

The Uncertainty of the TCE and MCE in the Agroindustrial System: a Study with Producers and Suppliers from Paraná

A incerteza sob a ótica da ECT e ECM no Sistema Agroindustrial do leite: um estudo com produtores e fornecedores paranaenses

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Resumo

O presente artigo tem como objetivo compreender a influência do atributo incerteza nas transações entre produtores e os processadores do Sistema Agroindustrial (SAG) lácteo localizados no estado do Paraná. A fase empírica do estudo foi realizada no estado do Paraná, por intermédio de pesquisa qualitativa do tipo descritiva. A coleta de dados foi realizada por meio de entrevistas semiestruturadas com produtores e processadores lácteos do Estado. Como resultado, identificou-se que as incertezas associadas ao ambiente e ao comportamento dos agentes são elevadas, sendo a adaptação o mecanismo de minimização dos efeitos resultantes. Enquanto a incerteza comportamental é mais evidente para aqueles que adotam o contrato informal, a incerteza informacional, acerca dos atributos do leite, é minimizada pela mensuração dos atributos do produto, o que reduz as incertezas associadas à distribuição de valor.

Palavras-chave: economia dos custos de transação; economia dos custos de mensuração; incerteza no setor lácteo paranaense.

Abstract

This article aimed to understand the influence of the uncertainty attribute in transactions between producers and processors of the milk Agrifood System (AFS) located in the state of Paraná. The empirical phase of the study was carried out in the state of Paraná, through qualitative descriptive research. Data collection was carried out through semi-structured interviews with dairy producers and processors in the State. As a result, we identified that the uncertainties associated with the environment and the behavior of agents are high, with adaptation being the mechanism to minimize the resulting effects. While behavioral uncertainty is more evident for those who adopt the informal contract, informational uncertainty about the attributes of milk is minimized by measuring the attributes of the product, which reduces the uncertainties associated with the distribution of value.

Keywords: transaction cost economics; measurement cost economics; uncertainty in the milk production system in Paraná.

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1 INTRODUCTION

In this paper, we discuss uncertainty in decisions of agribusiness managers. Uncertainty is an attribute considered by Williamson (1985) to be of great influence on the choice of vertical forms of governance in production chains, and an attribute that has efficiency over transactions.

Although Williamson (1985) assumes uncertainty as an integral part of the environment, being a constant that influences agents' decisions, it is its differentiated treatment as an attribute that defines its theoretical relevance, affecting in a particular way the choice of governance structures (WILLIAMSON, 1991). For the author, in the presence of high environmental uncertainty, the contractual relation does not present itself as the most efficient structure for exchanges, given that it does not favor a quick adaptation to changes, therefore considering the market or hierarchy the most efficient options. The dependence on adaptation, in the case of the contractual relationship, favors opportunistic behavior, generating transaction costs (WILLIAMSON, 1985, 1991).

This attribute is considered in the analysis of the dairy AGS, in Paraná. The use of Williamson's (1985) assumptions is observed in several studies in Brazil (FARINA, 1999; AZEVEDO, 2000; ZYLBERSZTAJN, 2005; SAES, 2009; SAES; SILVEIRA, 2014; ZYLBERSZTAJN, 2017, 2018), because it is an environment in which economic and environmental variations cause continuous disturbances, and align with the efficiency directions of the theory. The state of Paraná is responsible for a large part of the Brazilian production of milk. It occupies the second position in the country, with 4.4 billion liters, and in a ten-year period - 2008 to 2018 - Paraná's milk production increased by 55% (DERAL, 2020). However, despite Paraná's high development in dairy farming, there are still efficiency problems influenced by variations in factors such as: domestic consumption of dairy products, consumer prices, price paid to the producer, export and import of milk, and changes in demand (DERAL, 2020). Such factors generate continued uncertainties for the sector, which contribute to the discouragement producers feel regarding greater investments and even regarding their permanence in the sector (IBGE, 2018). Studies such as Verga (2014), Pereira et al. (2016) and Acosta and Souza (2017, 2018), showed that the focus on the relationship involving dairy producers and processors becomes relevant, since the complexity in transactions continuously generates uncertainties and renegotiations.

According to Zylbersztajn (2018), uncertainty plays a role in transactions and offers an empirical dimension that has been less explored in the literature, possibly due to measurement difficulties. In this sense, a look at this dimension from the perspective of the Agroindustrial Systems approach (AGSs), in particular, Transaction Cost Economics (TCE) and Measurement Cost Economics (MCE), allows to trace the context in which it presents itself and indicate paths for effective improvement actions. As for TCE, although Williamson (1985) assumes uncertainty as an integral part of the environment, its differentiated treatment as an attribute defines the relevance of its theoretical deepening, once it affects in a particular way the coordination of chains and the quick adaptation to changes, opening room for opportunistic behavior (WILLIAMSON, 1985, 1991). In this way, uncertainty in the work of Williamson (1991) takes on great importance, to the point that the author states that even at a level where asset specificity is present, one must consider the high degree of environmental (frequency of disturbances) and behavioral (opportunistic behavior) uncertainty.

As for the MCE, the generation of information through the measurable dimensions of the asset interferes in the transactions, contributing to the adaptation of the exchanges by reducing the uncertainties regarding the attributes transacted in rapid adjustment movements (BARZEL, 2001, 2005).



