

ADOPTION OF REGULATION MECHANISMS IN THE PRODUCTIVE CHAIN OF MILK: AN ANALYSIS BASED ON INTERNAL FACTORS OF COMPANIES

ABSTRACT

This chapter aimed to verify the existence of a relation between specific features of the companies and the adoption of regulation mechanisms by milk processing companies. The adoption of these mechanisms improves the quality and informs the consumer about the quality and safety of products offered. The sample comprises 47 companies under the Minas Gerais state Industrial Registry. This is a quantitative-oriented study and its data has been collected through a semi-structured questionnaire. The technique used to meet the objective was the regression based on binomial logit model. Results suggest that, for this work's sample, the adoption of regulation mechanisms is related to a specific feature of the company in a general way. It was also verified that there are differences in the company's characteristics which will influence it into adopting either formal or informal mechanisms. The adoption of formal mechanisms is influenced by the time of experience in the market, international experience, processed amount and diversification (the variety of products manufactured by the company in question). The adoption of informal mechanisms is influenced by the company's regional/nationwide experience and the percentage of qualified employees.

Key-words: food quality and safety, milk chain, mechanisms of regulation, resource-based view. regression based on binomial logit model.

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Recebido em 4/5/10. Aprovado em 8/5/12
Avaliado pelo sistema blind review
Avaliador científico: Ricardo Pereira Reis

1 INTRODUCTION

The specific characteristics of a firm are considered as major influencers of strategies adopted by companies, being among the most significant strategic resources according to researchers. A firm appears as a collection of knowledge resources that are encompassed by routines and processes of learning. Thus, benefits arise. In fact, firms develop or acquire a set of features that are superior to their competitors (PRAHALAD & HAMEL, 1990).

Given the requirements set by the consuming market and facing a fierce competition present worldwide, companies also find themselves forced to adopt strategies to meet the quality requirements imposed not only by the market but also by State regulators. In the food industry, beyond the issue of quality, food safety has been a decisive factor for the performance of the sector.

To minimize contamination risks and uncertainties regarding the attributes of food produced, companies

began to use regulatory mechanisms reducing problems of asymmetric information in order to intensify the relation with their suppliers or even to inform consumers about the quality and safety attributes of products that are offered in the market.

The dairy sector in Brazil in particular has faced serious challenges in providing quality and reliable products. Recent data indicate that from 9.5 billion liters produced in 2009, 33% were produced in an informal way, ie they did not receive inspection by health authorities (IBGE, 2010). In addition, in 3000 milk samples analyzed by the Ministry of Agriculture in 2010 there were 27 with evidence of adulterated milk (FOLHA DE SÃO PAULO, 2011).

It is known that the adoption of regulatory mechanisms especially in some sectors, besides provide improvements in product quality also allows the company to get financial gains. In this sense the question to be discussed is: why some firms in the industry can adopt regulatory mechanisms to ensure food security and not others? Is it possible to affirm that there are factors intrinsic to the firm that influence it in the decision to adopt these

Os autores agradecem a Fapemig pelo apoio financeiro à pesquisa.

mechanisms in order to provide security for consumers and avoid even sanctions such as fines and prohibition to sell their products, among others?

This study assumes that the competitiveness of companies is related to the adoption of regulatory mechanisms, and that this is influenced by their own individual characteristics. That is, the fact that the company has resources and capabilities controlled by the firm gives it the ability to create a competitive advantage, allowing it to have a better performance before its competitors. This has been a theoretical perspective in studies on the Resource-Based Vision referring to the dominant paradigm in strategy in which organizational resources are the main determinants of performance, emphasizing efficiency (RIVERA, 2008; TEECE, PISANO; SHUEN, 1997).

In this sense, given the lack of studies that verify the existence of the relation between the firm's resources and the adoption of regulatory mechanisms, this study was to identify which specific characteristics of the firm can influence the ability of this adoption, if there is a relation between them.

It is believed that the results of this study will provide subsidies that will make possible the development of actions that favor the improvement of the sector, since the knowledge of the characteristics of firms that form the dairy industry helps policymakers to guide programs and specific investments according to the needs of those companies.

