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Workforce agility and technological innovation enhancing sustainable lobster business in Indonesia

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Abstract: This research aims to explore the relationship between labor agility, technological innovation, and business sustainability in the lobster industry, specifically in Lobstamasta, Sawarna Village, Banten Province. With the significant contribution of the fishing industry to the national economy, this research emphasizes the importance of applying blue economy principles to increase productivity while preserving the environment. The research method used is a quantitative approach with a descriptive and analytical design, which relies on data collected from 60 respondents through a structured questionnaire. Data analysis was conducted using Structural Equation Modeling (SEM) with Partial Least Squares (PLS) to test the relationship between variables. The results show that labor agility has a significant positive influence on technological innovation (coefficient 0.833) and business sustainability (coefficient 0.553). In addition, technological innovation contributes to business sustainability with a coefficient of 0.388 and acts as a significant mediator in the relationship between labor agility and business sustainability. These findings underscore the importance of improving labor agility and implementing technological innovation to achieve sustainability in the lobster farming sector.

Keywords: *Workforce Agility; Technological Innovation; Sustainable Business; Lobster Aquaculture; Blue Economy*.

1. Introduction

The fisheries industry in Indonesia plays a crucial role in the national economy, contributing 8.2% to the world's total fisheries production in 2020, and ranking second in the world [1]. With the second longest coastline in the world, Indonesia has abundant marine resources, offering great potential for the development of various commodities, including lobster. Despite having an estimated market value of USD 7.2 billion by 2023, lobster still has a small share in the national market share, at only 0.5% Minister of Maritime Affairs and Fisheries [2]. This shows that the Indonesian lobster industry has not fully utilized the existing potential, and maximum efforts need to be made to increase its production.

In this context, the application of the *blue economy* concept becomes very relevant. *Blue economy* is an approach designed to support the development of a productive and environmentally friendly fishing industry, ensure sustainable management of natural resources, and support long-term sustainability [3]. By adopting the principles of the *blue economy*, the fisheries sector is expected to increase productivity while maintaining the existing marine ecosystem [4]. This is particularly important, given the many challenges faced by the fishing industry, including the impacts of climate change and environmental degradation [5].

Sawarna Village, located in Lebak District, Bayah Regency, Banten Province, is known for its marine potential, especially in rock lobster (*Panulirus Penicillatus*) cultivation. Rock lobster is an important asset to the life and economy of the local community. "*Lobstamasta*," as one of the MSMEs in

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the lobster industry in this village, has taken proactive steps to develop rock lobster rearing in ponds. This initiative not only opens up new economic opportunities, but also demonstrates how adaptation and innovation can drive economic progress at the local level [6, 7].

Despite this, Lobstamasta and other MSMEs in the lobster industry face a number of significant challenges. One of the main obstacles is the lack of commitment from trained human resources (HR) and the lack of knowledge in financial management and sustainable business practices [8]. In addition, dependence on the lobster fishing season and unpredictable weather conditions adds to the complexity faced, especially with the impact of global warming causing changes in marine ecosystems [9, 10]. To address these challenges, it is important to explore how labor agility can contribute to adopting new technologies based on *Artificial Intelligence* and *the Internet of Things* (AIoT).

Workforce agility is defined as the ability of individuals and organizations to adapt quickly and effectively to changes in the business environment. Research shows that an agile workforce can improve firms' responsiveness to emerging challenges, enabling them to compete effectively in dynamic markets [11, 12]. In the context of Lobstamasta, improving the agility of the workforce is crucial to ensure that they can adapt to rapid technological and market changes.

Technological innovation, particularly through the application of AIoT, has great potential to improve operational efficiency in lobster farming practices. By utilizing technology to monitor *real-time* environmental conditions, MSMEs can make better and faster decisions, which in turn can improve productivity and sustainability [13, 14]. This research will explore how the combination of labor agility and technological innovation can positively impact the sustainability of Lobstamasta's business model.

In response to these issues, this study aims to answer some important research questions.

