

Received: 07/23/2020

Accepted: 09/06/2022

COLLECTIVE ORGANIZATIONS AND RURAL PROPERTIES: DAIRY FARMING DIAGNOSTICS IN SOUTHERN MINAS GERAIS STATE

ORGANIZAÇÕES COLETIVAS E PROPRIEDADES RURAIS: DIAGNÓSTICO DA PECUÁRIA LEITEIRA NO SUL DE MINAS GERAIS

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Abstract

The milk production chain is a sector of great importance for the Brazilian economy, and it consists mostly of small producers. Collective cooperation practices are fundamental for assisting in the development of these activities and for strengthening dairy farming. However, milk producers often do not pay attention to the need to participate in the associations, cooperatives and other organizations of people (OP) that may provide help for many problems that devastate the everyday activities of dairy farms. This study aimed to investigate the main influences that these collective organizations can exert on dairy farms and to identify the structure of the relational interaction between them. A total of 115 dairy farmers from 8 cities in southern Minas Gerais state, including Campestre, Caldas, Ipuina, Poço Fundo, Elói Mendes, Poços de Caldas, Machado and Paraguaçu, were interviewed. Multivariate analysis was performed using Pearson correlation to identify the main existing influences. The results indicated correlations between the cooperatives, associations and other collective organizations and dairy farms in several areas, such as technological and managerial development, registration and access to information and production scale. It was possible to determine how the relationships between the collective organizations and dairy farms occur in southern Minas Gerais state. The results showed the influence that these collective organizations exert on dairy farms, which reinforces their importance for the milk production chain.

Keywords: Associativism. Cooperativism. Multivariate analysis. Commercialization relationships.

Resumo

A cadeia produtiva do leite é um setor de grande importância para a economia brasileira, sendo composta principalmente por pequenos produtores. As práticas de cooperação coletiva são fundamentais para auxiliar no desenvolvimento dessas atividades e fortalecer a pecuária leiteira. Entretanto, os produtores de leite geralmente não prestam atenção à necessidade de participar de

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associações, cooperativas e outras organizações de pessoas (OP) que podem fornecer ajuda para muitos problemas que devastam as atividades cotidianas das fazendas leiteiras. Este estudo teve como objetivo investigar as principais influências que essas organizações coletivas podem exercer nas fazendas leiteiras e identificar a estrutura da interação relacional entre elas. Foram entrevistados 115 produtores de leite de 8 cidades do sul de Minas Gerais, incluindo Campestre, Caldas, Ipuiúna, Poço Fundo, Elói Mendes, Poços de Caldas, Machado e Paraguaçu. A análise multivariada foi realizada usando a correlação de Pearson para identificar as principais influências existentes. Os resultados indicaram correlações entre cooperativas, associações e outras organizações coletivas e fazendas leiteiras em diversas áreas, como desenvolvimento tecnológico e gerencial, registro e acesso à informação e escala de produção. Foi possível determinar como as relações entre as organizações coletivas e as fazendas leiteiras ocorrem no sul de Minas Gerais. Os resultados mostraram a influência que essas organizações coletivas exercem nas fazendas leiteiras, o que reforça sua importância para a cadeia produtiva do leite.

Palavras-chave: Associativismo. Cooperativismo. Análise multivariada. Relações de comercialização.

Introduction

Agricultural production is an important source of income for producers who obtain family support from the field. Therefore, dairy farming has demonstrated enormous capacities for production and wealth and income generation for rural individuals.

The importance of dairy farming organizations for regional development is considerable, even when obstacles limit dairy activity, such as [managerial and] technological development (RIDDER et al., 2015). In southern Minas Gerais, another factor that interferes with the development of milk production is the producers' membership in cooperatives, associations and other collective organizations.

The participation of farmers in collective organizations is fundamental for strengthening the economic and social development of the dairy production chain; however, it is necessary for farmers to understand the advantages and benefits of these organizations. Ferreira, Souza and Costa (2018) use the term "cooperative education" to refer to this behavior by producers.

Cooperativism is important for the development of not only the collective organizations but also the entire region in which these organizations are formed, as emphasized by Melo, Plein and Bertolini (2019), who cite the importance of cooperativism for regional development. Those authors draw attention to the need for many researchers to delve deeper into this topic to better understand the behavior and influences of the relationships between producers and collective organizations.

