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Do Agribusiness Risks Affect ESG Practices in Swine Farming Operations?

Os Riscos do Agronegócio Afetam as Práticas de ESG em Propriedades Suinícolas?

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ABSTRACT

The objective of this study was to evaluate the influence of agribusiness risk identification and risk management on ESG practices in pig farms located in the state of Santa Catarina, Brazil. The research was quantitative, descriptive, and survey-based, involving a sample of 100 pig producers from the western mesoregion of the state. To analyze and interpret the results, an exploratory factor analysis (EFA) was initially conducted to identify and understand the underlying latent variables and their interrelationships, ensuring their validity based on the literature. Following the EFA, the data were processed and analyzed using Structural Equation Modeling (SEM), which was selected as the most appropriate method. The findings indicate that, through a mediating relationship, agribusiness risk identification and risk management significantly influence ESG practices on pig farms. Given the gap in the literature regarding risk management in pig farming, often addressed in isolation, this study contributes by demonstrating its relevance to ESG practices. Future research may explore the integration of these concepts in other agricultural sectors, thereby enhancing the understanding of integrated risk management.

Keywords: Risk Management. Risks in Agribusiness. ESG Practices.

RESUMO

O objetivo do estudo foi avaliar a influência da identificação de riscos e do gerenciamento de riscos nas práticas de ESG em propriedades de suínos do estado de Santa Catarina. A pesquisa foi caracterizada como quantitativa, descritiva e de levantamento, reunindo uma amostra de 100 produtores de suínos da mesorregião Oeste catarinense. Para analisar e interpretar os resultados, inicialmente, foi realizada uma análise fatorial exploratória com o objetivo de identificar e ter o conhecimento das variáveis latentes observadas e suas relações, destacando a validade de cada uma conforme a literatura. Em virtude da escolha do modelo e após a aplicação da análise fatorial exploratória, os dados foram processados e avaliados por meio da Modelagem de Equações Estruturais. Os resultados indicaram que, por meio de mediação, os riscos do agronegócio e o gerenciamento de riscos influenciam nas práticas de ESG nas fazendas de suínos. Considerando-se uma lacuna na literatura sobre a gestão dos riscos e sua aplicação em propriedades suinícolas, frequentemente tratada de forma isolada, o estudo trouxe como contribuição a utilidade das práticas de ESG. Pesquisas futuras podem confirmar a integração em outros setores agropecuários para enriquecer o conceito de gestão integrada dos riscos.

Palavras-chave: Gestão de Riscos. Riscos no Agronegócio. Práticas de ESG.

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1 INTRODUCTION

Agribusiness is increasingly exposed to a variety of risks involving market dynamics, political and economic environments, climatic conditions, pests, and diseases (Aoun, 2015). Therefore, producers must adopt effective strategies to mitigate such risks. The growth of the Brazilian economy is closely linked to the development of agribusiness (Moreira, 2009). In light of this growth, risk management becomes a strategic tool capable of reducing the likelihood of threats (Bromiley et al., 2015).

The main risks in rural properties can be categorized into production risks (climatic, operational, biological, and technological) and socioeconomic risks (market, financial, human, and institutional) (Harwood, 1999; Kimura, 2010). Beyond identifying these risks, rural producers must adopt control measures, such as detailed monitoring of weather forecasts, agricultural insurance, training programs, crop rotation, integrated pest management, planned input purchases, future market information, product diversification, credit reserves, debt renegotiation, lease strategies, and succession planning (Musser & Patrick, 2002).

Risk management serves as a means to monitor and prevent risks, thereby yielding beneficial outcomes. Given the uncertainties inherent in the rural sector, producers tend to focus on result-oriented management, making risk management an essential ally for planning income amidst agribusiness uncertainties (Alcantara, 2020). Climate change, one of the primary environmental risks faced by rural properties, significantly affects production, making risk management indispensable. Mitigation strategies and preparedness are crucial to confront such risks, ensuring more secure income projections (Barham et al., 2014; Xiaolong et al., 2017), improving long-term perspectives through livelihood strategies and fostering sustainable development in rural activities (Hang et al., 2022).

In regard to social issues, Anderson and Anderson (2009) emphasized improvements in financial and social matters through the implementation of risk management practices within sustainability frameworks, as societal, future-oriented, and environmental impacts remain central concerns. Moreover, when employed as a strategic tool, risk management contributes to sustainable outcomes. Atamanczuk and Gasparelo (2015) further argue that farmers are increasingly employing preventive financial resource management mechanisms, thus conceptualizing economic sustainability.

The concern with ESG (Environmental, Social, and Governance) practices emerged in 2015 and gained significant momentum following the COVID-19 pandemic (Nagai, 2023). In

this context, pig producers face specific challenges related to ESG practices, having to navigate external pressures, governmental regulations, national and international sanitary standards, and internal productivity aspects. In light of such challenges, integrating risk management with sustainability practices may foster the adoption of ESG principles (Zanin et al., 2020).