1) How does labor agility affect technological innovation in the context of lobster farming in Lobstamasta?
2) To what extent does technological innovation affect the sustainability of Lobstamasta's business model?
3) What is the mediating role of technological innovation in the relationship between labor agility and business sustainability?

These questions will help explain the dynamics between labor agility, technology and business sustainability in the context of the lobster industry.

Through this research, it is hoped that an innovative solution can be found that not only improves Lobstamasta's operational efficiency, but also contributes to village economic development and environmental conservation through a blue economy approach. The results of this research are expected to provide new insights into sustainable lobster farming practices, as well as a basis for policies that support the growth of MSMEs in the fisheries sector.

2. Literature Review

2.1. Labor Agility

Workforce agility refers to the ability of individuals and organizations to adapt quickly and effectively to changes in the business environment. This concept has become particularly important in the digital age, where change happens quickly and demands a rapid response from businesses. According to Breu, et al. [11] *agility* in the workplace is key to maintaining competitiveness, especially in a changing market. Research by Muduli [15] shows that an organizational culture that supports innovation and flexibility can improve the company's ability to adapt to change. This confirms that companies that have an adaptive work culture tend to be more able to face challenges and take opportunities.

Munteanu, et al. [12] also highlighted the importance of knowledge management in improving workforce agility. By sharing information and experiences among team members, organizations can improve their capability to adapt. Research that has been conducted by Petermann and Zacher [16] also shows that employee empowerment and managerial support are important factors that create an agile work environment. Employees who feel empowered are more likely to adapt to change, improving overall organizational performance.

The agility of the workforce at Lobstamasta is important to ensure that HR can adapt quickly to new technologies and challenges faced in the lobster industry.

2.2. Technology Innovation (AIoT)

Technological innovation, especially in the form of *Artificial Intelligence* and *the Internet of Things* (AIoT), plays an important role in improving efficiency and productivity in various sectors, including fisheries. Amara, et al. [17] examined the impact of open innovation and found that companies that adopt an open innovation approach tend to perform better. Research by Baierle, et al. [18] showed that investment in green innovation can provide a competitive advantage, which is particularly relevant for MSMEs in the context of sustainability.

Fu, et al. [19] examined the influence of technological capabilities on innovation and firm performance. The results show that technological capabilities contribute to open innovation and ecological innovation. Research by Kim [20] states that the integration of sustainability in business strategy can be achieved through innovation. This confirms that companies that focus on innovation tend to perform better in the market.

Digitalization also plays an important role in innovation. [21] found that digitalization contributes to faster and more efficient innovation. This suggests that companies that adopt digital technology are more innovative and able to adapt to changes in the market. In the context of Lobstamasta, the application of AIoT has the potential to improve operational efficiency and sustainability in lobster farming.

2.3. Sustainable Business Model

A sustainable business model is essential for MSMEs in the fisheries sector, including Lobstamasta. This model integrates economic, social and environmental goals into the operational strategies of small and medium-sized businesses. Baeshen, et al. [22] emphasized that implementing sustainability practices in MSMEs can improve operational efficiency and competitiveness. In the context of Lobstamasta, sustainability is not only about profitability, but also about responsibility to the community and the environment.

Caldera, et al. [23] found that a commitment to sustainability can positively affect the long-term performance of MSMEs. Sustainability practices implemented in the fisheries sector, such as wise resource management, not only help maintain the marine ecosystem but also ensure the viability of their businesses. This is particularly relevant given the challenges faced by the lobster industry in Indonesia, such as environmental degradation and the impact of climate change.

Malesios, et al. [24] showed that transparency in sustainability practices can increase stakeholder trust. For MSMEs, this means building better relationships with customers and the surrounding community, as well as improving their reputation in the market. Thus, sustainable business models not only help in sustaining business operations, but also contribute to improving the quality of life of local communities.

The integration of sustainability principles in Lobstamasta's business model can also help them deal with external challenges, such as price fluctuations and regulatory changes. By adopting environmentally and socially friendly strategies, MSMEs can strengthen their position in a competitive market. This research aims to explore how labor agility and technological innovation can support the implementation of sustainable business models in Lobstamasta.