Thus, the present study contributes to the deepening of the considerations of TCE and the MCE on the influence of uncertainty in transactions, since the use of the MCE adds complexity to the analytical rationale of TCE, regarding the use of contracting (BARZEL, 2005) for the adaptive capacity of agents. Given the effect of uncertainty on the efficiency of exchanges, the objective of this study is to understand the influence of the uncertainty attribute in transactions between producers and the processors of the Agroindustrial System (AGS) dairy, located in the state of Paraná.

2 LITERATURE REVIEW

This section is divided into three subsections: Transaction Cost Economics, Measurement Cost Economics, and the consideration of uncertainty in the context of TCE and MCE.

2.1 TRANSACTION COST ECONOMICS

Based on Coase's theories (1937), Oliver Williamson developed the Transaction Cost Economics (TCE) theory, in which the transaction is the basic unit of analysis. Transaction costs are economized from the alignment of transaction attributes with governance structures, which differ in their costs and adaptive capacities (WILLIAMSON, 1985; CALEMAN AND ZYLBERSZTAJN, 2012). Zylbersztajn (2005) states that the study of TCE is responsible for analyzing firms' as to which governance structures respond more efficiently to their objectives regarding the reduction of production and transaction costs. Such decisions are made based on transaction attributes (asset specificity, uncertainty and frequency), under the consideration of behavioral assumptions (bounded rationality and opportunistic behavior) (WILLIAMSON, 1985; AUGUSTO ET AL, 2014).

As to the recognition of asset specificity, Williamson (1996) affirms that it takes many forms, such as: locational; of physical assets; of human assets; of dedicated assets; of brand; and temporal. Zylbersztajn (1995) emphasizes that the specific assets are the most important inducers of the organizational form to be adopted by the transaction agents, as they are the main reason for the bilateral dependence to occur. This attribute, however, only becomes important when considering the behavioral assumptions (opportunism and bounded rationality) and with the uncertainties present in the transactions (WILLIAMSON, 1985; SILVA E SAES, 2022).

According to Farina (1999), uncertainty consists of a condition in which agents are unaware of the future results of a given transaction, and such unawareness can be the cause of contractual rupture and an increase in transaction costs. Although the attribute "asset specificity" is the key attribute in the choice of governance structures, the presence of uncertainty assumes significant importance, to the point of being able to determine the contractual relationship to be adopted (SAES, 2009). Regarding the frequency attribute, Williamson (1985) comments that it is associated with the number of times the relations between agents are carried out.

Bounded rationality, for Williamson (1985), is the cognitive assumption upon which the TCE resides, with economic actors acting rationally, but in a limited way. Because of this, Williamson (2008) states that all contracts that are established between contracting parties are considered incomplete, since there is an inability to imagine all possible contingencies. The pursuit of self-interest by agents puts transactions under constant threat of opportunism, which requires the presence of efficient structures to protect them.



Williamson (1979, p. 235) refers to governance structures as the "institutional framework within which the integrity of a transaction is decided". The way governance is established reflects the interaction between transaction attributes and behavioral assumptions, and may determine whether agents will relate through the spot market, through hybrid forms (contracts), or through vertical integration (ZYLBERSZTAJN, 2005).

2.2 MEASUREMENT COST ECONOMICS

Developed by Yoram Barzel, the Measurement Costs Economics (MCE) (1982; 2001; 2005), deals with the costs associated with the protection of agents through measurement. Barzel (1997) states that the MCE aims at maximizing transaction value, which occurs through the guarantee of the agents' property rights, which is given by the knowledge and protection of the asset's dimensions, so that they do not suffer value dissipation.

For Barzel, the transactions are decomposed in different dimensions (ZYLBERSZTAJN, 2005). Thus, each dimension of a transaction represents an exchange of property rights, characterized by a certain value for agents involved in the exchange and also by a measurement cost (ZYLBERSZTAJN, 2005). The value, present in the transfer of attributes and not of the asset, can be dissipated if the property rights are not adequately defined, occurring when the transaction attributes are difficult to measure (ZYLBERSZTAJN, 2005).

When considering that the objective of the MCE is to guarantee property rights, Barzel (1997, p. 2) states: "the property rights of individuals over assets consist of the rights, or the powers, to consume, obtain income and dispose of such assets". Transaction costs, for the author, are generated by the search for guarantees of economic rights (negotiation), since the legal rights of property, recognized as belonging to the individual, are already ratified by the State. In this sense, the economic right refers to the "ability, in expected terms, to benefit from a good or service" (BARZEL, 2003, p. 51).

Information presents itself, then, as the key point for guaranteeing legal and economic rights. According to Barzel (2005, p. 358), "with no information about a commodity, the makeup of the commodity and its value constitute black boxes". Thus, information becomes important, and organizations choose to adopt control mechanisms that better signal relevant information (BARZEL, 2005; AZEVEDO, 2000).

According to Barzel (2005), in one end, exchanges involve information available at the moment of exchange in *caveat emptor* (buyer risk) relationships, auctions, or market contracts. In these exchanges, agents determine the levels of the goods' attributes moments before the exchange takes place, since the cost of such measurement is considered low. The difficulty of obtaining information (measuring and distributing information) and of guaranteeing rights leads to mechanisms that involve everything from long-term relationships to, in an extreme case, vertical integration.

Also regarding the MCE, Zylbersztajn (2018) highlights that the theory still seems to be in a developmental stage, presenting a limited number of empirical studies compared to the contributions offered by the TCE (SANTOS et al., 2017).