Previous research has highlighted producers' perspectives and the contributions of integrated risk management. Alcantara (2020) discusses rural producers' perceptions regarding risk sources, the necessity of addressing them, and the strategies used to manage them. Meuwissen, Huirne, and Hardaker (2001) examined producers' perceptions of risk and management methods, emphasizing key risk sources such as price volatility and production uncertainty. Huirne et al. (2007) underscored the importance of risk identification in agriculture through surveys conducted with cattle, swine, poultry, and crop producers.

Furthermore, Camargo et al. (2018) investigated the sustainability dimensions - political, social, economic, and environmental - while leaving the governance pillar underexplored in the context of ESG practices. Their findings highlighted the social pillar as unsustainable among responding pig farms. This study seeks to revisit those findings in the aftermath of the pandemic and in light of society's evolving perception of the importance of ESG pillars. In this regard, the present research differentiates itself from previous literature by analyzing risk management within ESG practices, offering a deeper understanding and connecting risk identification to the relationship between risk management and ESG practices among pig producers - an area still underexplored in rural studies.

Thus, the research question arises: What is the influence of risk identification and risk management in agribusiness on ESG practices in pig farming properties? The objective of this study is to analyze the influence of risk identification and risk management in agribusiness on ESG practices in pig farming.

This research aims to contribute to the academic literature by addressing a gap and emphasizing the importance of risk identification and management in rural properties to mitigate the negative externalities of agricultural activities. Its practical contribution lies in presenting the most effective solutions to promote sustainable production across the ESG dimensions. It is expected that this study will assist farmers in identifying and managing such risks, thereby fostering a more sustainable environment, achieving more consistent financial returns, and securing a safer, more sustainable future for society as a whole.

2 THEORETICAL FRAMEWORK

2.1 BACKGROUND AND RESEARCH HYPOTHESES

Agribusiness is associated with various specific risk factors, such as climatic exposure and production-related diseases, which are inherent to this sector (Moreira, 2009). Saliba and Lanza (2018) highlight that there are multiple risks on rural properties, including occupational hazards and risks to workers' health. Moreover, the financial risk of farms - exacerbated by commodity price fluctuations in foreign markets - directly impacts the entire agribusiness supply chain (Meuwissen et al., 2001).

Table 1 presents variables and protection measures for different risk factors faced by rural producers. It outlines the analysis of two main spheres: production risks and socioeconomic risks, based on a compilation by Harwood (1999) and Kimura (2010), along with adaptations of the control actions proposed by Musser and Patrick (2002).

Table 1
Inherent Risks of Agricultural Activity and Control Actions

Risk Factors		Risk Variables	Control Actions
Production Risks	Climatic	• Excess or lack of rainfall	• Detailed monitoring of weather forecasts • Crop insurance
		• Hail	
		• Inadequate temperature	
		• Lack of sunlight	
	Operational	• Seeder malfunction	• Extra machinery capacity
		• Atraso na colheita	• Training
	Biological	• Pests	• Crop rotation
		• Incompatible genetic material	• Use of resistant crops
			• Pest monitoring
	Technological	• Geographic dispersion of production	
• Adaptation to new technology		• Continuous updating	
• Obsolescence		• Training	
Socioeconomic Risks	Market-related	• Oversupply	• Futures contracts
		• Price fluctuations in inputs and products	• Flexibility
			• Scheduled input purchasing
			• Future market information
	Financial		• Product diversification
		• Rising interest rates	• Maintaining liquidity
		• Changes in credit lines	• Maintaining credit reserves
			• Debt renegotiation
	• Leasing strategies		
	Human	• Access to accounting information	
		• Family succession	• Contingency planning with employees
		• Employee qualifications	• Family succession planning
			• Life insurance
	• Legal and accounting consulting		
	Institucional	• Human resource management	
• Changes in legislation and political environment		• Information on current legislation	

Source: Adapted from Harwood (1999), Kimura (2010), Musser & Patrick (2002).

The risk control variables support Parcell's (1998) understanding that rural producers must adopt both the identification and measurement of risks. Finger and Walquil (2013) emphasize that agribusiness has increasingly aligned itself with other economic sectors through the professionalization of management and greater integration into broader contexts and markets. This approach aims to reduce production costs and represents a way to mitigate market risks. Hence, risk management becomes a strategic path toward success and sustainability, illustrating that by managing risks, producers generate a sustainable impact on their activities (Buainain & Loyola, 2015).

Famá et al. (2002) discuss the need for integrated risk management, aiming to highlight the importance of an ideal system that offers a comprehensive view of all risks inherent to an organization. Identifying risks enables appropriate actions to mitigate, prevent, or transfer risks and increases the likelihood of achieving organizational goals. Within this context, reducing risks in agricultural activities remains a major challenge, and integrated management serves as a tool for improving planning and governance processes (World Bank, 2015).