While many studies address labor agility and technological innovation, there is still a gap in the literature exploring how these two aspects can be integrated in the context of MSMEs, particularly in the fisheries sector. Existing research tends to focus more on large companies and less on relevant practices for MSMEs such as Lobstamasta. This research aims to fill that gap by providing insights into how labor agility and technological innovation can contribute to business sustainability.

3. Methodology

This research utilizes a quantitative approach with a descriptive and analytical design. This approach was chosen to explore the relationship between labor agility, technological innovation, and business sustainability in the context of MSMEs, specifically in Lobstamasta. By using quantitative methods, this research can provide more objective and quantifiable data, which will help in understanding the dynamics that occur in the field. The data collected will be analyzed using *Structural Equation Modeling* (SEM) with *Partial Least Squares* (PLS), which is an appropriate method for testing causal relationships between variables in the model. The location of this research is Sawarna Village, Lebak District, Bayah Regency, Banten Province, Indonesia. Sawarna Village is known for its marine potential, especially in rock lobster (*Panulirus Penicillatus*) cultivation. Rock lobster is an important commodity that supports the life and economy of the Sawarna Village community.

The object of the study is business actors involved in the lobster industry in Sawarna Village, including fishermen, collectors, and entrepreneurs who manage lobster farming businesses. The study population consisted of 60 respondents who were selected by *purposive sampling*, taking into account their experience and involvement in the lobster industry. This approach ensured that respondents had sufficient understanding of the business practices and challenges faced in lobster farming.

4. Data Collection

Data was collected through the distribution of a questionnaire consisting of 40 structured questions. The questionnaire was divided into three main sections:

1. *Workforce Agility*: Includes 22 questions that measure aspects of workforce agility, including adaptability, collaboration, and response to change.
2. Technological Innovation: Consists of 8 questions that assess the use of technology in lobster farming practices and its impact on operational efficiency.
3. Sustainable Business: Contains 10 questions that explore the sustainability aspects of Lobstamasta's business model.

5. Data Analysis

The data collected from the questionnaire will be analyzed using PLS SEM, which is a multivariate analysis method that allows researchers to test the relationship between variables in the model simultaneously. PLS SEM is suitable for use in this study because it can handle data with relatively small sample sizes and does not require normal distribution assumptions.

The analysis process consists of several steps:

1. Validity and Reliability Testing: Construct validity was tested using convergent and discriminant analysis, while reliability was measured by Cronbach's Alpha values.
2. Outer Model Analysis: Describes the relationship between the indicators and the construct being measured. This will ensure that all indicators used are relevant and qualified.
3. Inner Model Analysis: Tests the relationships between constructs in the model, including the testing of previously established hypotheses.
4. Interpretation of Results: The results of the analysis will be interpreted to understand the influence of labor agility and technological innovation on business sustainability in Lobstamasta.

Through this methodology, the research is expected to provide deep insights into the dynamics between labor agility, technological innovation, and sustainability in the fisheries sector.

6. Results

This section presents an evaluation of the results of the analysis conducted to test the model and hypotheses using the PLS (*Partial Least Squares*) technique. The results are divided into two main parts: outer model evaluation and inner model evaluation.

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6.1. Outer Model Evaluation Results

Before analyzing the causal relationship between variables, the instruments used are tested for validity and reliability. This evaluation is important to ensure that questionnaire items can accurately measure the nature and concept of variables as well as the consistency of questionnaire items in measuring variables at various times and places.