2.3 THE CONSIDERATION OF UNCERTAINTY IN THE CONTEXT OF TCE AND MCE

In TCE theory, uncertainty is considered in environmental and behavioral terms (WILLIAMSON, 1985). Williamson (1985, 1991) states that the complexities of an environment in association with the assumption of bounded rationality of individuals relate to environmental uncertainty. In this context, environmental uncertainty is defined as the lack of



information about the external environment and is analyzed in terms of dynamics and complexity of the environment (YANES; OREJA; GARCÍA, 2010). According to the authors, complex and dynamic environments have a greater lack of information, comprising elements that change unpredictably. However, the low level of uncertainty is found when the environment is composed of few elements, comprising simple and stable environments. Williamson (1991) points out that turbulent environments become a variable that impacts governance structures.

The other type of uncertainty addressed by Williamson (1985, 1996) is behavioral uncertainty, related to the actions of economic agents. The link of bounded rationality and opportunism is a source of behavioral uncertainty (WILLIAMSON, 1985, 1996). Since contracts involving specific assets are incomplete due to bounded rationality, the asymmetry of information opens room for individuals to behave opportunistically, and such action can be understood as behavioral uncertainty (WILLIAMSON, 1985).

The meaning of uncertainty in the TCE is related to costs (WILLIAMSON, 1985; ROEHRICH et al., 2020). Thus, the agents involved in the exchanges strive to decrease them, adopting governance structures, which differ in their ability to adapt to uncertainty (GHOZZI; SOREGAROLI; SAUVÉE, 2016). In transactions involving specific assets, increased uncertainty demands adaptations to fill contractual gaps, and, in this case, the incompleteness of contracts can become targets for opportunistic behavior (AZEVEDO, 2000). The lack of support for this type of transaction results in maladaptation costs, arising from behavioral uncertainties.

Williamson (1991, 2008) assumes that the central problem of economic organization is adaptability, that is, the responsiveness of the governance structure to environmental uncertainties. The adaptation for which prices serve as the basis for parties to make appropriate decisions refers to autonomous adaptation (A) (WILLIAMSON, 1991, 2008). On the other hand, some environmental uncertainties require the parties to respond in a coordinated manner (C) by taking conscious and purposeful efforts through the internal coordination mechanism (vertical integration). As for the hybrid mode, Williamson (1991) states that there is a complication in adaptability when bilateral dependence is present, given that in a situation of high environmental uncertainty, incomplete contracts require *ex-post* gap filling.

According to Williamson (1985, 1991) and Zylbersztajn (1995), when the transactions face an environment with high level of uncertainty, two solutions can be considered: the decline in the specificity level and, thus, a greater standardization of the asset, making the governance via market possible; or the internal organization, with the intention of increasing the support for the arrangements and reducing transaction costs. It must be considered that the environmental uncertainty, associated with contractual incompleteness, leads to the possibility of opportunistic behavior of the agents in the presence of high specificity, justifying the search for internal organization.

According to Barzel (1997), the delimitation of property rights of transacted attributes is considered a fundamental point for the MCE theory. This delimitation, on the other hand, occurs when the parties have information about the dimensions of the asset, which occurs by measuring such dimensions. Uncertainty, then, is associated with the availability of information about the attributes of assets (BARZEL, 2005).

For Barzel (2005), the notion of MCE regarding the minimization of uncertainties is more general than that adopted by the TCE, given that what matters is the delimitation of rights through the presence of information and, consequently, the minimization of opportunistic behavior. It is considered that the easier it is for agents to measure asset attributes and obtain

information about them, the lower the measurement costs, and, consequently, the lower the uncertainties in the exchange, leading to the adoption of less complex governance structures (BARZEL, 2005).

Each structure has a comparative advantage in reducing capture costs (BARZEL, 2001, 2005). Minimizing measurement costs is expected to lead agents to use formal contracts more often as governance structures. Consequently, vertical integration is used less frequently (BARZEL, 2005). The negotiation of economic rights, however, occurs due to the difficulty of measurement and the impossibility of establishing legal rights, which influences the definition of the governance structures adopted (BARZEL, 2005).

3 METHODOLOGICAL PROCEDURES

The present article is of qualitative and descriptive nature. According to Denzin and Lincoln (2006), qualitative research is in charge of situating the researcher in the world through the interpretation of phenomena. Thus, descriptive research was present, since the study focused on the search for informational details about what was studied (TRIVIÑOS, 1987).

Primary data were collected on the properties of Paraná milk producers and processors, through semi-structured interviews in the period from October to December 2017. The selection of these interviewees was unintentional, based on consultation in the list of existing dairy processing and production establishments and request for voluntary participation in the study. We were careful to ensure the presence of representatives from different productive capacities and regions in the study, in order to identify possible specificities in this diversification and heterogeneity, ensuring representativeness to the study. The interviewees were distributed across four geographic regions: East-Central, West, Northwest, and Central-North. We conducted 27 interviews, which were recorded and involved: 15 producers, 11 processors, and 1 key agent in the sector. For the data survey, we prepared a script of semi-structured questions based on the theoretical framework present in this study (MERRIAM, 1998), whose information was grouped into categories of analysis. We sought to conduct a dense survey and description, however, the result is not generalizable in state and national terms since, for this, it would be necessary to have a larger number of interviewees.

Initially, we sought information that could characterize the profile of the producers and processors interviewed, identifying the validity of their participation in the study. Table 1 summarizes the main characteristics of the producers.

