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A Review on the Potential Millennial Farmers in Karanganyar District: Opportunities, Challenges, and Strategies

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Abstract

This study discusses the potential of millennial farmers in Karanganyar Regency. The purpose of this research is to see the opportunities that exist, know the challenges faced by millennial farmers, and understand the strategies used by millennial farmers in overcoming challenges in agricultural businesses. Karanganyar Regency was chosen as the research area because, according to census data from the Central Statistics Agency in 2023, Karanganyar Regency has the most significant number of Agricultural Business Households (RTUP) in Central Java Province. The approach used in this research is qualitative, with data obtained from primary data sources through questionnaires. This research involved a total of 104 respondents, namely millennial farmers aged 19-39 years who live in Karanganyar Regency. The data collection method used a closed questionnaire, while the data analysis method used was descriptive qualitative with content analysis. Source triangulation was used to measure data validity. The results showed that the potential of millennial farmers in Karanganyar Regency was quite effective because they were able to create broad market opportunities. In addition, they also managed to overcome challenges in the agricultural business through the strategies they developed.

Keywords: Farmers, Regeneration, Millennials, Agriculture

1 Introduction

The 2023 agricultural census Phase 1 of Central Java Province by the Central Bureau of Statistics stated the results in the form of Karanganyar Regency being the most significant number of Agricultural Business Households (RTUP) and Individual Agricultural Businesses (UTP) in Central Java Province.[1]

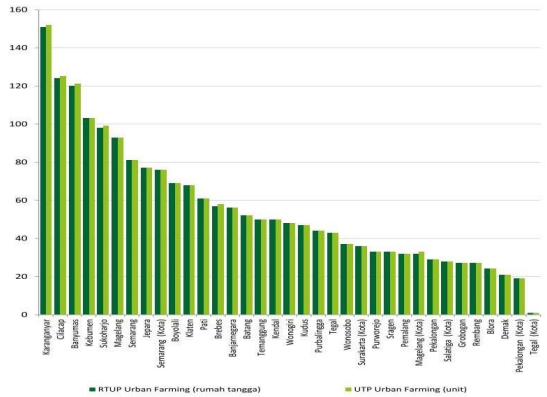

Fig.1. Number of Urban Farming Households (RTUP) and Urban Farming Individual Businesses (UTP) by Regency/City in Central Java Province, 2023 source: Central Java BPS.2023

Karanganyar Regency, which has the most Urban Farming RTUPs and Urban Farming UTPs in Central Java Province, is accompanied by an increase in the number of farmers, which can be seen from the summary results of ST2013 and ST2023.

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Table 1. Number of Farmers in Karanganyar Regency Based on Age

Farmer Age	Number of (people)	
	2013	2023
<15	16	7
15-24	110	924
25-34	4.658	7,613
35-44	21,051	22,862
45-54	32.104	34.285
55-64	27,838	35,709
65++	18,962	29,643
AMOUNT	104,739	131,043

Source: Statistics Indonesia Bureau, 2023

All data from a period of 10 years shows that farmers in Karanganyar Regency have increased. The number of farmers over the age of 35 has increased significantly compared to farmers under the age of 35, who are included in the term millennial farmers. The small number of increasing millennial farmers has become a hot topic in various regions, including Karanganyar Regency.

The participation of Karanganyar Regency youth involved in the agricultural sector is ranked 28th out of 35 regencies/cities in Central Java. Youth working in the agricultural sector in Karanganyar Regency is only 6.20%.[3]This problem of farmer regeneration is also experienced by other countries operating in the agrarian sector.[4]Farmer regeneration is the replacement of farmers of unproductive age with younger and more productive farmers.[5]Farmer regeneration can help agricultural productivity and promote sustainable agriculture, which can improve community food security.[6] One of the indicators of the level of regeneration in the agricultural sector is the system of utilizing digital technology, which can be expected to create modern, productive, and sustainable agriculture by using millennial farmer data. Millennial farmers are adaptive to digital technology, which includes the use of modern agricultural tools and machines, the use of the internet/smartphones/information technology, and artificial intelligence.[1]Therefore, millennial farmers who understand digital technology are the primary key to farmer regeneration.

Millennial Farmers are Indonesian citizens (WNI) aged 19 to 39 years who carry out agricultural businesses in the fields of food crops, horticulture, plantations, and livestock or carry out agricultural businesses using digital technology and the use of modern technology.[2] Millennial farmers are spread across every region in Indonesia, one of which is Karanganyar Regency.

Farmer regeneration, the current youth perspective on farmer work in Karanganyar Regency is vital to know, which is the main goal because youth are the generation that will continue work in the agricultural sector in the future, factors that influence the perception of millennial youth about farmer work are, significant income, job risks, career development, and work environment.[3]The number of millennial farmers in Karanganyar Regency is 17,193 people, or around 13.12% of farmers in Karanganyar Regency, consisting of 14,637 male millennial farmers; the remaining 2,556 are female.[2]

Sub-district agricultural data shows that there are 17,193 people, or 13.12% of the total farmers in Karanganyar, which is 131,043 people. The most significant number of millennial farmers is in Gondangrejo District, with 1,785 people, followed by Jumantono District, with 1,712 people, and Jenawi District, with 1,387 people.