Therefore, risk management encompasses a holistic view with the objective of enhancing value creation, preservation, and realization (Araújo, 2024). Evaluating risk management contributes to identifying risks more efficiently and quickly, which is crucial for agricultural activities that require swift decisions in response to climatic factors, an area of high engagement for the global agricultural sector (Girdžiūtė, 2012). Risk management research remains a central concern for sustainable agribusiness management, demanding a comprehensive approach that fosters reduced vulnerability (Zanin et al., 2020).

The agricultural sector has a direct connection to sustainable development due to its reliance on natural resources, which may be negatively affected by misuse (Santos & Cândido, 2013). On farms, sustainability is fundamentally tied to the maintenance of internal productive resources. Evaluating sustainability dimensions requires the inclusion of social, cultural, ecological, environmental, and economic aspects (Aguar & Munaretto, 2016).

Although rural activities are often linked to environmental degradation, sustainable initiatives aim to minimize the challenges faced by rural producers. Such initiatives are both necessary and motivating, especially when it comes to caring for natural resources (Giordano, 2000). ESG (Environmental, Social, and Governance) practices have emerged as indicators guiding companies in addressing environmental impacts, combating social injustices, and implementing governance frameworks. These practices aim to increase the precision of sustainable development goals across both public and private institutions (Walter, 2020).

ESG performance throughout the supply chain arises from improved control processes, fostering innovation, implementing strategic production projects with competitive advantages, reducing costs, and enhancing social outcomes (Natalli et al., 2020; Zanin et al., 2020). Accordingly, the ESG pillars aim to promote rural development through practices that ensure product quality and financial returns via a combination of environmentally sustainable strategies (Zanin et al., 2020).

According to Zanin et al. (2020), incorporating strategic planning contributes to environmental, social, and economic balance. Zhao (2022) analyzed ESG risk indices in Chinese companies and proposed recommendations for corporate practices in line with ESG compliance. These recommendations included identifying and assessing environmental, social, and governance risks based on probability and impact, as well as implementing control and monitoring measures for risk mitigation.

The study by Meuwissen, Huirne, and Hardaker (2001) examined rural producers' perceptions of risks and their management methods. The findings emphasized key sources of risk such as price and market volatility. Dairy producers identified price variability as the most significant risk, while pig farmers considered production risks to be more relevant.

Huirne, Meuwissen, and Asseldonk (2007) investigated the importance of agricultural risk using a 5-point Likert scale questionnaire administered to cattle, swine, poultry, and crop producers. Results showed that producers were able to perceive and consequently reduce risks—except for price-related risks. To understand whether risk identification in agribusiness positively influences sustainability outcomes, it is necessary to examine which factors influence each producer's perception. Based on this context, the following hypothesis is proposed:

H1: Agribusiness risk identification positively influences ESG practices.

The goal of risk management is to anticipate and reduce probabilities through the monitoring and understanding of existing risk indicators within the process (Alcantara, 2020; Meuwissen et al., 2001). Famá, Cardoso, and Mendonça (2002) argue that risk management enables an ideal system for managing risks inherent to the activity by providing a comprehensive view that considers both external and internal variables, along with their respective levels of control.

The risk management approach encourages rural organizations to identify, monitor, and manage risks to improve outcomes, reduce resource waste, and promote process efficiency (Corrêa et al., 2018). In this regard, integrated risk management reduces farmers' exposure to

losses, generating benefits for both the sector and the country (World Bank, 2015).

Some risks remain difficult for farmers to control. Thus, it is important to analyze how integrated risk management contributes to reduced vulnerability and improved sustainability outcomes. Integrated risk management seeks to proactively identify and treat risk threats. It is grounded in evidence collection through risk identification, measurement, management, control, and monitoring across social, environmental, and governance dimensions (World Bank, 2015).

Risk management is essential for delivering secure and sustainable results, involving the identification, assessment, and treatment of risks as a foundation for informed decision-making and strategy development. In this context, identifying and managing risk provides a strong foundation for ESG-related decision-making (Alcantara, 2020; Zanin et al., 2020). Based on the discussion above, the second research hypothesis is proposed:

H2: Agribusiness risk management positively influences ESG practices.

In agribusiness, Gomes et al. (2014) suggest implementing an integrated management system with scale-based assessments throughout the production and management processes. Market demands drive producers to seek innovation and adapt to systems that prioritize animal welfare and environmental preservation. In pig farming, producers recognize the significant environmental impact of their activity and, under regulatory scrutiny, often seek specific solutions such as waste treatment systems that may even generate profitable opportunities (Souza et al., 2009).

The concept of sustainable development was formalized in the 1980s by the Brundtland Report, drafted by the World Commission on Environment and Development, reflecting increasing concern with the management of natural resources (Malak-Rawlikowska et al., 2021; Scharf & Monzoni, 2004). Global environmental changes, particularly climate-related phenomena, are an ongoing reality. Still, public perceptions of these changes and associated risks vary due to psychological and cultural factors (Giulio et al., 2015).

