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Sustainability Analysis of Millennial Farmers' Development in Greater Malang

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ABSTRACT

Millennial farmers growing in the digital era have a strong ability to leverage the power of networks and social technology. In recent times, the agricultural scenery in Greater Malang has experienced substantial changes due to the heightened engagement of millennial farmers. Recognizing the importance of this phenomenon, our research aims to conduct a comprehensive sustainability analysis of the factors driving the rapid progress of millennial farmers in Greater Malang. The study seeks to uncover the interplay among various factors, including technology adoption, social and economic dynamics, environmental considerations, and policy frameworks. This type of research is quantitative descriptive. The analysis technique employed is Multidimensional Scaling (MDS). The sustainability assessment findings for Millennial Farmer Development in Greater Malang indicate a reasonably sustainable status, with an index score of 51.27. Among the five dimensions ecology, social, economic, technology, and institutional the social aspect demonstrates the highest sustainability index at 54.92, falling into the fairly sustainable category.

1. INTRODUCTION

The agricultural industry plays a vital role in advancing Indonesia's economy, evident from its substantial contribution to the Gross Domestic Product (GDP). The agricultural industry plays a pivotal role in fostering economic expansion, with most of Indonesia's population working in agriculture, making it the largest employer in Indonesia (Sepriani & Yuliawati, 2022). In the agricultural sector, a labor crisis can threaten its sustainability because of its crucial role in food provision. Several factors are responsible for the waning interest of young workers in entering the agricultural sector (Susilowati, 2016). One factor is the perceived lack of prestige and inadequate rewards in the agricultural sector, due to relatively small land ownership in farming endeavors. The challenge of dwindling numbers of young farmers in the agricultural sector, coupled with the prevalence of older farmers, can significantly impede the progress of sustainable agricultural development. This situation may affect various aspects such as agricultural productivity, market competitiveness, and rural economic strength, posing threats to food security and the long-term sustainability of the agricultural sector.

The millennial generation born between 1981 and 1996 has distinctive attitudes and preferences beginning to transform the agricultural sector. When they choose agriculture as a profession, millennial farmers bring a new perspective, a strong emphasis on sustainability, and a tendency to adopt modern technology into agriculture. Their innovative approach to farming holds great promise in addressing pressing issues such as sustainable food production, land use, and resource efficiency. Understanding the networking abilities of millennial farmers can explain their ability to collaborate and share knowledge, thus contributing to sustainable horticultural practices (Riptanti et al., 2022).

Millennial farmers, growing up in the digital era, have a strong ability to harness the power of networks and social technology (Caffaro et al., 2020). Programs like the millennial farmer initiative carried out by The Ministry of Agriculture of the Republic of Indonesia endeavor to rejuvenate agriculture for the future (Kumara Ardyanti et al., 2023). Essentially, they tend to collaborate and share knowledge, which can be beneficial in promoting sustainability in the agricultural field. These farmers are open to adopting innovations, including the Internet of Things, to enhance efficiency (Harisudin et al., 2023; Kusnandar et al., 2023). They advocate for sustainability, with over 50% actively implementing organic farming practices and promoting sustainable agriculture. Additionally, they utilize social media for marketing communication, expanding their reach and impact (Tutiasri, 2023).

In recent times, the agricultural environment in Greater Malang has experienced notable changes propelled by the heightened participation of millennial farmers. This shift has spurred a growing interest in understanding the sustainability factors driving rapid development in this demographic. Recognizing the importance of this phenomenon, our research aims to conduct a comprehensive sustainability analysis of the factors driving the rapid progress of millennial farmers in Greater Malang. The novelty of the research on the rapid development of millennial farmers in Greater Malang lies in the comprehensive sustainability analysis of the factors driving this phenomenon.

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2. METHOD

This type of research is quantitative descriptive to analyze existing data and facts, factual information at the research site. This research was conducted in the Greater Malang area. The considerations underlying the selection of this location are because Malang is the agricultural center in East Java, with many agricultural entrepreneurs. Malang is also one of the focus areas for government assistance programs, it is close to Surabaya which expands its market, and has a wide landscape ranging from lowlands to highlands.

The selection of respondents was carried out to obtain the necessary information and knowledge. Respondents were chosen based on their environmental conditions and their understanding of the issues being studied. Sample selection was made using a purposive sampling technique, which involved searching for millennial farmers aged 19-39 in Greater Malang through Google searches using keywords such as "millennial farmers", "young farmers", "progressive farmers", and "successful farmers". Seven respondents were successfully obtained using this technique. Then, the snowball sampling method was employed, which refers to a sampling technique that starts with a small number of samples and then gradually expands like a snowball, as explained (Sugiyono, 2014).

The evaluation of sustainability for the typology of millennial farmers in Greater Malang utilized the Multidimensional Scaling (MDS) method, employing the Rap-Shallot ordination technique, which is a modified iteration of Rapfish. This analysis spanned five dimensions: ecology, economics, social aspects, technology, and institutional factors (Saida et al., 2016). This method was initially introduced to assess the sustainability of capture fisheries (Pitcher & Preikshot, 2001).

