

Determinants of financial literacy of Madura Island farmers households: ordered probit regression analysis

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Abstract. The constraints of low financial literacy result in limited access to financial products and services, suboptimal financial management, and increased vulnerability to financial risks. This low level of financial literacy can hinder the economic progress and well-being of farmer households. This study aims to identify the determinants of financial literacy among farmer households on Madura Island. The research location was selected because it is known to have a low level of financial knowledge. A simple random sampling method was employed, yielding a sample of 123 households. Financial literacy was divided into three variables: knowledge, skills, and behavior. The results of the ordered probit regression analysis indicate that the variables positively influencing knowledge, skills, and behavior are age, education, income, access to credit, government assistance, and membership in farmer groups. Age negatively affects financial skills and behavior, while education positively influences financial knowledge. Household income has a significant positive effect on all dimensions of financial literacy, indicating the importance of improving the economic capacity of farmers. Conversely, membership in farmer groups has a negative effect on financial literacy, suggesting that the activities of these groups have not been optimal in enhancing their members' financial capacity. Additionally, government assistance without accompanying financial education has a negative impact on financial skills. These findings emphasize the need for educational interventions based on financial literacy that are more contextual and integrated with farmer empowerment programs. This study makes an important contribution to the literature on financial literacy in the agricultural sector and provides strategic recommendations for designing programs to improve the financial capacity of farmers in underdeveloped regions.

1 Introduction

In the context of the modern economy, the development of the agricultural sector no longer depends solely on the factors of production such as land, labor, and technology;

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entrepreneurship also plays a role (1). One important indicator that determines the level of entrepreneurship is financial literacy (2). Financial literacy refers to an individual's knowledge, skills, and behavior in understanding, managing, and making decisions related to financial aspects (3). This indicates that financial literacy is particularly important for risk-averse farmers, as they will be better at identifying entrepreneurial opportunities, raising funds, and having confidence in financial management (4). However, the National Survey on Financial Literacy and Inclusion (Survei Nasional Literasi dan Inklusi Keuangan - SNLIK) (5) shows that the financial literacy index of the population was 38.03% in 2019 (6). This is lower than the average financial literacy index of ASEAN countries, which is 50.6% (7).

For farmers, low financial literacy hinders access to credit and other financial services (8–10). In fact, access to credit and financial services can strengthen farmers' purchasing power for agricultural inputs and encourage the adoption of technology, which will then influence the increase in farm productivity (11,12). Ironically, there are still many farmers with low financial literacy. This is supported by the findings of (Otoritas Jasa Keuangan, 2025) (6), which observed the proportion of people with high financial literacy based on their type of occupation. The results showed that farmers and fishermen had the lowest proportion (20.75%), even lower than the unemployed (28.48%) and housewives (30.46%). This indicates that only 20.75% of farmers and fishermen have high financial literacy, while 79.25% have low financial literacy. There are several socio-demographic factors that influence the level of farmers' financial literacy, namely age, farmer education, household size, main occupation as a farmer, income, land size, and household assets (10,13–15).

Many studies have been conducted on financial literacy in the non-agricultural and agricultural sectors. However, there are several research gaps that we address. First, most financial literacy studies tend to view literacy as a single or aggregate variable (16–18). This approach risks overlooking the different characteristics and determinants among the dimensions of financial literacy. Therefore, we separate the dimensions of knowledge, skills, and behavior (19–22). Second, we conducted research on farmers on Madura Island, whose inhabitants are known to be hardworking, tough, diligent, independent, religious, and energetic (23). Furthermore, according to 2019 data, 54.84% of its population depends on the agricultural sector for their livelihood (24). Third, our research subjects are female farmers. They often face challenges such as lower levels of formal education and financial management experience compared to men (25).

Based on this background, this study aims to assess the determinants of knowledge, skills, and behavior. With this study, we hope to provide a more comprehensive understanding of the actual conditions of female farmers regarding financial literacy.

