kamaludin, Narmaditya, Wibowo, and Febrianto (2021), water resources play a crucial role in agriculture, necessitating sustainable management. Sufficient irrigation is crucial in arid regions or during periods of drought to ensure that crops receive the necessary moisture. This holds true when coupled with prudent water conservation practices (Sulaiman, Sulaeman, & Minasny, 2019).

The study's findings indicate that government support plays a significant role in mediating the complex relationship between cultivation methods, farm management, natural resources, and agricultural development. Raihan et al. (2022) found that governments exert substantial influence on agricultural practises and outcomes through the implementation of policies, incentives, and regulatory frameworks. Farmers can be incentivized to adopt innovative techniques, such as precision agriculture or organic farming, which enhance productivity and sustainability, through the provision of subsidies and grants (Magdalena & Suhatman, 2020). Like other regulatory frameworks, laws that promote effective farm management practises, such as crop rotation and integrated pest control, aim to encourage efficient resource utilisation and risk mitigation strategies.

Valetskaia, Vorobyova, and Torgashova (2020) argue that government assistance is necessary to foster a supportive environment for agricultural development. Investing in rural infrastructure, including roads, irrigation systems, and market facilities, facilitates the efficient movement of goods and services, thereby enhancing the connectivity between farmers and larger markets. In addition, policies that provide financial support, insurance, and technical knowledge enable farmers to adopt innovative practises and overcome unforeseen challenges (Moeis, Dartanto, Moeis, & Ikhsan, 2020). In conclusion, government assistance plays a vital role in connecting farming practises, farm management, natural resources, and the progress of agriculture. Thoughtfully designed policies and programmes can stimulate positive transformations in the agricultural sector, fostering sustainability, resilience, and economic growth.

## 8. Contributions and Implications

The study has significant implications for agricultural policy and practice. The results emphasise the importance of integrated strategies that consider farming practices, farm management, and resource management as interconnected components for promoting sustainable agriculture. This viewpoint highlights the importance of tailored solutions that consider the complex dynamics of agricultural systems. Moreover, the involvement of the government as a moderating factor underscores the significant influence of policy and regulatory frameworks on the outcomes of agricultural development.

## 9. Future Research Work

To encourage the adoption of best practises, policymakers should prioritise the development and implementation of supportive measures, including funding, incentives, and regulatory frameworks. The study provides guidance to policymakers on formulating policies to improve agricultural development through the implementation of effective rice cultivation techniques, farm management, and sustainable use of natural resources.

## 10. Limitations

The present study yields noteworthy implications; however, it is not without its limitations. The potential variations in agricultural environments across different regions or countries may pose challenges to the generalizability of the research. Various socioeconomic, climatic, and institutional factors may have an impact on the efficiency of farming practices, government initiatives, and cultivation techniques. Furthermore, it is plausible that the study may not have comprehensively accounted for all potential confounding variables that have the potential to impact agricultural growth. Further examination and assessment of additional variables that could potentially influence the observed associations would be advantageous in future research endeavours.