Table 1: Characteristics of the producers interviewed



Producer	Area destined for milk (ha)	Daily production (liters)	Time in the activity (years)	Importance of milk to income total	No. of workers	Region	Lactating animals	Average per animal
1	92	700	45	40%	3	Northwest	35	20.00
2	36	600	6	40%	3	North	31	19.35
3	10	50	3	70%	2	North	10	5.00
4	1	50	2	10%	1	Northwest	3	16.67
5	14	20	60	5%	1	Northwest	2	10.00
6	18	47,000	6	100%	20	East-Central	1,400	33.57
7	24	1,700	38	100%	4	East-Central	54	31.48
8	20	2,200	13	100%	6	East-Central	87	25.29
9	100	2,000	44	100%	6	East-Central	80	25.00
10	27	1,900	9	70%	5	East-Central	72	26.39
11	23	1,100	5	100%	4	East-Central	43	25.58
12	110	10,000	59	100%	10	North	400	25.00
13	24	1,500	18	70%	4	West	65	23.08
14	2	1,550	2	40%	4	West	63	24.60
15	36	900	7	80%	2	Northwest	39	23.08

Source: Prepared by the authors based on primary research data.

We identified that the size of the property and the area allocated to milk are not determinants for the daily amount produced, since the data show that the amount produced is not proportional to the area. According to the data, seven producers use 100% of their space for milk production and planting for feeding the animals, varying their production from 1,100 to 10,000 liters/day. The largest producer found (producer 6) produces 47,000 liters/day on 18 hectares. Despite being 100% dependent on income from milk, the farmer uses only 1.8% of his area.

The five highest productivity averages, which can be seen in table 1, are from producers who belong to the Central-Eastern region of the state of Paraná, considered the dairy basin of Paraná. These averages, according to the interviewees, are due to: higher incentives received; monitoring of animal feed by buyers; cooperative stores with lower prices, lectures, courses, among others.

As for the processing segment, 11 interviews were conducted with dairies and cooperatives (Table 2). We identified that not all the processors interviewed perform milk processing, since some cooperatives only capture the milk from producers and transfer it to the industry responsible for its processing.

Table 2: Characteristics of the buyers interviewed

Buyers	Installed capacity (liters/day)	Daily collection (liters/day)	No. of producers	Working period (years)	Type	Region
1	20,000	7,000	26	19	Dairy	North
2	70,000	70,000	380	51	Dairy	Northwest
3	300,000	300,000	1500	19	Dairy	Northwest
4	1,400	1,400	4	10	Dairy	North
5	3,000,000	850,000	360	65	Cooperative	East-Central
6	3,000,000	235,000	62	57	Cooperative	East-Central
7	1,400	1,400	Own production	23	Dairy	North
8	1,300,000	1,000,000	2,065	35	Cooperative	North
9	31,000	31,000	104	52	Cooperative	West
10	1,000,000	640,000	4.900*	40	Dairy	West
11	230,000	230,000	250	20	Cooperative	West

* The 4,900 producers supply 6 cooperatives, which supply this buyer.

Source: Prepared by the authors based on primary data.

Among the interviewees, we identified those responsible only for the collection and transfer to the supply centers and those who buy and process the milk. Only one buyer (buyer 7) has his own production, because he commercializes "type A" milk. During the interviews, all the buyers stated that they are inspected by government health inspection agencies, which can be the Municipal Inspection Service (SIM), Paraná Inspection Service (SIP) and the Federal Inspection Service (SIF).

We can highlight that the buyers with the highest production capacity (3 million) are from the Center-East region, and all of them deliver milk to the same Beneficiation Center. Together, they are responsible for delivering 1,085,000 liters per day, or 36% of the total. On the other hand, the buyers with the lowest production capacity (1,400) are from the Northern region of Paraná, and these are small dairies with municipal commercialization.

The data analysis step was performed by means of content analysis, which, according to Bardin (1979), consists of a set of techniques capable of analyzing communications, which is divided into three stages: pre-analysis; exploration of the material; treatment of results, inference and interpretation. To do so, we used the ATLAS/TI software, specific for qualitative data analysis (ATLAS.TI, 2020). Through this, we categorized the information described in the 27 interviews and, at the end of the process, we prepared three reports (one for producers, one for processors and one for the key agent) with the grouping of all information in each category.

The categories of analysis derived from the theoretical framework were: environmental uncertainty, behavioral uncertainty, informational uncertainty, and transactions, and served as analysis parameters between theory and empirical data.

4 PRESENTATION AND DISCUSSION OF RESULTS

In this section, two subsections are presented: a discussion of the transaction attributes between producers and processors in the Paraná dairy AGS and a discussion of the effects of uncertainty in the Paraná milk AGS.



4.1 TRANSACTION ATTRIBUTES BETWEEN PRODUCERS AND PROCESSORS IN PARANÁ'S DAIRY AGS

According to Williamson's (1985) proposals, milk is a specific asset (physical) to the activity, although it is not usually transaction specific, demanding durable investments and sunk costs when transactions do not go as planned. However, the producers affirmed that, in case they feel the need (with lower prices), they can still reallocate their product in the market, while the buyers can buy milk from the spot market (with higher prices), characterizing the asset as of medium specificity, with the exception of producers and buyers that adopt formal contracts. That's because they consider the specificity level higher, due to some differences of bilateral dependence. The buyer that has a formal contract (only one) demands a product above the standards established by the normative, collects the product on time and pays for quality, causing greater specific investments to be made by the producers. In this case, once the transaction does not occur, the loss of value will be greater.

