

Factors associated with the adoption of financial management practices by farmers in the state of Minas Gerais, Brazil

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Abstract

Objective: The main purpose of this research is to identify the characteristics associated with the adoption of financial management practices by Brazilian farmers, located in the region of Triângulo Mineiro.

Method: We collected the data using questionnaires. The database consists of the responses from 113 farmers who own rural properties in 20 different cities in the region of Triângulo Mineiro. We employed the multivariate regression analysis to test the study hypotheses. After obtaining the results, we addressed the robustness of the model through additional tests, which included the use of interaction variables and factor analysis.

Results and contributions of the article: The main results of the study suggest that the financial management practices are associated with the producer's age, knowledge of production costs, participation in training about financial management, and the perceived relevance of financial management. This study contributes by understanding the management characteristics of farmers located in an important Brazilian agribusiness region. It also provides information that may support government strategies, rural unions, rural cooperatives, financial institutions, and others interested in improving rural management.

Keywords: Agribusiness; Rural Management; Regionality; Brazilian Farmers; Minas Gerais.

1. Introduction

Monitoring the activity and seeking profitability, liquidity and solvency figure among the financial manager's main functions (Gloy & LaDue, 2003). In rural management, observing these practices is fundamental because, as highlighted by Barros, Xavier, Pessoa e Sobel (2015), several factors can generate negative impacts on agricultural activity, such as climatic conditions, diseases, and plagues. Especially in a sector permeated by such uncertainties, effective financial management becomes even more essential, as it can help to reduce and control the financial damage caused by these and other associated occurrences.

In this regard, Vogel and Wood Jr. (2012) stressed the importance of financial management, linking the absence of associated practice with emergency scenarios in which organizations find themselves compelled to seek external funding at high rates. In an analysis of agricultural enterprises in the United States, Khanal e Mishra (2016) also highlighted that management strategies and formal management controls can improve the performance and, considering the use of financial management technologies, factors like the farmer's education and age can also influence the performance, as well as experience in the activity, a characteristic identified by Seramim and Rojo (2016). According to Gloy, Hyde and LaDue (2002), property size is another element that can impact the adoption of management practices. Based on a research involving milk producers from the United States, these authors concluded that such practices can lead to greater profitability.

Despite the benefits and informational content generated from this management, in the Brazilian context, low adherence to these practices has been observed in the rural sector. Mazzioni et al. (2007) found that controls are precarious and that farmers lack knowledge of their results, characteristics that were also verified by Medeiros et al. (2012). This lack of management and financial control practices can negatively affect the performance, as observed by Khanal e Mishra (2016), and limit the growth of activity (Vogel & Wood Jr., 2012). In addition, Barros et al. (2015) reaffirmed the relevance of adopting these practices, verifying that financial management can reduce the risk of default in rural areas, while Miotto and Parente (2015) identified that effective financial management can reduce the risk of indebtedness.

Thus, studies on this topic are relevant and necessary because of the importance of rural activity for Brazil. The field of analysis in this research was delimited to the region of Triângulo Mineiro in the State of Minas Gerais. This state holds the third-largest share of the Brazilian GDP and its agribusiness performance is significant, as it holds the fourth-largest share of gross value added in Brazilian agriculture and the largest share in forest, cattle, fishing, and aquaculture production. The region of Triângulo Mineiro, in turn, stands out within the state because of its economic role, mainly in rural production, as three of the five cities in Minas Gerais with the highest gross value added in the agribusiness sector of the state's GDP are located in that region. Furthermore, cities in the Triângulo Mineiro figure among the largest producers in the state in terms of different items, such as milk, mango, orange, soy, corn, pineapple, sugar cane, goats, poultry, beef and sheep (IBGE, 2019).

In view of the economic and social relevance of rural activity, particularly in the Triângulo Mineiro region, and the importance of contributing for farmers to have the financial circumstances to stay in the trade, and in search of information that can lead to an understanding of how they operate in the management of their properties, the question that guided this study was: **What factors can be associated with the adoption of financial management practices by the farmers in the Triângulo Mineiro region?** Thus, the objective was to identify, through multivariate regressions, characteristics that can be motivating for farmers in this region to adopt financial management practices.

The results obtained in this research can help in the improvement of rural management, especially in relation to small producers who commonly have less support in the management of their business. The identified characteristics can also support the development of training programs by cooperatives and rural unions and the elaboration or improvement of public sector policies. Similarly, the findings can be of help for financial institutions' policies focused on the agribusiness sector with regard to credit granting, investment lines and the like.

While previous research focused on the financial management of rural cooperatives, on the presentation of the farmers and their management's characteristics and on factors correlated with the adoption of management practices (Costa, Chaddad, & Azevedo, 2012; Imlau et al., 2016; Tarifa & Schallenberger, 2016; Machado Filho, Caleman, & Cunha, 2017), in this research, factors were sought that can determine the adoption of these practices. Thus, the research can expand the literature on the subject by jointly testing a group of variables not observed in previous studies, based on data collected through a questionnaire developed by the authors and applied to an original sample.

In addition to these theoretical contributions, França, Mantovaneli Júnior and Sampaio (2012) also highlight the relevance of understanding regional aspects for the implementation of strategies that lead to integrated development. From this perspective, studies such as Fochezatto e Ghinis (2012), Felema, Raiher e Ferreira (2013), and Sjahza e Asmit (2019) highlighted this point of view. Thus, the analysis of the farmers' characteristics from a regional perspective can contribute to the development, besides providing subsidies for the elaboration of programs and policies aimed at the rural sector, a need observed by Borges, Guedes and Castro (2016).

