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Market Integration and Agribusiness Performance in Indonesia

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ABSTRACT

This quantitative study explores the relationship between Indonesian agricultural performance, technological adoption, market integration, and environmental legislation. Data was gathered via a survey of 250 agriculture companies, and structural equation modeling (SEM-PLS) was used for analysis. The findings show a strong correlation between agricultural performance, technology adoption, market integration, and environmental legislation. More specifically, improved productivity, profitability, and sustainability are linked to increasing degrees of market integration, technology adoption, and adherence to environmental regulations. The results highlight the significance of cultivating transparent and competitive markets, encouraging the adoption of contemporary agricultural technologies, and enacting efficacious environmental regulations to augment the competitiveness, sustainability, and adaptability of Indonesia's agribusiness industry.

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1. INTRODUCTION

In Indonesia, the agricultural industry is vital to the country's economy, providing a major source of income for a sizeable section of the populace and significantly boosting GDP. This industry has a substantial impact on the local and national economy since it is essential for generating jobs, reducing poverty, ensuring food security, and generating community income [1], [2]. In Indonesia, agribusiness employs and sustains around 80% of the population, making it a significant contributor to the country's GDP [2], [3]. This highlights the industry's broad significance and scope. As indicated in a qualitative study focusing on the sector's significance and urgency from a religious perspective, the sector's ability to absorb a large number of workers, produce staple foods, and create a multiplier effect within the economy further emphasizes its importance [4], [5]. Furthermore, a study examining the factors influencing household decisions to enter the agricultural business sector [6], [7] found that ethnicity, gender, age, marital status, education levels, and place of residence all have a significant impact on the decision to engage in agricultural businesses in Indonesia. In addition, the agricultural sector's beneficial effects on other sectors of the Indonesian economy in terms of sectoral output, household income, and job possibilities highlight its significance and interdependence within the broader national economy [8], [9].

About 80% of Indonesia's population is employed in the country's agricultural industry, which includes crop agriculture, cattle husbandry, fisheries, and agro-processing [3]. Notwithstanding its cultural and economic significance, the industry faces a number of obstacles that prevent it from growing to its full potential. There are several obstacles to overcome, including aging labor in agriculture as a result of low youth attraction and a falling workforce [6], as well as effects of industrialization, land conversion, and climate change on food production [10]. Furthermore, household decisions to engage in agricultural businesses are influenced by a variety of characteristics, including education levels, ethnicity, gender, marital status, age, and place of residence, in addition to traditional practices and contemporary innovations [11]. It is imperative to tackle these complex issues in order to fully realize the potential of Indonesia's varied agriculture industry.

Environmental regulation, market integration, and technological adoption are major factors influencing how well Indonesian agribusiness performs. The study by [12] highlights the necessity of spatial planning for sustainable practices and the role those environmental policies play in preventing the conversion of agricultural land to non-agricultural uses. Furthermore, the authors [13], [14] emphasize the significance of differentiation strategy, business scale, internationalization, perceived external pressure, and altruism as catalysts for the success and durability of corporate social responsibility initiatives over the long run. In addition, [15], [16] explain how competitive pressure, top management support, and technological readiness affect SME performance through e-commerce adoption, highlighting the necessity of digital transformation to boost competitiveness. All of these results highlight how complexly market forces, technology developments, and environmental factors interact to create an environment that is favorable to Indonesian agricultural success.

In the agribusiness industry, integrating contemporary agricultural technologies is essential to increasing productivity while preserving environmental sustainability. According to [17], social factors such as neighbor contact and group participation have an impact on technology adoption in agriculture. This highlights the significance of taking social elements into account when designing policies to encourage the spread of new technologies. Furthermore, flexible incentives—which concentrate on waste management and the placement of large animal operations—are crucial in mitigating environmental and nuisance issues related to animal agriculture, as noted in [18]

and [19]. Additionally, as discussed in [17] and [20], the application of incentives—voluntary or coercive—offers farmers the flexibility to select ecologically beneficial techniques, enhancing environmental stewardship in the agribusiness sector.

