Governance and efficiency in Brazilian agricultural cooperatives

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Wagner Dantas de Souza Junior
Doutor em Ciências Contábeis e Administração pela Universidade Regional de Blumenau - FURB
Universidade Regional de Blumenau - FURB
Endereço: Rua Antônio da Veiga, 140, Itoupava Seca, CEP 89030-903, Blumenau, SC
E-mail: **wdsouza@furb.br**

Geysler Rogis Flor Bertolini
Doutor em Engenharia de Produção pela Universidade Federal de Santa Catarina – UFSC
Universidade Estadual do Oeste do Paraná - UNIOESTE
Endereço: Rua Universitária, 1619, Jardim Universitário, CEP: 85819-110, Cascavel, PR
E-mail: **geysler.bertolini@unioeste.br**

Guillermo Díaz-Villavicencio
Doutor em Criação, Estratégia e Gestão de Empresas pela Universidade de Barcelona – UB
Universidade Federal de Integração Latino-Americana - UNILA
Endereço: Avenida Tancredo Neves, 6731, Conjunto B, CEP: 85867-970, Foz do Iguaçu, PR
E-mail: **guillermo.diaz@unila.edu.br**

Abstract

This paper examines the interplay between governance and efficiency within agricultural cooperatives in Brazil. The main objective of this study is to assess the levels of efficiency within cooperative governance. The sample includes 35 agricultural cooperatives and data from fiscal year 2017. The analysis methodology employs DEA-BCC specifications along with Spearman's Correlation. Inputs include number of employees, fixed assets, cost of goods sold, and operating expenses. The output in the model is driven by Economic Value Added, which measures the assessment of economic efficiency, and is operationalized in three distinct models. The results of the DEA approach provide compelling evidence that highlights the existence of varying degrees of efficiency among Brazilian rural cooperatives. This exploration identifies and highlights DMUs that adhere to efficiency benchmarks. Notably, four exemplary firms within this sector emerged as benchmarks, thus elucidating the existence of increasing returns to scale, thus suggesting a viable path for attenuating input levels to upgrade efficiency across all DMUs. The main contribution of the study is to demonstrate that economic value added, when adjusted to accommodate benefits accrued to cooperative members, emerges as a superior method for explaining the constant returns to scale of cooperative structure. Notably, the originality of this study is to demonstrate the direct and indirect benefits accruing to cooperative members, thereby generating competitive advantages. The findings of this study have valuable implications for the comprehensive assessment of cooperatives from a multidimensional perspective that encompasses accounting, economic, and social facets. Furthermore, this study is a pioneer in elucidating the symbiotic relationship between governance structures and economic efficiency within agricultural cooperatives.

Keywords: Governance. Agricultural Cooperatives. Data Envelopment Analysis.

1. Introduction

The inherent relationship between governance structures and cooperative members gives rise to latent challenges in the context of property rights within the "cooperative firm". Managing these societal constructs necessitates the strategic utilization of approaches to mitigate the complexities of cooperative governance, encompassing challenges related to member loyalty (FULTON, 1999; SYKUTA; COOK, 2001; MARASCHIN, 2004; CHADDAD, 2007; BHUYAN, 2007), investment decision-making (FERRIER; PORTER, 1991; COOK; ILIOPOULOS, 1998), and overall firm administration (ZYLBERSZTAJN, 2002; CHADDAD; COOK, 2007; POZZOBON; ZYLBERSZTAJN, 2011).

Substantiating prior research, a requisite avenue of exploration pertains to the analysis of the intricate relationship between governance and the economic efficiency of agricultural cooperatives. Ziętek-Kwaśniewska et al. (2022) explain that the literature has not exhausted the knowledge on the factors that maximize the economic efficiency of agricultural cooperatives, and new insights are needed to understand the competitive advantage between cooperatives vs. non-cooperatives.

As explained by Jamaluddin et al. (2023), cooperative governance is influenced beyond financial performance by social factors and members' interests, which affect investment choices and business strategy. Therefore, this inquiry aims to unravel the intricate associations between these variables while considering the preservation of the well-being of cooperative members and the enduring sustainability of these cooperative endeavors.

The discourse on cooperatives focuses on the search for discernible levels of efficiency in the costs of financial governance, efforts that aim to alleviate the challenges of tripartite governance within cooperatives (loyalty, investment, and management). However, according to Nilsson, Svendsen and Svendsen (2012), there has been a tendency for the share capital of large agricultural cooperatives to decrease due to the increase in conflicts of interest and loss of trust among members as the organization grows and seeks vertical and horizontal integration strategies. Therefore, the research is justified since property rights affect the choice of cooperative structure, economic efficiency, and productivity in returns to scale.