In the dairy AGS transactions in Paraná, frequency was analyzed in three points: the frequency of delivery and collection of milk; the frequency of payment; possibility of renegotiation. We identified that most collections take place every two days (48 hours), as guided by Normative Instruction No. 77 (MAPA, 2018). As for the periodicity of payment, we observed that this can happen in two ways: monthly or biweekly payment. The renegotiation can happen within the period of three to six months due to variation in the market price, volume delivered by the producer or some dissatisfaction of the parties.

Given the presence of asset specificity, the frequency with which dairy AGS transactions take place is aligned with the considerations of Williamson (1985), since, in this way, a return on investments is obtained, as well as a relationship of trust between agents and, consequently, the minimization of transaction costs.

As far as environmental uncertainty is concerned (WILLIAMSON, 1985), it is associated with the assumption of bounded rationality. We observed that, in the AGS of milk in Paraná, these uncertainties are present due to the impossibility of predicting future events, and the interviewees consider them in different ways: political, climatic, market, milk volume, and family succession (Table 3).



Table 3: Environmental uncertainties found in the sector

Environmental uncertainties	Description
Political	Issues about milk powder importation from Uruguay. This is because the entry of imported products into Brazil leaves the country in a position of vulnerability.
Climatic	Pointed out by most of the interviewees as an influence in the activity since it causes stress in the animals, changes in production, seasonality, and complications on the roads.
Market	Related to variations in consumer demands, purchasing power, and consumer preferences. Frequently, an expectation of sales is created and it is not fulfilled.
Milk volume	Processors rely on the exact amount of milk that is collected each day and sometimes producers send smaller quantities, so the industry often needs to buy milk on the spot market, increasing its costs.
Family succession	Due to the difficulty of commercializing the product, the producers' offspring prefer not to get involved in the production because they don't know if it will be a profitable activity in the future.

Source: Prepared by the authors from primary data.

Of all uncertainty categories, price uncertainty is unanimous among the interviewees and certainly the one that affects transactions the most. We identified that the milk scenario changes a lot from one month to the next due to market oscillations and, therefore, the agents cannot predict how much they will receive or how much they will have to pay for the milk in the following month, as stated by producer 14: "Today, production is practically unviable with this price we are receiving. We had hoped to go up, but the market is signaling that it will decrease even more". This condition can lead to opportunistic behavior in the search for better prices, given that most of them relate through informal commitments, raising transaction costs.

Behavioral uncertainties are associated with the assumption of opportunism (moral hazard), as described by Williamson (1985), in this case, justifying or originating in informal contracts. The difficulties regarding price and information asymmetries between agents make opportunistic behavior possible. According to the interviewees, the behavioral uncertainties were associated with the actions of adulteration, continuity in the delivery and devaluation of milk (Table 4).

Table 4: Behavioral uncertainties found in the sector



Behavioral uncertainties	Description
Adulteration of product composition	Many buyers reported that they pay attention to the issue of addition of water in the milk, since buyers pay for the volume delivered, as well as the delivery of milk before the antibiotic grace period. Therefore, all the necessary analyses are performed. In the case of buyer 5, their producers are committed to the quality of the milk, and there is no uncertainty about adulteration. According to one of their buyers, the cooperative remunerates the producers adequately so that problems like this do not happen.
Continuity of collection	It was observed that this uncertainty may be related to the fact that the buyer may stop collecting milk from the producer, and the producer may stop delivering milk to the buyer. As for producers (1 and 15), they reported that it has occurred that the dairy stopped collecting the product abruptly, while other producers showed insecurity about the continuity of collection. It was also observed that there is no uncertainty about the continuity of the collection by producers belonging to the Cooperative that transacts by formal contract, and the interruption notice must be given six months in advance. In addition, producers often receive proposals from competing dairies, which demand less quality and promise to pay a better price.
Devaluation of milk	The possibility of devaluation of milk that is delivered in line with or above the quality required by the buyer is real for producers. In this case, some producers reported that they have high quality according to the normative, but that they are not in the line of those who have high quality. Thus, a situation was identified where many producers are not adequately remunerated for the differentiation of their product.

Source: Prepared by the authors from primary data.

We identify, therefore, that uncertainties are present, and producers and buyers consider them as influencing transactions, once there is the risk of opportunistic behavior (WILLIAMSON, 1985). The vertically integrated producer, on the other hand, has the behavioral uncertainties reduced or even eliminated, and only the market uncertainty, notably the demand variation, is present.

4.2 EFFECTS OF UNCERTAINTY IN THE AGS OF PARANÁ'S MILK

Aligned with Williamson's (1985, 1991) assertions that uncertainties matter to the extent that assets are specific, the interviewees stated that the presence of environmental and behavioral uncertainties in the dairy AGS is capable of providing transactional costs (renegotiation and agreements), as well as influencing their decisions regarding investments in transactions and remaining in the sector.

According to the interviewees, political, climatic, market, family succession, volume, and price uncertainties are inherent to the activity. However, price instability is considered an aggravating factor, since it does not allow for planning. Buyer 5 states: "The uncertainty in milk is always high. You never know the price of milk".

The occurrence of environmental uncertainty ratifies the need for adaptation, as proposed by Azevedo (2000), and presents itself in the form of renegotiations, evaluations on the properties, technical visits, repetitions of physicochemical and microbiological exams, as well as increases or decreases in the production and processing of the product.