The results obtained from this article showed that empowering rural producers and guiding them on the relevance of financial management can be fundamental for the adoption and improvement of management practices. Although they know their production costs, a shortage was found in the use of control tools. Hence, and considering that the farmers perceive that financial management is important, there may be a management *gap* that can be better understood and exploited, which would provide contributions with efficiency gains.

2. Literature review and study hypotheses

This research aims to identify characteristics that can influence the adoption of financial management practices by farmers from the Triângulo Mineiro. These practices are understood in this study as actions related to the control of payments and receipts, management of cash and bank accounts, budget or programming for expenses and investments, among others related practices. The following subsections present the research hypotheses as possible factors associated with the farmers' accomplishment of management, H1 to H6 being the main hypotheses and H7 to H10 the possible control variables.

2.1 Perceived relevance of financial management

Discussing African farmers' perception of climate change, Pauw (2013) highlighted that understanding an individual's view on the topic can contribute to knowledge sharing and to the elaboration of policies and strategies, as perception is reflected in behavior (Nyanga, Johnsen, Aune, & Kalinda, 2011). Thus, it is of interest to verify whether these associations are applicable in relation to the farmers' perception of financial management practices and, specifically, whether this perception positively affects the implementation of this management.

The use of perception as an element related to an attitude or behavior can be observed in the case study by Grøn (2018). He analyzed relevant aspects of the formation and development of perception concerning the implementation of management practices and, therefore, perception was considered a dependent variable, while the practices that were implemented were used as explanatory variables.

Furthermore, O'Reilly (2009) identified that the investors' perception on the external auditor's opinion about the company's going concern affects the decision making and stock value. Khanal and Mishara (2016) and Khan, Tan and Chong (2017) found signs that the investor's perception of the return obtained earlier with the use of portfolios can influence his/her decisions on trading and risk exposure. Robinson, Taylor and Brice (2016), in turn, demonstrated that executives' optimistic perception on the safety level of information guided their actions related to the theme. Thus, considering that the perception of a given topic can affect individual attitudes and behavior, the hypothesis is raised that:

- **H1: the perception about the relevance of financial management positively affects the adoption of related practices.**

2.2 Use of control tools

Analyzing and controlling the business figure among the rural manager's tasks and this includes financial control activities (Gloy & LaDue, 2003), which, in turn, generate information that helps with planning and decision making. Nevertheless, earlier studies have shown that, in the rural context, these - control-related - management practices are little used (Machado & Nantes, 2011; Oaigen et al., 2013; Simioni, Binotto and Battiston, 2015). In addition, although the use of technological resources can contribute to the control of costs or other elements related to the activity, which positively affects the management of rural property (Machado Filho et al., 2017), these resources are also underutilized and farmers need continuous education on the merit of using them (Gloy & LaDue, 2003).

In this sense, Machado and Nantes (2011) observed that farmers control costs in a precarious way. Although the use of spreadsheets is an interesting option, as many do not have access to specialized *software* that meets the needs of the rural property, these authors highlighted that, usually, this tool ceases to be used due to lack of knowledge of the producer. Besides the positive effect the adoption of control tools has on the effectiveness of financial management, especially for the identification of production costs, Oaigen et al. (2013) highlighted that the business attitude and the level of control are important elements for competitiveness, but also found that the farmers' use of management tools is lower than expected, being a feature for improvement.

In the study by Simioni *et al.* (2015), the informal nature of management practice was highlighted. The authors identified that only 17% of the farmers consulted used notebooks or spreadsheets to record technical or economic data, which is a characteristic that negatively affects management, as "the maximization and greater efficiency in the use of technologies and knowledge and the use of resources available on the property depend on the proper management and control process of all factors involved in the production" (Simioniet al., 2015, p.168). Thus, the recording of data related to the activity contributes positively to the effectiveness of financial management, especially by providing information that helps in the calculation of the income, profitability indices, among other elements.

Ferreira, Lasso and Mainardes (2017), in turn, found that attitudes such as controlling business expenses – not confusing them with family expenses –, knowing the profit or loss and making decisions in times of financial difficulties are characteristics that farmers consider innovative. Furthermore, identifying farmers with management focused on the financial aspect, Hey and Morozino (2018) highlighted that one of the main concerns perceived is getting resources to cover the activity costs at the end of the production cycle and having sufficient profit to remunerate the work and the use of the property. This indicates that farmers who spend more effort to perform financial management tend to have control over production costs, corroborating the idea that having this control is positively associated with the adoption of financial management practices. Thus, the objective is to test the following hypothesis related to management control:

- **H2: the use of control tools, such as spreadsheets and reports, is positively related to the farmers' adoption of financial management practices.**

Considering the relevance of knowing the production costs, as this makes it possible to calculate the result, the following hypothesis is also tested:

- **H3: farmers' knowledge about the production costs is positively related to the adoption of financial management practices.**

2.3 Indebtedness of farmers

According to Miotto and Parente (2015, p.53), “individuals who apply better management of their income and expenses tend to avoid situations in which their expenses exceed their earnings, thereby reducing their risk of default.” They identified that, among Brazilian low-middle-class families, developing planning and conducting financial administration tends to be positively associated with low default situations. As a considerable part of the rural production takes place in the family context (MAPA, 2017), it is relevant to verify whether this relation applies to farmers who consider themselves indebted, which could contribute to their payment compliance - especially considering the possibility of debts incurred for non-productive ends, which do not generate additional revenues (Datta, Tiwari, & Shylajan, 2018).