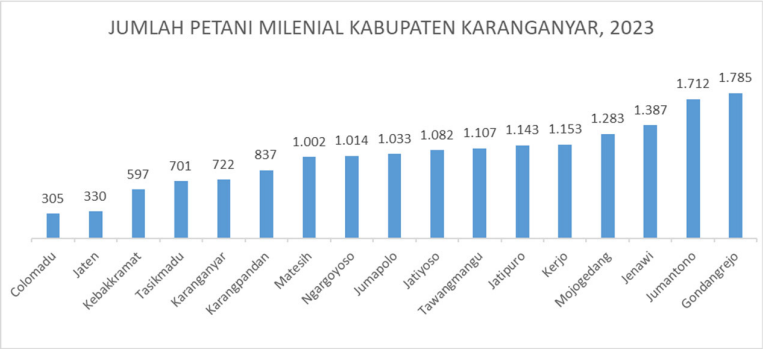

Fig.2. Number of millennial farmers in Karanganyar Regency, 2023
Source :BPS Karanganyar. 2023

Based on these results, Gondangrejo District has the most millennial farmers compared to Jenawi District, which has almost the same area, namely 5,679.95 km2 and 5,608.28 km2. This situation is due to the number of Gondangrejo residents. The District has 89,443 people, while the Jenawi District has only 27,668 people. Some of the land in Gondangrejo District is agricultural land that has relatively good potential for the development of agro-industrial crops.

Based on the area of rice field harvest in Gondangrejo District, it is 3,735.0 ha. Jenawi District only has a rice field harvest area of 1,814.6 ha. While Jumantono District, which is in second place, has an area of 5,355.44 km2 with a population of 50,289 people, the area of rice field harvest is 2,822.4 ha.

Table 2. Number of Millennial Farmers by Sub-district, Using Technology and Not Using Technology in Karanganyar Regency, 2023

Subdistrict	Using Technology	Not Using Technology	Millennial Farmers
Jatipuro	407	736	1.143
Jatiyoso	346	736	1,082
Jumapolo	291	742	1,033
Jumantono	517	1.195	1,712
Matesih	278	724	1.002
Tawangmangu	472	635	1.107
Ngargoyoso	277	737	1,014
Karangpandan	303	534	837
Karanganyar	382	340	722
Tasikmadu	254	447	701
Jaten	145	185	330
Colomadu	98	207	969
Gondangrejo	700	1,085	1,785

Kebakkramat	297	300	597
Mojogedang	477	706	1.283
Kerjo	362	791	1.153
Jenawi	491	896	1,387
AMOUNT	6.197	10,996	17,193

Source : BPS Karanganyar. 2023

The purpose of digital technology is to use artificial intelligence for agricultural business activities using smartphones, information technology, internet use, and drones. Meanwhile, the Use of Modern Technology aims to make agricultural practices effective and efficient with the use of technological elements. For example, modern techniques in agriculture include agricultural machines and tools that use the latest technology, both mechanical and digital.[2]

Based on the background, the problem in this study is about the potential of millennial farmers, the strategy for developing millennial farmers, and the opportunities and challenges for millennial farmers in Karanganyar Regency. The purpose of this study is to identify the potential of millennial farmers and the strategy for developing millennial farmers, as well as to identify the opportunities and challenges for millennial farmers in Karanganyar Regency.

2 Theoretical basis Farmer

Regeneration

Farmer regeneration or farmer renewal is an essential process, the process of transferring agricultural activities by giving land from parents to their children who are willing to become farmers as the next eneration. [8] Agricultural regeneration needs to be sustainable for several reasons. First, sustainable agriculture must be realized because farmer regeneration is a prerequisite. Second, updating agricultural behavior is very important to achieve food security in the future. Third, to achieve food sovereignty, it is crucial to update agricultural actors in terms of their ability to meet food needs independently. (Anwarudin et al., 2020)

According to Anjani Restiana Harmis in her research, there are 4 categories of stages in the regeneration of farmers from parents to the next generation, including:

1) Encourage farmers to pass on messages to their children and grandchildren so that they can continue agricultural activities. In urban areas, farmers tend to pass on messages to their children. In contrast, in rural areas, farmers tend to be reluctant to pass on messages to their children to continue agricultural activities.
2) Encouraging farmers to involve their children in agricultural activities shows that both urban and rural areas have incentives that tend to involve their children in agricultural activities.
3) The encouragement of farmers to convey messages of love and appreciation for agriculture to their children shows that farmers tend to encourage their children through messages of love and appreciation for agriculture, both in urban and rural areas.
4) By inviting farmers to educate their children that farming is a noble profession, both in urban and rural areas. Encouraging farmers tends to teach their children that farming is a noble job.

Millennial Farmers

Millennial Farmers are young people aged 20-39 who are ready to switch and get involved in the world of agriculture and must have an independent, progressive, and modern spirit in developing the agricultural sector to be better in the future. Millennial farmers replace older human resources with young human resources who have new, creative, and valuable innovations in agricultural development because agriculture is a critical sector in supporting the community's economy.[9]

Therefore, in this very modern era 4.0, millennial farmers are vital to ensure that the agricultural sector in Indonesia remains competitive with other advanced sectors. Which utilize innovation and technology.[10]

The presence of millennial farmers who represent today's young-spirited farmers, relatively good market access, and successful entrepreneurs are attractive to this millennial generation, who want to compete in the

agricultural sector. This matter also confirms the perception between farmers and farmers. Farmers believe that the Millennial generation can be a suitable catalyst for attracting the interest of the younger generation to work in the agricultural sector.[11]