This study is justified due to the importance of the dairy sector to southern Minas Gerais state and the need for a greater understanding of how cooperation can affect the dairy production process. Nevertheless, this research may contribute to the development of new public policies to stimulate the creation and the strengthening of associations and cooperatives that assist in the economic expansion of the milk production chain. Regulators and managers can also benefit from this work by understanding the interfaces of the relationships between farmers and collective organizations.

Indeed, this study aims to answer the following questions: what are the effects of cooperative practices on dairy farms, and how does the collective organization/dairy producer relationship develop in southern Minas Gerais? This study aims to investigate the main effects of collective organizations on dairy farms in southern Minas Gerais and to identify the interaction structure between these organizations and dairy farms.

Collective organizations

A collective organization is a union of people with a common goal of developing a particular activity with or without economic purposes, which may be formal (with a legal apparatus) or informal (organization of individuals without legal personality). Cooperatives and associations are two classic examples of this formal organizational structure, and they are considered important means to gather and store the products of small producers and to try to improve production quality;

these organizations are also instruments for the promotion and dissemination of technological and productive factors (SABBAG; COSTA, 2015). Cooperatives and associations also represent an important opportunity for dairy farmers to commercialize their production (RIDDER; SONOGO; RUFINO, 2015).

Cooperatives are organizations of people (OP) that aim to make collective decisions with the continued objective of surviving in the market and preserving their economic viability in relation to other companies that have great flexibility regarding decision-making conditions (FERNANDES; PIRES, 2016). The intensification of the expansion of cooperatives in Brazil since the 1980s (RODRIGUES; MARTINES FILHO, 2016) culminated in the reduction of some agricultural policies and the extinction of other policies, which forced the development of cooperatives and the adaptation of already existing cooperatives in order to remain competitive (MEDEIROS; PADILHA, 2015).

Cooperatives were created to transform capitalism, in which there is always a need for a deeper reconfiguration, both in terms of social relations and in the means of technological production. In other words, cooperatives should be expanded to allow the correct economic/social contribution to collective development (PAZAITIS; KOSTAKIS; BAUWENS, 2017). Cooperatives are responsible for relationships with buyers, government and certification agencies and various non-governmental organizations (NGOs), in addition to the farmers themselves who should have the perception of their effective participation and the benefits that can be obtained from more solid cooperatives (DONOVAN; BLARE; POOLE, 2017).

Cooperativism contributes to the development of the social and economic organization of productive activities (MELO; PLEIN; BERTOLINI, 2019). With the development of dairy farming, Estevam, Salvaro and Busarello (2015) report that the number of producers that have begun to participate in cooperative organizations has been increasing in recent years, especially among small farmers. This expansion of cooperativism in the rural environment, however, has never maintained this fast pace for long periods of time (SIMÃO et al., 2017).

The usefulness of cooperatives for dairy farming is due to the increased access of farmers to information and communication. Souza, Leite and Pereira (2018) add that communication is of fundamental importance for contributing to social development, which is one of the cooperative principles. The benefits that these organizations can provide to farmers by encouraging the improvement of milk quality and production scale is another important factor for cooperative development (FARIÑA; BERTOLINI; MENEGHATI, 2017).

Cooperatives need to be aware of the ability to add value to cooperative members' products and services, which is considered a great challenge for cooperative development. This need for awareness arises because it is the responsibility of cooperatives to coordinate the production chain with the maximum possible effectiveness, always seeking to meet the needs of cooperative members (SOUZA et al., 2017).

Associations are another important type of collective organization. Associativism can contribute to income generation by stimulating food supply and adding value to agricultural products and/or activities with the purpose of reducing poverty and encouraging social inclusion, and it is considered a key instrument for local development in Brazil (NUNES; SILVA; LIMA, 2017).

Associations may also benefit dairy producers by aiding in the formation of the sale price and commercialization (SABBAG; COSTA, 2015), thus ensuring better revenues than dairy producers could achieve on their own due to the smaller production scale. Therefore, associations are considered fundamental institutions for the dairy sector (RIBEIRO; RIMONDES, 2017).

Vargas and Silveira (2018) highlight some advantages of the adherence of farmers, including the possibility of improving techniques, selling milk and establishing partnerships with other organizations and companies. Guareski et al. (2019) add other advantages of participation in associations, such as the possibility of having specialized technical assistance and access to inputs with greater monetary attractiveness. Such practices can substantially stimulate growth of small farmers, ensuring better conditions for developing milk production.