2 THEORETICAL REFERENCES

2.1 Food safety and regulatory mechanisms

In search of a stronger competitive advantage, companies are looking for new management practices. This is the reality of most Brazilian companies in several industries, including companies in the dairy sector.

Issues such as food safety, environmental preservation and social responsibility have been widely discussed worldwide and are gaining importance in all sectors. Food safety ensures that consumers get a food with quality attributes that do not cause harm to their health.

In the food sector, more specifically in the dairy sector, there is a growing claim from government agencies and consumers in order to companies could develop environmentally friendly activities and provide safe products. In this sense, companies are being forced to comply with new laws to meet the food safety requirements.

Despite the importance of quality for companies that work with food, to manage a system of food production that excels in these attributes of quality and safety has been a major challenge for companies, once the achievement

of these attributes does not depend on it only, but on the entire chain in which it is inserted.

Therefore, companies find themselves forced to use mechanisms to assure consumers that the products they are offering are safe and have quality. In addition, consumers also need these mechanisms to be safe about what in fact they offer and sell, avoiding, for example, the engagement in civil and criminal actions because of poor quality (contaminated food). This ends causes damage to the corporate image of the company and consequently its market success (VIEIRA, 2007). To do so, they have some organizational mechanisms of regulation that allow them to establish certain safety standards. Thus, they can demonstrate to consumers that the food they demand is safe and presents quality. These mechanisms also allow the reduction of information asymmetry between the parties and the uncertainty of quality.

There are several studies on these mechanisms (SPERS, 2003; BALK-THEUWS et al., 2004; VIEIRA, 2007; PLAGGENHOEF, 2007; VINHOLIS; TOLEDO, SOUZA FILHO, 2009) and they are differently classified in each one. In this work, we chose to divide the regulatory mechanisms into two groups: formal and informal. The formal mechanisms of regulation are those used by companies to ensure and inform consumers that foods offered present quality. As an example, they mention brand creation, labeling, standards, traceability, seals and certificates to ensure a quality standard. Among these formal mechanisms, there are those that are required and those that are not required; that means the company use them if they considers it appropriate according to the need or to the standards required by consumers.

Informal mechanisms of regulation or self-regulation encompass mechanisms that are not regulated by any regulatory body, either a private or public one. They are mechanisms used by companies regarding their suppliers in order to improve reporting and increase control over actions that will guarantee the quality of products offered. Companies themselves through their strategies offer the best way to ensure the supply of quality products. According to Plaggenhoef (2007), self-regulation is currently a major topic for discussion in public and private spheres considering its importance for the performance of the entire chain.

The various forms of integration with suppliers in order to ensure quality and food safety are examples of informal mechanisms considered in this work, specifically technical services, differentiated payments, training and qualification of suppliers, as well as the computerized

system integrated with suppliers, the supply contract, and also the investment.

2.2 Resource-based view of the firm (RBV)

The resource-based view of the firm (RBV) has originated from the publication of the work of Penrose called *The theory of the growth of the firm* in 1959. The author inspired by the study of David Ricardo who understood the land as a resource expands the idea of the author and conceives the firm as a set of resources. According to Penrose (1995), a firm is more than one administrative unit. It is also a set of productive resources whose arrangement between the different uses and over time is determined by administrative decisions. And they resources provide to the company the ability to be differentiated in the market.

The work of the author brought numerous contributions to the field of industrial economics. In addition to conceiving the firm as a set of features it also points out that the competitiveness of businesses based on the heterogeneity of their resources. That allows them to gain competitive advantage compared to other companies. It is the heterogeneity rather than homogeneity of services available in their resources that offers to each firm its specificity (PENROSE 1995).

Besides the work of Penrose (1959), other studies are also seen as a seminal resource-based view (RBV). Among them there are those of Ansoff (1977), Wenerfelt (1984), Barney (1991) and Peteraf (1993). These authors have been devoted to classify the resources of a company since they are understood as an important point in the analysis of RBV.