The characteristics of young or millennial farmers tend to have better education than adult farmers. Most have not received training or internships, have access to IT, and have average awareness of agribusiness, but their motivation is still low. Therefore, it is necessary to study in depth the personalities of millennial farmers who have the potential to become drivers of agricultural development and farmer regeneration, especially those in rice-growing areas.[12]

Digital technology

The existence of digital technology will significantly encourage the acceleration of agricultural progress and have an impact on the development of the agricultural sector, which will help in poverty alleviation efforts. Likewise, the development of agricultural technology can be a solution to agricultural development[13]

With the emergence of a digital agricultural system, the government can control what is planted and harvested from one region to another with the hope that there is no significant difference between the data and the actual conditions. Through this system, the government can easily find out which regions are experiencing food surpluses and shortages, making it easier to find solutions. For farmers and consumers, the digital agricultural system will significantly help avoid and minimize price games from food tycoons and mafia. The existence of a digital agricultural system will facilitate distribution from farmers to consumers by shortening the food supply chain system. Therefore, it is expected to reduce the gap in food access, accelerate the fulfillment of food needs from one region to another, and make a real contribution to the development of the Indonesian economy.[14]

However, the use of advanced technology can cause an increase in food production costs, which is difficult for small farmers to bear. This issue causes the gap between the financial capabilities of small farmers and the application of modern technology to widen, making it increasingly difficult for small farmers to apply advanced technology. The current reality shows that it is challenging to increase agricultural output because small farmers cannot afford advanced technology. In Indonesia and developing countries, food production still depends on small farmers.[15]

3 Research Methods

A. Types of Research and Approaches 1. Types of research

In this study, a qualitative approach perspective was used. According to [16], Qualitative research focuses more on overall or holistic descriptions, explaining in detail what activities or situations are occurring rather than comparing the impact of certain behaviors or problem-solving, such as a person's attitudes or behaviors.

The purpose of qualitative research is to get an overview of the research being conducted. Qualitative research is conducted based on the opinions, ideas, and perceptions of others towards the subject being studied. Data collection techniques are carried out in a combined manner (triangulation), data analysis is inductive, and the results of qualitative research emphasize meaning rather than generalization. The data that has been carried out within the framework of qualitative research is not measured by numbers but by observations, interview results, and documentation results that will be presented at the time of the event where the research will take place.

The use of a qualitative approach in this study aims to describe the potential of millennial farmers as well as strategies for developing millennial farmers and the opportunities and challenges of millennial farmers in the Karanganyar district.

B. Location and Time of Research 1. Research Location

The research location is the place where the researcher conducts the research. This location provides a precise location that is right on target in research. This research was conducted in Karanganyar Regency, especially in three sub-districts with the most significant number of millennial farmers in Karanganyar Regency, namely Gondangrejo District, Jumantono District, and Jenawi District. The researcher conducted the research there because the three sub-districts are areas with the most significant number of millennial farmers in Karanganyar Regency, according to data from the Central Statistics Agency.

2. Research Time

In this research, the researcher needed research time, which was carried out from March 19, 2024 until now, October 14, 2024.

C. Data source 1. Primary Data

Primary data is data taken directly from research subjects using measuring instruments or direct data collection tools about research subjects as a source of research information.[17]The primary data source in this study was obtained through a questionnaire to a number of young people (between 19 and 39 years old) in three sub-districts that produce the most significant number of millennial farmers in Karanganyar Regency. **2. Secondary Data**

Secondary data is data obtained from other parties, not directly from researchers or their research subjects.[17]The task path of discussion is carried out before interpretation and deflation or conclusion or is used to obtain different information using previous data. In this study, secondary data sources were obtained from journals, internet sites, archives, books, or related articles.

D. Research Objects and Subjects 1. Research Object

The object of research is problematic and is used as research. The object of research in this study is the potential of Millennial Farmers and development strategies and opportunities and challenges for millennial farmers in Karanganyar Regency. **2. Research Subjects**

According to Sugiyono, the research subjects are the primary data sources in the research that have previously been summarized in detail, and people have information about the variables being studied. In this case, the subjects studied in qualitative research are referred to as consultants in obtaining the information obtained. In this study, the research subjects targeted were all young generations (between the ages of 19-39 years), especially in Gondangrejo District, Jumantono District, and Jenawi District, which are the areas that produce the most millennial youth in Karanganyar Regency.

E. Data collection technique 1. Questionnaire

Questionnaires or surveys are indirect data and information collection techniques (researchers do not directly ask respondents questions). The instrument or data collection tool is called a questionnaire, which contains a number of questions that must be answered or responded to by respondents. So, respondents have the freedom to provide answers or provide responses according to their respective perceptions.

According to Sugiyono, a questionnaire is an effort to collect information by asking a number of written questions that must be answered by respondents in writing. A questionnaire is a data collection technique that involves giving a series of written questions or answers to respondents.

F. Data Analysis Techniques 1. Content Analysis

This content analysis technique method is used to interpret and analyze the symbolic meaning contained in articles, literary works, papers, and other published journals containing unstructured data.[18]

According to Sugiyono, several stages are used in content analysis research using a qualitative approach. First is the description and orientation stage, where the researcher describes what has been seen, heard, felt, and asked. Second is the reduction stage, when the researcher reduces all the information obtained in the first stage to focus more on a particular problem. Data that needs to be classified is data that is interesting, important, useful, and recent—third the selection stage. The researcher explains the identified focus in more detail. In this third stage, after conducting an in-depth analysis of the data and information obtained, new insights, hypotheses, and discoveries are made.