From the perspective of small and medium-sized companies in Minas Gerais, Camargos, Camargos, Silva, Santos and Rodrigues (2010) also identified, among the conditioning factors of default, aspects related to financial management, especially to the administration of working capital. For agricultural activities, Barros *et al.* (2015) observed that, among the farmers in the sample used, there was approximately 50% chance of non-payment of debts and that the execution of financial management practices was one of the factors that positively affected the payment compliance. Thus, the results indicate that the tools and actions related to the financial management of the business help to reduce the risk of indebted farmers' defaulting. Thus, based on the premise that the indebted rural producer adopts management practices to avoid default, the objective is to test the following hypothesis:

- **H4: farmers' considering themselves as indebted positively affects the adoption of financial management practices.**

2.4 Client default

Similarly to the justifications mentioned with regard to the indebtedness of farmers and the management actions they can adopt to avoid default, it is relevant to analyze whether part of the clients' default positively affects the farmers' adoption of financial management practices, a fact that can support them to adapt their sales strategies and their mean operating and financial terms.

Besides the relevance of financial controls and tools that help managers to have control over their debts (Barros et al., 2015), corroborating their payment compliance and, in certain cases, even avoiding the assumption of obligations, financial management can also contribute to reducing the risk of client default or, if it occurs, can provide managers with information necessary for the fitness of their budget and financial planning. In that sense, Castagnolo and Ferro (2014), Duan, Kim, Kim and Shin (2018), and Gabbianelli (2018) evidenced the positive association between financial information and the improvement of aspects related to reducing or predicting the risk of default, while Crespi Júnior, Perera e Kerr (2017) highlighted how financial management actions can avoid or contain the damage caused by bad payers. Thus, the following hypothesis was tested:

- **H5: the farmer's perception of client default as a difficulty positively influences him/her to adopt financial management practices.**

2.5 Professional training of farmers

When farmers are trained to deal with management routines or tools, they can learn to apply them, improving their management practices. Training can also help farmers to use technological resources for management purposes, which contributes to optimize their time and speed up processes (Islam, Habes & Alam, 2018). Thus, the farmers getting trained can be a key factor for effective financial management.

Zanin, Oenning, Tres, Kruger and Gubiani (2014) associated non-participation in training courses with the absence of controls that assist in farmers' decision making, demonstrating that farmer training can positively influence the adoption and implementation of best management practices. In this sense, Martínez-García, Ugoretz, Arriaga-Jordán and Wattiaux (2015) identified, using *cluster* analysis, that farmers who take training programs and use cooperative services have a higher output than other groups, including either older and more experienced farmers or younger farmers with more years of formal education.

Identifying farmers who precariously use financial and operational management tools, Simioniet al. (2015) stated that there is a need to expand qualification programs, thus suggesting that farmer training positively affects management, both financial and related to the production process. Latawiec et al. (2017), in turn, highlighted the lack of access to technical extension as a factor that impedes the adoption of best management practices, which, according to part of the rural producers they consulted, would lead to better administrative management of the property. In other words, the perception was found that qualifying the producer contributes positively to better management, even if the courses or training are focused on operational aspects. In addition, studies like Kumar and Shrestha (2014), Huang, Vyas and Liang (2015) and Nakano, Tsusaka, Ainda and Pede (2018) also highlighted the relevance of farmer training. In view of the above arguments, the following hypothesis was tested:

- **H6: participation in financial management training positively affects the adoption of related practices.**

2.6 The educational level of farmers

When taking higher formal education levels, managers are supposed to develop different personal and professional skills, which can direct- or indirectly contribute to their qualification in this function. Hence, there is a greater probability of farmers with a higher education level performing better in the activity they manage when they apply the knowledge gained in formal education.

This association is commonly investigated in the literature. Gloy *et al.* (2002, p.242) argued that “the farmers’ level of formal education is a measure of the quality of the human capital stored in the property”. Nevertheless, the authors did not find a significant relationship in their study between formal education and the farmers’ profitability. Similarly, Simioni *et al.* (2015) did not verify a significant relationship between the farmers’ education and the increase in their income. Wilson, Mishra and Williams (2009) identified a lower performance in properties managed by young farmers. Similarly to Martínez-García *et al.* (2015), they highlighted that this result does not necessarily derive from inefficient management, but from the possibilities of getting returns from non-agricultural work, compromising the management of the property, which generating a negative association between financial management practices and the education level.

Oaigen *et al.* (2013), in turn, found that rural producers in the South have a higher level of education than those in the North of Brazil and are more competitive, and that the use of financial indicators and strategic planning are some of the critical factors in this competitiveness. The results of the study by Barros *et al.* (2015) showed that the probability of the farmer defaulting reduces if (s)he holds a higher education degree. Effective financial management contributes to better control and planning of company resources, which can reduce the risk of default, also providing tools that assist in the analysis of the business, such as financial indicators. Thus, despite the diversity of results observed in the literature regarding this variable, the following hypothesis regarding formal education was tested:

- **H7: the farmers’ level of education positively affects the adoption of financial management practices.**

2.7 The size of the rural property

Aspects related to financial performance and obtaining satisfactory profit margins can be positively associated with the adoption of good financial management practices, as they are expected to provide the necessary structure for the knowledge of information useful to decision-making. These practices are expected to be more common in larger rural properties, as they tend to have more human, financial and technological resources to invest in this management, besides possibly having a larger volume of operations.