Based on the work of these authors, it is clear that resources can be classified in different ways. However, Carvalho (2009) points out that in general the authors that research resources classify them into three categories: tangible assets (property, plant, raw materials and others), intangible assets (brands, culture, technology skills, skilled or not-skilled labor force, learning and experience accumulated, among others) and capabilities (ability to a firm properly administer a set of resources that it owns or controls).

Overall, the Resource Based View is concerned with the firm's distinctive competencies. For Rivera (2008), the key issue of analysis of RBV is the administration of tangible and intangible resources, the heterogeneity of firms and how these factors affect the dynamic sector and create sustainable competitive advantage for certain organizations. According to Prahalad and Hamel (1990), this is characterized as an approach toward the factor markets, rather than the product market. It is the possession

of strategic resources the main source of competitive advantage of companies.

The RBV seek the connection between the internal characteristics of the firm and its performance. The fact that the company has resources and capabilities controlled by the firm allows it the possibility to create a sustainable competitive advantage and a better perform compared to its competitors.

Based on what has been described within the theoretical perspective of the Resource-Based View, this paper will seek to identify some factors internal to the firm. These factors determine the adoption of regulatory mechanisms, considering that the companies have special skills that are unique to them. For example, longer in the market, international experience and skilled employees, among others, and that these skills give it more likely to adopt mechanisms to ensure quality and safety.

3 METHODOLOGY

This current research is classified as a quantitative survey of descriptive and explanatory nature. The study sample consisted of milk processors in the chain belonging to the state of Minas Gerais listed in the Industrial Registry of Minas Gerais State in 2004 (last record available during the study period).

For the definition of the sample it has been used non-probability sampling for convenience because of the difficulty of collecting data from the entire population. Because it is a non-probability sampling, the results can not be generalized to the entire population. But even so, this research becomes relevant since it allows verifying the mechanisms used by companies to improve the quality and safety in the milk chain as well as the factors internal to the firm that affect the adoption of these mechanisms.

Data were collected through a semi-structured questionnaire applied in 47 milk processing companies in the state of Minas Gerais, a sample of 34,3% from the population.

3.1 Conceptual Model

In the face of new consumer demands for quality products and insurance, companies try to find answers to meet these changing needs of consumers. Today, more than ever, consumers need to make sure that the food they consume is safe and of quality. One way for companies to demonstrate to consumers that their products present quality their use will not cause harm to the health is to use some regulatory mechanisms to ensure these attributes.

However, there is evidence that the individual characteristics of the company influence the adoption of regulatory mechanisms. Through the theoretical review, specifically the theory of the Resource-Based View, it was found that when the company has resources and capabilities controlled by the firm it has the ability to create a sustainable competitive advantage, allowing it to perform better than its competitors. They are special skills that are unique to each one and give them more opportunities to adopt quality mechanisms.

Given this exposure, we elaborated the conceptual model shown in Figure 1 to verify the existence of a relation between the individual characteristics of the firm and the adoption of regulatory mechanisms.

Based on the conceptual model constructed from the theoretical framework, it was possible to establish the influence of each specific feature of the company with the

potential adoption of certain mechanisms and describe the hypotheses to be answered in this work.

a) Size of the firm (SF)

The size of the firm can influence the adoption of regulatory mechanisms, ie, the larger the firm, the higher is the chance to adopt regulatory mechanisms. Lima et al. (2006) conducted an analysis of the adoption of traceability systems for cattle in Brazil. They concluded that the system is not strongly adopted by some medium and small producers. According to Spers (2003), the use of a seal or label can vary from the size of the firm. Among the reasons for this relation is the fact that large companies have more advantages over the specialization and access to financial resources and skilled labor, among others. Therefore, we expect a positive relation between the firm size and the adoption of mechanisms. In this sense, one can trace the first hypothesis of this research:

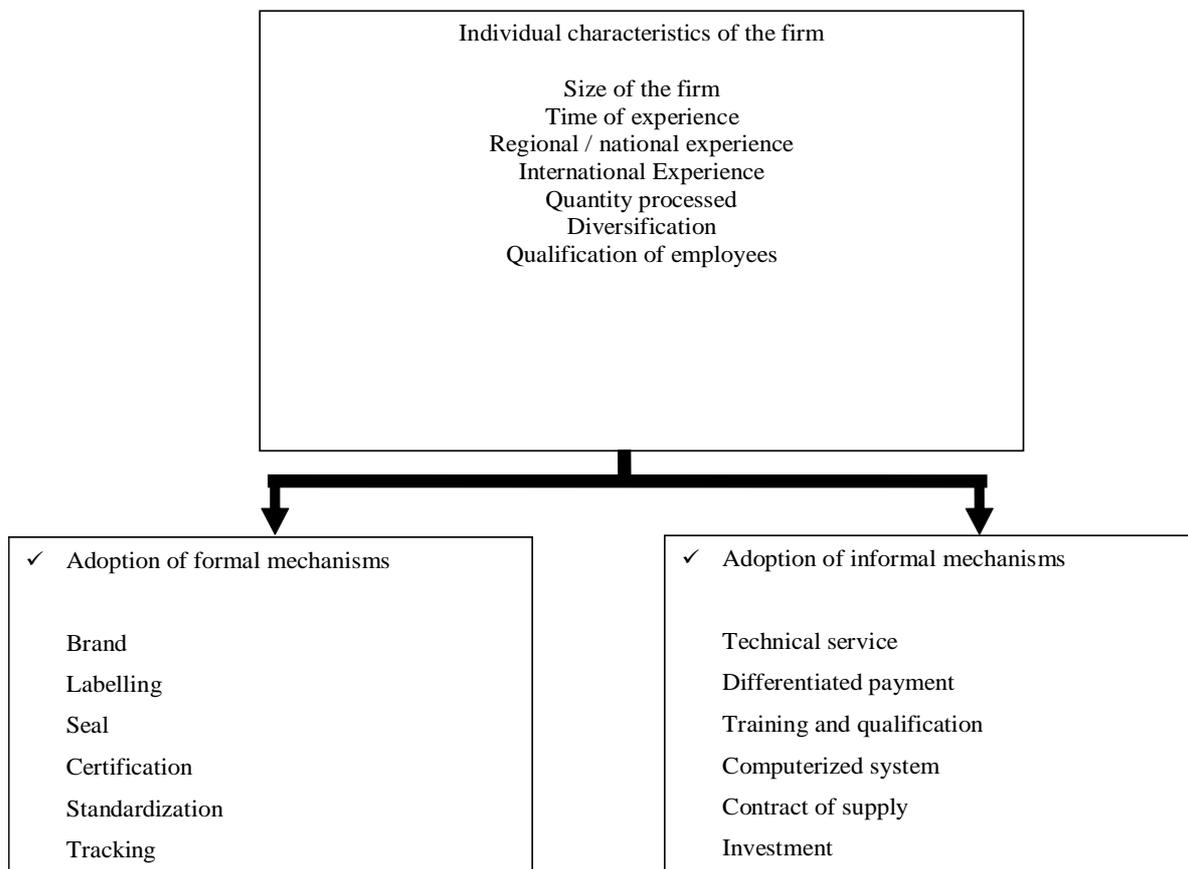


FIGURE 1 - Conceptual model to verify the existence of a relation between the characteristics of the firm and the adoption of regulatory mechanisms.

H1: The larger the size of the firm, the biggest the probability of adoption of regulatory mechanisms by the company.

b) Experience time (ET)

Companies that operate for longer on the market have increased chances of adopting regulatory mechanisms. This happens because many of the mechanisms considered in this work need time to be implemented. As an example, we can mention certification. In addition, mature companies can have accumulated stock of knowledge and built skills to adopt such mechanisms. Therefore, it is expected to obtain a positive relation between ET and the adoption of regulatory mechanisms. Thus, one can draw the following hypothesis:

H2: The longer the time of experience in the market, the highest the probability of adoption of regulatory mechanisms by the company.

c) National/regional experience (N/R/ E)

The fact that the company has national/ regional experience means that it trades its products in other states can also influence the adoption of regulatory mechanisms by the company. If the company wants to market to other states, they require products with better quality. In addition to being inspected by the Institute of Agriculture of Minas Gerais (IMA), they are also inspected by a federal agency, the Federal Research System (SIF). Therefore, although no studies to prove this relation, we expect to obtain a positive relation between N/R E and the adoption of mechanisms. In this sense, one can draw the following hypothesis:

H3: the fact that the company has regional/ national experience increases the likelihood of adoption of regulatory mechanisms by the company.

d) International experience (IE)

The fact that the company has international experience increases the chances of adopting regulatory mechanisms. This can be explained by the requirements that are imposed on companies that are exporting. The foreign market is highly rigorous and requires products of high quality standard, requiring the companies really adopt some mechanisms and compliance with international quality standards (TANABE, 2003). So, it's expected a positive relation to IE and the adoption of regulatory mechanisms. Thus, one can draw the following hypothesis:

H4: the fact that the company has international experience increases the likelihood of adoption of regulatory mechanisms by the company.

e) Quantity processed (QP)

The amount of milk processed by the company also has strong relation with the adoption of regulatory mechanisms, ie, the greater the amount processed by the company, the highest the chance that it adopt mechanisms to regulate the quality. Therefore, it is expected to obtain a positive relation between QP and adoption of regulatory mechanisms. Based on the foregoing, it is possible to outline the following assumption:

H5: the greater the amount of milk processed, the highest the probability of adoption of regulatory mechanisms by the company.

f) Diversification (DIV)

The amount of products manufactured by the company also increases the chances of it taking regulatory mechanisms, ie, the more diversified, the more likely the company to adopt mechanisms. Companies that diversify their product lines tend to adopt more mechanisms to differentiate them from their competitors and to improve their quality. Thus, they can sell to a larger share of the market. Therefore, it is expected to obtain a positive relation between DIV and adoption of regulatory mechanisms. Accordingly, the fifth hypothesis of this work is outlined as follows:

H6: the more diversified the company, the highest the probability of adoption of regulatory mechanisms by the company.

g) Qualification (QUAL)

The higher the percentage of qualified staff, the greater the probability of a company to adopt regulatory mechanisms. Companies that invest in qualified employees present a higher concern with the issue of quality, a requirement essential to the permanence of the firm in the market. Therefore, it is expected to obtain a positive relation between QUAL and adoption of regulatory mechanisms. Given this, the sixth hypothesis is outlined as follows:

H7: the higher the percentage of qualified employees, the greater the probability of adoption of regulatory mechanisms by the company.

2.3 Analysis Techniques

It has been performed a regression analysis in order to verify the existence of a relation between the individual characteristics of the firm and the adoption of regulatory mechanisms. The model chosen was the binomial logit because the dependent variable is dichotomous and may take zero or one.

For each one of the formal and informal regulatory mechanisms described in Figure 1 it has been performed a binomial logit regression. Briefly, the general model to be adjusted can be represented as follows:

$$\ln \frac{P_i}{1 - P_i} = \beta_0 + \beta_1 TF + \beta_2 TE + \beta_3 ER/N + \beta_4 EI + \beta_5 DIV + \beta_6 QP + \beta_7 QUAL$$

where \ln is the natural logarithm; P_i is the probability to companies adopt regulatory mechanisms; $1 - P_i$ is the probability of not adopting regulatory mechanisms; β_i ($i = 0, \dots, 7$) are the parameters to be estimated.

In this model, the dependent variable assumes binary values (0 and 1) wherein the adoption of mechanisms has value 1, and the not adoption of mechanisms, the value 0. The independent variables are composed by the following variables: firm size measured by the number of employees besides experience time in the market, regional/national experience, international experience, diversification, quantity processed and qualification of employees.

As the probabilities are unknown, the estimation of the model will be made by the method of maximum likelihood, which selects the coefficients that make the observed values more likely to have occurred.

The statistical package used for tabulation and processing of data was the Statistical Package for Social Science (SPSS).

4 RESULTS AND DISCUSSION

The sample of this study consisted of 47 dairy processing companies, four of which were exporters (8.5%) and 10 were cooperatives (21.3%). Overall, the sample consisted of experienced companies because most of them, 57.4%, is more than 21 years on the market and only 6.4% is less than 5 years. As for the size, 42.6% have up to 30 employees and 14.9% have more than 241 employees. Considering the Sebrae classification regarding the size of the company, it can be said that the sample is classified as follows: 34% are considered micro companies and 29.8% were small companies.