The milk production chain

The milk production chain is fundamental for various sectors of the economy because it includes processes ranging from the production of inputs destined for the production process to the commercialization and processing of dairy production. According to Ferrazza et al. (2015), the milk production chain is composed of approximately 80% of small family farmers. Smaller properties face

a series of difficulties that require further studies to develop new strategies that stimulate these producers.

The management of a dairy farm is a challenge for its owners. Oaigen and Barcellos (2008) argue that producers need to improve business management because the vast majority of producers are still unaware of basic issues, such as production costs and technical-financial indicators of agricultural activities. When dealing with small farms, these difficulties are intensified because producers often have few resources to perform this activity effectively (SOEST et al., 2019).

Cost management allows the strategic evaluation of information, which is relevant for more efficient decision-making; thus, the operational process of conducting a rural business alone is not sufficient, and a functional management system that ensures the desired growth is also needed (SANTOS; MARION; SEGATTI, 2002). The analysis of production costs also allows viability of investments and implementation studies to be performed (ZANIN et al., 2015).

Another factor that afflicts rural individuals is the limited level of technological instruction, which compromises their ability to absorb new ideas and introduce work tools that add value and facilitate the production process of rural properties. A study conducted by Mora et al. (2012), with Chilean farmers, showed that although most of the farmers were familiar with the Internet and the use of software, few had effectively managed to use these applications to innovate the performance of their organizations in the various stages of the production chain and trade. The similarities of the Brazilian and Chilean realities are explained by Monteiro Novo (2012), who states that this topic is the subject of international debate.

The resources required for production are, for the most part, inadequately invested in land, machinery, equipment and improvements, which are often left idle (ALMEIDA; SILVA, 2015). Consequently, numerous agricultural properties may become unable to monetize their businesses because high underutilized and unnecessary investments tend to prevent better financial returns from being realized.

In addition, most dairy farmers develop other commercial activities as an alternative means of income, limiting the level of specialization in the activity (ASSIS et al., 2016). The low specialization substantially interferes with the production process and can reduce production to levels that compromise all the activities of the dairy farm. Perobelli, Araújo Júnior and Castro (2018) emphasize that a low level of specialization prevents the correct identification of all strengths and weaknesses of the activity and can hinder the process of technical cooperation, which compromises dairy production competitiveness. Assis et al. (2016) corroborate this understanding and add that this is a national reality.

Methodology

A quantitative study of a descriptive nature (BRYMAN, 1989) was conducted with dairy farmers in southern Minas Gerais state. A semistructured questionnaire developed specifically for this research, which was composed of 13 questions on aspects related to various activities of the production and commercialization of milk, was used. The questions were designed so that it was possible to identify general information about the farms (location and size, among others), commercialization practices, diet, management, technological resources, property management and information. These aspects are related to the adoption of technologies for the production process, and the use of machinery, equipment and other devices that contribute to the development of agricultural activity are considered. The level of technological development of the adopted production systems was also correlated so that it was possible to identify the development of these properties from the sophistication of production systems.

Chart 1 presents the questions presented in the questionnaire.

Chart 1: Questions to milk producers in southern Minas Gerais

<p>Do you participate in collective organizations? If yes, which ones?</p> <p>What is the size of the area used for dairy farming?</p> <p>How many liters of milk are produced daily on your property?</p> <p>Who buys the milk produced?</p> <p>Why do you sell milk to this buyer?</p> <p>Do you invest in milk quality?</p> <p>What production system is used on your property?</p> <p>Do you record information on dairy farming (economic and zootechnical activities)?</p> <p>How are the administrative controls of dairy farming performed?</p> <p>What controls are performed?</p> <p>Do you calculate production costs and other economic indicators?</p> <p>How is dairy farming information obtained?</p> <p>What are the main production technologies used on your property?</p>

Source: prepared by the authors.

A total of 115 milk producers were interviewed between December 2016 and March 2017 in 8 municipalities in southern Minas Gerais, including Poço Fundo, Elói Mendes, Machado, Ipuiuna, Campestre, Paraguaçu, Caldas and Poços de Caldas. The interviews took place at events related to dairy farming, such as dairy cattle auctions, meetings of producers in formal and informal organizations and lectures on dairy farming. In these events, all the farmers who agreed to participate in and contribute to the study were interviewed. Farmers were also visited in different neighborhoods of these municipalities. Before starting the interview, a presentation of the objectives of the research and the identification of the farmers regarding their line of activity was performed, and only producers who stated that they produced milk on their farms were interviewed.