Anderson and Anderson (2009) highlighted improvements in both financial and social aspects following the implementation of risk management focused on sustainability, given the persistent concerns about society, the future, and the environment. As such, strategic risk management yields sustainable results. Menapace, Colson, and Raffaelli (2013) found a significant positive relationship between farmers' risk aversion levels and their subjective beliefs regarding the likelihood of crop losses. Their findings suggest that more risk-averse farmers are also more likely to perceive potential damages, while those with risk-neutral

attitudes perceive a lower probability of losses.

Zanin et al. (2020) analyzed the different dimensions of sustainability in the swine supply chain in industrial operations located in western Santa Catarina, Brazil. The study examined various stages of production—breeding, piglet rearing, finishing, and termination. Results showed that environmental sustainability policies were more prevalent in the breeding phase. Additionally, independent production was found to be less sustainable compared to the integration model, which demonstrated a higher level of sustainability.

When producers identify and manage risks and opportunities related to sustainability, they establish a risk management process that supports them in achieving their strategic objectives (Arjaliès & Mundy, 2013). Therefore, the third research hypothesis is proposed:

H3: Agribusiness risk management positively mediates the relationship between risk identification and ESG practices.

3. METHODOLOGY

In order to assess the identification of agribusiness risks and risk management in ESG practices on pig farms, a descriptive survey-based study was conducted using a quantitative approach. The research was carried out with pig farmers in the western region of the state of Santa Catarina, Brazil, as this area is considered a significant Brazilian exporter of pork (Epagri/Cepa, 2022).

The study population was defined as 150 pig farmers visited in the region. The final sample consisted of 100 rural producers from the municipalities of Cordilheira Alta, Coronel Freitas, Guaraciaba, Iporã do Oeste, Itapiranga, Palmitos, São João do Oeste, Tunápolis, and Xaxim, who voluntarily responded to the questionnaire, resulting in a response rate of 66.67% relative to the target population. The choice of this region is justified by its representativeness in Brazilian agribusiness, particularly in the swine production chain.

Table 2 presents the research constructs that represent the theoretical foundation of the concepts addressed. The literature offers various concepts and indicators related to agribusiness risks, risk management, and ESG practices. The theoretical gap identified lies in the integration of these themes.

For data collection, a questionnaire was administered directly to producers on their farms during October 2022, using a Likert scale. The questionnaire was validated based on the study by Conte (2022) and adapted for the swine production chain, drawing from the research of Alcantara (2020), Asseldonk (2007), the World Bank (2015), Zanin et al. (2020), and

Meuwissen, Huirne, and Hardaker (2001). In total, the instrument comprised 21 questions, organized into five distinct sections: profile of the rural enterprise owner; profile and identification of the swine production farm; agribusiness risks; agribusiness risk management; and ESG practices in agribusiness (Appendix).

Table 2
Research Constructs

Variable	Observable variables	Authors
Risk Management in Agribusiness	Risk Management Strategies (RMS)	Alcantara (2020); Conte (2022); Huirne et al. (2007); Meuwissen et al. (2001).
Agribusiness Risks	Environmental Risk Identification (ERI) Biological Risk Identification (BRI) Financial Risk Identification (FRI) Legal Risk Identification (LRI) Market Risk Identification (MRI) Operational Risk Identification (ORI)	Alcantara (2020); Conte (2022); Huirne et al. (2007); Meuwissen et al. (2001).
ESG Practices	Environmental (E) Social (S) Governance (G)	Banco Mundial (2015); Conte (2022); Zanin et al. (2020).

Source: Own elaboration (2025).

The collected data were compiled and organized in electronic spreadsheets for subsequent analysis and interpretation of results. For data analysis, Structural Equation Modeling (SEM) was employed using the SmartPLS 4 software, recognized as a robust and widely adopted approach for evaluating and measuring integrated risk management in the sustainability of pig farms. According to Aragón-Correa et al. (2008), SEM is an effective tool for testing hypotheses involving causal relationships between variables and other components. Codes (2005) further emphasizes that this technique stands out for its ability to test hypothetical relationships and explore interconnections among multiple variables.

4 RESULT ANALYSIS

A total of 100 responses were obtained from pig farmers in the Western mesoregion of Santa Catarina, of which 99% were male and 1% female. The majority of respondents (58%) were between 41 and 60 years old, while only 10% were between 21 and 30 years old. Regarding educational attainment, 28% of respondents had completed secondary education and 19% had not completed primary education, while only 14% held a university degree.

With regard to marital status, 76% of the respondents were married. Concerning the number of children, 48% declared having two children and 14% reported having none. When

asked about the number of children working on the farm, 60% stated that none of their children were directly involved in agricultural activities.

Most of the farms are located in the municipality of Itapiranga, accounting for 57% of the total, due to the presence of an integrated pig slaughtering unit. Regarding farm size, 58% of the respondents owned between 10 and 20 hectares, while only 1% owned more than 100 hectares. Concerning family generation, 67% of the interviewees were in the second generation, 19% in the third generation, and 14% represented the first generation leading pig farming activities.