2 Methods

2.1 Location and data collection

The research was conducted on Madura Island with corn farmer respondents. Primary data were collected from July to September 2023. Madura Island was chosen due to its potential for corn cultivation. The majority of Madura's areas are highly suitable for corn farming. Approximately 15.4% of Madura's land area, or 70,279.5 hectares, is suitable for corn farming. A total of 211,512.3 hectares, or 46.3%, is classified as suitable. 161,098.6 hectares, or 35.3%, and 13,732.0 hectares, or 3%, of Madura's total area are respectively unsuitable for corn farming (Amzeri, 2018). Furthermore, Madura's hybrid corn commodity is also known for its competitive and comparative advantages (26). The research was conducted in

Paterongan Village, Galis District Bangkalan Regency, and Bragung Village, Guluk-guluk District, Sumenep Regency, as shown in Figure 1.

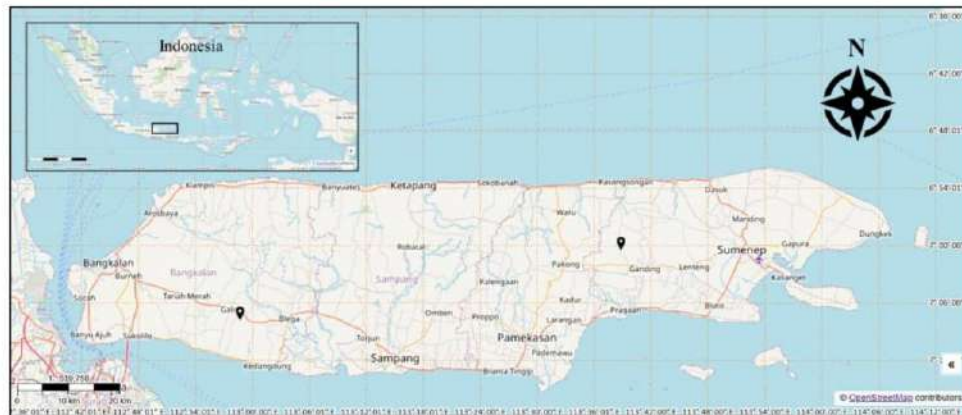


Figure 1. Study area (geoportal.big.go.id)

2.2 Sampling and data collection techniques

The primary method used in this research is a quantitative approach supported by a qualitative approach. The instrument used for the quantitative approach is a survey methodology and a questionnaire. According to Saslow (27), the survey approach requires extensive observation of human groups. Direct interviews with respondents were used in the survey research to collect information.

The sampling method for this research was simple random sampling. In scientific studies, simple random sampling is a widely used sampling technique. When participants in a study are randomly selected from a highly homogeneous group, simple random selection is used (28). Simple random sampling is the most basic and common sampling method, where the sample is selected unit by unit, with an equal probability of selection for each unit in each draw (29). The researcher created a numerical list of all sample sizes. When faced with a large sample size, a computer program is used to generate random numbers (30). The number of respondents selected was 123 corn farmers. The available funds, time, and labor determine the desired level of confidence. The required sample size decreases as the error rate increases, and conversely, a larger sample size is needed with a reduced error rate (31).

2.3 Data analysis technique

The data analysis method refers to two types of analysis, namely, descriptive statistical analysis and the Ordered Probit Regression analysis method. Respondent answers are explained using descriptive statistical analysis based on actual field data. The first step in organizing data before applying inferential statistics for analysis is to use descriptive statistics. According to Kaur et al. (2018) (32), descriptive statistics consist of nominal data (e.g., gender), ordinal data (e.g., Likert scale data), interval data (e.g., production and income), and ratio data (e.g., production and earnings). The results of descriptive statistical analysis include measures such as the mean and standard deviation, which are commonly used in research and studies. Pie charts and bar charts will also be used to display the analysis results.

Ordered probit regression is applied to determine the financial literacy of farmer households on Madura Island. Financial literacy uses an indicator variable consisting of

knowledge, skill, and behavior, where farmers are asked about their current level of financial literacy. These variables use a Likert scale that indicates the level of response from the farmers. Since the financial literacy variable is ordinal, ordered probit regression analysis is used. Ordinal data are data that have a natural order and are structured, but the distance between categories does not have a defined value. There are four categories in the study that will be observed: 1-Strongly disagree, 2-Disagree, 3-Agree, and 4-Strongly agree. According to Greene (2012) (33), ordered probit analysis is based on latent outcome variables, as shown by the following equation

$$Y_i^* = X_i\beta + \varepsilon_i \quad (1)$$

where Y_i^* is an unobserved latent variable; X_i shows the explanatory variables that this study observed, namely financial inclusion variables, farmer demographics, household characteristics, and household assets; β shows the coefficient of the explanatory variable; ε_i shows the error term; and i shows the category of farmer's financial literacy ($i=0, 1, 2$, and 3).