From this perspective, Gloy *et al.* (2002) identified that the size of the property is positively related to the financial performance and that the differences in the profitability of similar properties can be attributed to managerial factors. Zanin *et al.* (2014) found, based on a sample of 124 farmers, 81% of the properties being characterized as small, that in 54%, management controls were insufficient for decision making, and neither management reports nor rural accounting were used. Simioni *et al.* (2015), in turn, analyzed a sample in which more than 81% of the rural properties were small and identified that the management actions were basic and informal, without registers or process controls.

Machado Filho *et al.* (2017) observed a positive relationship between the size of rural properties and the adoption of control practices necessary to implement accounting and governance mechanisms. They highlighted the higher incidence of hired employees in these properties as a possible reason for this feature, which allows the farmer to dedicate more time to management. Similarly, Lai, Widmar and Wolf (2019) found that large farms tend to prioritize financial management, while Ndemewah, Menges and Hiebl (2019) obtained results that indicated the reduced use of management accounting practices in small properties.

Additionally, one can draw a parallel between the size of the rural property, the life cycle of the business and the management practices adopted. For Miller and Friesen (1984, p.1161), “certain transitions are expected to occur as young and small companies grow, age and become more complex”, and the use of management systems and controls figures among the elements that allow them to be classified in different life stages. This was observed by Auzair and Langfield-Smith (2005), who identified that these different stages influence the design of management control systems of Australian organizations, and by Davila and Foster (2005) when analyzing US *startups*, in which they found that the use of management tools, such as operating budgets, becomes more present as companies expand.

In view of the above, the following hypothesis of property size is tested:

- **H8: a positive relationship exists between the size of the property and the adoption of financial management practices.**

2.8 The farmer's age and experience

The farmer's characteristics, such as age and experience in the activity, can be factors that influence the financial performance. It is assumed that producers with more years of experience in rural activity have a better understanding of the business, of factors that can negatively affect their finances, and, thus, tend to have more accurate management practices, improved over time according to their experiences. As they gain this experience over time, the farmer's age would also be a variable likely to influence the adoption of management practices, and other age-related characteristics could also generate this effect, such as the degree of responsibility assumed, consolidation in the market and greater financial stability.

The impact of age on rural management was observed by Wilson *et al.* (2009), who identified that financial performance is lower when producers are young and higher when they are older. Barros *et al.* (2015, p.190), in turn, found that “producers in a higher age range tend to commit more strongly to repaying their debts”. In other words, the probability of default decreases as age increases, a characteristic that may indicate that the producer’s age positively influences the use or quality of the financial management practices adopted. Simioni *et al.* (2015), however, did not identify that a relationship tends to exist between the farmer’s income and age, whereas the results by Brown, Daigneault and Dawson (2019) demonstrated a positive association between age and prioritization of financial management. The correlation these authors obtained was positive only up to the age of 58 years though, when it became negative. According to them, after this age, farmers tend to change their lifestyle, which reduces the priority granted thus far to financial management practices.

Regarding experience, Martínez-García *et al.* (2015) observed that younger farmers tend to have less experience, while Seramim and Rojo (2016) identified that the farmer’s length of experience affects the activity’s profitability and economic sustainability. Similar associations were obtained in other activity sectors (Mion & Opramolla, 2014; Matemilola, Bany-Ariffin & Azman-Saini, 2018). Thus, having experience tends to be associated with a higher probability of positive financial results (Eschker, Gold, & Lane, 2017). In the search for consistent and continuous profit generation, financial management practices, such as the control of costs and expenses, are relevant and necessary factors, also for managers to know the result.

Despite the results of these studies, using cluster analysis, Hey and Morozini (2018) analyzed the relationship between strategies and the production cycle of agricultural commodities and, among producers with up to 10 years of activity, 50% were allocated to the group that focused on financial management. Among the farmers with more than 11 years of experience, this percentage was 38%, indicating that producers with fewer years of experience focused more on financial management. Compensating the length of experience by a higher level of education among younger farmers would lead to better management performance, being a positive reason for the result found. In this case, the farmer’s length of experience would not be positively related to financial management actions. Considering the factors exposed, the following hypotheses are tested:

- **H9: the farmer’s age positively influences the adoption of financial management practices.**
- **H10: experience as a farmer positively influences the adoption of financial management practices.**

3. Methodological procedures

The sample analyzed in this study consisted of 113 farmers from the region of Triângulo Mineiro, in the state of Minas Gerais. To collect the data, the survey method was used. A questionnaire developed for this research was applied to the farmers who were willing to answer it and who agreed with the Free and Informed Consent Form (TCLE). In total, there were 116 participants. Three questionnaires were excluded which had not been fully answered. The research project, together with the questionnaire elaborated based on the references reviewed, received approval from the Ethics Committee for Research involving Human Beings (CEP) at the Federal University of Uberlândia in December 2018.

The application of the questionnaires took place between January and April 2019 and focused on rural unions, cattle auctions, agribusiness fair, agro-ecological product fairs and the public service sector of the Minas Gerais Institute of Agriculture (IMA). At the start of the approach, the possible participants were asked whether they were farmers. After getting their confirmation, they received the TCLE, which included clarifications on the study objective, and the research questionnaire.

The participants were informed that their participation was voluntary, that their participation involved neither gains nor resources and that their identity would not be revealed. The mean response time was fifteen minutes, and the authors of the study waited with the respondents until the latter had finished their participation.