In terms of experience in pig farming, 39% of respondents had over 20 years of experience, 24% had between 11 and 15 years, and 18% had between 16 and 20 years. In the context of family succession, 49% of the respondents stated they had plans for at least one family successor. However, 36% reported no expectation of family succession, which may suggest a time limit for the continuity of pig farming operations.

Table 3 presents the internal consistency and convergent validity analyses, according to the criteria established by Hair Jr. et al. (2009; 2014), Henseler et al. (2015), Martins (2006), and Ringle, Silva, and Bido (2014).

Table 3
Reliability and Convergent Validity of the Reflective Factors

	Cronbach's alpha	Composite reliability (RHO C)	Average variance extracted (AVE)
Risk Management	0,874	0,905	0,617
Agribusiness Risks	0,953	0,957	0,508
ESG Practices	0,935	0,943	0,516

Source: Research data (2025).

Table 3 demonstrates that all suggested criteria are acceptable. The results indicate that the set of indicators presents internal consistency and that the observable variables are positively correlated with the latent variables, ensuring the reliability of the measurements. Table 4 presents the discriminant validity criteria based on the Heterotrait-Monotrait ratio (HTMT). These results confirm that the data meet the necessary requirements and reinforce construct validity (Hair Jr. et al., 2009).

Table 4
Heterotrait-Monotrait (HTMT)

	Risk Management	Agribusiness Risks	ESG Practices
Risk Management	1		

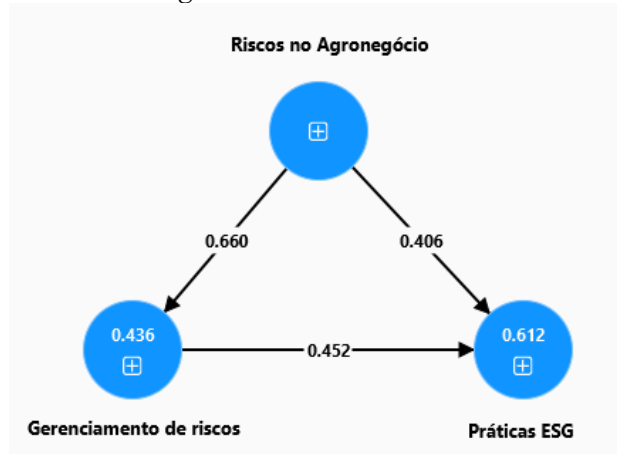
Agribusiness Risks	0,683	1	
ESG Practices	0,761	0,689	1

Source: Research data (2025).

For convergent validity (AVE), the acceptable threshold is above 0.50, as recommended by Hair Jr. et al. (2009; 2014). The tests yielded results of 0.508 for agribusiness risks, 0.617 for risk management, and 0.516 for sustainability. The correlations demonstrate that the study's latent variables are associated with each construct. These values confirm convergent validity through positive correlations among the variables. Moreover, composite reliability (RHO_C) also exceeded the recommended minimum value of 0.70.

The indicators in Table 4 confirm discriminant validity, as all values were below the 0.85 threshold, indicating proper differentiation among constructs. Thus, the analysis of discriminant validity is acceptable. Following these measurements, the structural model was assessed by analyzing the model's indirect effects and standardized coefficients (path coefficients), enabling comparison through the influence exerted among the variables, as shown in Figure 1.

Figure 1
Factor Loadings



Source: Own elaboration (2025).

In Figure 1, it can be observed that agribusiness risks strongly influence risk management (0.660), corroborating the study by Meuwissen, Huirne, and Hardaker (2007), who emphasize the role of risk management in reducing productive losses. Furthermore, agribusiness risks directly influence ESG practices (0.406), in line with Hair et al. (2014) and Zanin et al. (2020), who highlight that risk management in the agribusiness sector at the sustainability level reduces sectoral vulnerability.

Table 5
Significance of Factor Loadings of the Structural Paths

	Original Sample	Sample Mean	Standard Deviation	T-Statistic	P-values
Risk Management → ESG Practices	0,452	0,455	0,105	4,289	0,000
Agribusiness Risks → Risk Management	0,660	0,680	0,068	9,736	0,000
Agribusiness Risks → ESG Practices	0,406	0,412	0,128	3,175	0,002

Source: Research data (2025).

The T-test values ($p < 0.05$) presented in Table 5 demonstrate that the relationships are statistically significant, thus confirming the proposed hypotheses. Hypothesis 1, “Agribusiness risks positively influence ESG practices,” was confirmed, revealing a direct and positive relationship between risk identification in agribusiness and ESG practices. This finding is consistent with the studies by Meuwissen et al. (2001) and Huirne et al. (2007), who emphasized the importance of identifying agricultural risks.