As uncertainties are related to transactional costs in cases of maladaptation (WILLIAMSON, 1985), in the cases under study, we identified that agents use different structures to coordinate exchanges, which help to minimize behavioral uncertainties. The informal hybrid governance is the predominant one in the sector, both for dairies and cooperatives. This form occurs through verbal agreements between the producer and the buyer, who prefer to keep transactions informal, since in formal contracts it is difficult to make changes in case of problems. In this case, following Williamson (1991, 2008), producers and buyers make autonomous adaptations (A), which happen in a simple way and in a short period of time. Buyer 2 explains: "It's just talking. [...] At the same time that I have to charge the producer, I have to go there and negotiate. I have a very close contact with them".

One notices that, despite maintaining a relationship of consent, when faced with a contingency, the agents try to adapt themselves as they can. In this way, they decrease the specificity of milk (ZYLBERSZTAJN, 1995), but still keep at a medium level, according to the requirements. In addition, buyers adopt the Normative Instructions 76, 77 and 78 (MAPA, 2018) as support to keep the product with the minimum specificities, trying to reduce *ex-post* transaction costs, such as the change of producer.

Thus, as proposed by Azevedo (2000), we identified that the speed with which producers and buyers adapt to environmental uncertainties is an attempt to minimize opportunistic behavior and transactional costs. Buyer 1 stated: "I always work with margins. Then, I am safe with the lack of raw material; I end up with excess". However, despite the ease of adaptation to environmental uncertainties, the adaptation related to price does not happen easily, being considered as an exception by the interviewees. Producers lose when the price drops (reduction in profit) and buyers lose when the price rises (increase in cost), and this uncertainty is considered an aggravating factor for the sector, especially when the current structure is the informal contract.

If the transactions were made through the spot market, even in the face of medium specificity (as in milk), the agents could adapt in an easier way, looking for the price they like best (WILLIAMSON, 1985, 1991). However, the informal contract in effect for most of the producers demands a commitment of recurrence of the transactions, with previously defined collection and price, which limits the adaptation. Thus, the behavioral uncertainty regarding price is greater than for those who adopt a formal contract, since it does not guarantee the payment for quality over the base price, being necessary an *ex-post* negotiation for adjustment, not always favorable to the producer.

Governance via formal contract was identified in only one case (buyer 5 with its producers 6, 7, 8 and 9). According to this buyer: "There is a cooperative contract for you to start delivering milk and after a while you sign if you are going to deliver 100% of your production". However, despite Williamson (1985, 1991) proposing that formal contracts make adaptation difficult due to mutual consent, in this case, adaptations happen quickly, because it is a cooperative, where contact is facilitated, as buyer 5 explains: "The door here is open, they come in and discuss. Access is very easy".

We identified that, in these transactions, the adaptations are of the coordinated type (C). They always happen by the consent of both parties, but, as they are driven by a single objective, the adjustments are easy to happen, avoiding *ex-post* costs (WILLIAMSON, 1991). Once the adjustments happen in a coordinated way between the cooperative and the cooperated producer, even in face of high environmental uncertainties, the milk specificities are maintained (from medium to high). In this system, the perception that behavioral uncertainty is reduced is unanimous. Producer 6 states: "If we didn't have the cooperative, we would trust 50%. But today we trust a lot more, we are part of the cooperative. We trust 100%".

Facing high environmental uncertainties, we identified that producers and buyers that adopt the informal contract can easily adapt to environmental uncertainties, except for the uncertainty related to price. Thus, despite the minimization of production costs and the consequent reduction of milk specificities, the inefficiency of the informal contract is visualized by the emergence of transactional costs resulting from opportunistic behaviors. On the other hand, the efficiency of the formal contract, which generates greater guarantees, is close to the hierarchical governance, since the agents always adapt to the contingencies in a joint manner.

The discussion of information uncertainty by MCE complements the analysis of environmental and behavioral uncertainties by TCE. For the analysis of milk quality based on the Normative Instructions 76, 77 and 78 (MAPA, 2018), the product is broken down into dimensions (BARZEL, 1997; ZYLBERSZTAJN, 2005), which allow its measurement. We identified that the measurement of these dimensions is considered by the interviewees to be essential for the activity, once the agents are able to evaluate the product, and if the payment matches the quality (even if the ideal payment does not happen). Three milk quality requirements are present in the regulations and, with the exception of one buyer, are fully followed by the interviewed buyers: sensory, physicochemical and microbiological requirements.

The interviewees stated that these dimensions are easily and cheaply measurable. The position of the interviewees is described by buyer 3: "Information is a certainty. The quality results are our working parameters of continued education". The measurement is performed by the buyers and by external laboratories (all external analyses are performed, exclusively, in laboratories accredited by the Network of Milk Quality Control Laboratories, which is presented for the whole transaction, generating transaction costs to ensure that a poor performance of the producer segment does not reach the processor segment. This way, the appropriation of income by the producer or processor and even quality problems in the production process are avoided.