In addition to the development of the technical knowledge of the respondents, the study also addressed information related to the mechanisms used by producers to obtain higher levels of information and to be more informed about dairy farming. The questionnaire included questions regarding access to information resources, such as television, newspapers and magazines, radio, the Internet and other sources that producers could use to keep themselves informed. Producers who were not interested in obtaining new information and those whose information mechanism was informal conversations with neighbors and other people from the region with popular knowledge were also included in the study.

Regarding the data treatment, the data were first tabulated in an Excel[®] spreadsheet, and scores ranging from 1 to 7 were assigned. The second step was the *Kolmogorov-Smirnov* test, which assesses the normality of data. In the third step, the data were analyzed using Minitab[®] software, which performed the statistical analysis using Pearson correlation analysis – represented in this study by the letter "r". According to Figueiredo Filho and Silva Júnior (2009), this correlation is represented by:

$$r = \frac{1}{n-1} \sum \left(\frac{xi - \bar{X}}{Sx} \right) \left(\frac{yi - \bar{Y}}{Sy} \right)$$

where X and Y are the variables that will be analyzed, which are associated by the sharing of variance or by the distribution of linear frequencies. This analytical procedure generates a coefficient that varies from -1 to 1; a) when the coefficient is closer to 1, the directly proportional correlation is stronger; b) when it is closer to -1, the inversely proportional correlation is stronger; and c) when it is closer to 0, the directly proportional correlation (if positive) or inversely proportional correlation (if negative) is weaker (CÓRDULA; ARAUJO; SILVA, 2019). The significance of variables (Table 2) was determined considering $\alpha=5\%$.

The variables used for analysis are shown in Chart 2.

Chart 2: Variables used in the study

General variable	Specific variables
Participation in collective organizations	Cooperatives Formal associations Informal associations Other collective organizations
Size of the area used for milk production	
Daily milk production	
Main milk buyers	Primary buyer Secondary buyer Tertiary buyer
Motivations to sell the product to the main buyer	Does not delay payment Loyalty Lack of sale options Best price Friendship Other (citations of the interviewees)
Production system used	At grazing (intense) At grazing (extensive) Semiconfinement Confinement
Investment in milk quality	Yes No
Registration of information generated on the property	Yes No
Procedure for recording information	Software Electronic spreadsheet (Excel) On paper Other
Information recorded	Expenses and revenues Production costs Calving and dry-off Weighing of growing animals Milk control Temperature (maximum and minimum) Rainfall
Means of access to information	Newspapers Magazines Internet Specialized professionals Technical events Other
Main production technologies used	Artificial insemination Expansion tank Immersion tank Tractors and equipment Mechanical milking Milking with a milking bucket Irrigation equipment Power generator Waste management Other

Source: prepared by the authors.

The results presented here refer to the correlation of the participation of the dairy farms in associations, cooperatives and other OP with several variables related to milk production. The term OP will be used here to present the results and discuss their correlations.

Results and discussion

Aspects related to production

It was found that 68.7% of the respondents said that they did not participate in any association or cooperative; 29.6% reported being associated with a cooperative and/or association; and only 1.7% of participants did not answer this question. Regarding the institution with which the interviewees were associated, 66% reported participating only in cooperatives, followed by 17% who indicated participating in informal associations and/or other organizations that may perform similar collective work. Another 10% stated that they participated only in associations, and those who claimed to simultaneously participate in associations and cooperatives accounted for 7% of the participants.

The correlation coefficient between the area used for milk production and participation in associations and cooperatives was $r=0.201$ ($p=0.032$), which indicated that the size of the area destined for agricultural production can significantly influence the association of farmers with cooperatives because it has a proportional relationship with participation in these institutions. Thus, farmers who own larger areas are more likely to join a cooperative organization than those whose properties are smaller. It can also be inferred that these cooperatives also benefit substantially from large farms intended for agricultural production.

Milk production was correlated with producer participation in cooperatives and/or associations ($r=0.263$, $p=0.004$). The results also showed a directly proportional relationship regarding the area; a greater area resulted in a greater probability of increased milk production, as its correlation with the production resulted in a value of $r=0.491$ ($p<0.0001$). The size of the farms and their participation in cooperatives are factors that significantly impact the development of dairy cattle farming in southern Minas Gerais. This idea is shared by authors who indicate the importance of increased milk production for the development of milk production activity (BRAR et al., 2018; VINOLA et al., 2018).