## References

- Aghapour Sabbaghi, M., Nazari, M., Araghinejad, S., & Soufizadeh, S. (2020). Economic impacts of climate change on water resources and agriculture in Zayandehroud river basin in Iran. *Agricultural Water Management*, 241, 106323. doi: <https://doi.org/10.1016/j.agwat.2020.106323>
- Alizamir, S., Irvani, F., & Mamani, H. (2019). An Analysis of Price vs. Revenue Protection: Government Subsidies in the Agriculture Industry. *Management Science*, 65(1), 32-49. doi: <https://doi.org/10.1287/mnsc.2017.2927>
- Ammatillah, C. S., Sutardi, S., Aminah, S., & Nurmalingda, D. (2022). Farmers perceptions of paddy rice cultivation technology in Jakarta city. *IOP Conference Series: Earth and Environmental Science*, 1027(1), 012034. doi: <https://doi.org/10.1088/1755-1315/1027/1/012034>
- Basso, B., & Antle, J. (2020). Digital agriculture to design sustainable agricultural systems. *Nature Sustainability*, 3(4), 254-256. doi: <https://doi.org/10.1038/s41893-020-0510-0>
- Griesche, C., & Baeumner, A. J. (2020). Biosensors to support sustainable agriculture and food safety. *TrAC Trends in Analytical Chemistry*, 128, 115906. doi: <https://doi.org/10.1016/j.trac.2020.115906>
- Grilli, G., & Notaro, S. (2019). Exploring the influence of an extended theory of planned behaviour on preferences and willingness to pay for participatory natural resources management. *Journal of Environmental Management*, 232, 902-909. doi: <https://doi.org/10.1016/j.jenvman.2018.11.103>
- Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101-110. doi: <https://doi.org/10.1016/j.jbusres.2019.11.069>
- Higgins, C., Margot, H., Warnquist, S., Obeysekare, E., & Mehta, K. (2017). Mushroom cultivation in the developing world: A comparison of cultivation technologies. In *2017 IEEE Global Humanitarian Technology Conference (GHTC)* (pp. 1-7). IEEE. doi: <https://doi.org/10.1109/GHTC.2017.8239314>
- Hu, L., Du, P., Luo, H., Cheng, S., Wu, T., He, J., et al. (2019). The effect of different cultivation methods on rice growth and development. *Applied Ecology & Environmental Research*, 17(2), 3867-3875. doi: [http://dx.doi.org/10.15666/aeer/1702\\_38673875](http://dx.doi.org/10.15666/aeer/1702_38673875)
- Irvan, I. P., & Yuliarmi, N. N. (2019). Analysis of impact factors on farmers income. *International Research Journal of Management, IT and Social Sciences*, 6(5), 218-225. doi: <https://doi.org/10.21744/irjmis.v6n5.731>
- Jiang, S., Wang, J., Zhao, Y., Shang, Y., Gao, X., Li, H., et al. (2017). Sustainability of water resources for agriculture considering grain production, trade and consumption in China from 2004 to 2013. *Journal of Cleaner Production*, 149, 1210-1218. doi: <https://doi.org/10.1016/j.jclepro.2017.02.103>
- Jowett, K., Milne, A. E., Potts, S. G., Senapathi, D., & Storkey, J. (2022). Communicating carabids: Engaging farmers to encourage uptake of integrated pest management. *Pest Management Science*, 78(6), 2477-2491. doi: <https://doi.org/10.1002/ps.6878>
- Kamaludin, M., Narmaditya, B. S., Wibowo, A., & Febrianto, I. (2021). Agricultural land resource allocation to develop food crop commodities: lesson from Indonesia. *Heliyon*, 7(7), e07520. doi: <https://doi.org/10.1016/j.heliyon.2021.e07520>
- Kim, M.-K., Oh, J., Park, J.-H., & Joo, C. (2018). Perceived value and adoption intention for electric vehicles in Korea: Moderating effects of environmental traits and government supports. *Energy*, 159, 799-809. doi: <https://doi.org/10.1016/j.energy.2018.06.064>
- Kim, S.-j., Kim, E.-m., Suh, Y., & ZHENG, Z. (2016). The effect of service innovation on R&D activities and government support systems: the moderating role of government support systems in Korea. *Journal of Open Innovation: Technology, Market, and Complexity*, 2(1), 5. doi: <https://doi.org/10.1186/s40852-016-0032-1>



