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Influence of Challenges Associated with Frugal Business Modelling on the Agribusiness Sustainability: The Moderating Effect of Environmental Munificence

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Abstract

This study investigates the relationship between the challenges associated with frugal business modeling and the sustainability of agribusiness firms, as well as the moderating effect of environmental munificence. The study employed a cross-sectional survey design and targeted managers and operational staff working in agribusinesses affiliated with the National Association of Seed Traders of Ghana (NASTAG). The collected data underwent a series of statistical analyses, including the data analysis method used for this research is the Structural Equation Model Partial Least Square (SEM- PLS) with the help of the SmartPLS 4.0 application. These analyses were performed on the questionnaires, which contained variables assessing the challenges related to frugal business modelling, variables assessing the determinants of agribusiness sustainability as well variables assessing environmental munificence. The findings indicate that the challenges associated with frugal business modelling, such as resource constraints, information gaps, and institutional barriers, have a statistically significant negative influence on the level of sustainability exhibited by agribusiness firms. The moderating effect of environmental munificence only partially mitigates this negative relationship. The challenges inherent in frugal business modelling pose a significant threat to the sustainability of agribusiness operations, even in resource-abundant environments. Agribusiness firms and policymakers must develop comprehensive strategies to address these challenges, focusing on resource leveraging, knowledge sharing, collaborative partnerships, and supportive regulatory frameworks. The study highlights the complex and nuanced relationship between frugal innovation, sustainable business practices, and the role of contextual factors in the agricultural sector. The findings underscore the need for a holistic approach to fostering sustainable agribusiness development, with both organisational and policy-level interventions.

Keywords: Frugal business modelling, agribusiness sustainability, frugal innovation, system resource model, contingency model

1.0 Introduction

Agribusiness, the fusion of agriculture and business, has become a critical sector in driving economic growth, particularly in developing countries (Davis & Goldberg, 1957). However, the agribusiness landscape is fraught with numerous challenges, including the need to achieve more with fewer resources

- a concept known as frugality (Radjou & Prabhu, 2015). Frugal business modelling has emerged as a strategy for agribusinesses to navigate resource constraints and serve lower-income populations (Tiwari *et al.*, 2017).

Yet, the implementation of frugal business models is not without its own set of challenges. Weyori *et al.* (2017) suggest that the low productivity in the agricultural sector of developing countries can be linked to a lack of innovative concept development and insufficient adoption of advanced agricultural technologies introduced by agribusinesses. Factors such as access to technologies, indigenous networking, and social interactions among stakeholders have been identified as crucial in shaping the success of agribusiness models (Weyori *et al.*, 2017).

Furthermore, the sustainability of agribusiness institutions has become a pressing concern, with many ceasing operations due to insufficient funding (Fagerberg, Martin & Andersen, 2013). The issue of sustainability has been a prominent area of focus, but there has been limited attention given to addressing the key determinants of agribusiness sustainability, especially within the context of frugal business modelling (French et al., 2014).

The objective of this study is to investigate the influence of challenges related to frugal business modelling and the sustainability of agribusiness institutions. Additionally, the study will investigate the moderating role of environmental munificence, which refers to the availability of resources and opportunities in the external environment, in shaping the relationship between frugal business modelling challenges and agribusiness sustainability.

By addressing this research gap, this study seeks to provide valuable insights into the complex dynamics of frugal business modelling and its impact on the long-term viability of agribusiness enterprises, particularly in developing country contexts. The findings of this research can inform policymakers, agribusiness leaders, and stakeholders on the strategies and interventions required to enhance the sustainability of the agribusiness sector.

2.0 Review of Related Literature

2.1 Frugal Innovation Theory

In a time characterised by resource constraints and rising global disparities, the concept of frugal innovation has emerged as a transformative approach to value creation. The essence of frugal innovation lies in the ability to achieve more with fewer resources, minimising the use of scarce inputs like time, energy, and capital, while concurrently generating social and business value (Radjou & Prabhu, 2015). This innovative mindset represents a profound departure from traditional innovation models, offering a compelling alternative that is particularly relevant in the context of emerging markets and sustainable development.