No correlation was identified between the following variables: (I) the main dairy purchasing company of the farms and (II) the area destined for agricultural production. It was possible to observe that the companies that buy the milk did not contribute to the productive development of the dairy farms. These behaviors discourage the competitiveness of the dairy market because, as Leite Júnior, Lopes and Cardoso (2018) mention, they are not strategies to increase the competitiveness of dairy production.

The sale of milk to the main buyers is justified by the correlations with a lack of payment delay ($r= -0.311$, $p<0.001$), participation in associations or cooperatives ($r= -0.293$, $p<0.001$) and production ($r= -0.216$, $p=0.021$). Thus, a longer relationship between milk buyers and sellers results in a lower default rate. A lower delinquency of the industries that buy milk causes farmers to join other collective organizations with the intention of strengthening them. It can be inferred that milk producers are only concerned with increasing milk production when there is risk of capital loss due to not being paid for the sold produced milk.

The correlation between investments in milk quality and participation in associations or cooperatives had a value of $r=0.250$ ($p=0.007$), and with increased production, the value was $r=0.460$ ($p<0.001$). It can be concluded that participation in cooperatives assists in the improvement of milk quality and increases milk production of the associated farms. One of the factors in this relationship is the awarding of a bonus, where many cooperatives reward dairy producers with regard to milk volume and quality, which, according to Lopes et al. (2011), improves the profitability of the activity. In a structural view of cooperation, development arises from the organizational requirements necessary for cooperativism to be a strengthening agent of the cooperative dynamics (BENINI; BENINI, 2015).

The correlation between cooperation and the use of pastures under rotational grazing ($r=0.189$, $p=0.043$) and semiconfinement ($r=0.211$, $p=0.024$) indicated that cooperativism can strengthen the development of new technologies for milk production. These results also indicate that the incentive given by cooperatives in southern Minas Gerais to farmers who use the rotational grazing system appears to be lower than that given to farmers who use the semiconfinement system. However, pasture fertilization practices are encouraged by cooperatives ($r=0.391$, $p<0.0001$). Mariani et al. (2018) corroborate this understanding and add that the number of studies on this topic has expanded.

This understanding is confirmed by the correlation between cooperative participation and milk production in extensive systems ($r= -0.277$, $p=0.003$), which demonstrates that greater association of farmers with OP results in less use of extensive pasture production systems, a condition that demonstrates an important contribution of these institutions to the development of dairy farms. By correlating the extensive production systems with the area ($r= -0.316$, $p<0.001$) and

with production ($r = -0.416$, $p < 0.0001$), it can be inferred that production systems with little investment in milk activity do not contribute to the development of these farms and do not favor the adoption of cooperative practices. Silva, Rodrigues and Silva (2018) emphasize that various activities should be developed with cooperative support to achieve larger production scales.

Aspects related to management and information

The participation of farmers in cooperatives and/or associations also contributes to the development of the informational systems of farms. Their correlation with the manual recording of information resulted in a value of $r = 0.368$ ($p < 0.001$). This result suggests that farms in southern Minas Gerais tend to show increased concern with the recording of information as their involvement with collective organizations increases. Cooperative participation can contribute to improving the informational development of the farms, ensuring that, according to Bezerra et al. (2017), managerial problems decrease, which causes income to increase. Information also ensures that more sophisticated technological resources are used, which corroborates Moraes et al. (2018), who state that these factors directly affect dairy farms.

The information recorded about the farms was also correlated with the type of information recorded, the area and the production (Table 1). The correlations between the different types of information and the area, participation in associations and cooperatives and production showed a direct proportionality. All of the variables presented in Table 1 are interconnected, which suggests that the cooperative participation of a dairy farm can facilitate the best use of the area, an increase in production and the evolution of the information system.

Table 1: Correlations between area, participation in associations and/or cooperatives and production and main information recorded in dairy farms in southern Minas Gerais

Information	Area	Associations/cooperatives	Production
Expenses and revenues	0.284 ($p = 0.002$)	0.347 ($p < 0.0001$)	0.408 ($p < 0.0001$)
Calving and dry-off	0.223 ($p = 0.017$)	0.281 ($p = 0.002$)	0.475 ($p < 0.0001$)
Mating season and mating	0.264 ($p = 0.004$)	0.292 ($p = 0.002$)	0.566 ($p < 0.0001$)
Offspring weighing	0.192 ($p = 0.040$)	0.305 ($p < 0.001$)	0.387 ($p < 0.0001$)
Milk control	0.257 ($p = 0.005$)	0.359 ($p < 0.0001$)	0.557 ($p < 0.0001$)
Cost of production	-	0.312 ($p < 0.001$)	0.300 ($p < 0.001$)
Climatology	-	0.368 ($p < 0.001$)	0.299 with $p < 0.001$)

Source: research data.