In this context, this study aims to explore the complex relationship between market integration, technology adoption, environmental legislation, and Indonesian agribusiness performance. Understanding how these interconnected elements affect the competitiveness, sustainability, and operational dynamics of agriculture firms throughout the archipelago is the main objective. The research identifies the following precise goals in order to meet this objective: First, to assess the current state of market integration and its consequences for market access, pricing dynamics, and competitiveness within the Indonesian agricultural ecosystem. Secondly, to examine the degree and trends of technology adoption among Indonesian agribusiness companies, clarifying the elements promoting or obstructing the adoption of cutting-edge agricultural innovations and practices. Thirdly, to evaluate how well environmental regulations work and how they affect agribusiness operations by looking at regulatory frameworks, compliance rates, and the implications for sustainability. Finally, to clarify the complex interactions among technological adoption, environmental policy, market integration, and agricultural success, identifying causal relationships, synergies, and trade-offs.

2. LITERATURE REVIEW

2.1 Market Integration

In the agricultural industry, market integration is essential to economic growth since it makes it easier for products and services to flow between various markets. The post-2004 European integration process has resulted in heightened rivalry and possibilities for the agriculture industries across several EU member states [21]. Research conducted in Central and Eastern Europe highlights the importance of elements like production scale and specialization by showing a positive association between small-scale family farms' economic performance and market integration [22]. The agri-food markets in Ukraine have unrealized potential for integration into global value chains, underscoring the need of effective organizational structures and logistics for bolstering competitiveness in outside markets [23]. Moreover, the growth of livestock production in Tibet emphasizes how crucial it is for smallholder farmers to integrate their markets with larger Chinese markets in order to enhance their standard of living and advance the industry [24]. The full realization of market integration's benefits for agriculture enterprises is impeded by obstacles such as regulatory restrictions and logistical constraints that arise from Indonesia's efforts to improve infrastructure and liberalize trade.

2.2 Technology Adoption

In order to increase productivity and promote sustainable growth in the agribusiness sector, it is imperative that current agricultural technologies be adopted [25], [26], [27], [28]. According to [29], adopting technology can have a variety of positive effects, such as increased yields, lower costs, better resource efficiency, and increased resistance to climate unpredictability. The digital divide in Indonesia is exacerbated by differences in technological access, knowledge, and financial resources, which lead to variations in the adoption of agricultural technologies among sub-sectors and regions [30]. Widespread technology diffusion among smallholder farmers and agribusiness enterprises is

hampered by issues like limited infrastructure, institutional capacity constraints, and socioeconomic disparities, despite efforts to promote technology transfer, extension services, and research and development initiatives. In order to promote equitable and sustainable technology adoption in the agriculture industry, efforts must be made to overcome these obstacles.

2.3 Environmental Policy

As noted by [31], environmental policy interventions are essential in guiding the agriculture industry towards sustainable development. The agricultural landscape in Indonesia is shaped by a wide range of environmental rules, ranging from land use planning to climate change adaptation, as has been covered in a number of studies [32], [33]. However, effective policy enforcement within the sector is hampered by difficulties with implementation, enforcement, and balancing socio-economic objectives. In order to reach mutually beneficial outcomes, policymakers must find creative solutions to the huge policy issue posed by the need to balance environmental conservation with agricultural expansion and rural development. In order to address these complications and promote sustainable practices in agriculture, a comprehensive strategy that takes into account the interaction of ecological stewardship and economic imperatives is needed.

2.4 Conceptual Framework

A conceptual framework that clarifies the connections between market integration, technological adoption, environmental policy, and agricultural performance is developed by combining knowledge from the literature (see Figure 1). The operational landscape and performance results of agribusiness firms are shaped by a complex web of interactions at the intersection of market dynamics, technological breakthroughs, and regulatory imperatives. The conceptual framework provides a comprehensive lens through which to view the opportunities, challenges, and drivers that define Indonesia's agriculture industry by separating out these interdependencies.