In the context of Brazil, agricultural cooperatives emerge as hybrid organizational

structures that amalgamate diverse production factors for the purpose of creating and marketing food products while concurrently striving to fulfill the welfare of their members (MÉNARD, 2007). Those farmers affiliating with Brazilian agricultural cooperatives discover tangible advantages arising from their engagement in collective action, exemplified by activities such as input procurement, production sales, and logistics cost minimization as corroborated by the Ministry of Agriculture, Livestock, and Supply (MAPA, 2018).

The cooperative segment assumes a significant role within the national landscape, contributing to nearly 50% of Brazil's agricultural GDP and engaging over one million individuals. According to data from the Brazilian Cooperative Organization [OCB], the agricultural domain accounted for approximately 198,000 employments and encompassed a membership of one million individuals distributed across 1,618 cooperatives in the year 2017 (OCB, 2020). Moreover, projections by MAPA (2020) suggest that 48% of the total agricultural output within the Brazilian countryside is channeled through cooperatives. These dynamics operate within the framework of the Federal Law (BRASIL, 1971) that governs the principles governing property rights and operational guidelines for rural cooperatives.

In order to discern the interrelationship between member loyalty, investment decisions, and management practices, we propose the utilization of Economic Value Added (EVA) as the primary variable. Furthermore, we advocate for the employment of Data Envelopment Analysis (DEA) to formulate effective models for mitigating these challenges.

Our results demonstrate that for Brazilian cooperatives, in the period analyzed, there were constant returns to scale and an average margin of 40% of increase in economic efficiency levels. It was discovered through by the DEA models with adjusted EVA that the direct and indirect benefits associated with cooperatives have a strong positive association between governance and efficiency, and that the allocation of operating expenses is crucial for maximizing economic efficiency, in addition to mitigating conflicts of interest.

The paper subsequently advances beyond the introduction, delving into the establishment of the theoretical framework and hypotheses. This is succeeded by a detailed account of the methodological approach, including the proposition of DEA. The fourth section elucidates the composition of the dataset, which encompasses 35 cooperative units within the agricultural sector, thereby facilitating the generation of both descriptive findings and inferential insights. Conclusively, the ensuing sections amalgamate discussions and conclusions while also highlighting limitations and offering avenues for future research.

2. Theoretical Framework and Hypothesis

The notion of economic efficiency pertains to the optimal operational state that a firm can achieve within the contours of its situated market competition (NEVES; BRAGA, 2015). As such, a firm is deemed efficient when its performance is favorably juxtaposed with that of competitors in the same sector (MADAU et al., 2018).

In the context of cooperative societies, efficiency encompasses a fusion of economic and social rationale, entwining principles of mutual aid, solidarity, freedom, equality, and justice with economic performance (FERREIRA; BRAGA, 2007; ÖSTERBERG; NILSSON, 2009; LIU; YANG, 2014). This attribute stems from the distinct operational logic that characterizes hybrid organizational forms in contrast to traditional commercial entities. Schmitz and Glänzel (2016) elucidate that hybrid forms espouse sectoral logics marked by diverse objective functions, necessitating intricate decision-making processes that balance diverse stakeholder viewpoints.

Efficiency concerns within cooperative societies stem from the imperative of optimal resource utilization amid the constraints posed by the scarcity of productive factors like land, labor, and capital (HUANG et al., 2013). This quantification of efficiency serves as a tool for informed decision-making by revealing variables capable of enhancing efficiency and consequentially, overall performance (GOMES et al., 2005; DIAZ-VILLAVICENCIO, 2020).

Literature suggests that cooperatives exhibit limited technical efficiency. Guzmán and Arcas (2008) contend that productive scale and added value are linked to enhanced organizational performance within cooperatives. Fajardo (2006) conjectures that this is attributed to the cooperatives' central goal of maximizing value for their membership, rendering productive efficiency contingent upon the well-being of cooperative members. Hence, for Brandano et al. (2018), economies of scale emerge as a strategic level for segment competitiveness.

Five governance predicaments—namely, horizon, free ride, portfolio, control, and influence costs—have been identified as potential sources of inefficiency within the cooperative sector (PIVOTO et al., 2015). Addressing these gaps, Bhuyan (2007), Österberg and Nilsson (2009), Barraud-Didier et al. (2012), Power et al. (2012), and Cechin et al. (2013) underscore the imperative of strengthening the bond between cooperative organizations and their members. This entails creating mechanisms that incentivize

participation and foster member loyalty.