In the ordered probit analysis known as cut off or threshold on each category of financial literacy (FL) farmers. Thus, the model to be analyzed is shown by the following equation:

$$Y_i = \begin{cases} 0 & \text{jika } Y_i^* \leq a_0 \text{ (Level 0 FL)} \\ 1 & \text{jika } a_0 < Y_i^* \leq a_1 \text{ (Level 1 FL)} \\ 2 & \text{jika } a_1 < Y_i^* < a_2 \text{ (Level 2 FL)} \\ 3 & \text{jika } Y_i^* > a_2 \text{ (Level 3 FL)} \end{cases} \quad (2)$$

where Y_i indicates the FL proxy score; a_1 and a_2 indicate the cut off categories. The ordered probit regression model in this study is shown in the following equation:

$$FL = \alpha + \beta_1 AGE + \beta_2 EDU + \beta_3 MJ + \beta_4 INC + \beta_5 LAND + \beta_6 FS + \beta_7 GA + \beta_8 FG + \beta_9 CATT + \varepsilon \quad (3)$$

where FL is Financial Literacy (consists of 4 indicators: Knowledge, Skills, Behaviour); AGE is age of household head (years); EDU is level of education (years); MJ is Multiple Jobs, 1 if the farmer has a profession outside of agriculture, 0 if other; INC is household income (million IDR); LAND is land area (m²); FS is number of household members (people); GA is 1 if the farmer receives government assistance, 0 otherwise; FG is 1 if the farmer is a member of a farmer group, 0 otherwise; CATT is 1 if the farmer has livestock, 0 otherwise; α is the Constant or intercept of the model, and β_i is the Coefficient of variable i , where i is the order of the variable.

3 Result and Discussion

3.1 Farmer demographics and household characteristics

Table 1 shows the socio-demographic characteristics of corn farmers on Madura Island. Based on our findings, the average age of the farmer respondents is 43 years, reflecting a dominant working-age group (ages between 20 and 64 years) (34), with a wide distribution extending up to 80 years. The education level shows considerable variation, with a standard deviation of 3.349. The average education level of the respondents is 6.545, which is equivalent to the level of elementary to junior high school (35). In terms of economic activity, only about 9.8 percent of the respondents have additional employment outside the agricultural sector. This indicates that most respondents still rely heavily on agriculture as

their primary source of livelihood. Meanwhile, the average household income is IDR 20.6 million per year. However, the data distribution is quite broad, with a standard deviation score of 25.560. A similar pattern is observed in land ownership, where the average land area is moderate, with variation in ownership among respondents (Mean 0.298 ha; Standard deviation 0.228). The number of family members ranges from three to ten, with an average of 5-6 people per household. Around 37% of the respondents receive assistance from the government, and 42% are members of farmer groups. Finally, approximately 68% of the total respondents keep livestock, which not only serves as an alternative source of income but also reflects a form of investment (36).

Table 1. Descriptive Statistics of Independent Variables

Var	Definition	Mean	Std Dev	Min	Max
Age	Age of the farmer (years)	43.764	12.227	23	80
Edu	Education level of the farmer (years)	6.545	3.349	0	16
Multiple Jobs	1 if the farmer has a profession outside agriculture, 0 otherwise	0.098	0.298	0	1
Inc	Household income (IDR)	20.618	25.560	0	103
Land	Land area (m ²)	0.298	0.228	0	1
Family Size	Number of household members (people)	5.699	1.708	3	10
Government Assist	1 if the farmer receives government assistance, 0 otherwise	0.374	0.486	0	1
Farmers Group	1 if the farmer is a member of a farmer group, 0 otherwise	0.423	0.496	0	1
Cattle	1 if the farmer owns livestock, 0 otherwise	0.682	0.467	0	1