The procedure for assessing the sustainability of millennial farmer development in Malang Raya involves the following steps:

1. Selection and identification of sustainability attributes in each sustainability dimension through literature review, field observations, expert opinions, and previous research;
2. Assigning ratings to characteristics using an ordinal scale according to data from surveys and interviews;
3. Employing MDS for ordination analysis to ascertain the sustainability level in each dimension using the sustainability index scale;
4. Evaluating the index and sustainability level in each dimension;
5. Conducting sensitivity analysis (leverage analysis) to identify influential attributes affecting sustainability;
6. Employing Monte Carlo analysis to address uncertainty in dimensions.

The sustainability index and status scale are outlined in Table 1.

Table 1. Classification of Index and Sustainability Level

Value	Status
0,00 – 24,99	Low (not sustainable)
25,00 – 49,99	Moderate (less sustainable)
50,00 – 74,99	Satisfactory (fairly sustainable)
75,00 – 100,00	High (highly sustainable)

Source. (Pitcher & Preikshot, 2001)

3. RESULT AND DISCUSSION

Index and Sensitive Attributes in the Ecological Dimension

The sustainability index score for the ecological dimension, determined through Rap Analysis, is 51,64, categorizing it as fairly sustainable, falling within the range of index values from >50 to 75. The sustainability index is derived from evaluating seven attributes critical for sustainability assessment. Analysis of Attribute Leverage reveals that three attributes exert the most substantial influence within the ecological dimension, namely land ownership, agroclimatic suitability, and Efficiency of Resource Utilization.