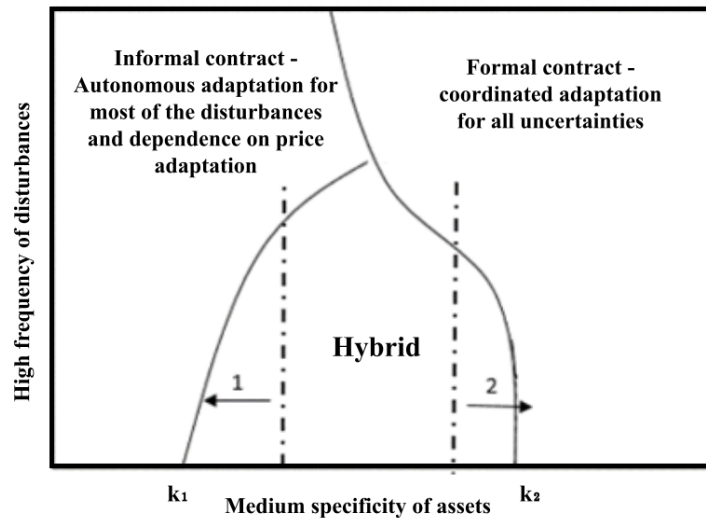
Given the possibility of measuring and obtaining information, coordination through less complex governance structures is feasible, allowing the adoption of formal and informal contracts in the sector (BARZEL, 2005). However, even in the face of obtaining information, only the formal contract can guarantee greater efficiency for the transactions, since the informal contract does not guarantee legal rights to producers and buyers, requiring renegotiations by price (economic right).

As for those that adopt formal contracts, the transaction costs for renegotiations are low, guaranteeing property rights for both segments (BARZEL, 2001, 2005). The use of formal contracts minimizes the possibility of appropriation of property rights by one of the parties.

Therefore, the availability of information about the traded asset allows the adoption of contracts as a governance structure (BARZEL, 2005). However, the absence of guarantees regarding the payment of property rights for those who adopt informal contracts makes this structure inefficient for coordinating exchanges on the producer side.

As for the governance structure in effect, the situation experienced by milk producers and buyers in the AGS of Paraná is aligned with the discussions of Williamson (1985, 1991) and Zylbersztajn (1995): when transactions face an environment with a high level of uncertainty, two solutions can be considered - the decline in the level of specificity and, thus, greater standardization of the asset, tending to governance via market; the internal organization, with the intention of increasing support for the arrangements and reducing transaction costs. Figure 1 explains the situation experienced by the agents of the sector in question.

Figure 1: Adaptation of producers and buyers in the face of high environmental uncertainty



Source: Prepared by the authors based on Williamson (1991) and primary data.

The choice for informal contracts predominates among the respondents. In this case, as shown in Figure 1, producers and buyers make autonomous type adaptations (A) for most of the uncertainties, considering them as simple. To do so, they decrease their production costs and, consequently, tend to decrease the asset specificity (direction of arrow 1). However, it was unanimous among the interviewees who have informal contracts the difficulties of adaptation regarding the price.

It was observed that this difficulty happens because, for this type of uncertainty, dependence on adaptation is required. That is, adaptations cannot happen autonomously. Even if informally, producers and buyers have a delivery and collection commitment. One can notice that the informal contract offers some flexibility and speed in the adaptation, although less than the market, which is guided by the autonomy of the parties. On the other hand, this non-alignment allows opportunistic behavior to happen more frequently, especially on the buyer's side, who may delay or speed up adjustments, which increases the influence of uncertainty in the transaction, generating transaction costs for the producer. On the MCE side, this cost is accentuated by the fact that most of the dimensions are guaranteed by the economic law, in cases of informal contracts, depending on agreements that may increase these losses. In this case, partially, the use of legal instruments and long-term relationships help to guarantee property rights, but are not able to ensure price (value), due to price variability.

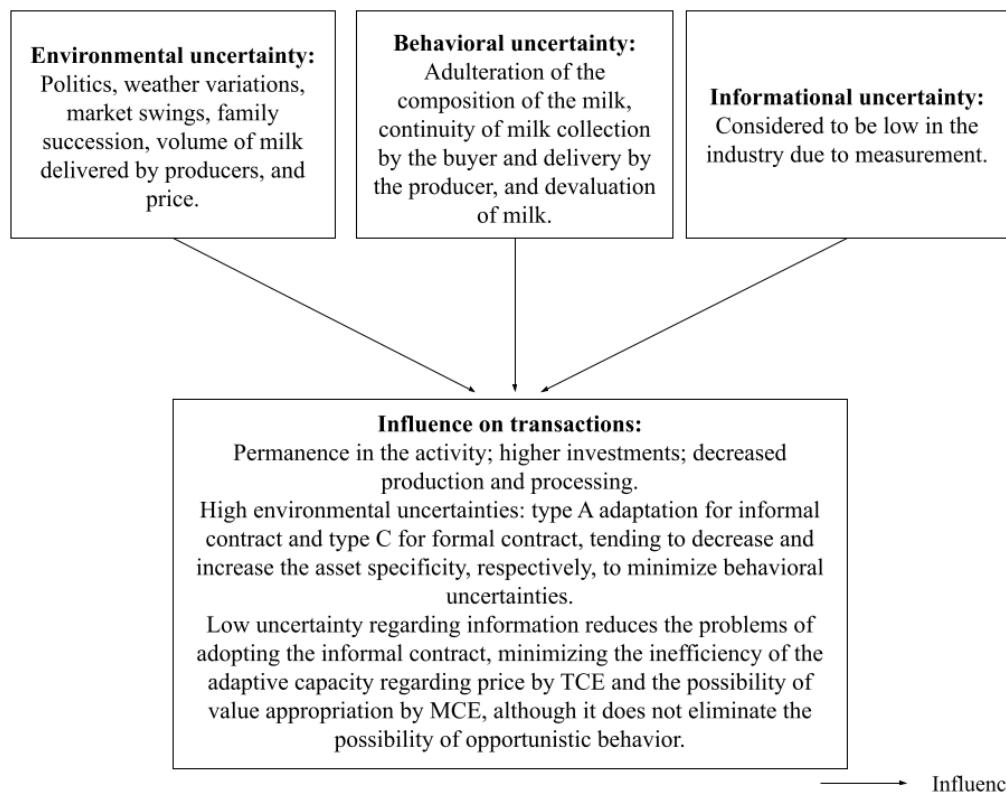
On the other hand, in the only case in which the interviewees have a formal contract, adaptations of the coordinated type (C) are made, keeping the asset with the same level of specificity proposed in the beginning of the transaction or even higher than the proposed one (direction of arrow 2). All the interviewees belonging to the cooperative that has a formal contract affirmed that even the price adjustments happen easily, minimizing the possibilities of opportunistic behaviors. Despite the theory proposing that hierarchy would be ideal in this case (WILLIAMSON, 1985), both producers and buyers stated that the cooperated/cooperative relationship offers enough support for exchanges, as well as low transactional costs. The formal contract, in this case, becomes efficient because it is close to vertical integration, and, thus, offers support to uncertainties and adaptations, and reduces transaction costs, notably because most of the transactions are supported by legal law.