3.2 Financial Literacy of Maize Farmers

Based on Table 2, it is evident that in terms of knowledge, 40.65% strongly disagree and 45.53% disagree with the statement that they understand the bank's terms when applying for a loan. A similar situation is observed with their understanding of the risks of borrowing money from a bank, with 36.59% strongly disagreeing and 46.34% disagreeing. However, we found a positive trend in understanding personal budgeting, where 57.72% of respondents agreed that they have an understanding of personal budgets. When asked if they were trusted by lenders due to their financial knowledge, 49.59% of respondents agreed, although there were still quite a few who were unsure or strongly disagreed. The complexity of financial products may discourage farmers from learning, which results in low financial literacy (37). Additionally, this lack of knowledge may increase respondents' vulnerability to predatory lending practices and harmful financial decision-making (38).

In terms of skills, about 50.41% agreed that they are capable of effectively utilizing financial services. However, in terms of technical skills such as calculating interest rates, the majority of respondents struggled (57.72%). The ability to determine the principal amount and loan interest is also still a challenge, with 31.71% strongly disagreeing. On the other hand, the behavior of borrowing money at the end of the month to meet needs was fairly evenly distributed. Regarding financial behavior, 89.43% of respondents do not deposit their money in banks, indicating the low utilization of formal financial institutions. A similar trend is seen in the use of ATMs, where the majority admitted not using this facility. However, in terms of the discipline to pay installments or loans, about 26.83% agreed, and 13.01% strongly agreed. This may be influenced by the lack of access to financial services. According

to Alamsyah et al. (2023) (39), many farmers in rural areas face barriers in accessing financial services due to high costs and inflexibility.

Table 2. Descriptive Statistics of Research Variables

Variable	1	2	3	4	5
Knowledge					
Understands the bank's terms when borrowing money	40.65	45.53	7.32	5.69	0.81
Knows the risks of borrowing money from a bank	36.59	46.34	8.94	8.13	0
Understands the concept of personal budgeting	10.57	15.45	7.32	57.72	8.94
Trusted by lenders due to financial knowledge	18.7	8.13	23.58	49.59	0
Skill					
Effectively utilizes financial services	14.63	12.2	11.38	50.41	11.38
Can calculate interest rates	39.02	18.7	1.63	34.96	5.69
Borrows money at the end of the month to meet needs	26.83	21.14	20.33	27.64	4.07
Determines the principal and interest amount of debt	31.71	21.95	5.69	34.96	5.69
Behaviour					
Saves money in the bank as a way to manage finances	51.22	38.21	5.69	2.44	2.44
Uses ATM to withdraw money from the bank	45.53	49.59	1.63	2.44	0.81
Pays credit/installments on time	43.9	8.13	8.13	26.83	13.01

Financial literacy among farmers shows a significant variation, reflecting the challenges that still need to be addressed. In terms of knowledge, the majority of farmers are at Level 2, accounting for approximately 56.1%. This indicates that they have begun to understand basic financial management concepts, although this understanding is not yet widespread across all groups. However, about 28.46% of farmers remain at Level 1, indicating that nearly a third of them still have very limited financial knowledge. As can be seen in Figure 2.