This underscores the necessity for policies enabling economic, financial, and social restructuring to sustain cooperatives' market presence. Cooperative governance thus emerges as a pivotal instrument ensuring self-management and safeguarding economic efficiency within these entities.

Economic efficiency is appraised through the amalgamation of production factors encompassing capital, land, inputs, and labor (DE KOEIJER et al., 2002; FERREIRA; BRAGA, 2007; GUZMÁN; ARCAS, 2008; CANDEMIR et al., 2011; SOBOH et al., 2011; WANG et al., 2012; CHEN et al., 2013; HUANG et al., 2013; NEVES; BRAGA, 2015; BRANDANO et al., 2018; TORRES-INGA et al., 2017). Based on this corpus of studies, the following hypothesis is postulated:

H_1. There are levels of economic efficiency in Brazilian agricultural cooperatives.

Silva et al. (2018) underscores the significance of gains in operational efficiency, strategic advantages, and cost of capital as pivotal aspects for value generation within a firm. These factors, herein referred to as value drivers, exert influence over the economic efficiency of agricultural cooperatives, thereby constituting influential determinants of their operational efficacy.

In the context of operational gains, cooperative enterprises can potentially achieve heightened efficiency in contrast to non-cooperatives, encompassing aspects such as goods distribution, input procurement, logistical operations, grain storage, personnel expenditures, and other synergistic benefits intrinsic to the sector (FAJARDO, 2006; BIALOSKORSKI NETO et al., 2006; GIMENES; GIMENES, 2006; SOUZA et al., 2011; POWER et al., 2012; SPANEVELLO; DAL'MAGRO, 2012).

Furthermore, these entities possess the potential to accrue capital cost efficiencies, particularly influenced by credit lines tailored for investments and funding provided by institutions like the National Bank for Economic and Social Development (BNDES). This, in turn, enables cooperative producers to access lines of credit under more favorable terms than if sought independently (CHADDAD; LAZZARINI, 2003; GIMENES; GIMENES, 2005).

Strategic management gains are also within the purview of these organizations, with technological innovation (RODRIGUES; GUILHOTO, 2004), marketing investments (LONDERO; BIALOSKORSKI NETO, 2014), and derivative contracts linked to agricultural production serving as avenues for enhancing strategic positioning (ALI;

BHARGAVA, 1998; BRESSAN et al., 2004; MARCOS-MATÁS et al., 2013).

These value drivers inherently intertwine both the social and economic dimensions of cooperative societies, collectively aimed at fulfilling the firm's objective function, which encompasses the collective well-being maximization. Disregarding these aspects in the assessment of performance and economic efficiency can distort interpretations of the firm's outcomes (HALL; GEYSER, 2004).

Recognizing that cooperative firms aim not only to generate net surpluses but also to confer indirect benefits upon their members, metrics for evaluating efficiency necessitate adaptation to capture the genuine value delivered by cooperatives to their members. The Economic Value Added indicator emerges as a suitable adaptable measure within this context (GEYSER; LIBENBERG, 2003; HALL; GEYSER, 2004; SILVA et al., 2018).

Consequently, the evaluation of economic efficiency in agricultural cooperatives becomes subject to the methodological choice adopted by researchers for gauging economic outcomes, inclusive of direct and indirect benefits conferred upon cooperative members. With this consideration, we present the following hypothesis:

H_2. There is a difference in the levels of economic efficiency according to the added value of benefits to cooperative members in Brazilian agricultural cooperatives.

Implicit governance costs in agribusiness exert a consequential impact on their operational efficiency. While certain costs find reflection in the firm's financial statements, including expenses related to the maintenance of the board of directors, executive board, bureaucracy, and control, others remain less overt, such as costs pertaining to influence and member loyalty (PIVOTO et al., 2015).

Studies conducted by Sueyoshi et al. (1998), Gómez (2006), Ferreira and Braga (2007), Guzmán and Arcas (2008), Pereira et al. (2009), Candemir et al. (2011), Wang et al. (2012), Chen et al. (2013), and Neves and Braga (2015) incorporate operational expenses as an input variable within DEA models. Notably, Wang et al. (2012) differentiated between operating expenses and management costs, positing that this accounting variable might serve as a proxy for assessing the efficacy of cooperative governance. Cooperatives grappling with pronounced governance challenges are expected to allocate greater operational expenses towards strategies aimed at member satisfaction, potentially impinging upon their economic efficiency. In view of these considerations, we posit the following hypothesis:

H_3. There is a positive correlation between governance costs and economic value added in Brazilian agricultural cooperatives.

