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Horizontal Arrangements and Competitiveness of Small-Scale Dairy Farmers in Paraná, Brazil

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Abstract

This study considers the effect that horizontal arrangements (HA) have on the ability of small-scale farmers' to stay competitive by analyzing whether dairy farmers in Brazil who engage in horizontal alliances are potentially more competitive.

Using a multidimensional approach and quantitative analysis, on-site surveys were conducted with 120 small-scale dairy farmers in Paraná, Brazil. The method utilized exploratory factor analysis (EFA), identifying four factors and corresponding drivers. A comparison was performed between two groups of farmers utilizing a Student's t-test. Results found significant differences between farmers engaged in horizontal arrangements from farmers who were not. We conclude that horizontal arrangements are important mechanisms for improving farmers' bargaining power, enhancing productivity and making technological advances—which may direct private and public efforts forward by encouraging more collective actions.

Keywords: agri-food chain coordination; factor analysis; potential competitiveness; collective action; agribusiness

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Introduction

In the last two decades, a remarkable reorganization is occurring within the global food chain resulting in a competitive environment that has grown more sophisticated and complex over time. This has led agribusiness enterprises to form alliances with other companies in order to access the capabilities or resources needed to compete (Van Duren and Sparling 1998).

Recent trends have reshaped Brazilian agribusiness, stimulating changes both in horizontal and vertical relationships (Wilkinson 2010). Coordinated efforts have increased and united consumer interests resulting in more productive external chains. Transformations in the Brazilian agri-food system have directed agents to make “strategic changes in the organization of the supply chain, increase coordination, reduce costs, and raise quality—which have had an important effect on the upstream segments of the chain, such as the farmers” (Farina 2003, 3).

The Brazilian dairy chain has adapted to globalization and deregulation since the 1990s (Jank, Farina and Galan 1999, Nogueira et al. 2006, Bánkuti and Bánkuti 2012). Institutional, technological advances, increased productivity and market changes have led to organizational rearrangements, including horizontal ones. In this paper, horizontal arrangements (HA) are defined as economic or social relations among actors at the same level of a supply chain, such as a group of farmers (Baum and Ingram 2002).

The dairy chain in Brazil strategically depends on strengthening farmers’ associations and structural competitiveness along the chain (MAPA 2011). Spers, Wright and Amedomar (2013) found that the most desirable future for dairy chain lie in empowering family-based farms through horizontal arrangements and emphasized better industry-producer relationships, focused on quality improvements and less formalities in the dairy sector. According to Carvalho and Rios (2007), HA organization is essential to upstream and downstream bargaining power. Farina (2003) considered collective mobilization of small dairy farmers essential to reaching scale requirements in new competitive scenarios.

Studies in other countries highlight the benefits of collective action in the dairy-production sector (Ratinger and Boskova 2013, Reardon et al. 2009). Ratokoarisoa and Gulati (2006) consider how the Indian dairy sector depends on productivity and efficiency in milk production and emphasizes the benefits small farmers cooperatives have gained through improving market access. Naik and Abraham (2009) highlight the importance of technology improvements towards furthering dairy farmers’ competitiveness, also highlighted by Farina (2003) in Brazil.

Farina (2003, 13) stated that “collective action through cooperatives or associations is important not only to be able to buy and sell at a better price, but is also vital to help smaller farmers adapt to new patterns – and much greater levels – of competition”. Thus, collective action is as an important strategy in enabling small-scale dairy farmers to reach competitiveness.

The evaluation of competitiveness in agribusiness is not an easy task, since there is no consensus in literature on methods and indexes to be used (Van Rooyen, Esterhuizen and Stroebel 2011). Farina (1999), in a systemic approach, emphasizes the role of competitive environment, coordination and public and private policies in firms’ competitiveness. Zylbersztajn and Neves

(2000) state that agribusiness competitiveness should include private strategies, collective strategies and public policies to further value creation along the chain.

Some studies use quantitative measures to assess agribusiness competitiveness, such as: price, productivity, production costs, market share and profitability (Ait El Mekki, Jaafari and Tyner 2006, Neves, Trombin, and Kalaki 2013, Carraresi and Banterle 2015). Others evaluate agribusiness competitiveness with specific tools, such as BSC (Balanced Scorecard) and SWOT analysis (Jank, Farina and Galan 1999; Coutinho et al. 2003; Bigliard and Bottani 2010).

This study examines competitiveness as a multidimensional construct, since many factors contribute to performance and results. Martin et al. (1991) examined agribusiness competitiveness, and the competitiveness drivers. In this context, we explore potential competitiveness, as formerly defined by Ferraz, Kupfer and Haguenauer (1995). Generally, studies on potential competitiveness utilize a comparative analysis to examine the different competitiveness drivers (Martin et al. 1991; Batalha and Silva 2007; Oaigen et al. 2013, Aro and Batalha 2013, Weise et al. 2013, Oliveira et al. 2014). Analyzing farmers' performance and the competitiveness drivers is an important issue, since it may lead to higher levels of competitiveness.

According to the USDA (2015), Brazil is the fifth largest milk producer in the world, with 33.4 billion liters in 2014, representing about 6% of world's production. The state of Paraná is a traditional dairy producer in Brazil, and has recently recovered its importance nationally. According to IBGE (2014), Brazilian milk production increased 24% between 2008 and 2013, while in Paraná it boosted to 54% in the same period. Moreover, the value of milk production between 2008 and 2013, in nominal terms, increased 90% in Brazil, while increasing 150% in Paraná (IBGE, 2014). Annual milk productivity in Brazil was on average 1,278 liters per cow in 2008 and 1,492 liters in 2013 (an increase of 17%); in Paraná, annual milk productivity was 2,120 liters per cow in 2008 and 2,534 liters in 2013—a 19% increase (IBGE 2014).