The foundations of frugal innovation draw from several established theoretical perspectives. The resource-based view of the firm (Barney, 1991) highlights the strategic importance of deploying scarce resources to gain a competitive edge, while the penurious innovation literature (Basu *et al.*, 2013) emphasises the value of innovating under resource constraints. Additionally, frugal innovation aligns with the concept of "jugaad" – an Indian term that refers to an innovative fix or a flexible workaround used to address a problem (Radjou *et al.*, 2012). This spirit of improvisation and the ability to create value with limited means forms a crucial underpinning of the frugal innovation approach.

At the heart of frugal innovation are several core characteristics that distinguish it from conventional innovation models. Affordability is a primary focus, as frugal innovations strive to create high-quality

products and services that are accessible to low-income consumers (Radjou & Prabhu, 2015). Simplicity in design and functionality is another hallmark, with frugal innovators eschewing unnecessary complexity in favour of elegant and efficient solutions (Bhatti *et al.*, 2018). Sustainability is also a key consideration, as frugal innovations are designed to be environmentally sustainable and socially responsible (Hossain, 2021). Additionally, frugal innovations are characterised by their flexibility, allowing them to be readily adapted to diverse user needs and contexts, as well as their scalability, enabling rapid diffusion to reach a large number of consumers (Radjou & Prabhu, 2015; Bhatti *et al.*, 2018).

The applications of frugal innovation are far-reaching, with significant impact in several domains. In emerging markets, frugal innovations have been widely adopted, addressing the pressing need for affordable and accessible solutions (Radjou & Prabhu, 2015). In the realm of social impact, frugal innovations have been instrumental in improving access to essential services, such as healthcare, energy, and education, in resource-constrained settings (Hossain, 2021). Furthermore, frugal innovations have the potential to contribute to environmental sustainability by minimising resource consumption and waste (Hossain, 2021). Perhaps most intriguing is the concept of "reverse innovation," where frugal innovations developed for emerging markets can be adapted and diffused to more affluent markets, challenging traditional innovation processes (Govindarajan & Trimble, 2012).

2.2 Contingency Theory

At the heart of contingency theory lies the recognition that organisations operate within dynamic and complex environments, and their ability to adapt to these changing conditions is crucial for their long-term success. The seminal work of Lawrence and Lorsch (1967) highlighted the need for organisations to integrate and differentiate their subunits in response to the demands of the external environment. This open systems perspective (Katz & Kahn, 1966) underscores the interdependent relationship between an organisation and its environment, requiring organisations to continuously align their internal structures and practices with evolving environmental factors.

Building on these foundational insights, contingency theory has continued to evolve, incorporating new theoretical perspectives and empirical findings. One notable advancement is the integration of the resource-based view of the firm (Barney, 1991) with the contingency approach. This integration recognises that an organisation's unique resources and capabilities play a vital role in shaping its ability to adapt to environmental contingencies (Nadkarni & Herrmann, 2010). Additionally, the cognitive perspective on contingency theory has emphasised the importance of managers' perceptions of environmental uncertainty and their ability to interpret and respond to contextual factors (Nadkarni & Barr, 2008).

These theoretical advancements have been accompanied by a wealth of empirical research exploring the contingent relationships between various organisational phenomena and their environmental and contextual determinants. Studies have examined how organisational structure, leadership, innovation, and management control systems are influenced by factors such as environmental dynamism, technological change, and competitive intensity. For instance, researchers have found that organic organisational structures, characterised by decentralisation and flexibility, tend to be more effective in turbulent environments, while mechanistic structures are more suitable for stable environments (Cao *et al.*, 2012). Similarly, the effectiveness of transformational leadership has been shown to be contingent on the level of environmental uncertainty (Waldman *et al.*, 2001), and the strategic decision-making

processes of organisations are shaped by both environmental and organisational factors (Elbanna & Child, 2007).

The contingency approach has also provided valuable insights into the factors that enable organisations to innovate and adapt to change. Studies have demonstrated that the relationship between organizational ambidexterity (the ability to balance exploration and exploitation) and performance is contingent on environmental dynamism (Jansen *et al.*, 2009), and the impact of organisational culture on innovation is influenced by the level of market competition (Uzkurt *et al.*, 2013).