G. Data Validation Method

According to[19], triangulation is a method that can be considered as one of the data collection techniques used by researchers to test whether or not the data has been obtained. In other words, triangulation is an effort to verify the accuracy of data and information obtained from various points of view. There are several types of triangulation, namely researcher triangulation (investigator triangulation), method/technique triangulation (Methodological triangulation), source/data triangulation (data triangulation), and theoretical triangulation (theoretical triangulation).

Data validation in this study data checking is done by triangulating the type of source/data checking data obtained from several sources such as interviews and observations. The data sources in question include all millennial generations who are involved or not in the agricultural sector in the Karanganyar Regency area, especially the three sub-districts that have the most significant number of millennial farmers in Karanganyar Regency, namely Gondangrejo District, Jumantono District, and Jenawi District.

4 Results and Discussion

a. Results

This study uses a questionnaire as a data collection technique, which was conducted in Karanganyar Regency with the criteria of millennial farmer respondents aged 19 to 39 years.
The results of the study on opportunities, challenges, and strategies by millennial farmers in Karanganyar Regency. Based on the results of the questionnaire

1. Respondent Characteristics

The characteristics in this study include gender, age, last education, type of agriculture, income from agriculture, land status, agricultural information, and agricultural motivation. Table 3. Gender of Millennial Farmers

No	Gender	Frequency (People)	Percentage (%)
1	Man	65	69.5%
2	Woman	39	37.5%
Amount		104	100%

Based on Table 1 above, we can see that millennial farmers have a relatively balanced distribution between men and women. However, there is a significant difference in the number, namely 65 out of 104 male respondents, which is more than women, who are only 39 out of 104 respondents. This result means that male millennial farmers tend to be more active in carrying out agricultural activities with the hope of being more effective.

Table 4. Age of Millennial Farmers

No	Age criteria	Frequency (People)	Percentage (%)
1	19 – 26 Years	72	69.2%
2	27 – 33 Years	19	18.3%
3	34 – 39 Years	13	12.5%
Amount		104	100%

Based on Table 2 of the age analysis above, we can see that most respondents are between 19 and 26 years old, as many as 72 out of 104 respondents. Furthermore, 19 out of 104 respondents were between 27 and 33 years old, and finally, the fewest respondents were only 13 out of 104 respondents aged 34 to 39 years. It can be concluded that the age of 19 to 26 years is the most dominant period in this study.

Table1. The Latest Education of Millennial Farmers

No	Last education	Frequency (People)	Percentage (%)
1	No school	0	0%
2	SD	4	3.8%
3	Junior High School	9	8.7%
4	Vocational School/Senior High School	57	54.8%
5	Bachelor/Diploma	33	31.7%
6	S2 and above	1	1%
Amount		104	100%

Based on Table 3, In the analysis of the last education, we can see that most respondents have achieved a higher level of education. However, 4 out of 104 respondents only have an elementary school education, and 9 out of 104 respondents have a junior high school education. However, most of the 57 out of 104 respondents have completed high school/vocational school education. After that, 33 out of 104 respondents have achieved the latest level of education equivalent to a Bachelor/Diploma, and only 1 person has achieved a Masters level of education or above.

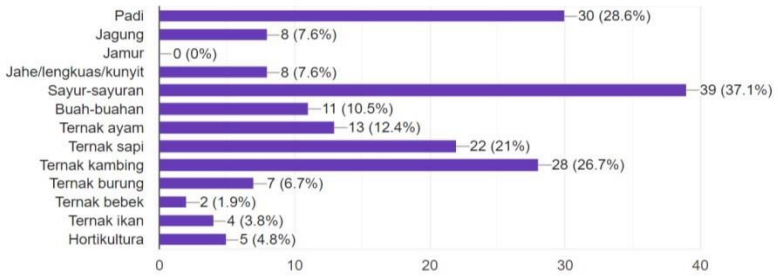

Fig.3. Types of Agriculture

Based on Figure 1 above, we can see that 30 out of 104 respondents planted rice. Furthermore, 8 out of 104 respondents planted corn. Moreover, none planted mushrooms. 8 out of 104 other respondents chose to plant ginger, turmeric, and galangal. 39 out of 104 respondents chose to plant vegetables. Tables. Only 11 out of 104 respondents planted fruits. In the field of animal husbandry, 13 out of 104 respondents raised chickens, and 22 out of 104 respondents raised cattle. Goat farming is the most common because 28 out of 104 respondents raised goats. At the same time, 7 out of 104 respondents raised birds. Only 2 out of 104 raised ducks. In addition, 4 out of 104 respondents raised fish. Finally, 5 out of 104 respondents did horticulture.