Cooperatives and horizontal arrangements in agribusiness are a remarkable feature of Paraná state. In Paraná, 71.7% of dairy farmers were engaged in at least one kind of HA, such as cooperatives (47% of farmers), labor union (41.2%), or farmers' associations (26.4%) (IPARDES 2008). In 2009, 13% of the dairy processors were somehow linked to farmers' associations, such as cooperatives (8.6% of processors) or rural unions (6% of them), indicating the emergence of complex arrangements in the state (IPARDES 2010).

Considering the importance of appropriate coordination and HA for agribusiness competitiveness and the relevance of Brazilian dairy chain, the aim of this paper is to analyze whether dairy farmers engaged in HA are potentially more competitive than those not engaged in HA in Paraná, Brazil. In this research, our assumption is that HA enhances dairy farmers' potential competitiveness, through better performance on competitiveness drivers. Our hypothesis is that dairy farmers engaged in HA are potentially more competitive than those not engaged in such arrangements.

Following this introduction, section two provides a literature review on agribusiness competitiveness and HA. Section three presents the methodological procedures. Section four comprises results and discussion and, finally, section five presents research conclusions and final remarks.

Agribusiness Competitiveness and Horizontal Arrangements (HA)

Due to the recent and dynamic changes occurring in agribusiness, agents have redefined individual and joint strategies towards greater coordination, which have consequently increased the need for competitiveness (Batalha and Silva 2007). Competitiveness refers to the ability of a business to remain and, if possible, expand in the market (Farina 1999, Batalha and Silva 2007).

Batalha and Souza Filho (2009) highlight the importance of potential competitiveness in the analysis of agribusiness competitiveness, formerly defined by Ferraz, Kupfer and Haguenauer (1995) as an *ex-ante* phenomenon. Potential competitiveness comprises the firm's capability to convert inputs in outputs, thus improving performance. Potential competitiveness concerns some factors driving firm's competitive position, the latter taken as revealed competitiveness (Ferraz, Kupfer and Haguenauer 1995).

Distinct studies present some driving factors, or competitiveness drivers, for potential competitiveness. In their seminal work, Martin et al. (1991), for instance, stated that a study on agribusiness competitiveness must be comparative and consider relevant aspects such as productivity, product characteristics, technology, costs and inputs, links in the chains, demand conditions, rules and standards, and industry structure, while emphasizing the interaction between these components.

Silva and Batalha (1999) proposed the evaluation of agribusiness competitiveness through competitiveness drivers, such as technology, management, market relationship, and institutional environment, indicating convergence with other studies. Many empirical studies adopted that approach in Brazil (Oaigen et al. 2013, Aro and Batalha 2013, Weise et al. 2013, Oliveira et al. 2014, among others). Batalha and Souza Filho (2009) synthesized the relation between potential and revealed competitiveness in agribusiness, considering technology, input and infrastructure, management, institutional environment, market structure and governance structure as competitiveness drivers (Figure 1).

Coordination is an important aspect for agribusiness competitiveness (Barros, Bánkuti and Martins 2012, Batalha and Souza Filho 2009, Zylbersztajn and Farina 2010). Coordination comprises horizontal, vertical or institutional arrangements between agents along the chain. For Begnis et al. (2008), business sustainability depends on the establishment of collaborative relationships. According to Pietrobelli and Rabellotti (2006), the success of low-income farmers depends, among other factors, on the efficiency of collective groups and joint actions, such as horizontal relationships.

Bijman et al. (2006) state that horizontal arrangements can improve efficiency and effectiveness of agri-food chains, especially considering low-income producers; once those arrangements promote economies of scale and scope, risk reduction, rural development, and increased bargaining power. Such arrangements are essential for national and international competitiveness of agri-food chains (Bijman et al. 2006), which converge with our assumptions.

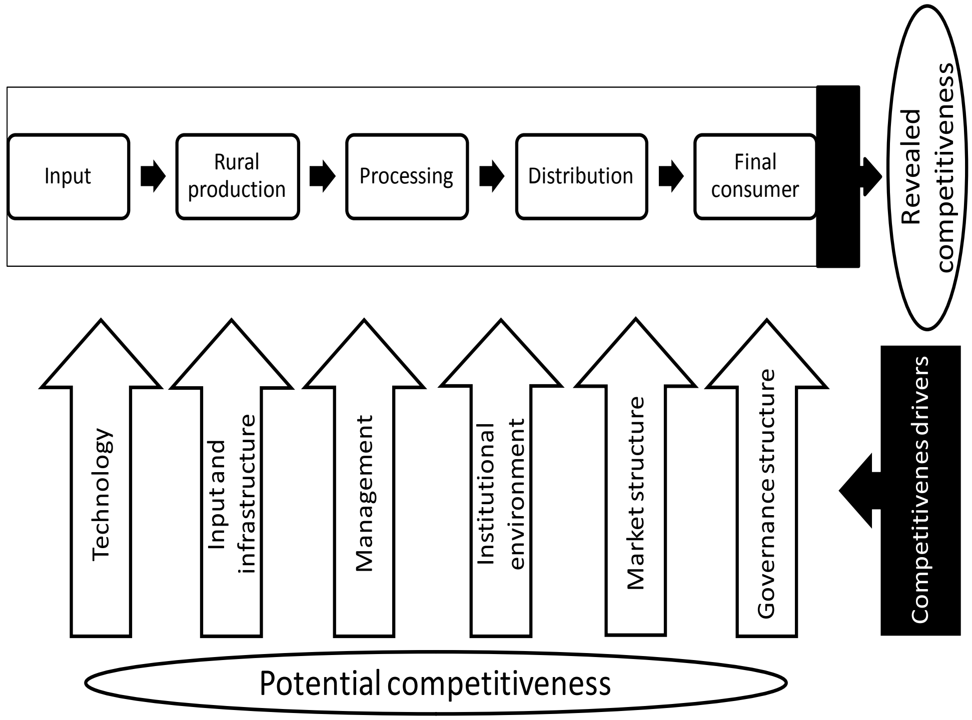

Figure 1. Potential Competitiveness and Competitiveness Drivers
Source. Adapted from Batalha and Souza Filho, 2009.