Regarding the amount of milk processed by the companies, 44.7% process more than 31,000 L/day and 27.7% process up to 10,000 L/day. As for diversification, 46.8% produce more than 11 products and 21.3% produce up to 5 products. It was observed that 42.6% have up to 5 qualified employees and 10.6% have more than 21 qualified employees.

It has been found about the international experience of firms that 8.5% of them export to other countries and more than half (74.5%) markets for other states.

Before describing the results in binary logit regressions, it is noteworthy that, although there are twelve regulatory mechanisms to be analyzed, only to five were built the logit models to empirically identify which characteristics of the firm make the company to adopt these regulatory mechanisms. By means of preliminary results, it has been verified that mechanisms such as brand, label, seal, standardization, technical assistance, contract and investment in equipment have been adopted by almost all companies. This prevents or not justifies the performance of regression. For example, the brand was the mechanism adopted by 95.7% of the companies, the labeling by 85.1%, standardization by 83%, technical assistance by 91.5% and investment by 83%.

Thus, certification, traceability, differentiated payment, training and qualification of suppliers and computerized mechanisms were considered to make the regression analysis.

Before proceeding to the estimation of logit regression models for each of these mechanisms, tests have been performed to verify the presence or absence of multicollinearity such as Spearman correlation test, the variance inflation factor (VIF) and tolerance (TOL), as well as Durbin Watson test to detect the autocorrelation between residues.

For the correlation matrix, it was found that the firm size (TF) and processed quantity (PQ) were highly correlated (0.841), which led to the elimination of the independent variable of the model TF. According to Hair Jr. et al. (2005), correlation values above 0.80 may indicate problems of multicollinearity.

In all models, the values of VIF were below 1 for all variables and the values of TOL above 0.1, indicating that the logit could be estimated reliably.

Through Durbin Watson test, it was detected the absence of autocorrelation in the five models in question which means that there is no time dependence of the successive values of the waste, ie, residues are not correlated.

To select which variables were most significant for each model, we estimated the correlation matrix between the dependent variable and the explanatory variables and they selected those that had higher and significant correlations. In addition to the correlation matrix, we also used the method of sequential search which approach

provides a method for selecting variables that maximize the expectations with a smaller number of variables used. The approach taken was backward elimination (“step back”), a process of trial and error to find the best estimates of the regression.

Once selected the variables to be used in the regression, five models were estimated. In Table 1 there are results from logit binary estimated. The analysis results indicate that the selected models showed satisfactory adjustment. The chi-square test was significant in all estimated models, indicating that they fit the data significantly. It was also found that models developed are fitted satisfactorily to the data, ie, they are correctly classifying the majority of data to a percentage above 69%. The adherence to the model was verified using the Hosmer and Lemeshow test, which tests the hypothesis that the observed data are significantly different from the values predicted by the model also used by Rodrigues and Guimarães (2004), Alves et al. (2007), Paixão and Gontijo (2007) and Mello and Slomski (2008). A best fit of model is observed by a smaller difference between the classification observed and the classification provided (HAIR JR. et al., 2005). It is expected a non-significant value for this test. In all the developed models, the Hosmer and Lemeshow test was not significant, indicating that they will provide good values.

Analyzing the models, it was found that each mechanism is related to certain characteristics of the firm, contrary to the expectation that all of them could influence.

We found that the time of experience (TE) and the fact that the company has international experience (IE) are characteristics that influence firms to adopt certification as a mechanism to improve the quality and safety of its products. This is because the longer the company operates in the market, the greater the probability of adopting a certification. And the fact that the company exported to other countries increases the probability that it could adopt the certification regarding those companies that do not export. This can be explained by the requirements that are imposed on companies that are exporting. These results allowed us to confirm the hypotheses (H2) and (H4) described in section 3.1. Both could be confirmed only for certification.