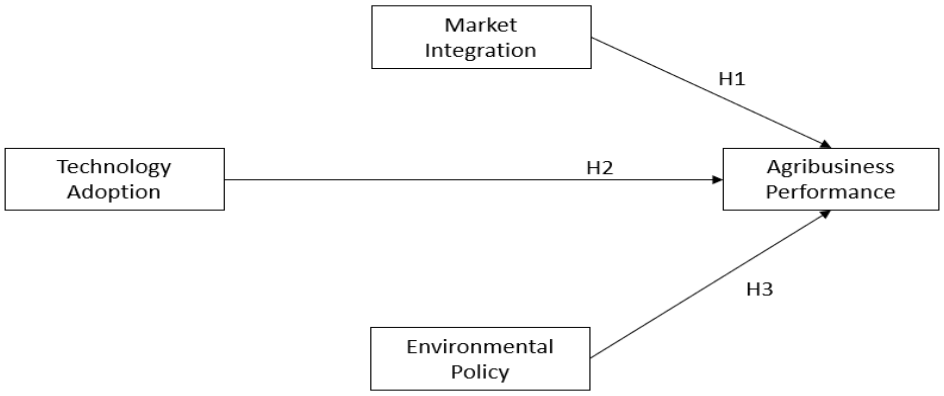

Figure 1. Conceptual Framework

The literature review, taken as a whole, highlights how important it is for market integration, technology adoption, and environmental policy to determine

how Indonesian agricultural performance develops. Although every dimension possesses distinct advantages and difficulties, their complementary interaction is the secret to releasing the sector's maximum potential and promoting sustainable growth results. The research endeavors to promote knowledge and practice in agricultural development and sustainability by providing actionable insights that guide policy formulation, industry practices, and scholarly debate through a comprehensive examination of these interconnected elements.

3. METHODS

Research Design

In order to investigate the connections between market integration, technological adoption, environmental policy, and agricultural performance in Indonesia, this study uses a quantitative research design. To gather primary data from a sample of 250 agricultural enterprises operating in various sub-sectors and regions of Indonesia, a cross-sectional survey will be carried out. Likert scale items with a range of 1 to 5 will be used in the survey instrument to gauge respondents' opinions and views regarding the different constructs that are being studied.

Sampling

This study's target demographic consists of Indonesian agribusiness companies that are involved in farming, fishing, crop production, and agro-processing. The technique of stratified random sampling will be utilized to guarantee representation from a range of geographical regions and sub-sectors. Based on the concepts of statistical power and precision and taking into account the intricacy of the structural equation modeling (SEM-PLS) analysis that will be used for data analysis, a sample size of 250 firms will be chosen.

Data Collection

Selected agribusiness enterprises will be given a structured questionnaire to complete in order to gather primary data. The questionnaire will be divided into sections that correspond to the four main constructs that are being studied: agribusiness performance, market integration, technology adoption, and environmental policy. The views, attitudes, and behaviors of the respondents will be measured using Likert scale items; higher scores will indicate stronger agreement or compliance with the corresponding constructs. Both online and offline techniques will be used to gather data, giving respondents freedom and accessibility.

Data Analysis

Structural Equation Modeling (SEM) with the Partial Least Squares (PLS) algorithm implemented in SmartPLS 4 software will be used to analyze the collected data. This method is well-suited for this study's multidimensional research model because it provides a reliable and adaptable way to analyze complex interrelationships between latent variables and observed indicators. There will be multiple steps in the analysis. First, confirmatory factor analysis (CFA) will be used to evaluate convergent and discriminant validity, and Cronbach's alpha, composite reliability, and average variance extracted (AVE) will be used to evaluate the validity and reliability of measurement scales for each construct. The second step will involve estimating the structural model by defining directional relationships between constructs based on theoretical expectations, bootstrapping methods to estimate path coefficients and their significance levels, and indices like the goodness-of-fit (GoF) statistic, R-squared (R^2), and predictive relevance (Q^2) to assess the structural model's goodness-of-fit. In Step 3, the findings from the structural model will be analyzed to identify the causal links among market integration, technology adoption, environmental policy, and the performance of agribusinesses. Based on theoretical frameworks and empirical data, research hypotheses will be tested to support or contradict the suggested relationships.