3. Methodology

This research assumes a descriptive and quantitative nature, drawing upon data derived from the financial statements of 35 Brazilian cooperatives for the year 2017. The Data Envelopment Analysis, a non-parametric method pioneered by Charnes et al. (1978), is employed as a methodology for evaluating the relative efficiencies of comparable decision-making units (DMUs) through a variety of mathematical programming models. The cooperatives, serving as DMUs within the sample, are depicted in Table 1.

Table 1: Sample

DMU	Cooperatives	State/BR	N° of Members	Total Equity (in millions R$)
1	COOCAFÉ	ES	9.153	58,52
2	COOPEAVI	ES	12.207	75,87
3	COMIGO	GO	7.012	1.459,92
4	COOPADAP	MG	118	95,28
5	C.VALE	PR	19.795	1.550,77
6	CAPAL	PR	2.830	334,68
7	CASTROLANDA	PR	876	1.037,44
8	COAGRO	PR	4.429	40,64
9	COAMO	PR	28.293	4.628,38
10	COASUL	PR	8.823	324,66
11	COCAMAR	PR	14.000	1.017,08
12	COOPAGRICOLA	PR	1.775	50,77
13	COOPAVEL	PR	5.066	291,14
14	COPACOL	PR	5.737	1.154,10
15	COPAGRIL	PR	5.200	284,01
16	FRIMESA	PR	3.828	508,89
17	FRISIA	PR	836	805,85
18	INTEGRADA	PR	9.291	551,63
19	LAR	PR	10.607	1.189,39
20	PRIMATO	PR	6.772	66,93
21	UNITA	PR	7.727	71,00
22	COOPERAGUDO	RS	7.784	16,64
23	COTRICAMPO	RS	6.058	415,85
24	COTRIJAL	RS	4.451	56,43
25	COTRIJUC	RS	9.816	419,34

26	COTRISAL	RS	6.000	104,00
27	COTRISEL	RS	4.668	177,29
28	AURIVERDE	SC	18.755	1.129,24
29	COOPERALFA	SC	1.454	424,29
30	COPERCAMPOS	SC	19.388	269,96
31	CAMDA	SP	4.560	30,42
32	CASUL	SP	14.050	953,62
33	COOXUPE	SP	160	148,56
34	COPLANA	SP	1.009	281,01
35	COPASUL	MS	9.153	58,52

Source: Research data.

The analysis encompasses the utilization of the DEA BCC-oriented output model and the Spearman correlation method. The output-oriented DEA-BCC model was selected to assess how much the economic efficiency reflected in the value generation of cooperatives changes when outputs increase or decrease at a different rate than inputs. This approach is useful for variable returns to scale analysis because it measures the net technical efficiency of each DMU, in this case, agricultural cooperatives.

In the output-oriented model, positive values indicate decreasing returns to scale, while negative values indicate increasing returns to scale; null values signify constant returns to scale. The DEA BCC introduced by Banker et al. (1984) is represented by Equation 1.

$$Min\ Eff_0 = \sum_{i-1}^{r} v_i\, x_{io} + v_* \qquad (1)$$

Where $\sum_{j-1}^{s} u_j\, y_{jo} = 1$; $\sum_{i=1}^{r} v_i\, x_{ik} - \sum_{i=1}^{s} u_j\, y_{jk} - v \leq 0, \forall k$ e $v_i, u_j \geq 0, v_* \in \Re$. Broadly speaking, the proposed model elucidates the technical efficiency level of the analyzed cooperatives, the contribution of scale factors (inputs) to each unit's efficiency level (weights), comparison of DMUs through benchmarks, and the target for each input in maximizing firm efficiency (targets).

Three output-oriented DEA BCC models were applied, each containing 35 DMUs. The DMUs were assessed within a model featuring four inputs, comprising the number of workers, fixed assets, cost of goods sold, and governance costs through the operational expenses' variable. An output variable, the EVA indicator, was assessed using three distinct calculation methods.