Table2. Income From Farming

No	Nominal	Frequency (People)	Percentage (%)
1	500,000 thousand – 2,999,999 million	59	56.7%
2	3,000,000 million – 6,999,999 million	33	31.7%
3	7,000,000 million – 9,999,999 million	3	2.9%
4	More than 10 million	9	8.7%
Amount		104	100%

Based on Table 4 above, in the analysis of income by agriculture, it can be seen that most respondents have relatively stable incomes. As many as 59 out of 104 respondents have income from agriculture between 500,000 thousand rupiah to 2,999,999 million rupiahs, and as many as 33 people out of 104 respondents have income from agriculture reaching 3,000,000 million rupiahs to 6,999,999 million rupiahs, and only 3 people out of 104 respondents have income from agriculture between 7,000,000 million to 9,999,999 million rupiahs. However, only 9 people out of 104 respondents have income from agriculture that can reach more than 10 million rupiahs.

Table3. Land Ownership Status

No	Land status	Frequency (People)	Percentage (%)
1	One's own	91	87.5%
2	Rent	8	7.7%
3	Loan	0	0%
4	Grants / Giving	2	1.9% 1.9%
5	Cooperation/Joint Venture	2	3.8%
6	Labor/work for people	4	
Amount		104	100%

Based on Table 5 above, in the analysis of agricultural land ownership status, we can see that most respondents have substantial control over their land ownership; namely, 91 out of 104 respondents have their land, although 8 out of 104 people rent land for their farms, besides that only 2 out of 104 respondents received land through grants/gifts and 2 other people out of 104 respondents carried out a cooperation/joint venture system in managing agricultural land.

Finally, 4 out of 104 respondents worked as laborers on other people's agricultural land. **Table4**. Agricultural Information

No	Agricultural information	Frequency (People)	Percentage (%)
1	Fellow Farmers	66	63.5%
2	Social Media / Online	51	49%
3	Training/workshop	9	8.7%
4	Extension institution	15	14.4%
5	Farmer group	37	35.6%
6	Books, newspapers, magazines, brochures	7	6.7%
Amount		104	100%

Analysis of agricultural information sources data shows that several sources of information have a significant role in providing knowledge to millennial farmers. Fellow farmers are the most dominant source of information because 66 out of 104 respondents often ask for advice from fellow millennial farmers. 51 out of 104 make social media a popular source of information, and social media platforms can provide more comprehensive information. However, only 9 out of 104 respondents use training/workshops as their source of agricultural information. In addition, extension institutions also play an essential role in providing sources of agricultural information, although only 15 out of 104 respondents chose it. 37 out of 104 respondents joined farmer groups to improve agricultural knowledge. Finally, only 7 out of 104 respondents chose books, newspapers, and magazines as sources of information.

Table5. Push to Agriculture

No	Push to agriculture	Frequency (People)	Percentage (%)
1	Interest in agriculture	33	31.7% 51.9%
2	Family heritage/tradition	54	38.5% 9.6%
3	Potential economic benefits	40	1%
4	Contribution to food security	10	
5	Government support	1	
Amount		104	100%

Based on Table 7 above, in the analysis of the young generation's drive to the agricultural sector, there are several interrelated factors. First, interest in agriculture itself is a supporting factor, with 33 out of 104 respondents showing interest in this field. In addition, family heritage/tradition is the most significant factor because 54 out of 104 respondents are influenced by traditions that their families or previous generations have carried out. The potential for profit is also a strong reason, with 40 out of 104 respondents seeing agriculture as a promising source of income. After that, the contribution to food security is also a motivation for some farmers, although only 10 out of 104 people choose this. Finally, government support is a supporting factor in increasing interest in agriculture, although 1 out of 104 respondents admit it. Thus, several driving factors become a compelling combination.

2. Agricultural Opportunities

There are several opportunities in the agricultural sector.

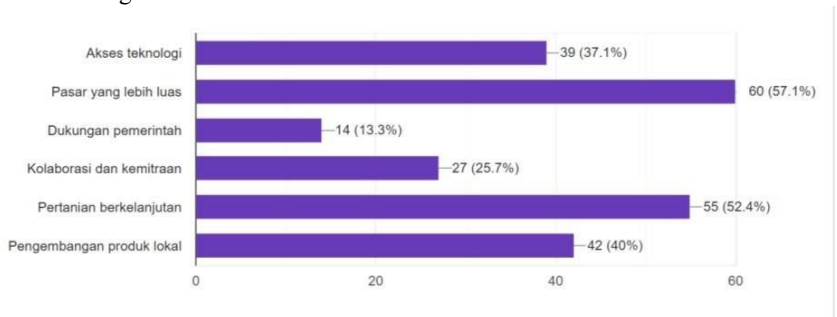

Fig.4. Agricultural Opportunities

Based on Figure 2 above, the data shows that there are several opportunities in the agricultural sector. 60 out of 104 respondents indicated that a broader market is the most opportunity in this study because it offers excellent opportunities for millennial farmers to increase income and reputation. After that, 55 out of 104 respondents also know the opportunities for agriculture to be sustainable, with millennial farmers who care about the environment and want to develop environmentally friendly practices. 42 out of 104 respondents are aware that farming can have the opportunity to develop local products that can compete with foreign products. Then, 39 out of 104 respondents know the importance of access to technology in increasing agricultural efficiency and productivity for product development. Furthermore, 27 out of 104 respondents see opportunities for collaboration for effective strategies in maintaining sustainability and improving the quality of agricultural production. Finally, 14 out of 104 respondents also chose government support as an opportunity to provide the infrastructure and resources needed for millennial farmers.