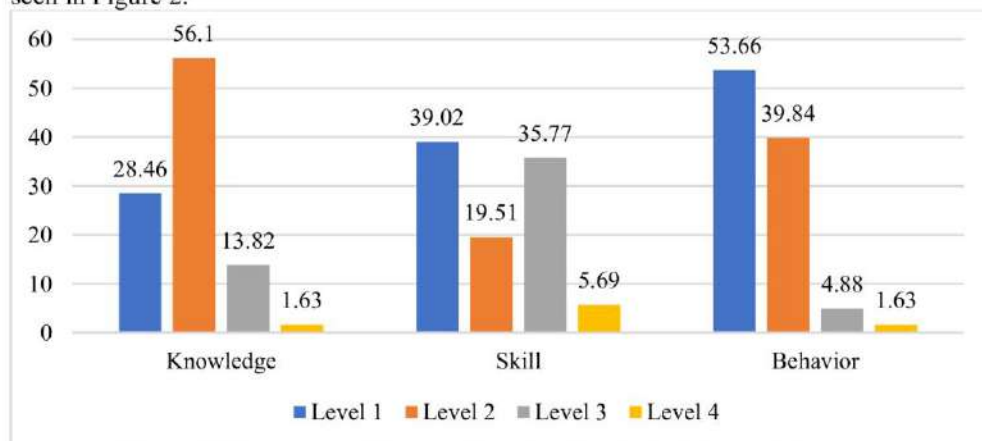


Figure 2. Percentage of farmers based on the level of financial literacy

Unlike knowledge, the ability or skills in financial management exhibit a rather interesting distribution. The majority of farmers are classified into Level 1 and Level 3, with 39.02% and 35.77%, respectively. This suggests that, while some farmers have begun to apply financial knowledge in their daily lives, many still encounter challenges in managing finances effectively, such as budgeting, regularly tracking expenses, or planning for long-term financial goals.

The most notable observation pertains to financial behavior. More than half of the farmers (53.66%) are categorized at Level 1 in terms of financial behavior. This indicates that, despite possessing some level of financial knowledge, not all farmers apply it in their daily lives. Financial behaviors such as maintaining savings discipline, avoiding consumer debt, and keeping financial records continue to pose significant challenges. Only a small proportion of respondents are classified in Levels 3 and 4, reflecting well-established and planned financial behaviors.

This phenomenon aligns with existing literature that suggests an increase in financial knowledge does not necessarily translate into behavioral changes. As noted by Lusardi & Mitchell (2014) (37), one of the key challenges in financial literacy is bridging the gap between knowledge and real-world actions. Therefore, financial education for farmers should not solely focus on theoretical knowledge but must also be rooted in practical, real-world applications, facilitating the integration of learned concepts into their daily business practices.

3.3 Correlation of Financial Literacy Indicators

Based on Table 3, the results of the descriptive analysis and correlation in this study provide an interesting insight into the financial literacy conditions among female farmers, particularly within the three main dimensions: knowledge, skills, and financial behavior. In terms of knowledge, the average score obtained was 0.886 with a standard deviation of 0.692. This figure indicates that the majority of respondents possess a reasonably good understanding of basic financial aspects. However, the relatively large variation in values suggests that this understanding is not evenly distributed across all respondent groups.

Table 3. Descriptive Statistics and Correlation of Dependent Variables

Var	Definisi	Mean	Std Dev	Correlation		
				Know	Skill	Bhvr
Know	Knowledge of female farmers about finance	0,886	0,692	1,000		
Skill	Skills of female farmers in managing finances	1,081	0,988	0,577 0,000	1,000	
Bhvr	Financial behavior of female farmers	0,545	0,668	0,631 0,000	0,764 0,000	1,000

Financial literacy among female farmers exhibits notable variation, reflecting challenges that still need to be addressed. From the knowledge dimension, the average score of 0.886 with a standard deviation of 0.692 indicates that the majority of respondents have a relatively good understanding of basic financial concepts. However, the considerable variation in the scores suggests that this understanding is not evenly distributed across all respondents.

The skills dimension, on the other hand, has the highest average score of 1.081, suggesting that many female farmers are quite active in applying their financial knowledge in daily practices such as recording expenses, budgeting, or saving. However, the standard deviation of 0.988 indicates a significant disparity between individuals, showing that not all respondents possess the same level of skills in managing their finances.

In contrast, the financial behavior dimension records the lowest average score of 0.545 with a standard deviation of 0.668. This finding suggests that although some female farmers have financial knowledge and skills, they have not fully implemented positive financial behaviors consistently. Practices such as long-term financial planning, regular saving, or managing daily expenses remain challenging for many respondents.

The correlation analysis among variables shows a positive and significant relationship between knowledge and financial skills ($r = 0.577$, $p < 0.01$). This means that the higher the level of knowledge, the more likely it is for female farmers to develop good financial skills. The correlation between knowledge and financial behavior is also positive and significant ($r = 0.631$, $p < 0.01$), reinforcing the argument that knowledge is an essential foundation for forming healthy financial behaviors. However, the strongest relationship is found between skills and financial behavior ($r = 0.764$, $p < 0.01$), indicating that practical skills play a critical role in shaping everyday financial habits and decisions.