The first model, in Equation 2, calculates the EVA in its traditional formula,

originally proposed for public companies (EHBAR; STEWART, 1999; STEWART III, 2005). This model captures the economic efficiency of agricultural cooperatives by considering the remuneration of net operating profit after taxes minus the cost of capital.

$$EVA = NOPAT - (WACC\ x\ CI) \quad (2)$$

Where NOPAT is the Net Operating Profit After Taxes is equal (+) Net sales (-) Operating expenses (=) Operating profit (-) Income tax. CI is Capital Investment, a proxy of Total Equity. WACC is Weighted Average Cost of Capital, measured by (Weight of equity x Cost of equity) + (Weight of debt x Cost of debt).

The second model, presented in Equation 3, adapts EVA to the financial statements of cooperatives, considering critical value generation points, resulting in the Adjusted EVA (SILVA et al., 2018). This model captures the economic efficiency of cooperatives by considering critical value generation points, calculating the remuneration of net income and subtracting the cost of employed capital.

$$EVA\ Adjusted = NOPAT - (WACC\ x\ CI\ Adjusted) \quad (3)$$

Where CI Adjusted is calculated from (-) Investments (+) Short-Term Loans and Financing (+) Dividends Payable (+) Debts with Related Parties (+) Long-Term Loans and Financing (+) Long-Term Debts with Related Parties (+) Equity (=) Invested Capital.

The third model, in Equation 4, establishes a simulated scenario based on the second model, considering indirect benefits available to cooperative members implicit in the firm's results. This model captures the economic efficiency of the cooperative within a scenario incorporating both direct (net surpluses) and indirect (price, technical assistance, capital risk, logistics and storage costs) benefits in the calculation of the net operating profit after taxes, minus the cost of employed capital.

$$EVA\ Adjusted\ with\ cooperative\ members\ benefits = NOPAT\ Adjusted - (WACC\ x\ CI\ Adjusted) \quad (4)$$

Where in Equation 3 is repeated, with the following adjustments to the balance sheet accounts for calculated NOPAT Adjusted: (-) 5% of fixed assets for logistics benefits; (-) 2% of fixed assets for storage benefit; (-) 1% benefit for reduction in third-party capital cost. Additionally, adjustments are made to the benefits in the income statement: (-) 0.5%

in Cost of Goods Sold (COGS); (-) 0.5% of Operating Expenses for logistics; (-) 0.5% of Operating Expenses for storage; and (-) 2% of Operating Expenses for technical assistance. This scenario was proposed by Silva et al. (2018), for demonstrated benefits to members of agricultural cooperatives.

The methodological protocol of this research can be summarized as follows: i) extraction of data from the financial reports of agricultural cooperatives; ii) calculation of the economic value added indicator; iii) formulation of descriptive statistics; iv) estimation of DEA models: efficiency levels, benchmarks, targets and returns to scale of the variables; and v) analysis of Spearman's correlation between the DEA models to assess the association between governance and economic efficiency. The ensuing section analyzes and discusses the results.

4. Data Analysis

In Model 1's EVA, the sample yielded an average of R$574 million in CI, a NOPAT of R$1.6 billion, ROIC of 3.87% per annum, WACC of 2.79% per annum, and an Economic Value Added of -288 million reais, indicating that, on average, companies eroded economic value during the period.

In Model 2's EVA, companies achieved an average CI of R$1.3 billion, NOPAT of R$103 million, ROIC of 0.07% per annum, WACC of 0.05% per annum, and an Adjusted EVA of R$23 million, signifying that companies added economic value during the period.

In Model 3's EVA, with benefits adjusted for members, the sample obtained an average CI of R$1.05 billion, NOPAT of R$182 million, ROIC of 0.18% per annum, WACC of 0.05% per annum, and an EVA of R$118 million, indicating that, on average, companies added economic value during the period.

The average number of employees is 2,457, and the value of fixed assets is R$391 million. The average cost of goods sold, which corresponds to the value passed on to cooperative members, is approximately R$1.4 billion. The average operating expense is R$242 million, encompassing all expenses for maintaining operational activities of the firm, such as payroll, administrative and commercial expenses, administrative board expenses, among others. The descriptive statistics of the inputs used in the models are presented in Table 2.

Table 2: Descriptive summary (values in millions R$)

Item	Number of Employees	Fixed Assets	COGS	Operating Expenses	EVA	EVA Adjusted	EVA Scenario
Minimum	33	15	63	13	-10,294	- 50	3
Mean	2,457	391	1,424	242	- 287	23	117
Median	1,326	241	1,094	137	78	13	87
Maximum	9,427	2,012	5,574	1,759	2,058	242	527
Std. Dev.	2,824	444	1,300	341	2,104	46	122

Source: Research data.