3. Agricultural Challenges

Table6. Challenges for Millennial Farmers

No	Agricultural challenges	Frequency (People)	Percentage (%)
1	Capital/funding	64	61%
2	Technology and innovation	40	38.1% 45.7%
3	Product Marketing	48	30.5% 16.2%
4	Agricultural knowledge	32	13.3% 71.4%
5	government policy	17	57.1%
6	Labor	14	33.3% 39%
7	Pests and diseases	75	29.5%
8	Climate change	60	
9	Land availability	35	
10	High production costs	41	
11	Availability of fertilizer	31	
Amount		104	100%

Agricultural challenge analysis Table data shows that many obstacles occur to millennial farmers. 64 out of 104 respondents believe that capital/funding is one of the biggest challenges because many millennial farmers feel they face difficulties in accessing financial resources to start or improve their agricultural businesses. 40 out of 104 respondents are also hampered in technology and innovation because they must continuously improve their knowledge to adopt new technologies. Marketing agricultural products is a challenge for 48 out of 104 respondents because of the difficulty in facing market competition. Moreover, 32 out of 104 respondents have difficulty with agricultural knowledge, which has an impact on failure. 17 out of 104 respondents feel that government policies are ineffective in overcoming agricultural problems. In addition, 17 out of 104 respondents found it challenging to find workers in the agricultural sector. Pests and diseases are the biggest challenges in this agricultural research. As many as 75 out of 104 respondents are harmed by pests and diseases in agriculture. Then, 60 out of 104 respondents are hampered by unexpected climate change that can disrupt the planting and harvest cycle. Land availability is a challenge for 31 out of 104 respondents. Furthermore, 41 out of 104 respondents are hampered by the high cost of production to buy raw materials and equipment. Finally, the availability of quality fertilizer is also an obstacle for 31 out of 104 respondents.

4. Strategies to Face Agricultural Challenges

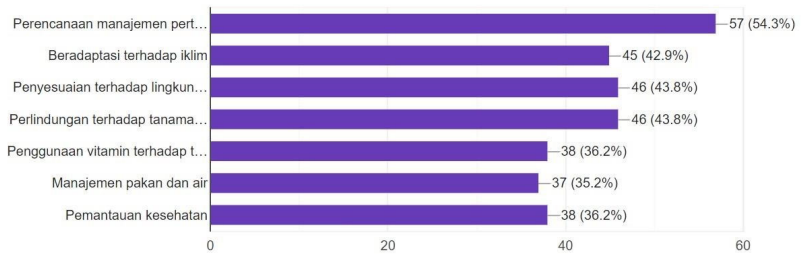

Fig.5. Strategies for Overcoming Uncertain Weather Changes

Based on the analysis, data obtained shows that conducting agricultural management planning is the most dominant strategy, proven by 57 out of 104 respondents doing the same thing to anticipate and overcome uncertain weather changes. 45 out of 104 respondents chose to adapt to the climate to reduce vulnerability to weather changes. Moreover, 46 out of 104 respondents made adjustments to the environment to reduce negative impacts. 46 out of 104 respondents were involved in protecting plants and livestock. Do not forget that 38 out of 104 respondents also use plant and livestock vitamins to increase resistance to weather changes. 37 out of 104 respondents also do feed and water management to help maintain the health of plants and livestock. Finally, direct health monitoring was done by 38 out of 104 respondents so that preventive measures could be taken before damage occurred.

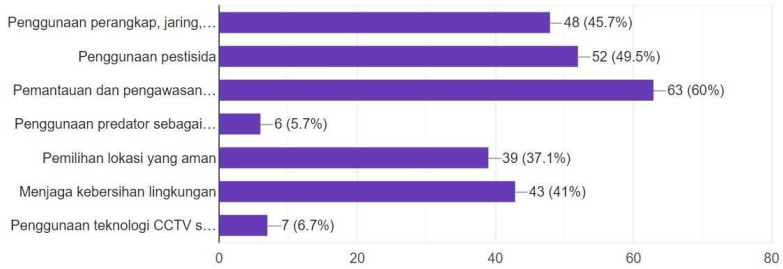

Fig.6. Strategy to Overcome Pest and Disease Attacks

Based on the analysis of pest/disease attack strategies, 48 out of 104 respondents felt that using traps and nets was an effective strategy for preventing direct plant damage. The use of pesticides was also chosen by 52 out of 104 respondents because they were believed to be able to kill diseases in plants. Meanwhile, 63 out of 104 chose to conduct direct monitoring and supervision to prevent agricultural damage. The use of predators as guards was also chosen by 6 out of 104 respondents. Choosing a safe location was a solution for 39 out of 104 respondents to anticipate the risk of pest and disease attacks. 43 out of 104 respondents felt that maintaining environmental cleanliness was critical in preventing pest and disease attacks—finally, the use of CCTV technology as surveillance was carried out by 7 out of 104 respondents.

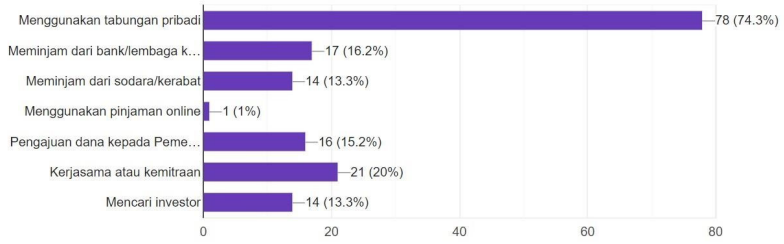

Fig.7. Strategy to Overcome Capital

Based on the analysis of capital strategies, data shows that 78 out of 104 respondents use personal savings as the primary source to finance agricultural activities; this is the most common strategy in this study. After that, borrowing from banks is a way for 17 out of 104 respondents. Meanwhile, 14 out of 104 respondents borrow from relatives/siblings because it is flexible. However, 1 out of 104 respondents use digital technology to make online loans as an agricultural financial solution. Moreover, 16 out of 104 respondents apply for funds from the government. Cooperation and partnerships are also an option for 21 out of 104 respondents with the aim of mutual benefit. Finally, 14 out of 104 respondents chose to look for investors to overcome agricultural capital problems.