Furthermore, the design and implementation of management control systems have been examined through the lens of contingency theory, with researchers highlighting the role of technology, organisational structure, and environmental uncertainty in shaping these systems (Chenhall, 2003).

2.3 Agribusiness and Frugal Business Modelling

The agribusiness system encompasses the entire range of activities involved in the procurement, distribution, production, and marketing of agricultural products, with a systematic interconnection to other related activities (Firmansyah *et al.*, 2003). This concept has since evolved, giving rise to "Agribusiness Systems Analysis," which acknowledges that agriculture is no longer an isolated sector but rather an interdependent system comprising specialised agents across interconnected industries.

Over time, the value added at the farm level has tended to decline as a percentage of the overall value of production, with significant strategic implications. Davis & Goldberg (1957) were the first to highlight that profit margins rise as a product gets closer to its ultimate market destination, and their Agribusiness Systems Model emphasises these inter-sectoral linkages. However, their research is based on the assumption of costless market processes and seamless interactions, without considering the role of other institutions.

The agribusiness system can be viewed as a collection of interdependent subsystems, each with specific inputs and a transformation process that converts these inputs into outputs. This framework is influenced by various disciplines, such as plant science, industrial strategies, marketing, and institutions, all working together to facilitate the production of agricultural goods and services (Thony, 2012). To enhance accessibility and affordability, the concept of frugality has emerged, involving the minimisation of resource use (raw materials, production resources, energy, fuel, water, waste, and financial resources). This approach is often linked to the pursuit of sustainability (Albert, 2019).

Zeschky *et al.* (2014) argue that resource-constrained innovations, such as frugal business models, can provide cost-effective alternatives to existing Western models, particularly suitable for consumers in developing markets. The concept of the business model itself has evolved, from its initial association with system modelling and operational endeavours to a more nuanced understanding that encompasses four key elements: value proposition, creation and delivery of value, revenue model, and customer interface (Chesbrough, 2007). This evolution has been influenced by the increasing availability and affordability of information technology, particularly with the widespread adoption of the internet for commercial purposes in the mid-1990s (Zott *et al.*, 2011). The whole concept of business models has evolved over time, from just being about the operational details to including things like the value provided to customers, how that value is created and delivered, and how the business makes money (Chesbrough, 2007). This has been influenced by the growth of the internet and technology.

2.4 Challenges associated with Frugal Business Modelling

Frugal innovation has emerged as a popular approach in recent years for developing sustainable business models that cater to the needs of low-income consumers. However, implementing frugal business models comes with its own set of challenges. Businesses that adopt such models must navigate various economic, social, and cultural factors that can influence their success. One significant challenge in establishing agribusinesses, as highlighted by Bruinsma (2009), is the lack of adequate funding and high lending rates. Many agribusinesses are founded by individuals with limited financial resources, resulting in financial stress and limited access to corporate or government support (Ousmane, 2008). To ensure the sustainability and growth of the agribusiness sector, it is crucial to improve efficiency and productivity by integrating into global value chains and promoting diversification of rural livelihoods.

Research on agribusiness operations in Australia has identified key challenges such as poor organisational structure, low output, insufficient technical knowledge, inadequate training, weak industrial relations, and inadequate management (Bandarla, 1991). Furthermore, Evans and Wurster (2000) emphasised the challenge of developing a comprehensive measurement of a company's capacity and capability, which is essential for identifying core competencies and sustaining a competitive advantage.

The security of intellectual capital and competence was identified as a significant challenge in agribusiness operations by Jules (2006). While agribusinesses may be capable of assessing their current operational capacity, they often struggle to identify the competencies and capacities required for future success.

According to Todd and Rose (2006), agribusinesses encounter challenges in accessing formal, low-interest credit. Access to credit is crucial for funding routine activities and formulating effective policies. The inability to access credit often hampers the growth and performance of agribusinesses, leading to suboptimal outcomes.

Overall, these challenges underscore the complex nature of agribusiness operations and highlight the importance of addressing financial, organisational, knowledge, and credit-related hurdles to achieve sustainable and successful outcomes.