Hypothesis 2, “Risk management positively influences ESG practices,” was also confirmed, showing that risk management promotes ESG practices. This aligns with the study by Zanin et al. (2020), who point out that integrated management fosters sustainability throughout the production chain. Hypothesis 3, “Agribusiness risks positively influence risk management,” which mediates ESG practices, confirms that risk management serves as a mediator between business risks and ESG practices.

Overall, the evidence gathered in this research suggests the existence of integration among the analyzed constructs. Although this integration is not widely recognized as a strategic tool by producers, it is incorporated as part of their operational routine. This integration is particularly evident among pig farmers, and the results demonstrate both the perspectives and planning necessary for the future of the activity.

5 FINAL CONSIDERATIONS

Agribusiness is exposed to a wide range of risks, which justifies the sector’s growing concern with risk management. This study enabled an understanding of the process of identifying and managing risks in the development of ESG practices in swine farming. Moreover, integrating risk management refers to the pursuit of more effective outcomes. In this context, although there are risk management models proposed in the literature, their integration still represents a gap to be explored.

The results indicated that, through mediation, agribusiness risks and risk management positively influence ESG practices on swine farms. It was shown that rural producers identify risks based on their personal experiences and beliefs. Furthermore, the study demonstrated that identifying risks before managing them can lead to more assertive outcomes, highlighting the relevance of producers' experience compared to conventional risk identification techniques.

Additionally, the lack of family successors on these farms stands out, which may lead to the abandonment of agricultural activities. In this regard, the absence of successors compromises not only the economic viability of producers but also the social and productive sustainability of rural areas as a whole. These findings underscore the existing risk of rural exodus and the need for the creation of tax incentives or differentiated rural credit for producers who include heirs in technical training and rural management programs.

The findings contribute to the literature by addressing the existing gap regarding the importance of risk identification on rural properties and the role of risk management in minimizing the negative externalities of agricultural activity. For rural producers, the results suggest better solutions to achieve sustainable production in environmental, social, and governance dimensions, going beyond practical experience to foster a sustainable environment, more efficient financial returns, and greater security for the future. In this way, the benefits extend to society as a whole, contributing to the ESG agenda, which remains underexplored in the agribusiness context.

Given the geographical limitation of this study, expanding data collection to different regions of the country could introduce new elements and generate more comprehensive results capable of elucidating the subject in a broader manner. The research points to opportunities for future studies in other segments of agribusiness and the inclusion of additional constructs that may impact ESG practices on producing farms.

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Apêndice A - Perfil do proprietário da empresa rural

1. Gênero:
☐ Feminino ☐ Masculino
2. Idade:
☐ Até 20 anos ☐ De 21 a 30 anos ☐ De 31 a 40 anos ☐ De 41 a 50 anos ☐ De 51 a 60 anos ☐ Acima de 60 anos
3. Formação escolar:
☐ Não alfabetizado ☐ Ensino fundamental incompleto ☐ Ensino fundamental completo ☐ Ensino médio incompleto ☐ Ensino médio completo ☐ Qualificação técnica ☐ Ensino superior incompleto ☐ Ensino superior completo
4. Estado civil
☐ Solteiro(a) ☐ Casado(a) ☐ União estável ☐ Divorciado(a) ☐ Viúvo(a)
5. Possui filhos?
☐ Nenhum ☐ 1 filho ☐ 2 filhos ☐ 3 filhos ☐ 4 filhos ☐ 5 ou mais
6. Quantos filhos trabalham na propriedade?
☐ Nenhum ☐ 1 filho ☐ 2 filhos ☐ 3 filhos ☐ 4 filhos ☐ 5 ou mais

Apêndice B - Informação da propriedade e identificação da atividade suinícola

1. Em qual município do estado de Santa Catarina sua propriedade está localizada? _____
2. Qual é o tamanho da sua propriedade?
☐ Menos de 10 hectares ☐ De 10 a 20 hectares ☐ De 21 a 50 hectares ☐ De 51 a 100 hectares ☐ Acima de 101 hectares
3. Em qual geração familiar a propriedade rural se encontra?
☐ Primeira geração ☐ Segunda geração ☐ Terceira geração ☐ Acima da terceira geração
4. Qual é o tempo de experiência na atividade suinícola?
☐ Menos de 1 ano ☐ De 1 a 5 anos ☐ De 6 a 10 anos ☐ De 11 a 15 anos ☐ De 16 a 20 anos ☐ Mais de 20 anos
5. Existe algum membro da família que dará continuidade aos negócios?
☐ Nenhuma pessoa ☐ 1 pessoas ☐ 2 pessoas ☐ 3 pessoas ☐ Mais de 3 pessoas
6. Qual é o número total de pessoas que trabalham na propriedade?
☐ 1 pessoa ☐ 2 pessoas ☐ 3 pessoas ☐ 4 pessoas ☐ 5 ou mais
7. Qual é o regime de integração da propriedade rural na atividade suinícola?
☐ Integrado ☐ Independente
8. Qual é o seu sistema de produção de suínos?
☐ Matrizes (UPL – Unidade produtora de leitão) ☐ Creche (UC – Unidade de creche) ☐ Terminação (UT – Unidade de terminação) ☐ Ciclo completo
9. Pretende realizar investimento para o crescimento da atividade suinícola?
☐ Sim ☐ Não ☐ Talvez
10. Qual é a capacidade/quantidade de produção de suínos por lote? _____
11. Indique a representatividade das culturas indicadas abaixo no faturamento da propriedade em %:
☐ % Suínos ☐ % Aves ☐ % Milho ☐ % Soja ☐ % Trigo ☐ % Verduras ☐ % Gado de corte ☐ % Gado de leite ☐ % Feijão ☐ % Outros
12. Qual é o faturamento anual da propriedade na atividade da suinocultura?
☐ Até R\$ 400.000,00 ☐ De R\$ 401.000,00 a R\$ 700.000,00 ☐ De R\$ 701.000,00 a R\$ 1.100.000,00 ☐ De R\$ 1.100.000,01 a R\$ 1.400.000,00 ☐ Acima de R\$ 1.400.000,00