The rural properties of the 113 participants are distributed across the cities of Araguari, Capinópolis, Cascalho Rico, Estrela do Sul, Ibiá, Indianópolis, Itarumã, Ituiutaba, Lagamar, Monte Alegre de Minas, Prata, Romaria, Tapuira, Tupaciguara, Uberaba and Uberlândia. Besides these cities in the Triângulo Mineiro, some participants owned properties in these cities and other places, which is why this list included the cities of Buritizeiro, Lagoa dos Patos and Várzea do Sul, in the North of Minas Gerais, and Cachoeira Alta, in the South of the state of Goiás.

Multivariate regression analysis was applied to identify the possible factors associated with the farmers' adoption of financial management practices. The regression model with robust standard errors was chosen to consistently estimate the variances, even if some form of heteroscedasticity were present in the sample. The farmer's financial management (FM_Performed) was the dependent variable in the study, obtained by the mean scores registered for items 7 to 12 of the research instrument and on which the influence of the explanatory variables presented in Table 1 was tested. It should be mentioned that the answers for each of the items in the variable FM_Performed were obtained on a Likert scale ranging from 1 ("I strongly disagree") to 5 ("I strongly agree").

Table 1

Variables used in the study

Dependent variable: Financial management performed - FM_Performed (Obtained using a 5-point Likert scale)	
Corresponding items in the research instrument:	
Q7. Does the farmer perform financial management?	
Q8. Does the farmer perform cash/bank management?	
Q9. Does the farmer perform payment control?	
Q10. Does the farmer perform control of debt collections?	
Q11. Does the farmer perform debt budgeting/programming?	
Q12. Does the farmer perform the budgeting/programming of new investments?	
Explanatory variables	
Variable	Corresponding item in the research instrument:
Relevance of financial management - FM_Relevance (Obtained on a 5-point Likert scale)	Q1. Is financial management relevant for the farmer?
	Q2. Is cash/bank management relevant for the farmer?
	Q3. Is payment control relevant for the farmer?
	Q4. Is the control of debt collections relevant for the farmer?
	Q5. Is the budget/programming of expenses relevant for the farmer?
	Q6. Is the budget/programming of new investments relevant for the farmer?
Use of control tools	Q22. Are there financial and production control tools (e.g.: reports, spreadsheets...)?
Knowledge of costs	Q18. Does the farmer know the cost of the products (s)he sells?
Indebtedness	Q17. Does the farmer consider that (s)he had debts?
Client default	Q13. Does the clients' default represent a factor of difficulty for the farmer?
Training	Q19. Has already participated in a financial management training?
Education	Q23. Has a technical degree?
	Q24. Has an undergraduate degree?
	Q25. Has a specialization degree?
	Q26. Has a master's or doctoral degree?
Size (ln)	Q14. Size of the property (in hectares)
Age	Q15. Farmer's age (in years)
Experience	Q16. Length of experience as a farmer (in years)

Source: elaborated by the authors.

Like FM_Performed, the explanatory variable referring to the farmer's perception of the relevance of financial management practices (FM_Relevance) was obtained by the average answers to a group of questions, whose answers are based on the Likert scale from 1 ("I strongly disagree") to 5 ("I strongly agree"). The reliability of these constructs was verified and certified using Cronbach's alpha as, for both, the coefficient obtained was higher than the 0.70 recommended by the literature (Hair et al., 2009; Bagozi&Yi, 2011).

The explanatory variable on the farmer's perception about client default being a difficulty was also measured by the Likert scale, while the variables related to indebtedness, knowledge of production costs, use of control tools and participation in financial management training were generated from dichotomous questions, whose answers were "yes" or "no".

Each item related to the farmer's formal education level, in turn, received one point, so that the variable education represents the sum of these scores, that is, each farmer received a score from 0 to 4. Thus, a farmer who possessed the four levels of education presented (technical, higher, specialization and master/doctorate), received 4 points; a farmer who had only taken the technical course, for example, received 1 point; farmers without any of these levels of education did not receive any point. Thus, the model tested in this study was based on the following equation:

$$FM_Performed = GF_Realizada = \beta_0 + \beta_1 GF_Relevância + \beta_2 Controles + \beta_3 Custos + \beta_4 Endiv + \beta_5 Inadim + \beta_6 Capacit + \beta_7 Escolar + \beta_8 Tam + \beta_9 Id + \beta_{10} Exper + \varepsilon$$

where:

- FM_Performed = mean answers on the adoption of financial management practices (items Q7 until Q12), which can thus vary from 1 to 5;
- FM_Relevance = mean answers on the perceived relevance of financial management practices (items Q1 until Q6), which can thus vary from 1 to 5;
- Controls = *dummy* for use of control tools, such as spreadsheets and reports, equal to 1 for farmers who answered "yes" and 0 in other cases;
- Costs = *dummy* for knowledge of production costs, equal to 1 for farmers who answered "yes" and 0 in other cases;
- Indebt = *dummy* for indebted farmers, equal to 1 for farmers who answered "yes" and 0 in other cases;
- Default = farmer's perception as to whether the clients' default is a difficulty, answered on a Likert scale from 1 to 5;
- Training = *dummy* for participation in financial management training courses, equal to 1 for farmers who answered "yes" and 0 for the other cases;
- Educ = sum of answers to the four questions on the levels of education. For each question, farmers who answered "yes" receive score 1 and the others 0;
- Siz = natural logarithm of the size of the rural property in hectares;
- Ag = farmer's age in years;
- Exper = farmer's experience in years;
- β = regression coefficient of each variable;
- ε = error term of the regression.