2.5 Theory of Sustainability

The theory of sustainability emphasises the efficient use and preservation of valuable resources. The stability, abundance, and flexibility of the organisations and institutions responsible for people's access to resources and their distribution are crucial for social sustainability. However, supporting the sustainability of these institutions is not just about preserving individual organisations. Instead, it means supporting people in creating and improving the legal, financial, and regulatory environments that allow strong institutions to thrive. Well-functioning institutions make it possible to allocate and use resources in an efficient and transparent way (Morita *et al.*, 2019).

The overall concept of sustainability has been shaped by influential reports like the Brundtland Report, Agenda 21, and the 2002 World Summit on Sustainable Development. These reports are recognised for establishing the "three-pillar" model, which includes the economic, environmental, and social aspects of sustainability theory.

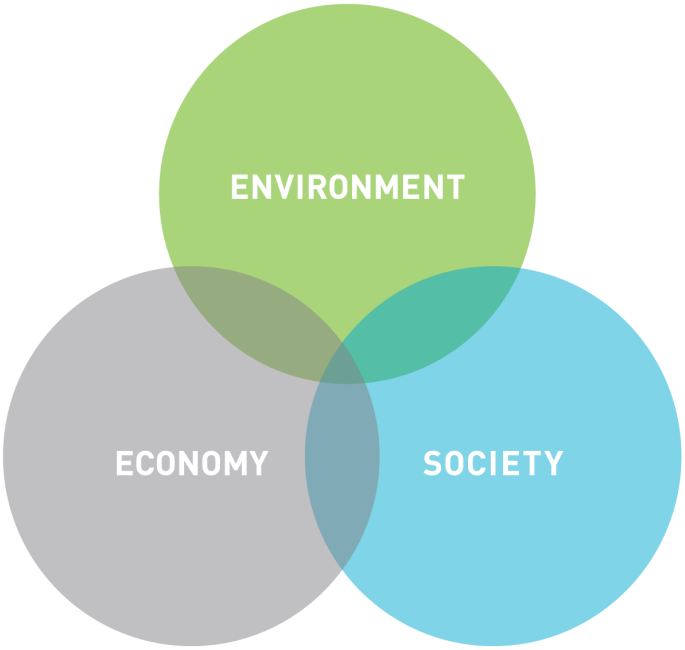

Figure 1: Three Pillars of Sustainability (Brundtland Report, 2022)

2.6 Moderating Variable

The prevailing conditions of the environment are considered a crucial factor that can influence the challenges associated with implementing frugal business models (Rosca *et al.*, 2020). In this context, "environmental munificence" refers to the extent to which the environment has the potential to support the growth and stability of organisations (Karna *et al.*, 2021). Environmental munificence can help organisations build up a cushion of additional resources, known as "slack resources," that can be used during periods of scarcity or to support organisational innovation (Mishina *et al.*, 2004). Conversely, in less munificent or abundant environments, resource acquisition can be more challenging, and competition for the limited available assets tends to intensify (Kuivalainen *et al.*, 2021). The level of environmental munificence likely influences the relationship between global development and firm performance outcomes. Firms operating in munificent environments tend to be less concerned about vulnerability and intense competition, as they can more easily access the resources they need (Zheng *et al.*, 2022). Munificent environments allow firms to more readily obtain the resources they require and mitigate resource scarcity issues. Therefore, a munificent domestic market environment, rather than just competitive advantage, may drive agribusiness firms to pursue international expansion (Bhatnagar & Gopalaswamy, 2021).

In summary, the overall abundance or scarcity of resources in the environmental context can be a critical factor shaping the challenges and opportunities for the implementation of frugal business models (Rosca *et al*., 2020).

3.0 Methodology

This study employed a cross-sectional survey approach to gather data from managers and operational staff working in fifty-eight (58) agribusinesses affiliated with the National Association of Seed Traders of Ghana (NASTAG). The purpose of the survey was to examine the relationships among the variables under investigation. The choice of this design was appropriate because the study adopted a quantitative approach, necessitating the measurement of variables.

The researchers used the Purposive Sampling Technique to select participants, focusing on managers, administrators, and operational staff from agribusinesses registered with NASTAG. Including top-level managers as subjects allowed the authors to gain insights into how these managers perceive the challenges of frugal business modelling and sustainability of agribusinesses as well as the moderating impact of environmental munificence on that relationship.