- Klerkx, L., & Jansen, J. (2010). Building knowledge systems for sustainable agriculture: supporting private advisors to adequately address sustainable farm management in regular service contacts. *International Journal of Agricultural Sustainability*, 8(3), 148-163. doi: <https://doi.org/10.3763/ijas.2009.0457>
- Koohafkan, P., Altieri, M. A., & Gimenez, E. H. (2012). Green Agriculture: foundations for biodiverse, resilient and productive agricultural systems. *International Journal of Agricultural Sustainability*, 10(1), 61-75. doi: <https://doi.org/10.1080/14735903.2011.610206>
- Kustepeli, Y., Gulcan, Y., Yercan, M., & Yildirim, B. (2023). The role of agricultural development cooperatives in establishing social capital. *The Annals of Regional Science*, 70(3), 681-704. doi: <https://doi.org/10.1007/s00168-019-00965-4>
- Lakhari, I. A., Gao, J., Syed, T. N., Chandio, F. A., & Buttar, N. A. (2018). Modern plant cultivation technologies in agriculture under controlled environment: a review on aeroponics. *Journal of Plant Interactions*, 13(1), 338-352. doi: <https://doi.org/10.1080/17429145.2018.1472308>
- Lu, S., Bai, X., Li, W., & Wang, N. (2019). Impacts of climate change on water resources and grain production. *Technological Forecasting and Social Change*, 143, 76-84. doi: <https://doi.org/10.1016/j.techfore.2019.01.015>
- Magdalena, S., & Suhatman, R. (2020). The Effect of Government Expenditures, Domestic Investment, Foreign Investment to the Economic Growth of Primary Sector in Central Kalimantan. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 3(3), 1692-1703. doi: <https://doi.org/10.33258/birci.v3i3.1101>
- Mariyono, J. (2019). Stepping up from subsistence to commercial intensive farming to enhance welfare of farmer households in Indonesia. *Asia & the Pacific Policy Studies*, 6(2), 246-265. doi: <https://doi.org/10.1002/app5.276>
- Moeis, F. R., Dartanto, T., Moeis, J. P., & Ikhsan, M. (2020). A longitudinal study of agriculture households in Indonesia: The effect of land and labor mobility on welfare and poverty dynamics. *World Development Perspectives*, 20, 100261. doi: <https://doi.org/10.1016/j.wdp.2020.100261>
- Otieno, H. M. O., Zingore, S., Chemining'wa, G. N., & Gachene, C. K. (2020). Maize (*Zea mays* L.) Growth and Yield Response to Tillage Methods and Fertilizer Combinations in the Midland Agro-ecological Zones of Kenya. *Turkish Journal of Agriculture - Food Science and Technology*, 8(3), 616-624. doi: <https://doi.org/10.24925/turjaf.v8i3.616-624.3097>
- Qaim, M. (2020). Role of New Plant Breeding Technologies for Food Security and Sustainable Agricultural Development. *Applied Economic Perspectives and Policy*, 42(2), 129-150. doi: <https://doi.org/10.1002/aep.13044>
- Raihan, A., Muhtasim, D. A., Pavel, M. I., Faruk, O., & Rahman, M. (2022). An econometric analysis of the potential emission reduction components in Indonesia. *Cleaner Production Letters*, 3, 100008. doi: <https://doi.org/10.1016/j.clpl.2022.100008>
- Rose, D. C., Sutherland, W. J., Barnes, A. P., Borthwick, F., Ffoulkes, C., Hall, C., et al. (2019). Integrated farm management for sustainable agriculture: Lessons for knowledge exchange and policy. *Land Use Policy*, 81, 834-842. doi: <https://doi.org/10.1016/j.landusepol.2018.11.001>
- Rusinamhodzi, L. (2020). Managing Crop Rotations in No-till Farming Systems. In Y. P. Dang, R. C. Dalal, & N. W. Menzies (Eds.), *No-till Farming Systems for Sustainable Agriculture: Challenges and Opportunities* (pp. 21-31). Springer International Publishing. doi: [https://doi.org/10.1007/978-3-030-46409-7\\_2](https://doi.org/10.1007/978-3-030-46409-7_2)
- Saberi, M., & Hamdan, A. (2019). The moderating role of governmental support in the relationship between entrepreneurship and economic growth. *Journal of Entrepreneurship in Emerging Economies*, 11(2), 200-216. doi: <https://doi.org/10.1108/JEEE-10-2017-0072>
- Said Mohamed, E., Belal, A. A., Koth Abd-Elmabod, S., El-Shirbeny, M. A., Gad, A., & Zahran, M. B. (2021). Smart farming for improving agricultural management. *The Egyptian Journal of Remote Sensing and Space Science*, 24(3, Part 2), 971-981. doi: <https://doi.org/10.1016/j.ejrs.2021.08.007>
- Sarker, M. N. I., Islam, M. S., Ali, M. A., Islam, M. S., Salam, M. A., & Mahmud, S. H. (2019). Promoting digital agriculture through big data for sustainable farm management. *International Journal of Innovation and Applied Studies*, 25(4), 1235-1240. Retrieved from <https://www.issr-journals.org/xplore/ijas/0025/004/IJIAS-19-008-04.pdf>
- Seow, A. N., Choong, Y. O., & Ramayah, T. (2021). Small and medium-size enterprises' business performance in tourism industry: the mediating role of innovative practice and moderating role of government support. *Asian Journal of Technology Innovation*, 29(2), 283-303. doi: <https://doi.org/10.1080/19761597.2020.1798796>
- Singh, R., Parihar, P., Singh, M., Bajguz, A., Kumar, J., Singh, S., et al. (2017). Uncovering Potential Applications of Cyanobacteria and Algal Metabolites in Biology, Agriculture and Medicine: Current Status and Future Prospects. *Frontiers in Microbiology*, 8, 1-37. doi: <https://doi.org/10.3389/fmicb.2017.00515>
- Sulaiman, A. A., Sulaeman, Y., & Minasny, B. (2019). A Framework for the Development of Wetland for Agricultural Use in Indonesia. *Resources*, 8(1), 34. doi: <https://doi.org/10.3390/resources8010034>
- Takeuchi-Storm, N., Moakes, S., Thüer, S., Grovermann, C., Verwer, C., Verkaik, J., et al. (2019). Parasite control in organic cattle farming: Management and farmers' perspectives from six European countries. *Veterinary Parasitology: Regional Studies and Reports*, 18, 100329. doi: <https://doi.org/10.1016/j.vprsr.2019.100329>
- Tse, C. H., Yim, C. K. B., Yin, E., Wan, F., & Jiao, H. (2021). R&D activities and innovation performance of MNE subsidiaries: The moderating effects of government support and entry mode. *Technological Forecasting and Social Change*, 166, 120603. doi: <https://doi.org/10.1016/j.techfore.2021.120603>