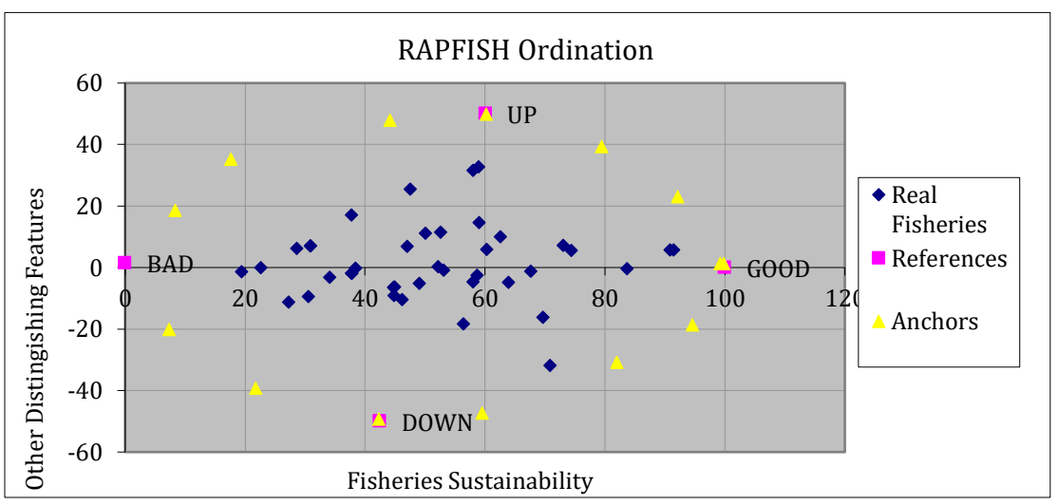

Figure 1. Rapfish Graph on Ecological Dimensi

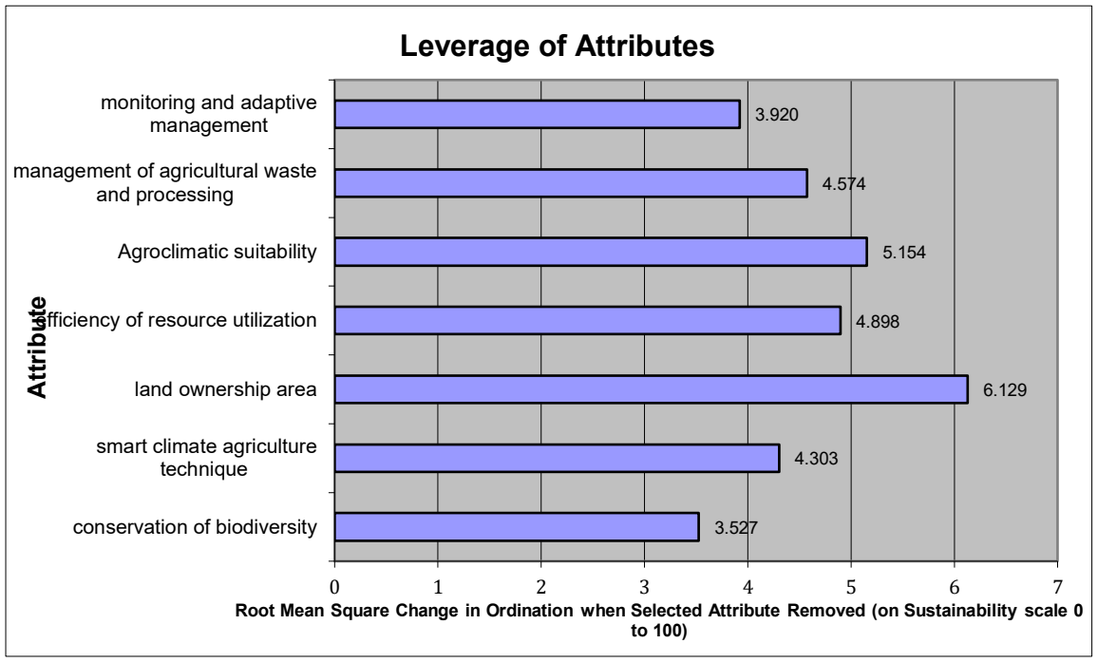

Figure 2. Sensitive Attributes Influencing Sustainability Ecological Dimension

Land ownership is a crucial factor affecting the ecological dimension of sustainable development for millennial farmers because it directly impacts their ability to invest and implement environmentally friendly and sustainable farming practices. The limited land assets and ownership among many millennial farmers pose a challenge for them to develop their agricultural businesses and implement sustainable practices (Novisma & Iskandar, 2023). Land ownership affects sustainable land use practices, which is important for ecological preservation and resource management (Wang et al., 2024).

Efficiency of resource utilization is a crucial factor for millennial farmers in running their businesses. Millennial farmers leverage agricultural technology innovations to optimize resource utilization (Polas et al., 2023). Millennial farmers show a keen interest in adopting innovative technologies like the Internet of Things (IoT), to practice sustainable agriculture and efficiently utilize natural resources (Harisudin et al., 2023). Some examples of efficient resource utilization in millennial agriculture include Precision Farming Technology: Millennial farmers adopt precision farming technologies such as drones, smart irrigation, and remote sensing to optimize the use of water, fertilizers, and pesticides, resulting in higher sustainable farming practices and more efficient natural resource utilization (Widiyanti et al., 2021). Therefore, resource utilization efficiency by millennial farmers plays a crucial role in shaping the agricultural sector and its sustainability.

Index and Sensitive Attributes in the Economic Dimension

The sustainability index score for the economic dimension, determined through Rap Analysis, is 53,25, placing it within the fairly sustainable category with index values ranging from >50 to 75. The sustainability index is shaped by nine attributes essential for sustainability assessment. Analysis of Attribute Leverage within the economic dimension reveals two attributes that have the most significant impact, namely Economic Efficiency and Business Capital.