Of the 35 evaluated cooperatives, in efficiency model 1, 9 were classified as 100% efficient in the standard frontier. In model 2, 15 cooperatives are 100% efficient. In model 3, 19 firms are 100% efficient. Efficiency levels are shown in Table 3.

Table 3: Levels of economic efficiency of the DEA model

DMUs	Model 1				Model 2				Model 3			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Average Efficiency	42%	12%	54%	51%	55%	12%	60%	58%	84%	70%	46%	59%
Efficient DMUs (=1)	9	4	2	2	15	4	7	8	19	12	0	1
Efficiency ≥ 0,7 < 1,00	4	2	10	10	3	1	9	8	10	8	9	17
Efficiency ≥ 0,31 ≤ 0,69	5	1	22	22	5	1	18	18	6	13	25	16
Efficiency > 0,0 ≤ 0,30	7	10	1	1	5	10	1	1	0	0	1	1
DMUs Inefficient (=0)	10	18	0	0	7	19	0	0	0	0	0	0
Total of DMUs	35	35	35	35	35	35	35	35	35	33	35	35

Notes: Legend: (1) Standard Efficiency, (2) Inverted Frontier Efficiency, (3) Composite Efficiency, and (4) Normalized Composite Efficiency.

Source: Research data.

With these adjustments aimed at enhancing the evaluation of the DEA BCC model, levels of efficiency were determined for the DMUs across the three applied models. As such, the rejection of the first research hypothesis (H_1) is not warranted, as it suggests the existence of levels of economic efficiency in Brazilian agricultural cooperatives.

The benchmark results of the multiplier model indicate that the cooperatives that most frequently appeared as reference points for other units across all three models were: Integrada (28 occurrences), Cotrijuc (18), Primato (16), Capal (15), and Casul (15).

Additionally, the average scale returns for the sample were calculated (Table 4). In Model 1, to achieve maximum economic efficiency, cooperatives should, on average, decrease their number of workers by 14.69%, reduce fixed asset values by 11.91%, decrease the cost of goods sold by 0.94%, and lower operating expenses by 5.51%. In Model 2, firms should reduce their workforce by 1.86%, cost of goods sold by 2.03%, and operating expenses by 0.77%. In Model 3, organizations should only moderately decrease their workforce by an average of 4.94%.

Table 4: Returns to scale of DEA models

Model	Input/Output	Variables	Ascending Returns	Descending Returns	Global
Model 1 – EVA Traditional	*Inputs*	Number of workers	(-) 14.69	0.00	(-) 44.06
		Fixed Assets	(-) 11.91	(-) 5.74	(-) 46.23
		COGS	(-) 0.94	(-) 1.94	(-) 31.46
		Operational expenses	(-) 5.51	(-) 5.54	(-) 39.63
	Output	EVA	(+) 82.69	(+) 5,728	(+) 5,783
Model 2 - EVA Adjusted	*Inputs*	Number of workers	(-) 1.86	(-) 12.20	(-) 28.11
		Fixed Assets	0.00	(-) 2.23	(-) 22.23
		COGS	(-) 2.03	0.00	(-) 22.03
		Operational expenses	(-) 0.77	(-) 0.43	(-) 21.20
	Output	EVA Adjusted	(+) 573.09	(+) 72.83	(+) 625.91
Model 3 - EVA Adjusted with cooperative members benefits	*Inputs*	Number of workers	(-) 4.94	(-) 9.43	(-) 14.37
		Fixed Assets	0.00	(-) 1.74	(-) 1.74
		COGS	0.00	0.00	0.00
		Operational expenses	0.00	0.00	0.00
	Output	EVA	(+) 10.91	(+) 6.40	(+) 17.31

Source: Research data.

Hence, upon scrutinizing the influence of weights, benchmarks, targets, and the presence of scale returns within the DMUs of the analyzed DEA BCC model, the rejection of the second research hypothesis is not warranted. Hypothesis H_2 posits the existence of differentiation in levels of economic efficiency based on the added value of benefits provided to members in Brazilian agricultural cooperatives. Depending on the researcher's perspective or stakeholder interested in the economic outcome of agricultural cooperative societies, the interplay of input-output relationships may impact the levels of economic efficiency of the firms under analysis.

Finally, to ascertain the relationship between governance and economic efficiency in agricultural cooperatives, the Spearman rank correlation technique was employed,

comparing the input variable "operational expenses" (governance) with the output variable "Economic Value Added" (EVA) in the three proposed models.