Apêndice C- Riscos no agronegócio

1. A partir da sua percepção, indique em que medida os riscos listados abaixo impactam na atividade de produção de suínos (escala tipo *Likert* de 5 pontos, 1- Não impacta, 2- Pouco impacta, 3- Indiferente, 4- Impacta parcialmente, 5- Impacta totalmente):
 - a. Risco ambiental:
 - i. Condições climáticas (seca, excesso de chuva, ciclones, etc.);
 - ii. Risco relacionado ao fornecimento de água;
 - iii. Riscos relacionados aos resíduos gerados pela atividade;
 - iv. Risco relacionado com a qualidade da água (problemas de contaminação).
 - b. Risco biológico:
 - i. Contaminação da ração;
 - ii. Perdas na produção decorrentes da transmissão de doenças no plantel;
 - iii. Danos severos de pragas (presença de insetos ou roedores no galpão).
 - c. Risco financeiro:
 - i. Dificuldades de acesso às fontes de financiamento para investimento;
 - ii. Aumento da taxa de juros de financiamento;
 - iii. Redução no preço de venda dos suínos;
 - iv. Variação da taxa de juros de financiamento.
 - d. Risco de inovação:
 - i. Perda de competitividade decorrentes da falta de investimento em tecnologias.
 - e. Risco legal:
 - i. Regulações ambientais, trabalhistas e tributárias;
 - ii. Perda de incentivos fiscais;
 - iii. Imposição governamental para transmissão de movimentações operacionais da atividade rural;
 - iv. Perda de subvenção do governo.
 - f. Risco de mercado:
 - i. Aumento nos custos de produção;
 - ii. Recessão econômica do país;
 - iii. Mudanças de hábito do consumidor;
 - iv. Aumento da Inflação;
 - v. Problemas na exportação da produção.
 - g. Risco operacional:
 - i. Danos/problemas às máquinas e equipamentos;
 - ii. Produtividade abaixo do esperado;
 - iii. Risco de falta de sucessão familiar;
 - iv. Escassez de mão de obra familiar;
 - v. Falta de segurança (ocorrência de roubos);
 - vi. Greves e processos trabalhistas dos funcionários da propriedade;
 - vii. Problemas com o abastecimento de eletricidade;
 - viii. Risco humano ou pessoal (acidentes, doenças, problemas pessoais, etc.).

Apêndice D - gerenciamento de riscos no agronegócio

1. A partir da sua percepção, indique em que medida você utiliza ou não as estratégias de gerenciamento de riscos listadas abaixo na atividade suinícola (escala tipo *Likert* de 5 pontos, sendo 1- Não utilizado, 2- Pouco utilizado, 3- Utilizado ocasionalmente, 4- Utilizado, 5- Utilizado sempre):
 - a. Risco ambiental:
 - i. Falta de água: Estocagem de água através de cisternas;
 - ii. Resíduos gerados pela atividade: Aproveitamento dos resíduos suínos para gerar energia elétrica;
 - iii. Resíduos gerados pela atividade: Participação em programas de capacitação ambiental;
 - iv. Condições climáticas (seca, excesso de chuva, ciclones, etc.): Construção de valas para direcionar a água ou inundações para longe de certas áreas;
 - v. Condições climáticas (seca, excesso de chuva, ciclones, etc.): Contratar um seguro para a propriedade que tenha cobertura para danos provocados pelo mau tempo;
 - vi. Condições climáticas (seca, excesso de chuva, ciclones, etc.): Implementação de práticas de conservação do solo e da água.
 - b. Risco biológico:
 - i. Perdas na produção decorrentes da transmissão de doenças: Vacinas mais eficientes;
 - ii. Perdas na produção decorrentes da transmissão de doenças: Isolamento do galpão a outros animais através de barreiras físicas (cercas) e barreiras naturais (árvores);
 - iii. Perdas na produção decorrentes da transmissão de doenças: Controle de entrada e saída de insumos, equipamentos, pessoas que passam pela portaria de acesso a granja de suínos.
 - c. Riscos de inovação:
 - i. Perda de competitividade decorrente da falta de investimento em tecnologias: Diminuir riscos com a adoção de tecnologias que auxiliem em todo o processo produtivo - incluindo a gestão de custos da propriedade rural.
 - d. Risco de mercado:
 - i. Política de garantia de preço mínimo através de contrato: Contratos antecipados/integrado;
 - ii. Estocagem de materiais: Armazenagem através da construção de silos e armazéns.
 - e. Risco financeiro:
 - i. Risco de perdas com vendas: Seguro contra perdas no recebimento de vendas;
 - ii. Contratos de financiamentos: Taxa de juros de financiamento: fixa em contrato.
 - f. Risco legal:
 - i. Risco trabalhista: Assessoria contábil-jurídica de avaliação de risco;
 - ii. Risco tributário: Assessoria contábil-jurídica de avaliação de risco;
 - iii. Risco ambiental: Assessoria jurídica-ambiental de avaliação de risco;
 - iv. Incentivo ao produtor: Controle semanal de peso/conversão.