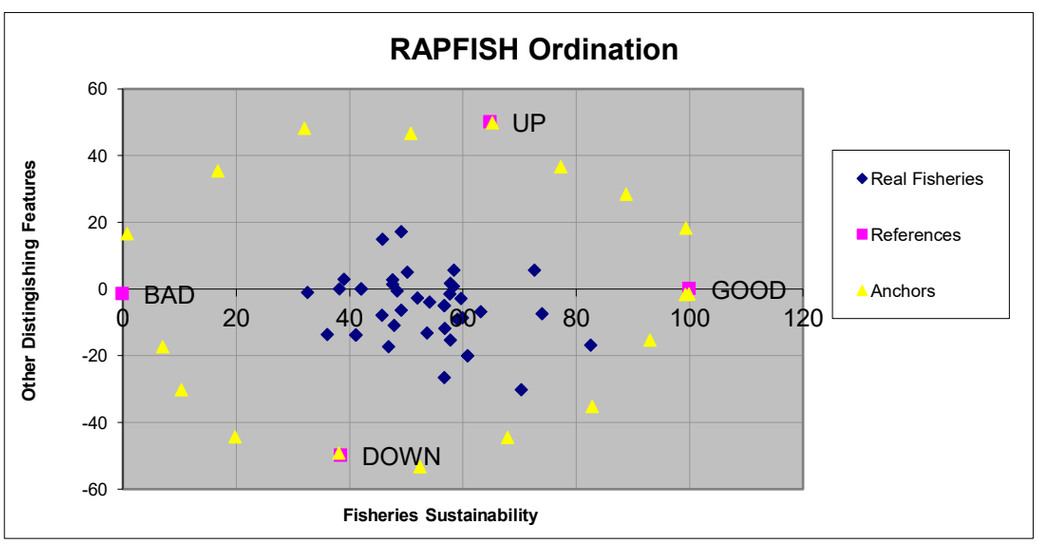

Figure 3. Rapfish Graph on Economic Dimension

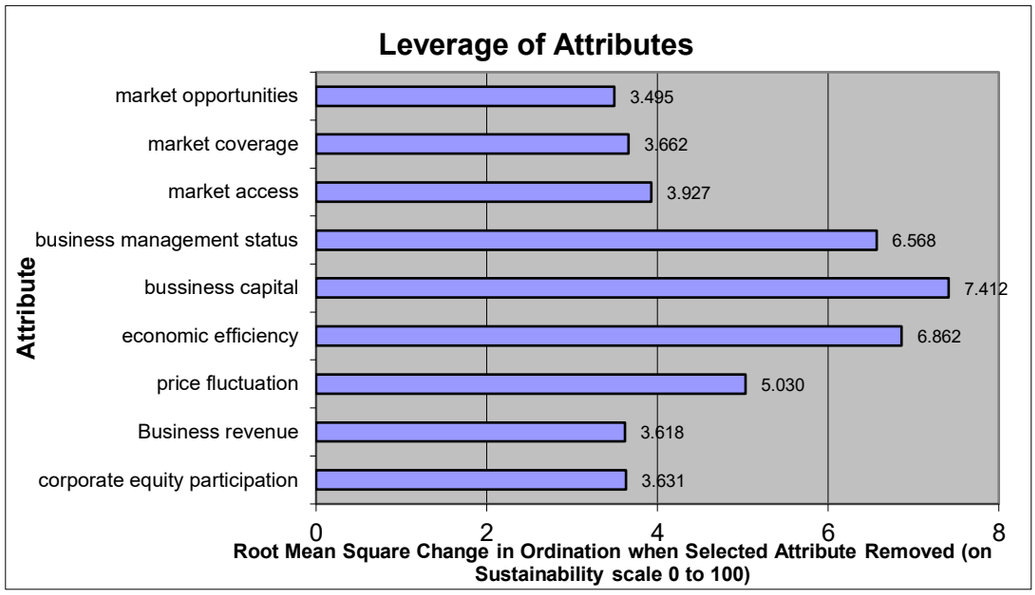

Figure 4. Sensitive Attributes Influencing Sustainability Economic Dimension

The economic efficiency of millennial farmers significantly influences the sustainability of the economic dimension in agricultural development. Millennial farmers are expected to make farming more efficient and profitable by relying on technology, innovation, and entrepreneurship (Dumasari et al., 2022). The implementation of automatic equipment, drones, robotics, and precision farming technology contributes to higher levels of sustainable farming practices and efficient utilization of natural resources (Novisma & Iskandar, 2023). By leveraging this technology, millennial farmers can reduce production costs, increase productivity, and enhance the overall economic sustainability of their farming operations (Zulpardiasyah & Eko, 2022). Therefore, the economic efficiency of millennial farmers, driven by the adoption of modern technology and innovative practices, plays a crucial role in ensuring the sustainability of the economic dimension in agricultural development.

The sustainability of the economic dimension in the development of millennial farmers is heavily influenced by their access to business capital. Millennial farmers often face challenges in accessing capital, which can affect their ability to invest in technology, increase productivity, and manage their farming operations profitably (Mahbubi, 2022). Limited access to capital can hinder the implementation of sustainable and efficient farming practices, as well as their ability to acquire land and resources. Therefore, the availability of business capital is a crucial factor in ensuring the sustainability of millennial farmers' economies and their ability to manage their farming operations intelligently and profitably.

Index and Sensitive Attributes in the Social Dimension

The sustainability index score for the social dimension, as determined by Rap Analysis, is 54,92, placing it within the category of fairly sustainable, which encompasses index values ranging from >50 to 75. The sustainability index is shaped by ten attributes crucial for sustainability assessment. Analysis of Attribute Leverage within the social dimension reveals two attributes that have the most significant impact, namely a specific interest in agriculture, trial and error in business, and Family Participation.