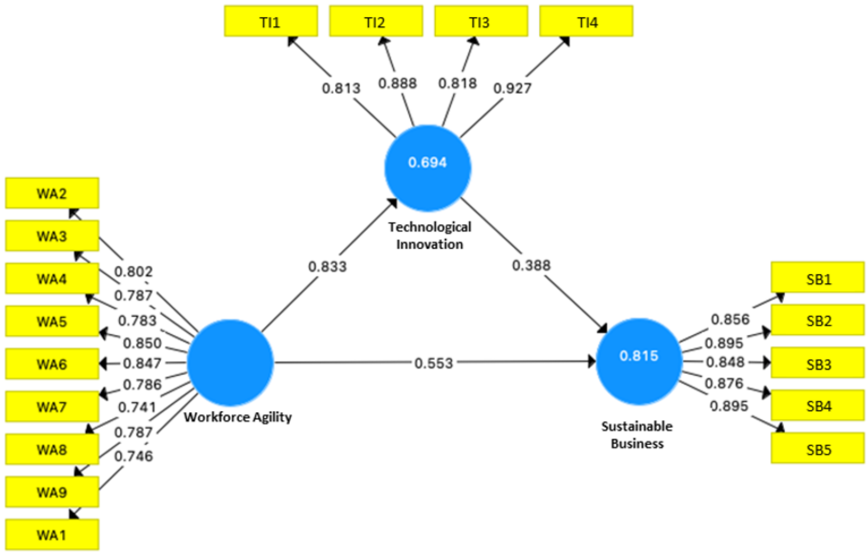

Figure 1.
PLS outer model path diagram.

1. Convergent Validity: The validity test results show that all indicators for each variable have a loading factor value greater than 0.7. This indicates that the indicators have been declared statistically valid and meet the rules set by Hair Jr, et al. [25]. The diagram below (Figure 1.) shows the research model based on the *convergent validity* results.
2. Construct Validity: To assess construct validity, the analysis is carried out by calculating the *Average Variance Extracted* (AVE) value. Based on Table 1, all variables in this study have an AVE value greater than 0.5, indicating that the construct has good construct *validity* [26].

Table 1.
Average variance extracted (AVE).

	Average variance extracted (AVE)
Sustainable business	0.764
Technological innovation	0.744
Workforce agility	0.628

3. Discriminant Validity: Discriminant validity is measured by comparing the root of the AVE of each construct with the correlation between latent variables. Table 2, shows the *cross loading* value of each indicator, where the value of each indicator on the construct is higher than that of other constructs, so this study has good *discriminant validity* [27].

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Table 2.
Cross loading value.

	Sustainable business	Technological innovation	Workforce agility
BS1	0.856	0.843	0.809
BS2	0.895	0.799	0.794
BS3	0.848	0.667	0.687
BS4	0.876	0.715	0.757
BS5	0.895	0.666	0.772
TI1	0.657	0.813	0.656
TI2	0.798	0.888	0.756
TI3	0.600	0.818	0.698
TI4	0.849	0.927	0.760
WA2	0.688	0.613	0.802
WA3	0.652	0.647	0.787
WA4	0.671	0.671	0.783
WA5	0.727	0.665	0.850
WA6	0.787	0.649	0.847
WA7	0.765	0.659	0.786
WA8	0.728	0.675	0.741
WA9	0.688	0.778	0.787
WA1	0.495	0.555	0.746

4. Composite Reliability: To determine construct reliability, *Cronbach's alpha* and *Composite Reliability* values were tested. Table 3, shows that all constructs have *Cronbach's alpha* values greater than 0.6 and *Composite Reliability* greater than 0.7, so it can be said that all constructs in the research model have good internal consistency [28].

Table 3.
Composite reliability and cronbach's alpha.

	Cronbach's alpha	Composite reliability
Sustainable business	0.923	0.942
Technological innovation	0.885	0.921
Workforce agility	0.926	0.938

6.2. Inner Model Evaluation Results

Inner model evaluation is conducted to predict the causal relationship between variables and hypothesis testing. The results of this analysis show the coefficient of determination, *predictive relevance*, *goodness of fit*, as well as the path coefficient and parameter coefficient.