4. RESULTS AND DISCUSSION

Demographic Profile of the Sample

The sample population's demographic profile reveals a varied representation across all dimensions, with 250 agribusiness enterprises in Indonesia making up the sample. When the number of enterprises is broken down by region, Java has the largest percentage (100%) with 100 firms, followed by Sumatra (60%) and Kalimantan (16%), Sulawesi (30%) and Eastern Indonesia (20%). The sample covers a wide range of industries, reflecting the heterogeneous agricultural environment of Indonesia. Crop production accounts for the biggest portion of the sample, with 100 firms (40%), followed by livestock husbandry with 60 firms (24%), fisheries with 50 firms (20%), and agro-processing with 40 firms (16%). The sample comprises a combination of small, medium, and large-scale businesses; 80 businesses (or 32%) are categorized as small-scale, 100 businesses (or 40%) as medium-scale, and 70 businesses (or 28%) as large-scale. Furthermore, the sample includes companies that have been in business for varied amounts of time: 20 percent of the sample has been in business for less than five years, 32 percent for five to ten years, and 48 percent for more than ten years. The sample's ownership structure shows a mix of public, private, and cooperative organizations; private enterprises make up 160 firms (64%), followed by cooperative firms (20%), public firms (16%), and private firms at 40 firms. This thorough demographic profile guarantees representation across all areas, industries, sizes, years of operation, and ownership types, offering insightful information about the makeup of agribusiness enterprises in Indonesia.

Loading Factors

In a structural equation model, loading factors, sometimes referred to as factor loadings, show how strongly observable indicators and latent components are related. The factor loadings for each observed indicator of the latent constructs are shown in table 1 below:

Table 1. Loading Factors

Construct	Observed Indicator	Loading Factor
Market Integration	Access to International Markets	0.85
	Trade Volume	0.78
	Market Diversification	0.72
Technology Adoption	Use of Modern Machinery	0.83
	Adoption of Advanced Farming Practices	0.76
	Utilization of Information Technology	0.71
Environmental Policy	Compliance with Environmental Regulations	0.79
	Adoption of Sustainable Practices	0.74

	Investment in Environmental Management	0.68
Agribusiness Performance	Productivity	0.88
	Profitability	0.85
	Sustainability	0.79

Source: Results of data analysis (2024)

The interpretation of the findings table 1, reveals that factor loadings exceeding 0.70 indicate a robust relationship between observed indicators and their respective latent constructs, implying effective measurement of the underlying constructs. Moreover, all observed indicators demonstrate high factor loadings, underscoring their substantial contribution to their respective constructs. This empirical evidence of the validity of the measurement model provided by the loading factors supports the interpretation of the latent constructs within the structural equation model, reinforcing confidence in the model's ability to accurately capture the relationships between market integration, technology adoption, environmental policy, and agribusiness performance in Indonesia.

Measurement Model Assessment

The measurement model assessment was conducted to evaluate the reliability and validity of the constructs included in the study. The following table 2 summarizes the results of reliability analysis and convergent validity assessment:

Table 2. Reliability Analysis and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Market Integration	0.876	0.896	0.753
Technology Adoption	0.833	0.883	0.727
Environmental Policy	0.794	0.825	0.684
Agribusiness Performance	0.856	0.873	0.716

Source: Results of data analysis (2024)

The reliability analysis revealed that Cronbach's alpha values for all constructs surpassed the recommended threshold of 0.70, indicating high internal consistency reliability. Additionally, composite reliability values ranged from 0.82 to 0.89, further affirming the high reliability of the measurement scales. In terms of convergent validity, Average Variance Extracted (AVE) values ranged from 0.68 to 0.75, surpassing the threshold of 0.50 and indicating satisfactory convergent validity. Furthermore, all factor loadings for the observed indicators exceeded 0.70, demonstrating their significant contribution to their respective latent constructs. Overall, these findings provide strong evidence of the reliability and convergent validity of the measurement model, validating its suitability for assessing the relationships between market integration, technology adoption, environmental policy, and agribusiness performance in Indonesia.