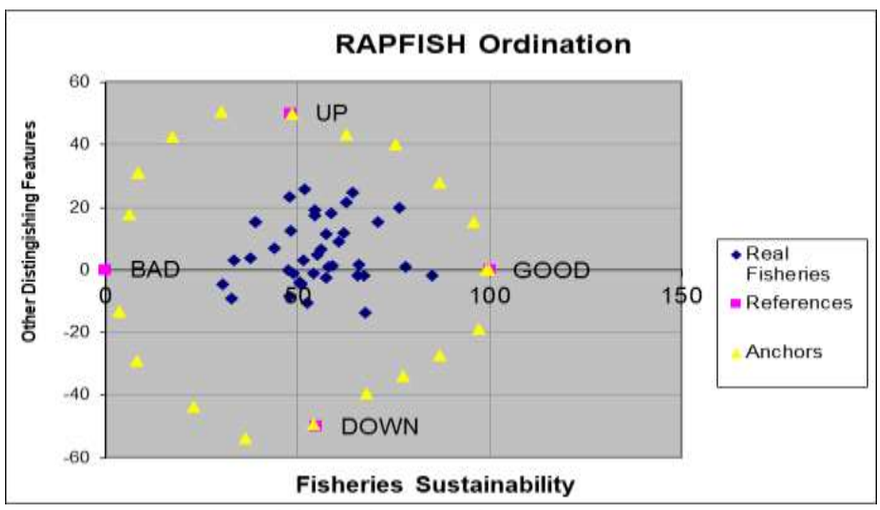

Figure 5. Rapfish Graph on Social Dimension

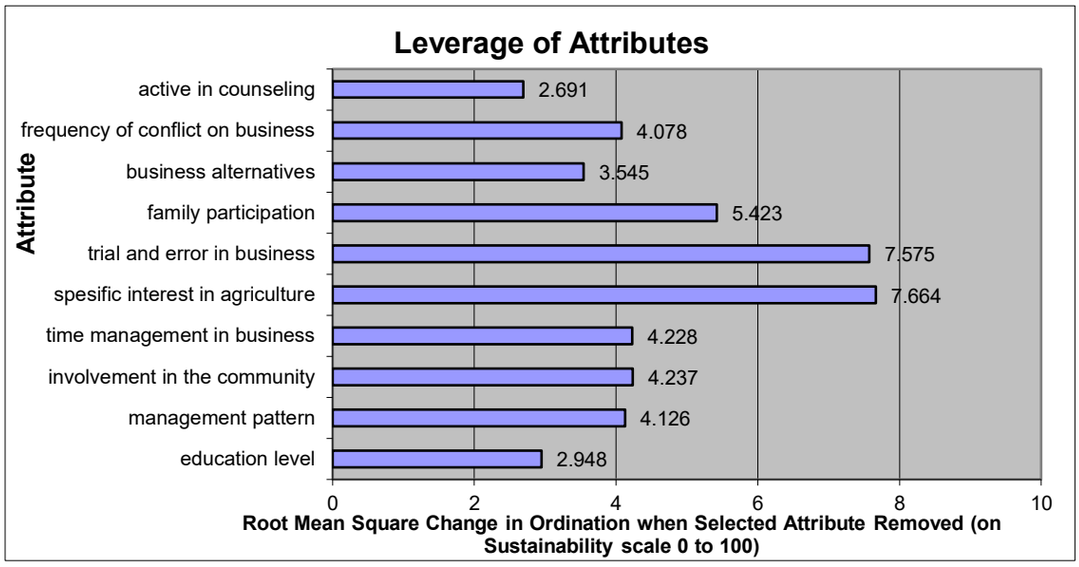

Figure 6. Sensitive Attributes Influencing Sustainability Social Dimension

The motivation for farming plays a significant role in shaping the sustainability of the social dimension in the development of millennial farmers. Millennial farmers are motivated by a specific interest in agriculture, and trial and error in business which drives their participation and involvement in farming activities (Ardyanti et al., 2024; Kurniawan et al., 2023). This motivation is fueled by a desire to contribute to sustainable farming practices, preserve the environment, and address global issues such as climate change and food security. Additionally, millennial farmers' motivation is influenced by their perceptions of farming, environmental support, social assessment, and their ability to make decisions based on family interests and circumstances (Effendy et al., 2022). Their strong interest in the environment and attention to social media further demonstrate their commitment to innovation and sustainability in agriculture. In general, the motivation of millennial farmers plays a pivotal role in influencing the social dimension of sustainability in agriculture, as it molds their attitudes, behaviors, and efforts to create a more sustainable and environmentally conscious agricultural sector.

Family participation significantly impacts the sustainability aspect within the development of millennial farmers' social dimension. Family participation is a key factor in shaping millennial farmers' identity and behavior. Family involvement encourages social learning and passes down traditional agricultural knowledge, thereby enhancing sustainability (D'angelo et al., 2021). Greater family participation may occasionally result in tensions stemming from uncertainties surrounding farming outcomes. However, family involvement also plays a role in preserving and evolving the identity of farmers through diverse channels such as education, belonging, and social connections. Transiting cultural values through family involvement preserves agricultural heritage and promotes sustainable practices (Milone & Ventura, 2019). Intergenerational farming transition and family involvement, including spouses and children, are crucial in shaping the social dimension of sustainability in millennial farmer development.

Index and Sensitive Attributes in the Technology Dimension

The sustainability index score for the technology dimension, determined through Rap Analysis, is 50,50, categorizing it as fairly sustainable, within the range of index values from >50 to 75. The sustainability index is shaped by seven attributes essential for sustainability assessment. Analysis of Attribute Leverage within the technology dimension reveals that two attributes have the most significant impact, namely Digital Communication and Digital Literacy.