The total population of NASTAG is 289, and the sample size was determined using the Slovin (1960) formula. According to Slovin's formula, when the error tolerance is not specified, the researcher can determine their error tolerance by subtracting 1 from an estimate of the confidence level. In this case, the researcher aimed for a 95 percent confidence level, resulting in a sample size of 205.

The researchers distributed questionnaires through an online Google Form and received 205 responses from the participants. The collected data underwent a series of statistical analyses, including the Structural Equation Model Partial Least Square (SEM-PLS) with the help of the SmartPLS 4.0 application.

4.0 Results and Findings

4.1 Structural Equation Model (SEM) Analysis - Reliability and Viability

For this part of the study, the construct was assessed with the extracted variables challenges associated with FBM moderated by variable environmental munificence. Similar to the earlier analysis, reliability and validity was determined using Cronbach's Alpha, Composite Reliability, Average Variance Extracted (AVE) and Heterotrait-monotrait ratio (HTMT). As per the recommended values of Vinzi *et al.* (2010), to prove model suitability are as follows Cronbach's Alpha (≥0.70), Composite Reliability (≥0.70), AVE (≥0.50) and HTMT (≤ 0.85). Tables 1 and 2 shows that all variables all met the threshold, as such, it is established that there is good evidence of reliability and validity constructs used for the proposed model for the study.

Table 1: Convergent Validity for Variables Moderating Effect of Environmental Munificence on the Relationship between level of Challenges associated FBM and the Sustainability of Agribusinesses

Latent Variables	CA (≥0.70)	rho_a (≥0.70)	rho_c (≥0.70)	AVE (≥0.50)
Challenges of FBM	0.690	0.785	0.815	0.602
Sustainability	0.778	0.822	0.854	0.664

Source: Field Data (2023) | CA = Cronbach's alpha; rho_a = Composite reliability; rho_c = Composite reliability; AVE = Average Variance Extracted

Table 2: Discriminant Validity for Variables Moderating Effect of Environmental Munificence on the Relationship between level of Challenges associated FBM and the Sustainability of Agribusinesses

	HTMT	Threshold
Environmental Munificence <-> Challenges	0.421	**≤ 0.85**
Sustainability <-> Challenges	0.415	
Sustainability <-> Environmenrtal Munificence	0.097	

Source: Field Data (2023) | HTMT = Heterotrait-monotrait ratio

4.2 Path Analysis

Figure 1 below depicts the path diagram. The path diagram analysis produces path coefficients analysis which are captured in Table 3. All paths represented by directed arrows (Figure 2) in the conceptual model indicate causal relationships. The paths of the full model serve as the underlying structure to research objective.

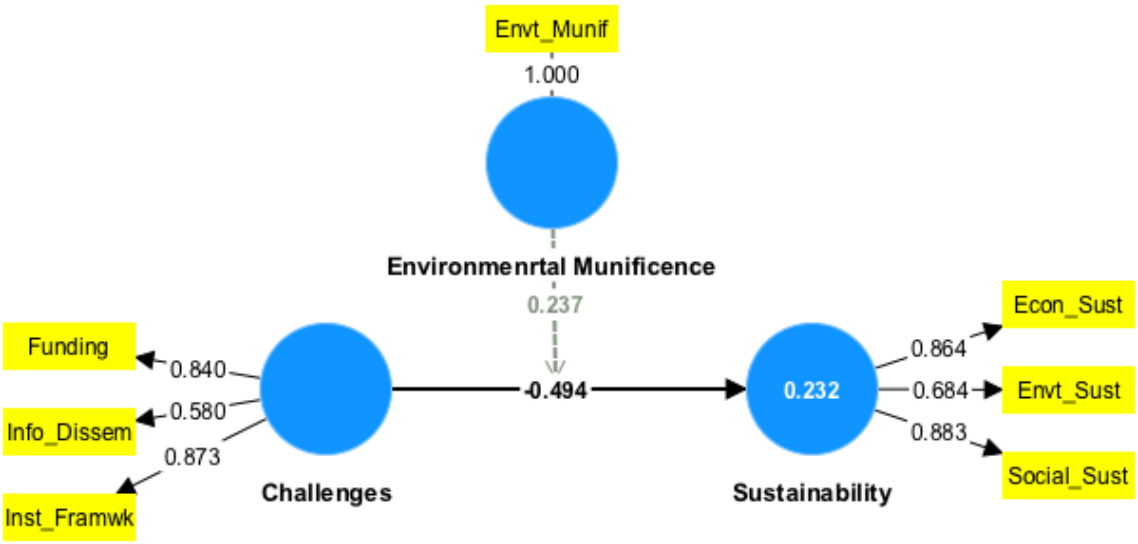

Figure 2: Path Diagram for Environmental munificence moderation impact on the relationship between Challenges associated FBM and Sustainability of Agribusinesses
Source: Field data (2023)