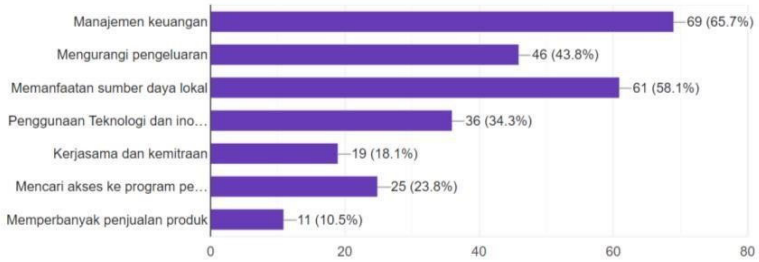

Fig.8 Strategy to Overcome High Production Costs

Based on the data above, 69 out of 104 respondents used financial management as the primary strategy for overcoming high production costs. After that, 46 out of 104 respondents reduced raw material costs. Furthermore, 61 out of 104 respondents chose to utilize local resources to reduce production costs. The use of technology and innovation is also vital for efficiency because 36 out of 104 chose it. Moreover, 19 out of 104 respondents cooperated to share risks and costs. In addition, 25 out of 104 respondents chose to seek subsidies and financing programs from the government. Finally, 11 out of 104 respondents focused on increasing product sales to seek more significant profits.

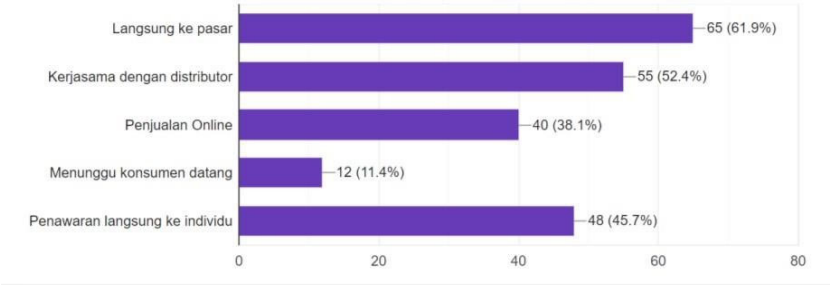

Fig.9. Agricultural Product Marketing Strategy

The direct market dominated product marketing strategy analysis because 65 out of 104 respondents chose that method. Meanwhile, 55 out of 104 respondents cooperated with distributors to increase product marketing. Furthermore, 40 out of 104 respondents used online media to reach a broader market. However, 12 out of 104 just waited for consumers to come in to sell their products. Finally, direct offers to individuals were made by 48 out of 104 respondents to build consumer trust.

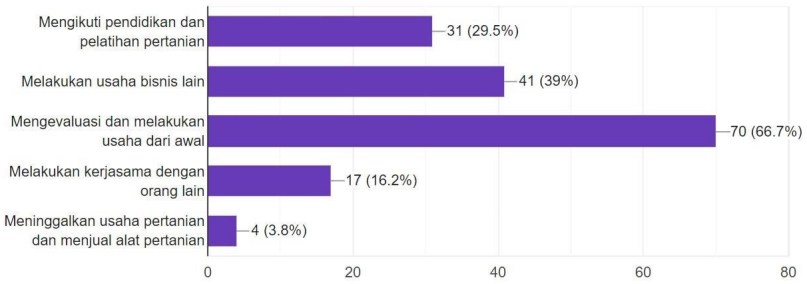

Fig.10. Strategy When Failing

In this study, we found that when experiencing failure in the agricultural business, respondents have to take steps to deal with it. 70 out of 104 respondents chose to evaluate and start their agricultural business from the beginning again. Furthermore, 41 out of 104 respondents decided to leave the agricultural business and do other business ventures. Furthermore, 31 out of 104 respondents took education and training to improve their agricultural skills. Cooperating with others was an option for 17 out of 104 respondents. Finally, 4 out of 104 respondents chose to leave the agricultural business and sell their agricultural equipment.

Other Factors 1. Farmer group

Table7. Participation of farmer groups

No	Participation of farmer groups	Frequency (People)	Percentage (%)
1	Follow	43	59%
2	Do not follow	61	41%
Amount		104	100%

Based on Table 9 above, it can be concluded that regarding the participation of farmer groups in agricultural development programs, 61 out of 104 respondents have participated and joined farmer groups to develop and improve their agricultural skills. In comparison, 43 out of 104 respondents have not or do not participate in farmer groups.