It is noteworthy that the when the company has international experience it is more likely to influence

adoption of certification by the companies, which can be evidenced by its highest regression coefficient.

In the second model it has been noted that unlike the certification, the adoption of traceability was influenced by the amount and diversification processed, that is, the more milk the company processes and the more different products it manufactures, the more likely it adopts this mechanism, confirming the hypotheses H5 and H6. Analyzing the values of regression coefficients, it was found that when the company is diversified, this influences most likely the adoption of traceability compared with the processed amount variable.

Through these results, we conclude that the small and midsize companies find it difficult to adopt traceability, mainly due to implementation costs.

Concerning the adoption of differentiated payment, it was observed that the training of employees is a characteristic that influences the company to adopt such a mechanism. The results allowed confirming the hypothesis H7, indicating that the higher the percentage of qualified staff, the greater the likelihood that the company adopt this mechanism.

The results also showed that the adoption of the mechanism, training and qualification of suppliers is influenced by the fact that the company has regional/national experience, ie the fact that the company sell to other states increases the probability that it could adopt the training and instruction mechanism for companies who do not sell to other states. This confirms H3 and H7.

Finally, the qualification of employees of the firm is a characteristic that influences the adoption of computerized mechanism, confirming the hypothesis H7, ie, the higher the percentage of qualified employees in the company, the greater the probability of adopting the same system computerized with suppliers in order to improve the quality of its products.

The results showed also that the characteristics of the firm differentiate the adoption of formal and informal mechanisms. Time of experience in the market, international experience, amount processed and diversification are characteristics that influence the adoption of formal mechanisms. On the other hand, the fact that the company has regional/ national experience and the percentage of qualified employees are characteristics that influence the adoption of informal mechanisms.

TABLE 1 – Results of logistic regression analysis for determinants of adoption of regulatory mechanisms.

Independent variables	FORMAL MECHANISMS			INFORMAL MECHANISMS		
	Certification	Tracking	Differentiated payment	Training and instruction	Computerized system	
Intercept	-4,384*	-3,047 ^{n.s.}	-1,997 ^{n.s.}	-9,979 ^{n.s.}	-4,429*	
Experience time	1,113**	-0,633 ^{n.s.}	-0,519 ^{n.s.}	-	0,472 ^{n.s.}	
National/ regional experience	-	-	-1,411 ^{n.s.}	7,919*	-	
International experience	3,590*	-2,590 ^{n.s.}	-	-	-	
Amount processed	0,566 ^{n.s.}	1,043**	0,658 ^{n.s.}	-	0,236 ^{n.s.}	
Diversification	-	1,280*	1,141 ^{n.s.}	-	-	
Qualification	-0,410 ^{n.s.}	0,107 ^{n.s.}	0,293*	1,000 ^{n.s.}	0,080*	
X ² of model	14,326**	11,826**	13,206**	15,889***	6,807*	
Adhesion to the model	2,438 ^{n.s.}	3,319 ^{n.s.}	5,832 ^{n.s.}	0,177 ^{n.s.}	3,842 ^{n.s.}	
% Concordance	75%	77,8%	86,1%	91,7%	69,4%	

Source: Survey data. N=47; ***p<0,001; **p<0,05; *p<0,10; n.s (not significant)

5 CONCLUSION

In this work it was attempted identifying the existence of a relation between the specific characteristics of the firm and the adoption of regulatory mechanisms. The results found suggest that for the sample of this study the adoption of regulatory mechanisms, in general, is related to some specific features of the company. The adoption of certification is related to the time of the company experience of the market and with its international experience. In contrast, the adoption of traceability is related to the amount of milk processed by the company and its diversification. It was found that the fact that the company has regional/ national experience is related to the adoption of mechanism of training and education to providers. The adoption of differentiated payment and information system is related to the percentage of qualified staff.

There was also no difference between the firm characteristics that influence companies to adopt formal and informal mechanisms. The results suggest that the adoption of formal mechanisms is influenced by the time of the company's experience in the market, its international experience, amount processed and diversification. In contrast, the adoption of informal mechanisms is influenced by the fact that the company has regional/ national experience and the percentage of qualified employees.

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