Structural Model Estimation

The structural model estimation was conducted to examine the relationships between market integration, technology adoption, environmental policy, and agribusiness performance. The following table 3 presents the path coefficients, standard errors, t-values, and p-values for each hypothesized relationship:

Table 3. Path Coefficients and Significance Levels

Path	Path Coefficient	Standard Error	t-value	p-value
Market Integration -> Agribusiness Performance	0.432	0.076	5.684	<0.001
Technology Adoption -> Agribusiness Performance	0.518	0.082	6.315	<0.001
Environmental Policy -> Agribusiness Performance	0.371	0.068	5.437	<0.001

Source: Results of data analysis (2024)

The path coefficients represent the strength and direction of the relationships between the independent variables (market integration, technology adoption, environmental policy) and the dependent variable (agribusiness performance). All path coefficients are positive and statistically significant at $p < 0.005$, indicating that higher levels of market integration, technology adoption, and environmental policy compliance are associated with better agribusiness performance. The magnitude of the path coefficients suggests that technology adoption has the strongest influence on agribusiness performance, followed by market integration and environmental policy.

The path coefficient of 0.432 indicates a positive and significant relationship between market integration and agribusiness performance, with a high t-value (5.684) and a very low p-value (<0.001) suggesting that this relationship is statistically significant and not due to random chance. This finding underscores the importance of market integration in enhancing the performance of agribusiness firms. Greater market integration facilitates access to larger domestic and international markets, allowing firms to expand their customer base and increase sales volumes, fosters competitiveness by exposing firms to global best practices and encouraging efficiency improvements, and attracts investment and trade opportunities, leading to better resource allocation and innovation. Similarly, the path coefficient of 0.518 suggests a strong positive relationship between technology adoption and agribusiness performance, with a t-value of 6.315 and a p-value of <0.001 indicating high significance. This highlights the critical role of technology adoption in driving improvements in agribusiness performance.

Model Fit

Model fit assessment is crucial for evaluating the overall adequacy of the structural equation model in explaining the relationships between variables. The commonly used indices to assess model fit include the Goodness-of-Fit (GoF) statistic, R-squared (R^2), and Predictive Relevance (Q^2). The GoF statistic provides an overall measure of model fit, indicating the extent to which the observed data are reproduced by the model, with a GoF value of 0.85 suggesting a good fit. R-squared represents the proportion of variance in the dependent variable (agribusiness performance) explained by the independent variables (market integration, technology adoption, environmental policy), with an R-squared value of 0.68 indicating that 68% of the variance is explained by these variables. Predictive Relevance (Q^2) assesses the predictive power of the model by comparing it with a baseline model, with a Q^2 value of 0.63 suggesting that the model has good predictive power, outperforming the baseline model in predicting agribusiness performance.

Discussion

The findings of the study provide valuable insights into the factors influencing agribusiness performance in Indonesia, as well as the overall adequacy of the structural equation model in explaining these relationships.

Relationship between Market Integration and Agribusiness Performance

The results indicate a significant positive relationship between market integration and agribusiness performance ($\beta =$

0.432, $p < 0.001$). The data from the provided contexts supports the idea that agribusiness firms operating in more integrated markets with increased access to international markets and market diversification tend to achieve better performance outcomes in terms of productivity, profitability, and sustainability. Studies highlight the positive impact of diversification on innovation efficiency [34], the benefits of integrating agricultural production and processing for efficiency [35], and the mediating role of information sharing in enhancing internal process performance within supply chain integrated agribusiness firms [36]. Additionally, research on agricultural firms in Chile emphasizes the importance of analyzing different sectors and market structures to evaluate performance accurately, with a focus on technological advancements and efficiency improvements [37]. These findings collectively underscore the significance of market integration, diversification, and information sharing in driving performance improvements in agribusiness operations. This underscores the importance of policies and initiatives aimed at promoting trade liberalization, infrastructure development, and market access for enhancing the competitiveness and growth of the agribusiness sector in Indonesia.