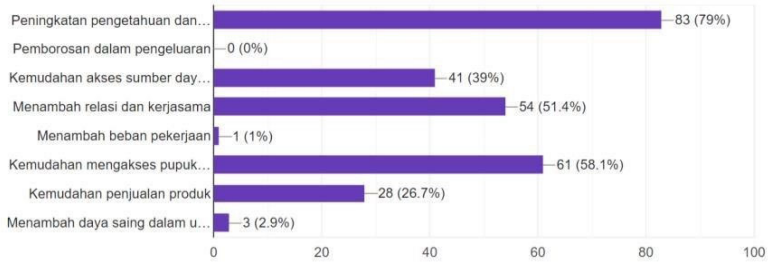

Fig.11. Benefits of Joining a Farmer Group

Based on Figure 9 above, we can see that for respondents who join farmer groups, it can have an impact on their agriculture; 83 out of 104 respondents feel that their farming knowledge and skills have increased. Moreover, it does not have an impact on wasteful spending when joining farmer groups. 41 out of 104 respondents also have an impact on ease of access to resources. 54 out of 104 respondents can establish cooperation in farmer groups. However, 1 out of 104 respondents feel that joining farmer group activities can increase the workload. Finally, 61 out of 104 respondents can easily access subsidized fertilizers.

B. Discussion

This study discusses the potential of millennial farmers in Karanganyar Regency and aims to determine existing opportunities. Furthermore, challenges for a millennial farmer and strategies for overcoming these challenges. The discussion of the objectives of the research conducted, among others:

a. Analysis of opportunities for millennial farmers in Karanganyar Regency.

The results of the study show that there are several opportunities for millennial farmers, namely access to technology, broader markets, government support, collaboration and partnerships, sustainable agriculture, and local product development. Several of these opportunities are interrelated. A broader market is the most enormous opportunity in this study, and this finding is in accordance with research from[20]. Basically, the results of the agricultural sector and its derivative products have quite broad market potential.

Access to technology is also one of the most extensive opportunities for millennial farmers. 89 out of 104 respondents use technology access to increase productivity and efficiency. This result is in line with research from[21], where technology access can increase productivity, and technological innovation makes production more efficient. In the advancement of technology access, 74 out of 104 respondents use social media, and the most significant number of respondents, 66 out of 104 people, use social media to access information, according to research from[22]. Social media has the potential to be used to read and watch agricultural business information content, discuss farming experiences, solve agricultural problems, and seek business opportunities and collaboration in agricultural businesses.

b. Analysis of challenges for millennial farmers in Karanganyar Regency

The results of the questionnaire from the analysis of the challenges faced by millennial farmers showed that 75 out of 104 respondents stated that pests and diseases were the most significant challenges experienced by millennial farmers. Research from[23]stated that pests and diseases that attack plants and livestock are natural enemies for farmers.

Capital or funding in agricultural businesses is the second biggest challenge, as proven by 64 out of 104 respondents choosing it, as stated in the research.[24]Lack of capital in agricultural businesses results in limited production processes, ultimately affecting income. Farmers need capital to create, maintain, and develop agricultural efficiency.

After that, 60 out of 104 respondents felt that climate change was one of the biggest challenges for their agricultural business, according to research from[25]. Climate change is a severe threat to the agricultural sector. Irregular rainfall patterns, pest attacks, droughts, floods, and increased air temperatures are the impacts of climate change.

c. Potential Strategies to face challenges in agricultural business

In the challenge of capital in agricultural businesses, the strategy of 78 out of 104 respondents was to use personal savings to start their agricultural businesses, according to research from[26]. Capital is a resource used for farming activities. Capital can come from personal savings or other parties in the form of loans.

Carrying out direct supervision and monitoring is the most effective strategy in dealing with pest and disease attacks, as proven by 63 out of 104 respondents using the same strategy in dealing with these challenges, according to research from[27]Efforts to protect agricultural products from pest attacks are always carried out, namely by means of routine monitoring and inspections as well as taking preventive measures if pest attacks occur.

57 of 104 respondents implemented agricultural management planning strategies to face the challenges of climate change/unpredictable weather, according to research from[28]. Agricultural management needs to be carried out by adapting to minimize negative impacts and optimize the positive impacts of climate change.

In the challenge of marketing agricultural products, 65 out of 104 respondents still use the strategy of coming directly to the market to offer their agricultural products, according to research from[29]where currently, the marketing process is still carried out conventionally through distribution of harvest results through intermediary traders or direct marketing from market to market.

The strategy used by 69 of the 104 respondents was to carry out financial management to overcome the problem of increasingly high production costs, according to research from[30]. Financial management is related to the effective allocation of funds and efforts to raise funds for business financing so that when funds have been collected, they can overcome the problem of high production costs.

5 CONCLUSION

Based on the results of the study "The Potential of millennial farmers in Karanganyar Regency; opportunities, challenges, strategies." It was found that becoming a millennial farmer provides an excellent opportunity to create a broader market and make agriculture sustainable. Nevertheless, there are also three most significant challenges for millennial farmers. The first is the emergence of pests and diseases that are very detrimental to agricultural businesses and are constrained by capital or funding for their agricultural businesses. The last is uncertain climate change that affects their planting and harvesting seasons.

This study also explains the strategies to face challenges in agriculture, direct monitoring and supervision, and the use of pesticides, which are strategies that are widely used to overcome problems from pest and disease attacks. Using personal savings and cooperation or partnerships are strategies to address the challenges of capital and funding for agricultural businesses. Due to the existence of uncertain climate change, millennial farmers have begun carrying out agricultural management planning strategies to reduce and prevent losses in agricultural businesses.

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