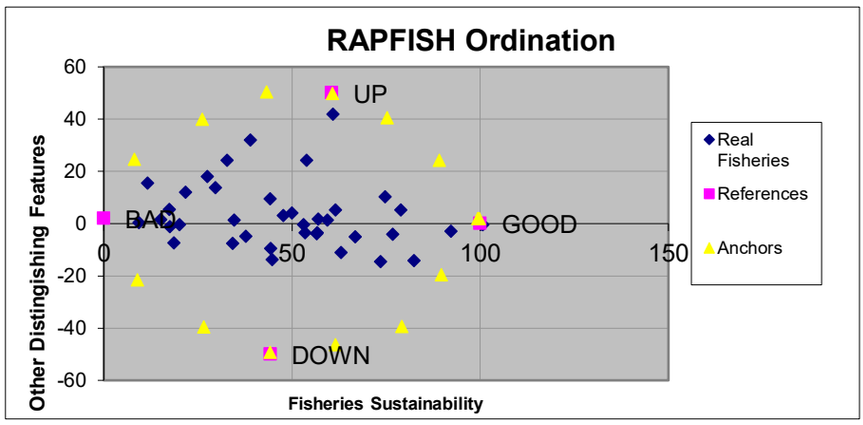

Figure 7. Rapfish Graph on Technology Dimension

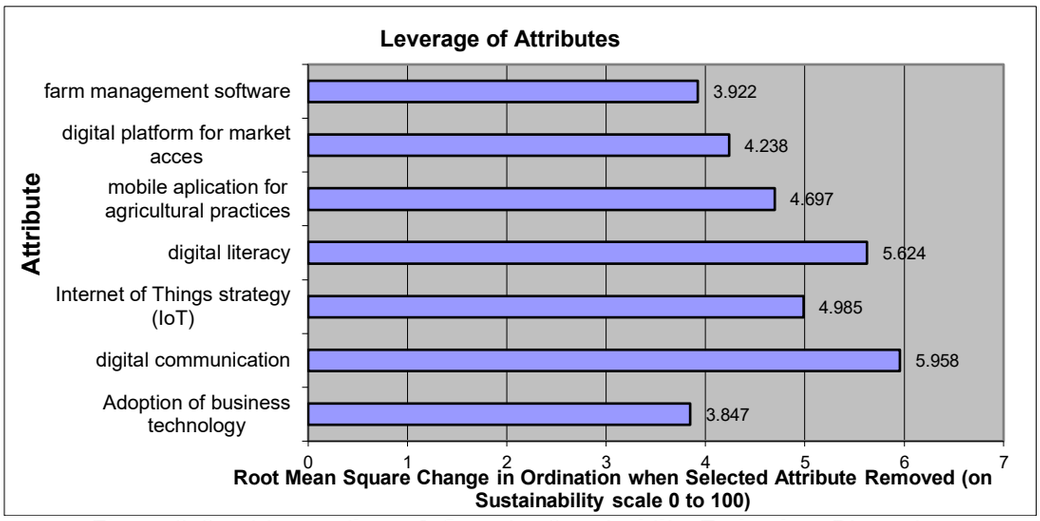

Figure 8. Sensitive Attributes Influencing Sustainability Technology Dimension

Digital communication significantly impacts the sustainability aspect of the advancement of technology among millennial farmers. Millennial farmers leverage digital communication to support their farming businesses, including social media for marketing and networking (Djuwendah et al., 2023; Riptanti et al., 2022). Social media platforms offer new ways for farmers to communicate and engage with the community to promote their products. Digital communication channels facilitate the dissemination of information and knowledge about innovative agricultural technology, leading to the widespread adoption of agricultural technology among millennial farmers (Golicz et al., 2021). The utilization of technology and digital media is essential for millennial farmers to engage in online-based marketing and make decisions regarding changes or innovations in their farming practices.

Digital literacy is essential in shaping the sustainability of technology within the advancement of millennial farmers in Greater Malang. Digital literacy enables millennial farmers to effectively adopt and utilize agricultural technology, thereby enhancing productivity and efficiency (Novisma & Iskandar, 2023). The digital literacy skills required for millennial farmers to adopt sustainable farming practices include utilizing digital technology. Millennial farmers must be proficient in using digital technology, including farm machinery and digital communication, to effectively manage their farms and stay abreast of the latest farming practices (Widiyanti et al., 2021). Millennial farmers also require digital literacy skills to market their products efficiently and access information related to utilizing digital communication and online communities for technology adoption and marketing purposes (Djuwendah et al., 2023).

Index and Sensitive Attributes in the Institutional Dimension

The sustainability index score for the institutional dimension, as determined by Rap Analysis, is 46,02, placing it within the category of less sustainable, which encompasses index values ranging from 25 to 50. The sustainability index is shaped by nine attributes essential for sustainability assessment. Analysis of Attribute Leverage within the institutional dimension reveals that two attributes have the most significant impact, namely Guidance and concouling, and Corporate Presence.