The correlation of the variables presented in Table 1 for the types of information (expenses and revenues, calving and dry-off, mating season and mating, offspring weighing, milk control and cost of production) and the production scale of the farms indicated that these coefficients are more strongly related to the production scale, given that their values were higher than those found for the correlations with the area and the farmers' participation in associations and/or cooperatives. Lopes et al. (2008) reinforce this understanding by emphasizing that the indicators extracted from the records in farms have a strong relationship with the production scale to achieve the desired economic results.

The correlations between properties that estimate production costs and the participation in associations and/or cooperatives and the scale of production (Table 1) indicated that associations and cooperatives contribute significantly to the development of more efficient milk production management, which is concerned with management of costs. Donovan, Blare and Poole (2017) add that cooperatives are important for helping farmers by offering various services that assist in the development of the agricultural profile.

These results, corroborated by Donovan, Blare and Poole (2017), are confirmed by the coefficient between the production scale of the farms and the knowledge of farmers about the total milk production activity costs ($r = 0.328$, $p = 0.004$). Higher milk production contributed to a higher level of rationality of farmers regarding the production costs of dairy farming, which strengthened the participation of cooperatives as supporters of this process because these organizations stimulate the informational development and knowledge of the associated producers. Williamson (1991)

describes that the rationality of all human beings is limited by their field of knowledge and that it is necessary to raise this level of rationality so that better results can be achieved in organizations.

Cooperatives in southern Minas Gerais seem to stimulate the access of farmers to technical information through the distribution of newspapers and magazines, resulting in a correlation coefficient of $r=0.347$ ($p=0001$). Participation in cooperatives encourages producers to better inform themselves about the milk activity by reading newspapers and technical journals, as well as by developing knowledge by recording information associated with the everyday activities of the farms.

However, access to the Internet, television and technical assistance did not present a significant correlation. The access of farmers is still small in the context of more sophisticated technological resources for access to information, which has a negative effect on farmers because they are limited to the information provided by cooperatives. Unfortunately, restricting access to these technologies can, according to Leite (2019), limit the improvement in profitability, productivity and development of the milk production chain.

The correlation among other technologies for productive processes and cooperativism was notable and included use of tractors and equipment ($r=0.288$, $p<0.002$) and artificial insemination practices (0.302 , $p<0.001$). It can be inferred that participation in associations and/or cooperatives may stimulate the development of dairy farming by encouraging farmers to use machines, equipment and other technologies in production processes. Studies conducted by Bassotto et al. (2019) demonstrate the importance of these technologies for the reality of farmers, and the authors state that even small dairy farms can use these resources to achieve better results in the production process.

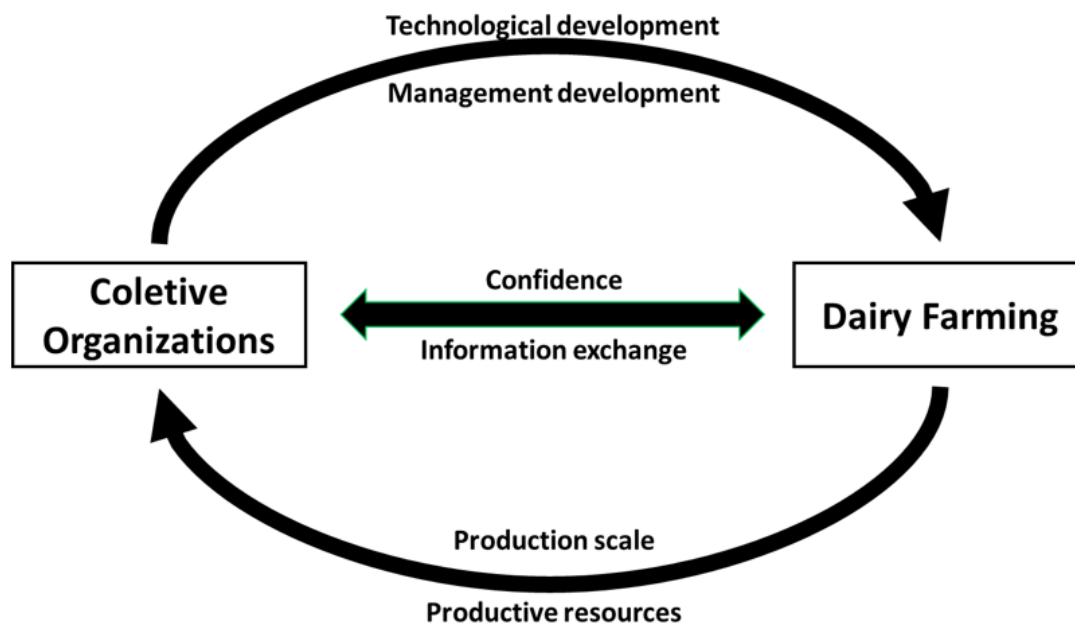
The participation of farmers in collective organizations proved to be of fundamental importance for the development of dairy farming. Estevam, Salvaro and Busarello (2015) also claim that cooperatives are important for farmers as a mechanism of strengthening their activities by reducing business risks, which is linked to the possibility for producers to have differentiated commercialization within the informal market.