- Tudi, M., Daniel Ruan, H., Wang, L., Lyu, J., Sadler, R., Connell, D., et al. (2021). Agriculture Development, Pesticide Application and Its Impact on the Environment. *International Journal of Environmental Research and Public Health*, 18(3), 1112. doi: <https://doi.org/10.3390/ijerph18031112>
- Valetskaia, T. I., Vorobyova, V. V., & Torgashova, N. A. (2020). The Impact of State Support on the Profitability of Agricultural Enterprises in the Altai Region. In A. V. Bogoviz (Ed.), *Complex Systems: Innovation and Sustainability in the Digital Age* (Vol. 1, pp. 557-564). Springer International Publishing. doi: [https://doi.org/10.1007/978-3-030-44703-8\\_61](https://doi.org/10.1007/978-3-030-44703-8_61)
- Wright, W., & Annes, A. (2016). Farm Women and the Empowerment Potential in Value-Added Agriculture. *Rural Sociology*, 81(4), 545-571. doi: <https://doi.org/10.1111/ruso.12105>
- Yang, J., & Liu, X. (2023). The role of sustainable development goals, financial knowledge and investment strategies on the organizational profitability: Moderating impact of government support. *Economic research-Ekonomska istraživanja*, 36(1), 1570-1591. doi: <https://doi.org/10.1080/1331677X.2022.2090405>
- Zhai, Z., Martínez, J. F., Beltran, V., & Martínez, N. L. (2020). Decision support systems for agriculture 4.0: Survey and challenges. *Computers and Electronics in Agriculture*, 170, 105256. doi: <https://doi.org/10.1016/j.compag.2020.105256>
- Zulu-Chisanga, S., Chabala, M., & Mandawa-Bray, B. (2021). The differential effects of government support, inter-firm collaboration and firm resources on SME performance in a developing economy. *Journal of Entrepreneurship in Emerging Economies*, 13(2), 175-195. doi: <https://doi.org/10.1108/JEEE-07-2019-0105>