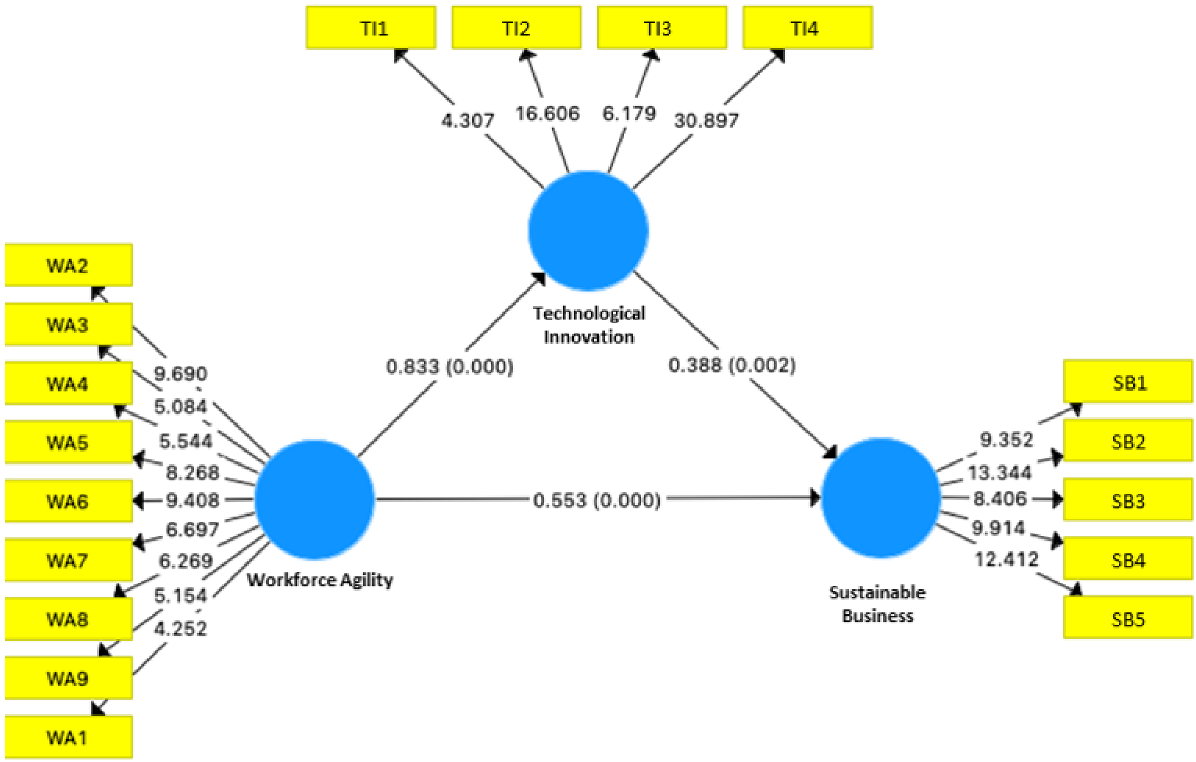

Figure 2.
PLS inner model path diagram.

1. Coefficient of Determination: The coefficient of determination (R^2) value provides information on how much variation in the dependent variable can be explained by the independent variables. Based on Table 4, the R^2 value for sustainable business is 81.5%, which means that the independent variables explain 81.5% of the variation in this model [29].

Table 4.
R-square.

	R square
Sustainable Business	0.815
Technological innovation	0.694

2. Predictive Relevance: The Q^2 value is calculated to assess how well the observed values are generated by the model. The calculation results show a *predictive relevance* value of 0.943, indicating that the analysis model has excellent *predictive relevance* [30].
3. Goodness of Fit: Goodness of fit in this study was calculated at 0.637. Based on the GoF criteria, this value indicates that the model has good performance [31].
4. Hypothesis Testing: Hypothesis testing was carried out with the estimation of path coefficients. The test results (Table 5.) show that:

Table 5.
Path coefficients.