As reported by Fernandez-Stark et al. (2012), collaborative networks among low-income dairy farmers are essential to overcoming obstacles in competitive agri-food systems: they facilitate the dissemination of information about technical and productive changes, better farming practices, new materials and new production standards; those, in turn, support improvements in productivity, quality and food safety.

Horizontal arrangements are important mechanisms to access critical resources, decrease costs through economies of scale, improve network coordination, and cope with opportunism and the exercise of power in contractual relationships along the chain (Fernandez-Stark et al. 2012). Thus, HA can help farmers enhance performance in different aspects, bringing improvements in access to market, transactional conditions, technology, productivity, among others, and, consequently, to competitiveness.

Methodological Procedures

Adapting a quantitative approach, this research surveyed 120 small-scale dairy farmers using a semi-structured schedule. On-site surveys were conducted in 2013, in four regions across Paraná: Central North, Western Center, West and Southwest. Locations were selected for their regional dairy production and heterogeneity. According to information obtained from the Brazilian Census of Agriculture (2006), 7,100 rural farms were engaged in milk production in Paraná, of which 3,322 are located in the regions studied (47% of total). Combined, the four regions account for almost 50% of the family-based farms engaged in milk production in Paraná, which consists of: 736 units in Central North, 702 in the West, 679 in the Southwest and 307 in the Western Center (IBGE 2006).

In 2013, farmers in Western Center produced about 158 million liters of milk; in Central North, 212 million liters; in the West, 1.04 billion liters; and in the Southwest, 1.1 million liters. Collectively, the four regions produced about 2.5 billion liters of milk, which corresponds to 58% of the total production in Paraná. Such production generated R$ 2.2 billion in 2012 (US$ 1.23 billion) and 56% of the value of milk production in the state (IBGE 2015). Farmers' selection followed random criteria, from a previous list of dairy farmers in those regions.

Considering the adoption of potential competitiveness, multivariate techniques allowed the construction of competitiveness drivers from a set of variables. Data were treated and statistically analyzed, through the Statistical Package for Social Sciences – SPSS ®, version 18 (SPSS 2009). We performed an exploratory factor analysis (EFA). The extraction method utilized principal component analysis (PCA). We used a varimax rotation type standardization of Kaiser Meyer Olkin (KMO) and Bartlett's test of sphericity (Smith et al. 2002, Lebart 2000).

As stated by Hair et al. (2009), a factor is an underlying dimension summarizing a set of original variables, aligned with the concept of competitiveness drivers. EFA first comprised a set of 15 variables, including managerial, productive, technological, market and institutional aspects. Focusing on the segment of rural production, the competitiveness drivers shown in Figure 1 are directed at a priori selection of variables, described as:

- Technology: milking technology, cooling method;
- Input and infrastructure: number of animals, cattle genetic pattern, productivity;
- Management: sources of managerial information, access to technical assistance;
- Institutional environment: adhering to Brazilian legal requirements, participation in informal markets;
- Market structure: size of farm, milk production;
- Governance structures: ex ante conflicts, ex post conflicts, criteria for milk price definition, compliance with processor's requirements.

Variables presenting low or medium factor loadings (lower than |0.05| through Pearson method) must be removed after the prior analysis (Fávero et al. 2009), leading the final analysis to focus on the most relevant variables. To define the number of factors, we used the Kaiser criterion, which is based on the eigenvalues greater than |1.0|, as suggested by Laros (2012), Fávero et al. (2009) and Hair et al. (2009).

After generating the factors, we performed mean tests between two groups: Group 1 contained farmers engaged in HA; and Group 2 contained farmers not engaged in such arrangements. We define "participation in HA" as any form of horizontal collective group, such as affiliation with cooperatives, associations, labor unions, purchasing groups, and others. To compare groups, we performed Student's t-test, considering a significance level of 0.05.

Results and Discussion

The average area managed by120 farmers was 15.9 hectares, containing an average of 18 dairy cows. Cows were predominantly crossbred animals, representing 59.1% of the total dairy cattle. Average milk production was 236.3 liters per day, comprising 13.6 kg of milk/cow/day, on average. Regarding farmers, the average age was 46 years old, with an average of 17 years of experience in dairy production. Additionally, 35% of the farmers had completed the equivalent of middle school, and 55% attended all or part of high school. Descriptive data, thus, indicates small-scale production was conducted by experienced, literate, and not so young farmers.

Factor analysis resulted in the exclusion of five variables, due to their low or medium factor loadings. The remaining ten variables were grouped in four factors (Table 1), all dependent on Kaiser criterion and eigenvalues greater than |1.0|. The cumulative total variance explained, using the four factors, was 72.1%, thereby satisfying the minimum criteria established for the main component analysis. The analysis resulted in KMO value of 0.718 and Bartlett's test of 0.00, indicating that the variables used are suitable for exploratory factor analysis statistics (Fávero et. al. 2009, Hair et al. 2009).

Table1. Factor Matrix

Variables	**Factors**			
	F1	**F2**	**F3**	**F4**
Ex-post transaction conflicts	**0.937**	-0.138	0.095	-0.037
Criteria for milk price definition	**0.947**	-0.105	0.080	-0.024
Compliance with processor's requirements	**0.929**	-0.127	-0.109	-0.035
Cattle genetic pattern	-0.200	**0.618**	0.006	0.006
Milking technology	-0.066	**0.731**	-0.114	-0.087
Productivity	-0.047	**0.742**	0.012	0.115
Cooling method	-0.011	0.345	**0.757**	0.098
Adequacy to Brazilian requirements - NI 62	-0.064	-0.246	**0.828**	-0.057
Access to technical assistance	-0.017	-0.064	0.098	**0.885**
Sources of managerial information	0.065	-0.021	0.047	**0.505**

Source. Field research, 2013.