Table 2 below displays the descriptive statistics of the study variables. Panel A summarizes the information related to the scalar variables, while Panel B contains the information of the dichotomous variables:

Table 2
Descriptive statistics of the study variables

<i>Panel A</i>					
Scalar Variables	n	Mean	Stand. Dev.	Min.	Max.
FM-Performed	113	3.941	0.797	1.667	5
FM-Relevance	113	4.661	0.427	3.167	5
Size (hectares)	113	244.92	337.9	3	1700
Size (Ln)	113	4.607	1.490	1.099	7.438
Age (years)	113	52.575	15.24	21	85
Experience (years)	113	25.717	16.17	2	77
Education	113	0.912	1.023	0	4
Default	113	4.363	1.009	1	5

<i>Panel B</i>			
Dichotomous Variables	n	Yes	No
Has Contr. Tools?	113	54.87%	45.13%
Knowl. Production Cost?	113	79.65%	20.35%
Financ. Manag. Training?	113	42.48%	57.52%
Indebted?	113	13.27%	86.73%

Source: research results.

On a scale from 1 to 5, the mean relevance of financial management was 4.661, demonstrating that, in general, the farmers perceive that it is important for the activity. Despite this, and considering the same scale, the mean score for the adoption of financial management practices was 3.941, indicating that the farmers perceive some practices as relevant, but do not adopt them or perform them precariously.

The sample components' profile was diverse and ranged from young farmers with few years of experience to eighty-year-old farmers who had been farming for decades, which can be verified based on the mean and median age (52.58 and 53 years, respectively) and the experience as a farmer (25.71 and 20 years, respectively). The average size of the properties was 245 hectares, with the median of 120 hectares. Regarding education, 27% of the participants hold a technical degree, 42% an undergraduate degree, 19% a specialization degree, and 4% an M.Sc. or Ph.D. On the other hand, approximately 45% of the respondents do not hold any of these levels of formal education.

The farmer's mean perception of whether client default is a difficulty, also measured on the Likert scale, corresponded to 4.363. In other words, most participants agreed that the clients' not paying their debts to the farmers represents a difficulty for the latter.

About 13% of the respondents considered themselves indebted. Among these, the average adoption to financial management practices was 3.72, lower than the average of 3.97 observed among farmers who did not consider themselves indebted. As for knowing the production costs, 79.65% of the farmers affirmed that they would know the costs incurred until the product is ready for sale. Despite this, only 54.87% reported using control tools such as reports and spreadsheets. Appendix A contains the correlation matrix between the study variables.

4. Results

To test which factors can influence the farmers' adoption of financial management practices. Multivariate regression with robust standard errors was applied, the results of which are displayed in Table 3:

Table 3
Multivariate regression results

Variables	Coef.	Rob. Standard Error	t	signif.
FM_Relevance	0.493	0.158	3.12	0.002 ***
Control Tools	0.139	0.133	1.04	0.300
Knowledge Production Costs	0.525	0.192	2.73	0.007 ***
Indebtedness	-0.206	0.171	-1.21	0.229
Default	0.048	0.068	0.71	0.479
Training in Financial Management	0.387	0.141	2.74	0.007 ***
Education	0.015	0.078	0.20	0.844
Size (Ln)	0.047	0.040	1.17	0.246
Age (years)	0.013	0.005	2.44	0.016 **
Experience (years)	-0.004	0.005	-0.80	0.423
Constant	-0.028	0.793	-0.04	0.972

number of observations: 113
 r-squared: 36.46%
 adjusted r-squared: 30.23%
 VIF (mean): 1.36 VIF (maximum): 1.77

Notes: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Source: Research results.

The mean coefficient related to the variance inflation factor (VIF) was 1.36, indicating the absence of multicollinearity between the variables. The adjusted *r-squared* demonstrated that the proposed model explains 30.23% of the variance observed in the farmer's financial management. Considering the significance observed, the results of the regression showed evidence that the farmer's age, knowledge about the production costs, participation in training and perceived relevance of financial management influence the effective adoption of associated practices positively.

Before starting the discussion of the hypotheses, an additional analysis was carried out, in view of the positive, moderate, and significant correlation between the variables age and experience. Although the VIF statistic suggested the absence of multicollinearity, the correlation matrix (Appendix A) suggests that the variables age and experience are moderately correlated. Thus, the quantitative model was estimated again, alternating the variables age and experience. The results are available in Appendix B, and, in general, are equivalent to those set forth in Table 3 in terms of sign and level of statistical significance for the other variables in the model (except for the variable Financial Management Training, which was significant at 1% in the general model and in the model without the age variable, and became significant at 5% in the model without the experience variable).

Based on the results obtained, hypothesis H1 that the farmer's perception on the relevance of financial management influences the adoption of associated practices was not rejected. This relationship corroborates the statement by Nyanga et al. (2011) that perception is reflected in behavior and, moreover, is in line with previous studies that reported the association between perception and behavior (Robinson, Taylor, Brice, 2016; Khan, Tan, Chong, 2017). In this sense, the importance of factors that can influence the farmer's perception regarding financial management is observed, as the results indicated the association between this perception and the actual adoption of related practices.