Regarding the MCE assumptions, even in the presence of medium asset specificity, obtaining information about the measurable dimensions of milk influences transactions. We identified that the uncertainties regarding information are reduced and that, as a result, producers and buyers are able to minimize the chances of implicit maximizing behaviors.

The hybrid form, in this case, can be adopted as a governance structure (BARZEL, 2001, 2005). However, for those who adopt informal contracts, governance structure alignment was observed only on the part of buyers. Because of the measurement of product dimensions, buyers are able to secure their rights to obtain a quality product. However, producers are not totally sure about the price that will be paid for the milk, with attempts at renegotiation and consequent transaction costs. On the other hand, for those who adopt formal contracts, the governance structure adopted is aligned with the possibility of measurement, and most of the rights are legally guaranteed. Consequently, there are low transaction costs.

In general, when considering the proposed categories of analysis, we identify that the presence of environmental and behavioral uncertainty and the low presence of informational uncertainty influence transactions, as presented in Figure 2.

Figure 2: Interpretation of the analysis categories after the sector analysis



Source: Prepared by the authors based on primary data.

Regarding the complementary nature of MCE to TCE, although the informal contract is not aligned with the assumptions of Barzel (2001, 2005), the availability of information allows the agents to know the characteristics of the product they are selling or buying, offering support to those who have no guarantee that they will have their rights recognized.

5 FINAL CONSIDERATIONS

As a result, we identified that the informal contract is predominant in the industry. However, we found one case of vertical integration and one case of formal contract adoption. Furthermore, we identified that environmental uncertainties are high, being considered in terms of politics, climate, marketing, family succession, volume, and price. Of all the environmental uncertainties, price instability was the most mentioned in the interviews, being considered as an aggravating factor for the transactions, once it does not allow planning. According to the theoretical proposition adopted, more complex structures seem to respond better to these uncertainties.

Once the environmental uncertainties are always present, the agents try to minimize their effects by means of adaptations, which present themselves in the form of renegotiations, evaluations at the property, technical visits, repetitions of physicochemical and microbiological exams, as well as increases or decreases in the production and processing of the product. Meanwhile, behavioral uncertainty was reported by the interviewees regarding the adulteration of the composition of the milk with water to increase the volume delivered (milk quality), continuity of milk collection by the buyer and delivery by the producer, and non-valuation of milk that is delivered in accordance with or above the required quality.

The contractual structure predominates in the sector, but behavioral uncertainties are more evident for those who adopt the informal contract, since it is not efficient in coordinating dairy AGS transactions.

In view of the inefficiency of informal contracts for both theories, it was identified that uncertainties influence the transactions between producers and buyers, and specifically the transactions between producers and buyers that adopt the informal contract. Thus, there are influences of uncertainties regarding the permanence in the activity, higher investments, and decrease in production and processing. However, the ease of measuring milk quality allows producers and buyers to remain in the activity even in the face of high environmental and behavioral uncertainties. The availability of information allows agents to know the characteristics of the product they are selling or buying, offering support to those who have no guarantee as to the recognition of their rights.

It is considered, therefore, that the low uncertainty of information reduces the problems of adopting the informal contract, minimizing both the effects of inefficient adaptive capacity regarding price, by the TCE, and regarding the possibility of value appropriation, by the MCE.

This empirical targeting of the state of Paraná is important as it offers opportunities to improve bilateral relations between producers and buyers in the dairy AGS, allowing new information to be added to the transactions. This analysis, meanwhile, can be induced for the national context, given that the conditions keep certain reciprocities. Such opportunities for improvement are aligned with the agents' prevention of environmental and behavioral contingencies, especially with regard to price oscillations.

The present article has limitations such as: short period for the interviews, considering that they were conducted in different regions of Paraná, low availability of producers and buyers to participate in the research, and difficulty of contact with large and medium-sized buyers.

Furthermore, in view of the research results, some points should be considered as relevant to be studied further: the instability of the price paid for milk was the main uncertainty found in the sector and the one that most influences the decision of producers and buyers. Thus, a study focused on the differences in the influence of price oscillations for producers and buyers who adopt formal and informal contracts would contribute to the development of the sector.

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