In the EVA® model, a weak and positive correlation was found between the variables (Rho = 0.13). However, by normal standards, the association between the two variables would not be considered statistically significant as the p-value was greater than 0.5%. Conversely, in the Adjusted EVA model (Rho = 0.82) and Scenario EVA model (Rho = 0.95), as per normal analytical standards, it is evident that the association between the two variables would be considered statistically significant (p < 0.05%). In these two models, a strong relationship between the variables is observed. The relationship is positive, indicating that the variables increase simultaneously. The Spearman correlation analysis is presented in Table 5.

Table 5: Spearman's Correlation

Model	Rho	*p*-value	Result
Model 1 – EVA	0.13	0.45	There is no correlation
Model 2 - EVA Adjusted	0.82	0	There is correlation
Model 3 - EVA Adjusted with cooperative members benefits	0.95	0	There is correlation

Source: Research data.

Hence, it is feasible to endorse the third hypothesis (H3) of the study, which asserts that a positive correlation exists between governance costs and levels of economic efficiency in Brazilian agricultural cooperatives. This correlation is observed within the dimensions considering the economic outcomes through the models (1) e (2).

These findings complement the works of Sueyoshi et al. (1998), Gómez (2006), Ferreira and Braga (2007), Guzmán and Arcas (2008), Pereira et al. (2009), Candemir et al. (2011), Wang et al. (2012), and Chen et al. (2013), who identified a significant relationship between operational expenses and productive efficiency in agricultural cooperatives. It is underscored that the construct of cooperative firm governance was evaluated through the proxy of operational expenses in this study.

Nonetheless, prudent consideration is necessary regarding the scope of what constitutes the maintenance of firm governance. The cooperative firm incurs expenses associated with the maintenance of the formal structure of its corporate governance, encompassing costs related to directors, internal and external auditing, as well as those associated with accounting disclosure, costs linked to contractual agency problem resolution like the remuneration of cooperative directors, bureaucracy-related expenses, implicit costs

stemming from democracy within the firm's decision-making process, costs of influence, and other implicit costs within the organizational management process.

Governance problems arising from diffuse ownership rights tend to exacerbate decision- making in such organizations due to numerous conflicts of interest among cooperatives regarding the optimal decision-making strategy for their cooperative organization (PIVOTO et al., 2015). For instance, the free rider problem, if present within the organization, diminishes the economic participation of cooperatives in the firm's outcome, thereby impacting its level of efficiency. Similarly, the horizon problem, if unaddressed, can negatively affect firm efficiency, especially if cooperatives oppose retaining surplus earnings for capitalizing the cooperative, instead preferring to rely on external credit, thereby inflating the cost of equity capital.

Certain cooperatives may exert control over factors such as labor and expenses or inputs. However, if efficiency in capital or asset utilization is not achieved, challenges may arise in generating cash flows for sustained growth. Following this line of thought, cooperatives must strive for maximum efficiency in their production processes through their assets, with the goal of generating economic surplus within the period. Sustaining growth may necessitate diversifying the portfolio of production units throughout the value chain, integrating technology into production processes, and seeking economies of scope and scale to generate surplus productivity.

The control problem is entwined with the internal management's need to align with owner interests. Thus, if managers make decisions that prioritize their own benefit over collective benefit, agency conflicts may emerge. The control issue impacts economies of scale, as many managerial decisions in these organizations might not align with classical financial concepts such as return on investment, cost of capital opportunity, or economic efficiency. Instead, they cater solely to immediate cooperative interests, which can impoverish firm management and lead to issues of productive and allocative inefficiency.

In a similar vein, influence costs emerge when a series of decisions impact the distribution of benefits and costs for the cooperative, and when open channels of communication exist between affected parties and decision-makers. The exercise of these groups is detrimental to the sustainable development of the organization. Consequently, it is not straightforward to reduce governance-related expenses or costs without accounting for the existing trade-off in managing the firm.

The data describing relative efficiency constitutes strong evidence to be considered when evaluating cooperative performance. The act of evaluation demands a position of

favorability or unfavourability towards the object under assessment, culminating in a consequential decision for action. Evaluation entails data collection, analysis, and synthesis of elements that configure the evaluated object, coupled with a valuation or quality attribution process. This process ensues from comparing the configuration of the evaluated object. In this regard, DEA can support the evaluation actions of cooperative administrators and, consequently, offer insights to alter or affirm management and institutional governance practices.