Knowledge about production costs is another variable that permits identifying farmers who adopt financial management practices, as hypothesis H3 was significant, which states that knowing about these costs positively affects the management practices. Nevertheless, the regression results related to this variable do not permit disagreeing from Machado and Nantes (2011), who stated that rural producers control costs precariously and find it difficult to use control tools, such as spreadsheets. This is because, as highlighted earlier, it was observed that there are producers who say that they know their costs, but do not use control tools. Moreover, hypothesis H2 was not statistically significant, regarding the positive association between the use of controls and the adoption of financial management practices.

The significance of hypothesis H3 can derive from the factor reported by Hey and Morozino (2018). According to these authors, farmers who focus their management on the financial aspect know their costs, because the main concern observed is to obtain sufficient profit to pay for work and property. Thus, cost control tends to figure among the practices commonly adopted among farmers who focus on financial management. As this study did not aim to identify the different management profiles of rural managers, it cannot be said that, in fact, the significance stems from this justification. The significance of hypothesis H3 and the non-significant effect of H2 may indicate, however, that farmers adopt only sufficient financial management practices to know their costs.

Hypothesis H6 on the positive impact of financial management training on the adoption of practices related to this management was not rejected either. This is in line with the results by Zanin et al. (2014), which indicated the positive influence of professional training on the adoption and execution of best management practices, and also aligns with the perception by Simioni, Binotto and Battiston (2015) on the positive association between training and management. Thus, the evidence shows that professional training can play a relevant role in the adoption or improvement of management practices by rural managers.

On the other hand, hypothesis H7 was not significant regarding the possible impact of education on the adoption of financial management practices. Hence, it cannot be affirmed that more years of formal education influence producers to accomplish financial management. The non-significance of this variable was also verified in the studies by Gloyet *et al.* (2002) and Simioni, Binotto and Battiston (2015), which associated it with the farmers' profitability. This result may be related to the observation by Wilson *et al.* (2009), who highlighted that farmers with an undergraduate or graduate degree may have other sources of income, so that property management becomes a secondary factor. In addition, the possibility of farmers' education including areas of knowledge that are not directly associated with the development of managerial skills is not excluding, thus not affecting their performance as a rural manager.

It was also identified that the farmers' age positively affects their financial management, so that hypothesis H9 is not rejected. This result supports the argument by Wilson *et al.* (2009) as to whether financial performance is superior among older producers - if the relationship indicated by Gloy and LaDue (2003) between financial management and performance is considered. For Barros *et al.* (2015), the increase in age reduces the likelihood of the producer defaulting, which may be an indication of the adoption of best management practices. Based on the study by Brown *et al.* (2019), it was verified that the significance of this variable persisted when it was replaced by age squared, without affecting the result of the other variables, which indicates the consistency of the association between age and the farmer's financial management.

Although the literature provides evidence that experience affects performance and, therefore, management practices (Gloy&Ladue, 2003; Seramim& Rojo, 2016; Matemilola et al., 2018), hypothesis H10 was not significant, which refers to the positive impact of experience on financial management practices, as this variable was not statistically significant. Thus, the positive association of the farmers' age with their financial management practices does not seem to stem from experience, but from other factors. In addition to hypotheses H2, H7, and H10, the variables indebtedness (H4), default (H5), and size (H8) were not significant either. Hence, it cannot be affirmed that these factors affect the farmers' adoption of financial management practices. The lack of statistical significance of hypothesis H8 does not support the results obtained by Machado Filho *et al.*(2017) and Lai *et al.* (2019), which associated the size of the property with greater adherence to management practices. This may indicate that the small producers in the sample tend to engage in financial management acts or that large producers do not.

The non-significant effect of the variable H5 did not corroborate the claims by Castagnolo e Ferro (2014), Duan et al. (2018) and Gabbianelli (2018) regarding the benefits that the information generated by financial management can provide to reduce the risk of client default. As most producers agreed that clients' default represents a difficulty, the non-significance of this variable may indicate that they are unaware of the advantages that effective financial management can offer in relation to this problem. Another possible justification is the reduction of the risk of default when selling production indirectly, through cooperatives for example, a situation in which, as a result of a more effective guarantee of receipt, this variable would not generate reflections in management.

The results of this study also differed from those of Camargos et al. (2010) and Barros et al. (2015), which argued that a relationship exists between the defaulting farmer and financial management. Thus, it could not be affirmed that indebted farmers perceive that financial management can reduce the risks of default.

5. Robustness tests

To check the robustness of the model and the results found, the tests were repeated, making some adjustments. To support the argument presented in the analysis of the results that the significance of the *Age* variable does not seem to derive from the years of experience in rural activities, initially, using multiplication of *dummies*, the effect of a possible interaction between these variables was tested, with score 1 for farmers with above-average age and years of experience and 0 for farmers below the average. In the multivariate regression, the effect of this interaction was not significant, which indicates a non-association between the interaction of the responses of older and more experienced producers with the dependent variable, which supports the interpretation in the analysis of the results.

As the measurement of the variables *GF_Performed* and *GF_Relevance* was based on the mean of their respective items, the choice was made to also replicate the regression, changing the way of obtaining these variables, *ceteris paribus*, replacing the mean of the answers with factor loadings. This factor analysis procedure is possible, considering that both variables (*GF_Performed* and *GF_Relevance*) were obtained from a set of six questions each. For both variables, the first factor recorded loadings superior to the second factor in relation to most items. Hence, the first factor of each analysis was selected and the variables *GF_Performed* and *GF_Relevance* were measured in this new round of analyses through the *scores* of the factor analysis.