These findings highlight the importance of financial education that not only focuses on enhancing knowledge but also encourages the strengthening of practical skills that can be directly applied in daily life. As financial skills improve, more positive financial behaviors tend to form, such as budgeting, saving regularly, and making wiser financial decisions. In other words, financial literacy is not just about understanding concepts but also about the ability and willingness to consistently apply them. Overall, the results of this study support the views of Lusardi & Mitchell (2014) (37) and Atkinson & Messy (2012) (40), who argue that financial literacy is multidimensional. Therefore, the development of knowledge, skills, and behaviors needs to be balanced and integrated to enhance financial well-being, particularly for female farmers who play a vital role in family and rural community economies.

3.4 The Determinants of Financial Literacy in Maize Farmer Households Using Ordered Probit Regression

The results of the analysis are presented in Table 4, which shows the estimated coefficients, standard errors, and significance levels for the three dimensions of financial literacy: knowledge (know2), skills (skill2), and behavior (bhvr2). Several variables significantly affect financial literacy (knowledge, skill, behavior), including the variable age, which has a negative impact on the skill and behavior dimensions, with coefficients of -0.044 and -0.030, respectively. Both are significant at the 1% and 5% levels. These findings suggest that as farmers age, their skills and behavior in financial literacy tend to decline. This is consistent with previous research, which found that older age is often associated with a decline in cognitive capacity in financial management (41).

The education variable (EDU) has a positive effect on the knowledge dimension with a coefficient of 0.074 and is significant at the 10% level. This indicates that higher education levels improve farmers' financial knowledge. This result supports the study by Klapper et al. (2015) (42), which shows that formal education plays an important role in improving financial literacy in developing countries.

Household income significantly contributes positively to all three dimensions of financial literacy, with coefficients of 0.016 for knowledge, 0.012 for skills, and 0.014 for behavior (all significant at the 1% level). This suggests that households with higher incomes tend to have better financial literacy. This finding is in line with research by Atkinson & Messy (2012) (40), which shows that income levels are positively correlated with financial management capabilities.

Participation in farmers' groups shows a negative and significant relationship with all three dimensions of financial literacy. The coefficients range from -1.053 to -1.561, with significance at the 1% level. This indicates that members of farmers' groups tend to have lower levels of financial literacy. It is likely that the interactions in these groups are more focused on technical aspects of production rather than on improving financial management

capacity (43). Furthermore, the effectiveness of farmers' groups in rural areas can enhance the welfare of their members (44).

Government assistance shows a negative and significant impact on skills (skill), with a coefficient of -0.557 at the 5% significance level. This suggests that receiving assistance, without adequate financial education, could reduce the financial management independence of farmer households. A study by Drexler et al. (2014) (45), emphasizes the importance of financial training along with the provision of assistance to improve the effectiveness of interventions.

Tabel 1. Output analisis regresi ordered probit

Var	know2		skill2		bhvr2	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
AGE	-0,003	0,012	-0,044***	0,013	-0,030**	0,013
EDU	0,074*	0,038	0,026	0,040	0,053	0,044
MJ	0,516	0,377	0,447	0,388	0,147	0,419
INC	0,016***	0,005	0,012***	0,005	0,014***	0,005
LAND	0,210	0,490	0,142	0,509	-0,047	0,586
FS	-0,021	0,073	-0,050	0,077	-0,055	0,082
GA	0,100	0,235	-0,557**	0,246	-0,078	0,257
FG	-1,053***	0,271	-1,561***	0,287	-1,345***	0,307
CATT	-0,084	0,245	0,095	0,253	0,166	0,267
/cut1	-0,520	0,710	-2,969	0,756	-1,310	0,767
/cut2	1,505	0,719	-2,139	0,738	0,664	0,768
/cut3	2,908	0,776	-0,093	0,717	1,299	0,800

1. Financial Knowledge (Knowledge)

The ordered probit regression results presented in Table 4 indicate several factors significantly affecting the financial knowledge of female farmers. One such factor is the level of education (Edu), which has a positive and significant effect at the 10% level ($p < 0.1$). This means that the higher the educational level of a female farmer, the greater the likelihood that she will have a better understanding of financial concepts. This finding aligns with previous research by Klapper et.al, (2015) (42), which emphasized that education is a crucial foundation in the development of financial literacy.