Thus, four competitiveness drivers summarize the potential competitiveness in this research. Chart 1 presents factors, variables and their respective descriptions. Factor 1 (F1) included variables related to transactions between dairy farmers and processors, composed of the following variables: *ex-post* transaction conflicts, criteria for milk price definition and compliance with processor's requirements (Chart 1). Therefore, F1 stands for Market Relations (MR), directly related to chain coordination. F1 represents an important dimension of potential competitiveness, supported on the statements by Martin et al. (1991), Batalha and Souza Filho (2009), Zylbersztajn and Farina (2010) and Barros, Bánkuti and Martins (2012). F1 is important since the better the relationship between farmer-processor, the lower the possibility of opportunism and, consequently, the lower the risk for dairy farmers (Zylbersztajn 1995, 2009). Barriers to opportunistic behavior are an important factor to increase competitiveness (Fernandez-Stark et al. 2012, Verschoore and Balestrin 2008). In such situations, higher efficiency can lead to lower transaction costs and improve competitiveness in the chain (Fernandez-Stark et al. 2012).

Chart 1. Competitiveness drivers: factors, variables and descriptions

Factor	Variables	Description
F1 (MR)	*Ex-post* transaction conflicts	Emergence of ex-post conflicts and the need for renegotiation with processor
	Criteria for milk price definition	Transparency and farmer's participation in milk price definition
	Compliance with processor's requirements	Compliance with requirements, such as volume and quality standards.
F2 (PT)	Genetic pattern	Genetic pattern of dairy cattle (specialized or non-specialized dairy cattle breed)
	Milking technology	Use of manual or mechanical milking
	Productivity	Liters of milk per cow in milk
F3 (IA)	Cooling method	Method for cooling milk in farm
	Compliance with Brazilian requirements	Compliance with Normative Instruction 62/2011 (Ministry of Agriculture)
F4 (FM)	Access to technical assistance	Access to private or public technical assistance for dairy production
	Sources of managerial and market information	Number of sources of information about dairy market and farm management

Source. Field Research, 2013.

Factor 2 (F2) is comprised of variables related to technological production system, including: genetic pattern of cattle, milking technology and productivity. According to Martin et al. (1991), productivity is an important measurement in agribusiness competitiveness. Verschoore and Balestrin (2008) also identify productivity as an important indicator in assessing competitive gains. Barriga (1995) found technology plays an important role in increasing productivity, enabling low-income producers to compete with others. Thus, F2 comprises Productivity and Technology (PT), aligned with the findings of Batalha and Souza Filho (2009), Naik and Abraham (2009) and Farina (2003).

Two variables comprise Factor 3 (F3): cooling method and compliance with Brazilian requirements for milk production, more specifically concerning Normative Instruction 62 (NI 62) (Brasil 2011). This factor indicates institutional adequacy (IA), as variables related to the legal aspects required for milk production. Institutions and legal requirements are important components of competitiveness, as emphasized by Martin et al. (1991) and Batalha and Souza Filho (2009). Souza and Alves (2010) found that some farmers are leaving the sector because of their inability to adapt to changes in the dairy market over recent years. According to Bánkuti, Bánkuti and Souza Filho (2009), adjustments to regulation and standards are needed as it has become an important institutional barrier to dairy farmers, and the analysis is fundamental to understanding agribusiness competitiveness. According to the authors, failures on institutional adequacy may push farmers to informal market, undermining competitiveness.

Variables related to farm management form Factor 4 (F4): access to technical assistance for dairy production and sources of managerial and market information. Silva and Batalha (1999) and Oaigen et al. (2013) indicate that farm management is important to enhancing agribusiness competitiveness. In addition, education and training are important aspects for agribusiness competitiveness (Martin et al. 1991). According to Neves et al. (2002), the more farmers are involved in training courses, the higher the gains in quality, productivity, and food security.

Fernandez-Stark et al. (2012) considered how qualification and training for dairy farmers could enhance competitiveness due to (a) improvements in productivity and product quality; (b) product and process adjustments to legal and market requirements and (c) the development of entrepreneurial skills. Management training is seen as important as physical capital (Farina 2003); and also supports F4, labeled farm management (FM).

Independent variable "Participation in HA" distinguished farmers in two groups: those engaged in HA (Group 1 = 67 dairy farmers) and those not engaged in HA (Group 2 = 53 dairy farmers). Since a factor is a linear combination (linear function) of original variables (Hair et al. 2009), we cannot assume a value of reference for competitiveness from each factor. Nevertheless, factors values allow us to do a comparative analysis between groups, in relative terms.

For the factors considered, the mean values in Table 2 show the relative performances of farmers in each group. A negative value indicates a worse performance of a group compared with the other group of farmers. Results indicated Group 1 (G1) and Group 2 (G2) are different in Market Relations (MR), Productivity and Technology (PT), with farmers engaged in HA achieving higher values. Differences in MR (p-value=0.023) indicate that market conditions were better for farmers in G1. It means that farmers engaged in HA were more able to negotiate prices, deal with *ex-post* conflicts and cope with buyers' requirements, which is in accordance with statements from Carvalho and Rios (2007), Farina (2003) and Ratokoarisoa and Gulati (2006). Thus, dairy farmers engaged in HA seemed to know better how to conduct business and work with buyers. This can limit opportunistic behavior of other agents through enhanced bargaining power, supporting the findings of Bijman et al. (2006) and Fernandez-Stark et al. (2012).