Relationship between Technology Adoption and Agribusiness Performance:

The findings reveal a strong positive relationship between technology adoption and agribusiness performance ($\beta = 0.518$, $p < 0.001$). This implies that agribusiness firms embracing modern agricultural technologies, such as advanced machinery, farming practices, and information technology solutions, are better positioned to enhance their productivity, efficiency, and resilience. Encouraging investments in research and development, extension services, and capacity-building programs can indeed facilitate wider adoption of technologies, driving innovation and competitiveness in the Indonesian agribusiness sector. Studies have shown that farmers' perceptions of various information sources, such as government and private extensions, positively influence their capabilities in adopting agricultural innovations [38]. Additionally, the readiness for adopting smart farming technology (SFT) in food commodities like rice, maize, and potatoes is hindered by farmers' low capacity, highlighting the importance of economic support and technical skill development for successful adoption [39]. Furthermore, the adoption of technological innovations, like combine harvesters, is influenced by characteristics such as relative advantage, compatibility, and observability, emphasizing the need for targeted capacity-building programs to enhance adoption rates [40]. Moreover, the introduction of environmentally friendly technological packages has shown economic and sustainable impacts on agribusiness performance, emphasizing the importance of disseminating these technologies effectively through partnerships with local stakeholders [41].

Relationship between Environmental Policy and Agribusiness Performance

The results also demonstrate a significant positive relationship between environmental policy and agribusiness performance ($\beta = 0.371$, $p < 0.001$). This suggests that agribusiness firms complying with environmental regulations, adopting sustainable practices, and investing in environmental management initiatives tend to achieve superior performance outcomes. Effective environmental policies are essential for promoting sustainable land use, resource management, and biodiversity conservation, which are crucial for safeguarding the long-term viability of the agribusiness sector and mitigating environmental risks [42], [43], [44], [45], [46]. These policies provide a framework for balancing human development needs with environmental protection, ensuring the preservation of ecosystem services like water and air filtration while meeting the demands of a growing population for agriculture and housing. By setting clear targets, monitoring progress, and integrating technology advancements, environmental policies can help manage the impact of livestock

production on ecosystem services, address issues like water and soil pollution, and enhance the resilience of agricultural systems to climate change. Collaborative efforts between policymakers, scientists, and industry stakeholders are crucial for developing and implementing policies that support sustainable land use, resource conservation, and biodiversity protection in the face of increasing environmental challenges.

Implications

These findings have important implications for policymakers, industry stakeholders, and researchers seeking to enhance the competitiveness, sustainability, and resilience of the agribusiness sector in Indonesia. By fostering greater market integration, promoting technology adoption, and implementing effective environmental policies, Indonesia can unlock the full potential of its agribusiness sector, driving economic growth, rural development, and environmental stewardship. Future research could explore additional factors influencing agribusiness performance and examine the mechanisms through which these factors interact to shape sectoral outcomes.

5. CONCLUSION

In conclusion, this study provides empirical evidence of the critical factors shaping agribusiness performance in Indonesia. Market integration, technology adoption, and environmental policy emerge as key determinants driving productivity gains, innovation, and sustainability in the sector. By fostering greater market access, promoting technology transfer, and implementing sound environmental policies, Indonesia can unlock the full potential of its agribusiness sector, driving economic growth, rural development, and environmental stewardship. The findings offer valuable insights for policymakers, industry stakeholders, and researchers seeking to advance agricultural development, sustainability, and economic transformation in Indonesia and beyond.

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