Additionally, the study shows that external factors such as household income and membership in farmer groups also contribute to the level of financial knowledge of female farmers. Household income has a positive and significant effect on financial knowledge ($p < 0.01$), indicating that the higher the income, the greater the access individuals have to information, services, and financial resources that can enhance their understanding. This finding is in line with the research by Robb & Woodyard (2011) (46), which showed that individuals with higher income levels tend to have better financial literacy because they interact more frequently with formal financial products and services.

However, interestingly, membership in farmer groups shows a negative and significant effect on financial knowledge ($p < 0.01$). This suggests that farmer groups have not yet fully utilized their potential as educational platforms for financial management. It is likely that the activities of these groups are still primarily focused on technical aspects of agricultural production, such as land cultivation, fertilizer distribution, or market access. A study by Yuwono et al. (2017) (47), found that most farmers have not optimally utilized formal financial institutions, with only a small fraction consistently planning household expenses. This indicates that while farmer groups have the potential to serve as financial education platforms, this role has yet to be fully realized. Meanwhile, research by Sevriana & Widuhung (2023) (48), on the Saluyu Farmer Group revealed that limited access to formal

financial services has led communities to prefer informal financial services, such as moneylenders, which are perceived as simpler and more accessible.

2. Financial Skills (Skill)

The analysis reveals that age has a negative and significant effect on the financial skills of female farmers at the 1% level ($p < 0.01$). This finding indicates that as age increases, the ability to manage finances tends to decline. More broadly, this can be attributed to generational differences, where older age groups may face limitations in accessing and using modern financial information or technologies. Moreover, learning new skills such as digital financial recordkeeping or using app-based financial services can be particularly challenging for older female farmers. This is not solely due to technological limitations, but also to limited exposure to financial innovations and a lack of age-friendly learning environments.

This decline in skills could also be caused by psychosocial factors, such as reduced motivation to learn or a lack of confidence in managing the increasingly complex financial aspects of household finances. This finding is consistent with research by Hanushek et al. (2025) (49), which showed that numeracy skills tend to decline with age, especially in groups that infrequently use these skills in their daily lives. The study also found that the decline in numeracy skills was more pronounced among women, particularly in contexts where social support for the sustainable development of financial capacity is lacking.

In the case of female farmers, limited access to technology-based financial education, as well as minimal support for lifelong learning, are likely significant barriers. Therefore, it is important for economic empowerment and financial literacy programs to adopt inclusive approaches that target not only younger generations but also give special attention to the learning needs of older age groups. Strengthening the role of local facilitators or agricultural extension workers in delivering financial information in a contextual and easily understandable manner can be a relevant strategy.

Education has a positive influence on financial skills, although it is not statistically significant. This suggests that higher education levels tend to improve the ability to manage finances, although other factors may also play a role. This finding is in line with research by Tafonao et al. (2024) (50), which found that education level positively affected financial literacy among female farmers in the village of Hou, Bawolato District, Nias Regency. The study highlighted that higher education can improve understanding and skills in financial management.

Meanwhile, household income again proves to have a positive and significant effect ($p < 0.01$), reinforcing the argument that better economic conditions provide space for more skilled financial practices, such as budgeting, tracking expenses, and prioritizing needs. Research by Astuti et al. (2022) (51), supports this finding, showing that both education level and household income contribute to financial literacy among housewives in Margabakti Subdistrict, Tasikmalaya City. The study found that housewives with higher education and income levels tend to have better financial literacy. Thus, while formal education is important, increasing household income also plays a crucial role in improving the financial skills of female farmers. Integrated economic empowerment programs with financial education could be an effective strategy for improving financial literacy and skills among female farmers.

Farmer group membership again shows a negative and significant effect ($p < 0.01$). This suggests that the presence of farmer groups has not yet been able to enhance the members' skills in financial management. Similar findings were raised in a study by Yuwono et al. (2017) (47), which revealed that low financial literacy among farmers is closely related to limited access to formal financial institutions and a lack of knowledge about financial management. The study noted that only a small number of farmers utilized financial institutions for saving or financing, and less than 6% of them consistently planned household expenses. This reflects that farmer groups, in many cases, have not optimally performed

their educational function in financial matters, indicating the need for efforts to strengthen the capacity and role of institutional groups in fostering better financial habits.