Table 2. Means of factors for dairy farmers engaged in HA (G1) and not engaged in HA (G2)

HA Participation	**n**	**Means ***			
		MR	**PT**	**IA**	**FM**
G 1 (Yes)	67	0.1157[a]	0.2052[a]	-0.0896[a]	-0.1558[a]
G 2 (No)	53	-0.2221[b]	-0.2594[b]	0.1132[a]	0.1969[a]

Note. Means in columns followed by different letters are statistically different (p <0.05), using Student's t-Test.

Regarding productivity and technology (PT), results indicate differences between groups (p-value=0.013) with farmers engaged in HA presenting higher values than farmers not engaged in HA. Thus, HA may bring technological and technical improvements, an important condition to enhancing potential competitiveness. These findings support previous statements from Naik and Abraham (2009) and Ratokoarisoa and Gulati (2006).

No statistical difference (p-value=0.268) was observed between dairy farmers in G1 and G2 for F3 (IA), which indicates that participation in HA has not influenced compliance with legal requirements or the method chosen for cooling milk. Ninety percent of interviewed farmers produced in accordance with Brazilian legal requirements, especially to NI 62 (Brasil 2011). Conditions imposed by processors may bring such results, since dairy processors in those regions have enforced farmers to follow NI 62. Thus, it seems that enforcement to legal requirements are linked to industry's action, which concurs with Farina (2003), when considering the emergence of the strictly coordinated system within the dairy sector in Brazil. In this sense, although institutional adequacy is an important competitiveness driver, it appears not to be related to HA, as it is not linked to any other aspects.

Finally, there was not a difference (p-value=0.254) between G1 and G2 in the case of F4 (FM). Horizontal arrangements have not given farmers better results in management and technical assistance. The organizational environment in Paraná has favored access to such information in recent years. Technical and productive information is widely available and easily accessible to farmers, such as that offered by the National Rural Educational Service – SENAR and Paraná Institute of Technical Assistance and Rural Extension - EMATER. The organizational environment has also given support to farmers in this research, since 65% of them received technical assistance from public organizations. In addition, the emergence of vertical coordination by processors may also have influenced results in F4. In this research, 11 % of the farmers surveyed declared that processors provide technical and/or managerial assistance and were important sources of information. Again, greater coordination by processors in the dairy chain seems to influence results in farm management.

Figure 2 illustrates the primary findings. In our analysis, four competitiveness drivers (factors) summarize potential competitiveness of small-scale dairy farmers. Results show that HA enhances productivity, technological, and market conditions for dairy farmers, although they are not related to the institutional and managerial aspects. Our findings are relevant to understanding the role of HA plays in dairy chain competitiveness, specifically concerning rural production. The emergence of HA among farmers may help improve potential competitiveness, at least in some regards, especially in those more directly linked to market performance. If farmers can reach higher productivity levels, better technical and technological conditions, improve bargaining power and mitigate processors' opportunistic behavior, they will have more opportunities to improve economic performance and be competitive. Moreover, evidence shows that HA engagement may provide farmers ways to self-invest through access to better prices, and other key resources such as cooling equipment, milking methods and specialized dairy cattle breeds.

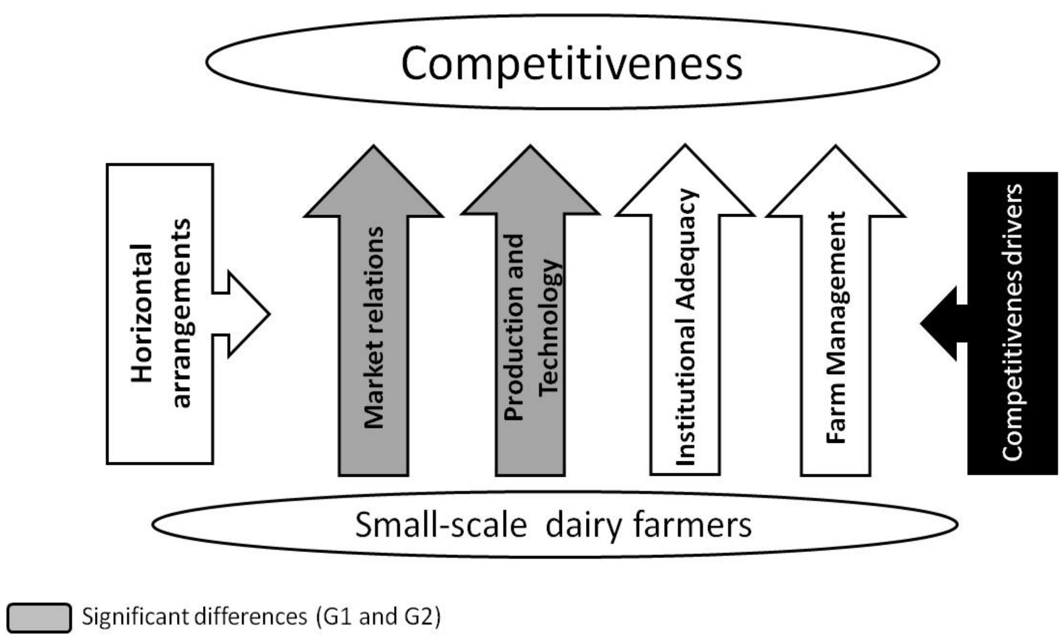

Figure 2. Potential Competitiveness and Competitive Drivers

Dairy chain restructuration, as emphasized by Farina (2003), has enabled the development of private vertical coordination in Brazil, giving processors new roles. In this sense, vertical relations prevail, and, although they can be loaded with benefits, concerns about power asymmetries emerge, as stated by Driers et al. (2009). Thus, in such complex arrangements, headed by industry, HA may be an important mechanism to balance asymmetries in the chain, favoring potential competitiveness.