- g. Risco operacional:
- i. Risco de acidente de trabalho / trabalhista: Seguro de vida para os empregados;
 - ii. Risco de logística do produto: Seguro para a entrega da produção;
 - iii. Risco com manuseio de máquinas e equipamentos: Seguro para as máquinas, equipamentos e propriedade;
 - iv. Custo elevado com energia elétrica: Reaproveitamento de dejetos para geração de energia elétrica;
 - v. Oscilação na temperatura do ambiente (galpão): Uso de termômetros e de sistemas (equipamentos) de ventilação e de aquecimento;
 - vi. Falta de segurança (ocorrência de roubos): Monitoramento e seguros;
 - vii. Falta de mão de obra qualificada: Investir em treinamentos e cursos de qualificação para os empregados;
 - viii. Problemas com o abastecimento de energia elétrica: Aquisição de geradores de energia elétrica.

Apêndice E - práticas de ESG no agronegócio

Indique em que medida você realiza ou não as práticas ambientais, sociais e de governança corporativa (ESG), listadas abaixo: (escala tipo *Likert* de 5 pontos, sendo 1- Não realizado, 2- Pouco realizado, 3- Realizado ocasionalmente, 4- Realizado, 5- Realizado sempre):

a. Ambiental:

- i. Prevenção contra resíduos e desperdícios;
- ii. Reaproveitamento de resíduos gerados na produção;
- iii. Utilização de matéria prima de fonte secundária (reciclagem);
- iv. Redução no uso de água;
- v. Combate ao desperdício de energia elétrica;
- vi. Adoção de energias limpas e renováveis (por exemplo: biodigestor);
- vii. Redução da quantidade de resíduos tóxicos e perigosos gerados na produção;
- viii. Redução das emissões dos gases de efeito estufa gerados na produção e no transporte;
- ix. Implantação um sistema de esgoto ou algum tipo de fossa na propriedade;
- x. Plantio de árvores para fins de conservação do solo;
- xi. Captação da água da chuva e/ou reutiliza água;
- xii. Faz coleta seletiva de lixo;
- xiii. Atendimento das normas e legislação (manter áreas de preservação permanente - APP, por exemplo);
- xiv. Controle e manejo de pragas (baratas, pulgas, roedores, etc.);
- xv. Realiza a preservação ambiental e dos recursos naturais;
- xvi. Proteção a nascentes e fontes de água;
- xvii. Adubação orgânica, compostagem e emprego de biofertilizantes;
- xviii. Devolução de embalagens de medicamentos utilizados na produção.

b. Social:

- i. Redução de acidentes de trabalho e medidas tomadas após o acidente;
- ii. Atuação junto a escolas e oferecer capacitação para a comunidade;
- iii. Preparo para emergências (primeiros socorros);
- iv. Capacitação para funcionários;
- v. Benefícios oferecidos aos funcionários;
- vi. Exigência de uso correto de EPIs pelos trabalhadores;
- vii. Contrata trabalhadores em regime de CLT;
- viii. Participou de programas educacionais e de capacitação na área ambiental;
- ix. Promoção de políticas e relações de trabalho;
- x. Conformidade com as leis trabalhistas vigentes.

c. Governança corporativa:

- i. Conformidade nos pagamentos dos tributos;
- ii. Adoção de algum indicador de sustentabilidade;
- iii. Avaliação dos impactos ambientais decorrentes da atividade suinícola;

- iv. Monitoramento de forma adequada do trabalho dos funcionários quando não está presente na propriedade;
- v. Implementação de um conselho de família (conselho responsável por propor e monitorar as atividades da família);
- vi. Criação e divulgação de relatório de sustentabilidade;
- vii. Mapeamento de riscos corporativos e operacionais;
- viii. Regras ou políticas de remuneração do trabalho dos sócios;
- ix. Plano de sucessão familiar.