Relationships between OP and dairy farms

The correlation studies demonstrate the proportionality between variables. The present study indicated several aspects of milk production that can be influenced by cooperatives, associations and other collective organizations. Similarly, the development of dairy farming benefits these organizations by contributing to the strengthening of the milk producer/buyer relationship, in addition to contributing to other aspects of the milk production chain, such as increasing the scale of production.

The results of the correlations allowed the identification of 3 important relational pathways between collective organizations and dairy farms (Figure 1). The first (dairy farms/OP) shows the main effects that dairy activities have on the development and strengthening of OP (production scale and agricultural area). The second (OP/dairy farms) indicates that organizations assist dairy farms by contributing to the technological and managerial development of these activities. The third pathway indicates a way in which both OP and dairy farms should have high information exchange and trust so that the relationship between them is long-lasting.

Figure 1: Relational structure between collective organizations and cooperatives in the south of the state of Minas Gerais in 2017



Source: prepared by the authors.

The relationships between collective organizations and dairy farms should be seen as win-win relationships in which the results can only be achieved if both work together. Thus, dairy farms contribute to the development of the cooperative environment as the use of productive resources improves and as the scale of production increases. Ridder et al. (2015) warn that the scale of production may be linked to the size of the area destined for milk production because it is a necessary resource for the production process.

However, Melo, Plein and Bertolini (2019) warn that the increase in the scale of production, especially of small farmers, is a challenge due to numerous aspects, including the level of specialization and management, among others. These authors corroborate the results of this study and demonstrate that technological and management development are two aspects in which collective organizations excel in helping dairy farms develop and increase their milk production scales.

The interaction between collective organizations and dairy farms demonstrates two other mutual factors that should be considered so that greater strengthening of trade relations occurs between institutions: trust and information. Trust is fundamental to ensure that the business relationships between cooperatives and farms are strengthened and maintained for long periods of time. Similarly, the exchange of information has been shown to be another factor that encourages the loyalty of dairy farms to cooperatives, which, in turn, tend to provide specialized technical knowledge to farmers, ensuring that both can help each other in the development of their respective activities.

Final considerations

The aim of this study was to investigate the main effects of collective organizations on dairy farms in southern Minas Gerais and to determine interaction structure between these organizations and dairy farms.

The analysis of the correlations provides an understanding of the interaction between different collective organizations and dairy farms, showing the main areas in which the relationship between both can be strengthened or weakened. This interaction also allows the identification of the main factors that demonstrate the importance of dairy producers associating with collective organizations to maintain better development indices.

It was also possible to identify the interactions that occur through these commercial relationships, what should (or should not) happen for such relationships to be strengthened and how

much collective organizations can assist dairy farms in various factors related to managerial and technological development. Milk farms can also contribute to the development of these collective organizations through increased milk production and the resources required for production. Other aspects, such as the exchange of information and trust, should be encouraged in both organizations as a mechanism for strengthening cooperative practices.

This study was limited to an examination of the behavior of different factors within dairy farms that may be affected by cooperative participation. Additional research that explores the impact of the strengthening (or weakening) of this interaction (collective organizations/dairy farm) can help to identify new practices that stimulate the incentive for cooperativism.

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