	Original sample (O)	T statistics (|O/STDEV|)	P values
WA → SB	0.553	4.728	0.000
WA → TI	0.833	6.617	0.000
TI → SB	0.388	3.071	0.002
WA → TI → SB	0.324	3.005	0.003

A. Effect of Workforce Agility on Sustainable Business: The parameter coefficient value of 0.553 with T-statistic 4.728 > 1.96 and p-value 0.000 < 0.05 shows a significant positive effect, so H1 is accepted.
B. Effect of Workforce Agility on Technological Innovation: The parameter coefficient value of 0.833 with T-statistic 6.617 > 1.96 and p-value 0.000 < 0.05 indicates a significant positive effect, so H2 is accepted.
C. Effect of Technological Innovation on Sustainable Business: The parameter coefficient value of 0.388 with a T-statistic of 3.071 > 1.96 and a p-value of 0.002 < 0.05 indicates a significant positive effect, so H3 is accepted.
D. The Mediating Role of Technological Innovation: Results show that technological innovation significantly mediates the relationship between *workforce agility* and business sustainability, with a T-statistic of 3.005 > 1.96 and a p-value of 0.003 < 0.05, so H4 is accepted.

7. Discussion

7.1. Interpretation of Results

The results of this study indicate a significant relationship between *workforce agility*, technological innovation, and business sustainability in the fisheries MSME sector of Sawarna Village, especially Lobstamasta. *Workforce agility* is proven to have a positive effect on technological innovation and business sustainability, which is reflected in the results of hypothesis testing with a significant T-statistic value.

This study found that *workforce agility* has a significant influence on business sustainability, with a coefficient of 0.553 and a T-statistic of 4.728. This indicates that the more agile the workforce is in facing changes, both in technology and the market, the greater the contribution to business sustainability in Lobstamasta. This is in line with the findings of Breu, et al. [11] which highlighted the importance of workforce agility in responding to changes in the dynamic business environment. In the context of MSMEs like Lobstamasta, where resources are limited, a workforce that is able to adapt quickly becomes a very valuable asset. Muduli [15] also found that an organizational culture that supports innovation and flexibility encourages workforce agility, which in turn has a positive impact on the company's ability to remain sustainable. Munteanu, et al. [12] even strengthens this argument by showing how good knowledge management in organizations helps increase *agility*, enabling workers to implement more sustainable practices.

Workforce agility is also shown to play an important role in driving technological innovation, with a coefficient of 0.833 and a T-statistic of 6.617. This means that a flexible and fast-adapting workforce is better able to deal with new technologies, which in turn accelerates innovation at Lobstamasta. This is in accordance with research conducted by Muduli [15] emphasizing the importance of a work culture that supports innovation, as this allows the workforce to adopt technology more efficiently. Breu, et al. [11] also explained that workforce agility makes it easier for organizations to respond to technological developments, and this is evident in the context of Lobstamasta, where the adoption of AIoT technology is smoother due to the readiness of an agile workforce. Munteanu, et al. [12] also mentioned that well-managed knowledge allows the workforce to be more adaptive to technology, so innovation occurs faster and more effectively.

On the other hand, technological innovation itself also plays an important role in business sustainability, with a coefficient of 0.388 and a T-statistic of 3.071. The application of AIoT technology, such as the use of IoT sensors to monitor water quality and automation in lobster farming, has helped Lobstamasta improve operational efficiency and ensure better environmental sustainability. In line with the research conducted by Peng, et al. [21] found that digitalization plays a big role in accelerating innovation, which in turn supports business sustainability. Fu, et al. [19] also emphasized that innovative technologies not only improve efficiency, but also help companies better manage resources, so that business sustainability can be maintained in the long run. In addition, Kim [20] highlighted that technological innovation integrated with sustainability strategies allows companies to excel both in terms of the environment and profitability, which is certainly relevant to what is happening in Lobstamasta.

The research also shows that technological innovation plays an important mediating role in the relationship between *workforce agility* and business sustainability, with a T-statistic of 3.005. This suggests that an agile workforce is more effective in supporting sustainability when they are supported by technological innovation. This is in line with research conducted by Muduli [15] highlighting that an agile workforce tends to more quickly utilize technology to support sustainability goals. Breu, et al. [11] also emphasized that technology enables an agile workforce to respond to change more effectively, strengthening the link between agility and sustainability. In the context of Lobstamasta, O'Donncha and Grant [14] found that technologies such as AIoT assist an agile workforce in making real-time data-driven decisions, ultimately improving operational efficiency and ensuring long-term sustainability.