Conclusions

The importance of understanding the multidimensional facets of agribusiness competitiveness motivated this research. Evidence supports our research hypothesis, showing that dairy farmers in HA are potentially more competitive than those not engaged in such arrangements, specifically within market relations (MR) and productivity and technology (PT). On the other hand, no significant differences were found among competitiveness drivers (IA and FM) related to institutional and organizational environments, which further confirm the relevance of contextualizing competitiveness using a systemic approach. The lack of significant differences for factors IA and FM may also suggest the emergence of vertical coordination by industry, indicating complex arrangements in the dairy sector. Deeper studies on competitiveness and vertical arrangements could bring relevant contributions to the analysis of agri-food systems.

This research highlights the viability of comparing potential competitiveness through factor analysis, as presented. Nevertheless, other variables could be added to future studies as suggested in agribusiness competitiveness models. Future research could apply other statistical methods to assess competitiveness, especially those resulting in absolute values of reference and more accurate measurements. This may provide a more directed analysis of competitiveness, even when the aim is not to compare groups. Additionally, future studies with farmers in HA, examining revealed-competitiveness and performance measures drivers such as profitability and return on investment, could further advance the field of agribusiness research.

Our findings reveal the complexity of analyzing competitiveness, further reinforcing its multidimensionality. The emergence of HA among farmers can help improve competitiveness for the rural segment, either by enhancing technical and productive performance, or through improving intersegment relationships and farmers' bargaining power which ultimately impacts public and private policies within the dairy sector. In this sense, farmers should be more engaged in collective actions, and the government could create public policies to stimulate the formation of HA, which could help farmers enhance their performance in the intrafirm aspects of technology and productivity; and with extrafirm concerns such as market relations and contractual imbalances.

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References

Ait El Mekki, A., S. Jaafari and W. Tyner. 2006. Economic Competitiveness of the Meat Sub-sector in Morocco: The Case of Beef and Poultry. Paper presented at the Ninth Annual Conference on Global Economic Analysis, GTAP/UNECA. Addis Ababa, Ethiopia, June. http://www.gtap.agecon.purdue.edu/resources/download/2563.pdf [accessed September 28, 2015].

Aro, E. R. and M. O. Batalha. 2013. Competitividade da madeira serrada do estado do Mato Grosso-Brasil (Competitiveness of lumber in Mato Grosso state-Brazil). *Gestão & Regionalidade* 29 (87): 81-94.

Bánkuti, F. I. and S. M. S. Bánkuti. 2012. Sistema Agroindustrial do Leite: cenário atual e perspectivas (Dairy agrisystem: current scenario and perspectives). In *V Sul Leite*, edited by Geraldo Tadeu dos Santos. Nova Sthampa, Maringá, Paraná, 13-24.

Bánkuti, F. I., S. M. S. Bánkuti and H. M. Souza Filho, 2009. Entraves para inserção de produtores de leite no mercado formal da Região de São Carlos, Estado de São Paulo (Barriers to the inclusion of dairy farmers in formal market in São Carlos region, SP). *Informações Econômicas* 39 (7): 19-31.

Barriga, C. 1995. Tecnologia e competitividade em agronegócios (Technology and competitiveness in agribusiness). *Revista de Administração* 30: 83-90.

Barros, A.F., F.I. Bánkuti and M. I. E. G. Martins. 2012. Arranjos organizacionais da piscicultura na baixada cuiabana, estado de Mato Grosso [Organizational arrangements in fish farming in the Cuiabana Lowlands, Mato Grosso state, Brazil]. *Informações Econômicas* 42: 5-12.

Batalha, M. O. and H. M. Souza Filho. 2009. Analisando a Competitividade de Cadeias Agroindustriais: uma proposição metodológica (Analysing agrifood chain competitiveness: a methodological proposal). In *Agronegócio no MERCOSUL: uma agenda para o desenvolvimento,* edited by M.O. Batalha and H.M. Souza Filho. Atlas, São Paulo, 1-22.

Batalha, M.O. and A. L. Silva. 2007. Gerenciamento de sistemas agroindustriais: definições, especificidades e correntes metodológicas (Agrisystem management: definitions, especificities and methodological approaches). In *Gestão Agroindustrial,* edited by M. O. Batalha. Atlas, São Paulo, 2–60.

Baum J.A.C. and P. Ingram. 2002. Interorganizational learning and network organization: toward a behavioral theory of the interfirm. In *The Economics of change, choice and structure,* edited by M. Augier and J.G. March. Edward Elgar, Cheltenham, United Kingdom, 191-218.

Begnis, H. S., E. A. Pedrozo and V. D. F. B. Estivalete. 2008. Cooperação como estratégia segundo diferentes perspectivas teóricas (Cooperation while strategy under different theoretical approaches). *Revista de Ciências da Administração*, 10 (21): 97-121.

Bigliardi, B. and E. Bottani. 2010. Performance measurement in the food supply chain: a balanced scorecard approach. *Facilities* 28 (5/6): 249 – 260. doi:10.1108/026327711031493.

Bijman, J., S. W. F. Omta, J. H. Trienekens, J. H. M. Wijnands and E. M. F Wubben. 2006. Management and organization in international agri-food chains and networks. In *International Agri-Food Chains and Networks: Management and Organization*, edited by J. Bijman, S. W. F. Omta, J. H. Trienekens, J. H. M. Wijnands and E. M. F Wubben. Wageningen Academic Publishers, Wageningen, 15-28.

Brasil. 2011. *Instrução Normativa N°62* (Normative Instruction N.62). Ministério da Agricultura, Pecuária e Abastecimento. http://sistemasweb.agricultura.gov.br/sislegis /action/detal haAto.do?method=consultarLegislacaoFederal [accessed August 22, 2013].