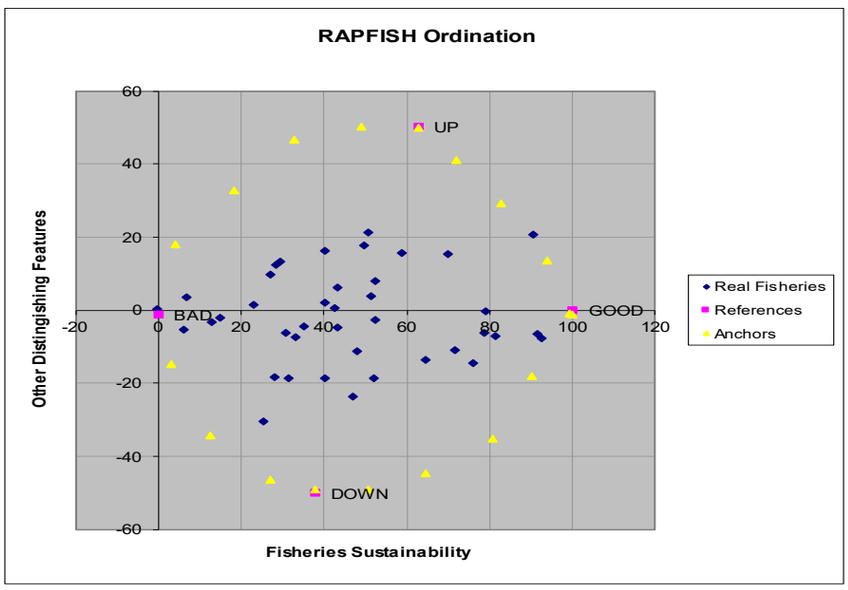

Figure 9. Rapfish Graph on Institutional Dimension

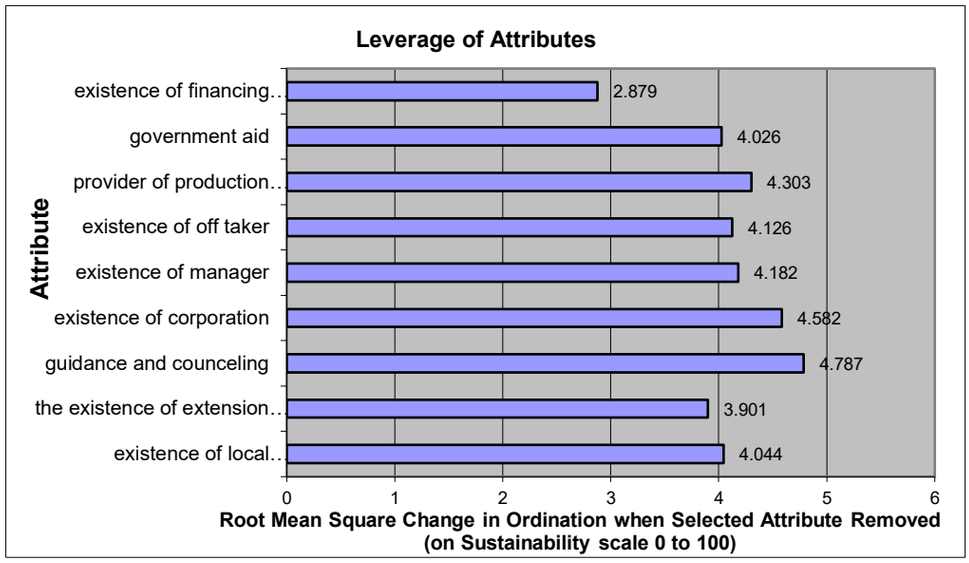

Figure 10. Sensitive Attributes Influencing Sustainability Institutional Dimension

Guidance and counseling are pivotal in bolstering the institutional aspect of sustainability assessment for millennial farmers. These services offer support and resources that aid in establishing a robust institutional framework within the farming sector (Ayu Umaiya & Perwitasari, 2024). Through counseling sessions, farmers gain the necessary knowledge and abilities for sustainable farming, nurturing a culture of ongoing improvement and adaptability within agricultural setups. Moreover, counseling assists in tackling unique challenges encountered by millennial farmers, like technological advancements and shifts in market dynamics, thereby fortifying the resilience and sustainability of agricultural institutions overall (Suryahadikusumah & Kurniasari, 2020).

The presence of corporations significantly influences the sustainability of the institutional dimension in the progression of millennial farmer development. Millennial farmers are early adopters of the latest technology, and they actively leverage digital technology and social media to expand market share and address various challenges. Corporate involvement in the agricultural sector can provide millennial farmers with access to resources, markets, and technology that can significantly impact the sustainability of their institutional dimension (Riptanti et al., 2022; Widiyanti et al., 2021). Corporations provide resources and support, influencing the institutional sustainability of millennial farmers by facilitating access to technology, finance, and infrastructure (Harisudin et al., 2023; Kusnandar et al., 2023).

Index and Sustainability Status of Millennial Farmer Development in Greater Malang

In the kite diagram, it is shown that all dimensions exhibit sustainability. Based on the RAPFISH analysis results, the sustainability index value of Millennial Farmer Development in Greater Malang is 51.27. This value falls within the category of fairly sustainable, ranging from index values >50-75. Among the five analyzed dimensions, the highest sustainability value is indicated by the social dimension at 54.92, categorized as fairly sustainable. This is followed by the economic dimension with an index value of 53.25, also categorized as fairly sustainable. Next is the ecological dimension with an index value of 51.64, falling within the fairly sustainable category. The technology dimension follows with an index value of 50.5, also falling within the fairly sustainable category. Meanwhile, the institutional dimension shows a lower sustainability value at 46.02 categorized as lower sustainable.