3. Financial Behavior (Behavior)

Financial behavior, which reflects the actual implementation of knowledge and skills, is influenced by several important factors. Age has a negative and significant effect ($p < 0.05$), reinforcing the idea that the older the respondent, the less likely they are to consistently apply positive financial behavior. This phenomenon can be attributed to several factors, such as limitations in accessing the latest financial information, adapting to digital technology, and habits that have been established over the years, which may be difficult to change. This finding is consistent with research by Octovera & Rahadi (2023) (52), which examined financial literacy and the lifestyles of housewives in shaping family financial behavior. The study found that although financial literacy affects financial behavior, age also plays an important role in determining how effectively individuals apply financial knowledge in daily life. They noted that older age groups tend to have financial behaviors that are less adaptive to changes and innovations in financial management. Therefore, it is important for financial education programs to consider an age-appropriate approach, especially for senior female farmers. A more personalized and practical approach, as well as the use of appropriate learning methods, can help improve the effectiveness of financial literacy programs and encourage more positive financial behaviors among female farmers of all ages.

Household income consistently proves to be an important determinant, with a positive and significant effect ($p < 0.01$). This means that higher income plays a role in promoting healthy financial behaviors, such as saving, planning financial needs, and avoiding unnecessary consumption. This finding aligns with research by Maghfiroh et al. (2023) (53), which found that income has a positive and significant effect on the financial management of housewives in Pamotan Hamlet, Pamotan Village, Sambeng Subdistrict. This study highlights that income is one of the key factors in financial management. Therefore, increasing household income can be an effective strategy in encouraging healthy financial behaviors among female farmers. Economic empowerment programs integrated with financial education can help improve the overall financial well-being of the community.

However, once again, membership in farmer groups shows a negative and significant effect on financial behavior ($p < 0.01$), indicating that these groups have not yet become spaces capable of forming good financial habits. This is an important note for strengthening the institutional capacity of farmer groups moving forward. Research by Yuwono et al. (2017) (47), supports this finding, stating that low levels of financial literacy among farmers are caused by a lack of knowledge and access to formal financial institutions. In their study, only a small number of farmers used financial institutions for saving or borrowing funds, and less than 6% consistently planned household expenses. This suggests that farmer groups have not played an optimal role in improving the financial literacy of their members.

4 Conclusions and Policy Recommendations

This study examines the determinants of financial literacy among maize farming households in Madura Island by utilizing ordered probit regression analysis across three dimensions of financial literacy: knowledge, skills, and behavior. The findings of this study indicate that the financial literacy of maize farming households in Madura Island is influenced by a combination of individual, social, and economic factors. It was found that education and income serve as reinforcing factors for financial literacy, suggesting that enhancing the cognitive and economic capacities of individuals can improve their financial understanding and skills. Conversely, older age was identified as a factor that negatively impacts financial skills and behavior, indicating the need for an adaptive literacy approach for older age groups.

Ironically, the existence of farmer groups, which should ideally serve as a platform for strengthening financial capacity, was negatively associated with literacy levels, reflecting the limited institutional focus on financial management aspects within farmer organizations. Furthermore, government assistance that is not accompanied by financial literacy improvements could potentially undermine farmers' financial skills, highlighting the importance of designing more sustainable and education-based interventions. Overall, financial literacy among farmers is not solely an individual issue but is closely tied to the dynamics of the social environment, institutional structures, and the effectiveness of the development programs they access. Therefore, strategies for improving financial literacy among farmers should combine approaches that strengthen individual capacities with institutional reforms that are more responsive to financial literacy needs.

Based on the research findings, it is recommended that community-based financial education programs be enhanced with a focus on contextual and practical approaches, especially for rural women farmers. Additionally, the reorientation of farmer groups is crucial, by expanding their role as centers for financial learning, not just as agricultural production entities. Government assistance programs should be integrated with financial literacy modules so that the interventions are not merely consumptive but can enhance the financial independence of farming households. A financial literacy strategy that takes age into account is also necessary, as the learning needs of young farmers and older farmers differ significantly. It is expected that improvements in financial literacy will make a tangible contribution to the economic welfare of farmers in Madura Island and strengthen their long-term financial resilience.

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