Carraresi, L. and A. Banterle. 2015. Agri-food Competitive Performance in EU Countries: A Fifteen-Year Retrospective. *International Food and Agribusiness Management Review* 18 (2): 37-62.

Carvalho, D. M. and G. S. L. Rios. 2007. Participação, viabilidade e sustentabilidade: dimensões de desenvolvimento local numa associação de produtores rurais (Participation, viability and sustainability: dimensions of local development at an agricultural producers association). *Organizações Rurais & Agroindustriais* 9:402-420.

Coutinho, L. M. Laplane, N. Tavares Filho, D. Kupfer, E M. M. Q. Farina and R. Sabbatini. (coord.). 2003. Estudo da competitividade de cadeias integradas no Brasil: impactos das zonas de livre comércio (Study of competitiveness of integrated chains in Brazil: impacts of free trade zones). UNICAMP-IE-NEIT, MDIC, MCT, FINEP. Campinas, São Paulo: Unicamp. 1-18. http://www.inova.unicamp.br/inovacao/report/Estudo Competitividade Cade ias070423.pdf [accessed October 25, 2015].

Driers, L., E. Germenji, N. Noev and J. F.M. Swinnen. 2009. Farmers, vertical coordination, and the restructuring of dairy supply chains in Central and Eastern Europe. *World Development* 37 (11): 1742-1758. doi:10.1016/j.worlddev.2008.08.029

Farina, E. M. M. Q. 1999. Competitividade e coordenação dos sistemas agroindustriais: um ensaio conceitual (Competitiveness and coordination of agrisystems: a theoretical essay). *Gestão & Produção* 6 (3): 147-161.

Farina, E. M. M. Q. 2003. The Latin American perspective on the impacts of the global food economy: the case of Brazil. Paper presented at Conference on Changing Dimensions of the Food Economy: Exploring the Policy Issues. The Hague, Netherlands, February.

Fávero, L. P., P. Belfiore, F. L. Silva and B. L. Chan. 2009. *Análise de dados: modelagem multivariada para tomada de decisões* (Data analysis: multivariate modelling for decision making). Elsevier, Rio de Janeiro.

Fernandez-Stark, K., P. Bamper. P. and G. Gereffi. 2012. *Inclusion of small- and medium-sized producers in high value agrofood value chains*. Duke Center on Globalization, Governance and Competitiveness, FOMIN. http://www.cggc.duke.edu/pdfs/CGGC-IDB_%20Inclusion _of_Small-_and_Medium-Sized_Producers_in_High-Value_Agro Food _Value _Chains_ May_1_2012.pdf [accessed May 21, 2014].

Ferraz, J. C. D. Kupfer and L. Haguenauer. 1996. *Made in Brazil*. Editora Campus, Rio de Janeiro.

Hair, J. F., W. C. Black, W.C., B. J. Babin, B.J., R. E. Anderson. 2009. *Multivariate data analysis*. Seventh ed. Englewood Cliffs, New Jersey.

IBGE. Instituto Brasileiro de Geografia e Estatística. 2006. Censo Agropecuário 2006 (Agricultural Census 2006). http://sidra.ibge.gov.br [accessed August 4, 2013].

IBGE. Instituto Brasileiro de Geografia e Estatística. 2014. Pesquisa trimestral do leite (Quarterly survey of milk). http://www.sidra.ibge.gov.br [accessed October 2, 2014].

IBGE. Instituto Brasileiro de Geografia e Estatística. 2015. Pesquisa da Pecuária Municipal (Municipal livestock survey). http://sibra.ibge.gov.br [accessed July 20, 2014].

IPARDES. Instituto Paranaense de Desenvolvimento Econômico e Social. 2008. *Caracterização Socioeconômica da atividade leiteira no Paraná* (Socioeconomic characterization of dairy farming in Paraná). IPARDES, Curitiba. http://www.ipardes.gov.br/biblioteca/docs/ relatorio_atividade_leiteira_parana.pdf [accessed September 10, 2010].

IPARDES. Instituto Paranaense de Desenvolvimento Econômico e Social. 2010. *Caracterização da indústria de processamento e transformação do leite no Paraná* (Characterization of milk processing industry in Paraná). IPARDES, Curitiba. http://www.ipardes.gov.br/ biblioteca/docs/caracterizacao_industria_leite.pdf [accessed Apr 2, 2013].

Jank, M. S., E. M. M. Q. Farina and V. B. Galan. 1999. *Agribusiness do leite no Brasil* (Dairy agribusiness in Brazil). Milkbizz, São Paulo.

Jank, M. S., E. M. M. Q. Farina and V. B. Galan. 1999. *Competitividade do Sistema Agro industrial do Leite* (Competitiveness of dairy agrisystem). PENSA-USP: São Paulo.

Laros, J. A. 2012. O uso da análise fatorial: algumas diretrizes para pesquisadores (The use of factor analysis: some guidelines for researchers). In *Análise fatorial para pesquisadores*, edited by L. Pasquali. LabPAM Saber e Tecnologia, Brasilia, 141-160.

Lebart, L. 2000. Contiguity analysis and classification. In *Data Analysis*, edited by W. Gaul, O. Opitz and M. Schader. Springer, Berlin, 233-244.

MAPA. Ministério da Agricultura Pecuária e Abastecimento. 2011. *Agenda Estratégica 2010-2015. Leite e Derivados* (Strategic agenda 2010-2015: milk and dairy products) MAPA / ACS, Brasília. http://www.agricultura.gov.br/arq_editor/file/camaras_setoriais/ AGES/ leite.pdf [accessed April 4, 2013]

Martin, L., R. Westgren, R., E. Van Duren. 1991. Agribusiness competitiveness across national boundaries. *American Journal of Agricultural Economics* 73: 1456-1464.