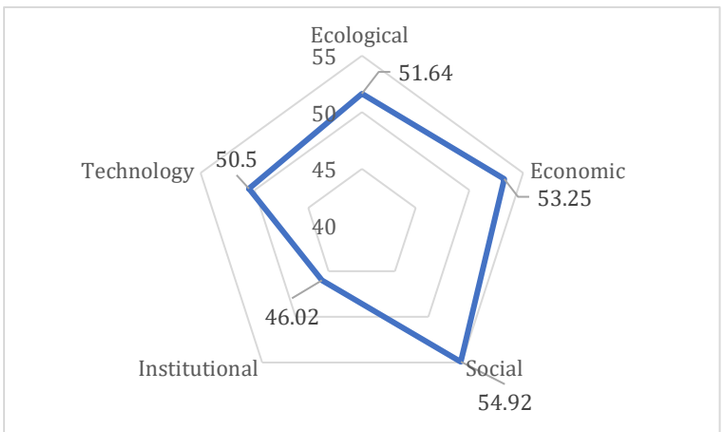

Figure 11. Index and Sustainability Status of Millennial Development in Greater Malang

The social dimension significantly contributes to the sustainability of millennial farmer development in Malang Raya. The special interest shown by millennial farmers in engaging in agriculture is a crucial factor supporting the enhancement of their technical skills and advancing the agricultural industry. The involvement of the millennial generation in agricultural production also benefits this sector, as they prioritize quality and have better motivation to engage in farming activities (Novisma & Iskandar, 2023). Furthermore, the development of information technology enables millennial farmers in Malang Raya to easily communicate with business associates and other stakeholders, thereby further strengthening the social dimension plays a vital role in ensuring the sustainability of millennial farmer development in Greater Malang.

Millennial farmers in Malang Raya collaborate with their communities to promote social sustainability in their farming practices through various means. They utilize information technology and social media To broaden their market presence and networking opportunities, they are adept at swiftly accessing market information, particularly with the progress of information technology. Additionally, they use digital technology for business purposes and personal branding. This suggests that the social aspect plays a pivotal role in ensuring the sustainability of millennial farmer development in Malang. By focusing on the social dimension and its related attributes, stakeholders can effectively address the unique challenges faced by millennial farmers while promoting sustainable farming practices and fostering dynamic rural communities.

In contrast, the institutional dimension exhibits the lowest sustainability value. The institutional dimension has a constrained impact on the sustainability of millennial farmers and highlights several important factors, including the traditional institutional framework inadequately addressing the needs and unique challenges faced by millennial farmers (Harisudin et al., 2023; Kusnandar et al., 2023). This is in line with corporations in Malang Raya not yet being fully formed and meeting the needs of millennial farmers. Additionally, there is a gap in the implementation of policies or support mechanisms from the government (Kumara Ardyanti et al., 2023)that are inadequate and not tailored to the evolving agricultural landscape in Malang Raya, addressing these challenges requires a holistic approach involving a review of existing institutional frameworks, enhancing policy coherence, promoting innovation in support mechanisms, and engaging millennial farmers actively in decision-making processes.

4. CONCLUSIONS AND RECOMMENDATIONS

The sustainability analysis results of Millennial Farmer Development in Malang Raya show a moderately sustainable index value of 51.27. Among the five dimensions - ecology, social, economic, technological, and institutional - the highest sustainability index value is shown by the social dimension at 54.92, categorized as moderately sustainable. This indicates that the social dimension has the most significant impact on the development of millennial farmers in Malang Raya. From the Leverage of Attributes analysis in the social dimension, two attributes significantly influence the development process of millennial farmers in Malang Raya: the presence of farming motivation in the form of special interest and family participation. The special interest shown by millennial farmers in engaging in agriculture is a crucial factor supporting the enhancement of their technical skills and benefiting the agricultural sector. Family participation is a key factor in shaping the identity and behavior of millennial farmers. Family involvement encourages social learning and transmits agricultural knowledge, thereby enhancing sustainability. On the other hand, the institutional dimension reflects the lowest sustainability. The institutional dimension has a restricted impact on the sustainability of millennial farmers. It highlights several important factors, including the inadequacy of traditional institutional frameworks in addressing the needs and unique challenges faced by millennial farmers. Additionally, there is a gap in the implementation of policies or support mechanisms from the Government that are inadequate and not tailored to the evolving agricultural landscape in Malang Raya. To address the challenges related to the development of millennial farmers in Malang Raya, a holistic approach is needed involving a review of existing institutional frameworks, enhancing policy coherence, promoting innovation in support mechanisms, and actively involving millennial farmers in the decision-making process. Stakeholders can effectively address the unique challenges faced by millennial farmers while promoting sustainable farming practices and fostering dynamic rural communities. Further research is needed on the in-depth analysis of the farming efficiency of millennial farmers and other businesses outside the agricultural sector as part of the millennial farmers' business units.

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