8. Practical Implications

Based on the results of the study, there are several practical implications that are relevant for implementation in the field:

1. HR Capacity Development: The results of this study indicate the importance of workforce agility in enhancing business sustainability. Therefore, training programs that focus on technological adaptation and innovation are necessary. This training should include skills in technology management, use of AIoT, as well as strategies to deal with changes in the fisheries market.
2. Smart Technology Adoption: The application of AIoT technology in Lobstamasta's operations is proven to improve efficiency and sustainability. IoT sensors and cultivation process automation can help MSMEs monitor lobster pond conditions in *real-time* and reduce risks caused by unstable environmental conditions. This technology can also optimize resource usage and increase productivity.
3. Collaboration between MSMEs and Government: For technological innovations to be more widely implemented in the MSME sector, collaboration between businesses, government, and technology providers is essential. The government can support these initiatives through technology subsidies, training, and policies that encourage technology adoption for sustainability. This collaboration will help MSMEs in the fisheries sector face global challenges and ensure that they can compete in the wider market.
4. Sustainable Business Model: This research emphasizes the importance of sustainable business models that integrate *blue economy* principles with innovative technologies. By integrating environmental and social sustainability, MSMEs like Lobstamasta can improve their business reputation and attract more investors and customers who care about the environment.

9. Research Limitations

While this study provides significant insights into the relationship between *workforce agility*, technological innovation, and business sustainability, there are some limitations that need to be noted:

1. Sample Size: This study only involved 60 respondents from one village, which may limit the generalizability of the results to a larger population. Future research needs to involve more respondents from various locations to increase the external validity of the results.
2. Focus on One Sector: This study focuses on MSMEs in the fisheries sector, specifically lobster farming. While the findings are relevant to that sector, the results may not be fully applicable to MSMEs in other sectors. Further research is needed to see if the same relationship holds true in other industries.
3. Limitations of Qualitative Data: This research used a quantitative approach, which means that qualitative data, such as in-depth interviews, were not used to understand more deeply other factors that may affect workforce agility and business sustainability. Future research could combine qualitative and quantitative approaches to gain a more holistic understanding.

10. Conclusion

This research emphasizes the importance of integration between *workforce agility* and technological innovation to achieve business sustainability in the MSME sector, particularly in the fishing industry. In an era of change and uncertainty, workforce agility is key to adapting to new technologies and facing emerging challenges in the market. On the other hand, AIoT-based technology is proven to help improve operational efficiency and maintain environmental sustainability, especially in the fisheries sector which relies heavily on a healthy ecosystem.

Sustainability is not just about sustaining business today, but also about building a better future for the environment and surrounding communities. By combining technological innovation and sustainable practices, MSMEs can play an important role in realizing the vision of a *blue economy* that focuses on the balance between economic growth and preservation of natural resources. Therefore, it is important for MSME players, governments, and technology providers to work together to create an ecosystem that supports innovation and sustainability in the future.

11. Recommendations for Further Research

Based on the limitations identified, there are several recommendations for future research:

1. Multi-sector Research: Further research could expand the scope to include different sectors of MSMEs, so as to explore whether the findings on *workforce agility* and technological innovation apply in other sectors, such as agriculture or manufacturing.
2. Mixed Methods Approach: Combining quantitative and qualitative methods can provide a deeper understanding of the dynamics on the ground. In-depth interviews with businesses and case study analysis can complement quantitative findings and provide a richer context on the factors affecting business sustainability.
3. The Role of Government Policy: Future research could explore the role of government policies in supporting the adoption of smart technologies by MSMEs. An in-depth policy analysis could provide insights into how government regulation and support can improve the adoption of technological innovations in fisheries and other sectors.
4. Longitudinal Studies: To understand the long-term impact of workforce agility and technological innovation on business sustainability, longitudinal studies can be conducted. These studies will help monitor changes in business performance and technology impact over time.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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