Naik, G., M. Abraham. 2009. Interventions in the Food Value Chain to Improve Quality and Competitiveness: A Case Study of Dairy Cooperative in India. Centre for Public Policy Indian Institute of Management Bangalore. Paper presented at IFAMA World Forum and Symposium, Budapest, Hungary, 20-June. http://www.ifama.org/files/conf/2009/Symposium/1007_case.pdf [accessed October 15, 2015].

Neves, M. F., D. Zylbersztajn, C. Machado Filho and R. T. Bombig. 2002. Marketing e ações coletivas em redes de empresas: o caso da carne bovina no Mato Grosso do Sul (Marketing and collective actions in firms' networks: the case of beef chain in Mato Grosso do Sul). Paper presented at 40th Congresso da Sociedade Brasileira de Administração, Economia e Sociologia Rural, SOBER. Passo Fundo, RS, July.

Neves, M.F., V. G. Trombin and R. B. Kalakic. 2013. Competitiveness of the Orange Juice Chain in Brazil. *International Food and Agribusiness Management Review* 16(4):141-158.

Nogueira, M.P., C. P. Turco, H. A. B. Paiva, H. A. B. Lopes, M. B., 2006. Produção leiteira (Dairy farming). In *Estratégias para o leite no Brasil*, edited by M.A. Cônsoli and M. F. Neves. Atlas, São Paulo, 90-120.

Oaigen, R.P., J. O. J. Barcellos, M. E. A. Canozzi, J. C. Soares, L. C. Canellas, C.O. Alves, H. R. Tavares and F. M. Costa. 2013. Interregional competitiveness of the beef cattle production system. *Ciência Rural* 43: 1489-1495.

Pietrobelli, C. and R. Rabellotti. 2006. *Upgrading to Compete Global Value Chains, Clusters, and SMEs in Latin America.* Inter-American Development Bank. Sustainable Development Department Best Practices Series. Washington, D.C.

Rakotoarisoa, M. and A. Gulati. 2006. Competitiveness and trade potential of India's dairy industry. *Food Policy* 31: 216-227.

Ratinger, T. and I. Bošková. 2013. Strategies and effects of milk producer organizations in the Czech Republic. *Agricultural Economics* 59: 113-124.

Reardon, T., C. B. Barrett, J. A. Berdegue, and J. F. M. Swinnen. 2009. Agrifood industry transformation and small farmers in developing countries. *World Development* 37:1717-1727.

Silva, C.A.B. and M. O. Batalha. 1999. Competitividade em sistemas agroindustriais: metodologia e estudo de caso (Competitiveness in agrifood chains: methodology and case study). Paper presented at II Workshop Brasileiro de Gestão de Sistemas Agroalimentares. Ribeirão Preto. November.

Smith, R.R., V. L. Moreira, V.L. and L. L. Latrille. 2002. Caracterización de sistemas productivos lecheros en la X región de Chile mediante análisis multivariable (Characterization of dairy productive systems in the Tenth Region of Chile using multivariate analysis). *Agricultura Técnica* 62 (3): 375-395.

Souza, J.B.L. and A. F. Alves. 2010. Especialização produtiva e retornos associados para os produtores de leite (Productive specialization and returns for dairy farmers). *Economia & Tecnologia* 23 (6): 151-160.

Spers, R., G. J. T. Wright and A. A. Amedomar. 2013. Cenários para a cadeia produtiva de leite no Brasil em 2020 (Scnearios for dairy chain in Brazil in 2020). *Revista de administração* 48 (2): 254-267.

USDA. United States Department of Agriculture. 2015. Production, Supply and Distribution Online. Foreign Agricultural Service (FAS/USDA).

Van Duren, E. and D. Sparling. 1998. Supply Chain Management and the Canadian Agri-food Sector. *Canadian Journal of Agricultural Economics / Revue canadienne d'agroeconomie* 46 (4): 479-489.

Van Rooyen, J. V., D. Esterhuizen and L. Stroebel. 2011. Analyzing the Competitive Performance of the South African Wine Industry. *International Food and Agribusiness Management Review*14 (4):179-200.

Verschoore, J.R. and A. Balestrin. 2008. Ganhos competitivos das empresas em redes de cooperação (Competitive gains of firms in cooperation network). *Revista de Administração* 1 (1): 1-21.

Weise, A. D., I. Barchet, J. C. M. Siluk and P. Schrippe. 2013. Aspectos direcionadores da competitividade da cadeia produtiva de carne ovina no Rio Grande do Sul (Competitiveness drivers of lamb meat chain in Rio Grande do Sul). *Revista ADMpg Gestão Estratégica* 6 (2): 43-50.

Wilkinson, J. 2010. Transformations and perspectives of Brazilian agribusiness. *Brazilian Journal of Animal Science* 39: 26-34. doi: 10.1590/S1516-35982010001300004.

Zylbersztajn, D. 1995. Estruturas de governança e coordenação do *agribusiness*: uma aplicação da nova economia das instituições (Governance structures and agribusiness coordination: an application of new institutional economics). Pos-Doctoral Thesis, Departamento de Administração, Faculdade de Economia, Administração e Contabilidade. Universidade de São Paulo, São Paulo.

Zylbersztajn, D. 2009. From contracts to networks: new directions in the study of governance of agro-food-energy networks. Paper presented at International European Forum on Systems Dynamics and Innovation in Food Networks, Austria, February. http://purl.umn.edu/100479. [accessed April 4, 2012]

Zylbersztajn, D. and E. M. M. Q. Farina. 2010. Dynamics of network governance: a contribution to the study of complex forms. *REAd. Revista Eletrônica de Administração* 16 (1): 1-18.

Zylbersztajn. D. and M.F. Neves. (org.). 2000. Economia & Gestão de Negócios Agroalimentares (Agribusiness economics and management). São Paulo: Pioneira. 1:428.