In summary, the DEA technique can assist decision-making in the assessment process of firms. For managers and cooperatives, it provides data on firm performance and that of competitors in the context of market conditions, facilitating the enhancement of methods, strategies, and internal processes. This pursuit aims to refine firm management and governance, thereby ameliorating performance and fulfilling its objective function of maximizing cooperative members' well-being. Consequently, the validation of the three researched hypotheses can be confirmed (see Table 6).

Table 6: Summary of Hypothesis Test Results

Hypothesis	Direction of Variables				Models			Status
					(1)	(2)	(3)	
H_1	Number of workers	Fixed Assets	COGS	Governance	Yes	Yes	Yes	Accepted
H_2	Number of workers	Fixed Assets	COGS	Governance	Yes	Yes	Yes	Accepted
H_3				Governance	-	Yes	Yes	Accepted

Source: own elaboration.

5. Discussion and Conclusion

This study has contributed by presenting the impact of governance on the economic efficiency of the organization. Three models were developed to consider economic efficiency from three perspectives. The outcomes presented encompassed the generation of value-added economic value, efficiency levels, benchmarks, weights, targets, and scale returns. This facilitated a discussion on how organizational management can alter the firm's status quo by reflecting on the alignment of implemented strategies to address governance issues while considering firm efficiency.

In summary, the results indicate that in the period analyzed there were constant returns to scale and an average margin of 40% of increase in economic efficiency levels. It was also discovered by the DEA models (2) and (3) with adjusted EVA that the direct and indirect benefits associated with cooperative members influence constant returns to scale. We found through Spearman's correlation that there is a positive association between

governance and economic efficiency, and that the allocation of operating expenses is a relevant variable for maximizing economic efficiency, both due to financial relevance and to mitigate conflicts of interest.

The results demonstrated that concerning the calculation of economic value added, the 35 DMUs incurred an average loss of 288 million Brazilian reais in Model 1, a profit of 23 million reais in Model 2, and 118 million reais in Model 3. This underscores how the choice of performance evaluation instrument for cooperatives influences exercise outcomes.

For the calculated efficiency levels, an average normalized efficiency of 51% was obtained for DMUs in the first model, 58% in the second model, and 59% in the third model. This indicates that, on average, there is an approximately 40% margin for cooperatives to enhance their efficiency level. The primary firms identified as benchmarks in descending order across the three calculated models were the Integrated Cooperative, Cotrijuc, Primato, Capal, and Casul.

The returns to scale obtained from the calculated targets guide critical managerial decisions to improve business performance. DMUs considered 100% efficient exhibited constant returns to scale. These findings hold practical implications. If a manager evaluates the cooperative from a traditional economic assessment standpoint (Model 1), generating net earnings by the end of the exercise necessitates reducing expenses to maximize their economic function.

Conversely, if the manager evaluates the cooperative from a social standpoint (Models 2 and 3), they will increase operational expenses, as these expenses signify services delivered to cooperatives. This action could indeed maximize the final EVA, similar to spending on preventive maintenance of production processes, logistic storage, and technical assistance.

The relationship between governance expenditures and efficiency was evaluated using the Spearman rank correlation, comparing the input value of operational expenses with the DEA output in the proposed three models. In Model 1, a weak and positive relationship between the variables was found, but it was not statistically significant. Conversely, in Models 2 and 3, a strong and significant association was evident.

This signifies that in agricultural cooperatives, when evaluated purely from an economic perspective (Model 1), their efficiency is not associated with governance expenses. However, when evaluated from both an economic and social perspective (Models 2 and 3), considering direct and indirect benefits associated with cooperatives, a strong positive association between governance and economic efficiency is apparent. Therefore, if managers

seek to enhance the value generated by the firm, they should assess whether operational expense allocations satisfy cooperatives' needs to fulfill their objective function.

The main contribution of this research was to demonstrate that economic value added, when adjusted to accommodate benefits accrued to cooperative members, emerges as a superior method to explain the constant returns to scale of the cooperative structure. Thus, the analysis of the economic performance of agricultural cooperatives should consider the impact of direct and indirect benefits accrued to members on the firm's bottom line.

The limitations of this research pertain to the chosen DEA model's definition, including its orientation and the relationship between the research variables. An important aspect is the incorporation of variables related to work quality, spatial, macroeconomic, and contextual factors into the modeling. Additionally, the absence of data from multiple years precluded the possibility of a longitudinal study. These aspects could be addressed in future studies.

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