The results indicated that the *r squared* of the new model decreased to 24.47%, pointing out that this model explains the variation observed in the dependent variable less than the original version. The variables corresponding to the knowledge of production costs and the perception about the relevance of financial management remained significant, but at 5%. The *Age* variable, in turn, was no longer significant, with a significance level bordering on 10%. In comparison with the originally proposed model, there was no change in the sign of the variable, and no new variable gained significance after these changes.

6. Final considerations

Agribusiness in Brazil is relevant both economically and socially and, as demonstrated in previous studies (Medeiros et al., 2012; Kruger et al., 2014), in many cases, the farmers' management is precarious or even non-existent, which can compromise their performance and, therefore, generate negative impacts for society and the economy. Therefore, the main contribution of this study, was the understanding of characteristics that can influence farmers to develop financial management in their properties, which, in turn, can contribute to the development of actions that aim to clarify or train the rural managers to deal with bottlenecks that make management practice unfeasible.

The main results of the study indicated that training farmers in financial management aspects can be a key element for them to adopt these practices. Simioni, Binotto and Battiston (2015) and Nakano *et al.* (2018) highlighted the relevance of developing professional qualification measures for the farmers and this study contributed by demonstrating that these actions aimed at professional improvement tend to offer practical returns.

Age was also shown as a characteristic that is associated with the adoption of financial management practices, and it is suggested in this study that, similar to what Brown *et al.* (2019) indicated, this relationship stems from the farmer's stage or lifestyle. In an additional robustness analysis, the age variable loses significance, which indicates that its effect may be stronger for certain types of activities related to financial management.

The significance found for hypothesis H3 indicated that farmers are concerned with carrying out management practices necessary to know their production costs. Due to the points observed and highlighted in the descriptive statistics and in the hypothesis H2, it was assumed that, despite the knowledge about the production costs, they are not necessarily monitored with formal controls. Finally, the farmers' perception of the relevance of financial management practices is another factor that influences financial management. This information is relevant, as it demonstrates that family members, rural unions and public authorities, among other possible influences of farmers' behavior, can indirectly help them to adopt managerial practices.

The identification of these characteristics associated with farmers from the Triângulo Mineiro region can contribute to the development of public actions or policies aimed at the sector. Initiatives in this sense can be enhanced when knowing regional aspects, so that they are adapted to the particularities of farmers in the region, in addition to allowing comparisons with other localities, which can support the development of integrated strategies.

Regarding the limitations of the study, a convenience sample was used. Thus, the results of the research are not necessarily generalizable. Similarly, the delimitation of the sample to the Triângulo Mineiro region provides useful information about farmers in the region, but does not permit extending the results to other locations. Nevertheless, the informational relevance of comparing the results obtained here to those obtained for other regions of the country is highlighted, and this is a suggestion for future studies. As the choice was made to generate a dependent variable based on the farmers' perception of their practices, it is relevant to seek other means or new scales to measure the financial management actions practiced, especially because some changes occurred in the results when the financial management variables were obtained using factor analysis. Therefore, it is suggested that future studies propose new ways of obtaining this variable in order to compare the results found here.

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Appendix A. Correlation Matrix between the Study Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
FM_Performed (1)	1,000										
FM_Relevance (2)	0,363	1,000									
Size (Ln) (3)	0,177	0,055	1,000								
Age (years) (4)	0,051	-0,214	0,073	1,000							
Experience (years) (5)	-0,102	-0,282	0,058	0,591	1,000						
Education (6)	0,256	0,234	0,247	-0,227	-0,182	1,000					
Default (7)	0,080	0,078	-0,138	-0,152	-0,114	0,023	1,000				
Has Manag. Contr.? (8)	0,347	0,301	0,187	-0,221	-0,237	0,358	0,062	1,000			
Knowl. Production Cost? (9)	0,392	0,157	0,171	-0,077	-0,148	0,194	0,073	0,381	1,000		
Financ. Manag. Training? (10)	0,331	0,223	0,063	-0,223	-0,069	0,479	0,117	0,348	0,123	1,000	
Indebted (11)	-0,081	0,057	0,110	0,009	0,162	0,034	0,118	-0,065	-0,061	0,033	1,000

Notes: the upper part of each line shows Pearson's correlation coefficient between the variables; the lower part indicates the level of significance.

Appendix B. Additional analysis about the effect of the age and experience variables

Variables	Complete Model		Model w/ Exper		Model w/ Age	
	Coef.	signif.	Coef.	signif.	Coef.	signif.
FM_Relevance	0,493	0,002 ***	0,515	0,002 ***	0,495	0,003 ***
Control Tools	0,139	0,300	0,147	0,262	0,119	0,380
Knowledge Production Costs	0,525	0,007 ***	0,533	0,006 ***	0,545	0,005 ***
Indebtedness	-0,206	0,229	-0,237	0,157	-0,257	0,168
Default	0,048	0,479	0,053	0,421	0,044	0,502
Financial Management Training	0,387	0,007 ***	0,368	0,009 ***	0,329	0,029 **
Education	0,015	0,844	0,020	0,796	0,004	0,963
Size (Ln)	0,047	0,246	0,046	0,258	0,056	0,180
Age (years)	0,013	0,016 **	0,011	0,014 **		
Experience (years)	-0,004	0,423				
Constant	-0,028	0,972	-0,135	0,867	0,487	0,547
number of observations	113		113		113	
r-squared	36,46%		36,09%		32,55%	
adjusted r-squared	30,23%		30,51%		26,66%	

Notes: *p<0.10; **p<0.05; ***p<0.01.

Source: Research results.