Table 3 shows that the environmental munificence moderation impact on challenges associated with FBM have positive coefficient and statistically significant influence on the sustainability of agribusinesses. The path coefficient of moderation construct as shown in table 3 is 0.237 at a significance p-value which is less than P<0.05. This means that the null hypothesis formulated to answer the research question of the fourth objective is rejected. It is therefore concluded that the environmental munificence moderation impact on challenges associated with FBM had significant positive effect on the sustainability of agribusinesses in Ghana. The R^2 value from Table 4 of the model is 0.232 who shows the model has a low degree of explanatory power. The R^2 value shows that the explanatory power of sustainability contributed by challenges associated with FBM challenges of FMB moderated by environmental munificence is 23.2%. Effect size is the effect of exogenous variables on endogenous variables using the explanatory effect value f^2 of environmental munificence and challenges to sustainability as shown by Table 4 is 0.088. This displays a small-effect explanatory ability. This represents that exogenous variables may be mildly capable of explaining endogenous variables, with a small degree of explanatory effect value. Therefore, the model in this study explains the latent variables well and it has a small degree of explanatory power.

Table 3: Path Coefficient of Moderating Effect of Environmental Munificence on Challenges associated with FMB and Sustainability of Agribusinesses

Path Analysis	Path coefficient	P Values
Environmental Munificence x Challenges -> Sustainability	0.237	0.000

Source: Field Data (2023)

Table 4: R^2 Value and f^2 Value

Path Analysis	R^2	R^2 Adjusted	f^2
Environmental Munificence x Challenges -> Sustainability	-0.400	0.220	0.088

Source: Field Data (2023)

4.3 Model Fit

Table 5 shows a model that has no multicollinearity problem since all the variables had VIF values are less than the threshold of 3, and thus conclusive that there is no multicollinearity problem and as the model fit is acceptable. Table 6 shows the SRMR value of the model evaluation verification to be 0.108 and the NFI value of 0.558. Therefore, though the SRMR and NFI values are not within the acceptable value ranges, the values can be deemed to be fairly acceptable. Thus, the model can be deemed to be reasonably fitted in general.

Table 5: Collinearity Statistics for Moderating Effect of Environmental Munificence on Challenges associated with FBM and Sustainability of Agribusinesses (VIF)

Variables	VIF
Outer Model List	
Environmental Munificence	1.000
Environmental Munificence x Challenges	1.000
Inner Model List	
Environmental Munificence x Challenges -> Sustainability	1.150

Source: Field Data (2023)

Table 6: Model Fit for Moderating Effect of Environmental Munificence on Challenges associated with FBM and Sustainability of Agribusinesses

Model Evaluation	Value
SRMR	0.108
NFI	0.558

Source: Field Data (2023)

5.0 Conclusions

The challenge associated with frugal business modelling had a statistically significant negative influence on the level of sustainability exhibited by agribusinesses. The study also found that after moderating by environmental munificence on funding, information and dissemination, and institutional framework challenges remained negative coefficient and statistically significant influence on the sustainability of agribusinesses.

From a theoretical standpoint, the finding that environmental munificence, while able to moderate some of the negative effects, does not fully eliminate the adverse influence of frugal business modelling challenges on sustainability, highlights the importance of considering contextual factors in the study of sustainable business practices. This supports the contingency theory perspective, which emphasises the

need to account for the specific environmental conditions that shape organisational outcomes (Rosca *et al.*, 2020).

From a practical standpoint, this conclusion suggests that agribusiness firms need to carefully navigate the challenges associated with implementing frugal business models to ensure the long-term sustainability of their operations. Managers may need to develop strategies to address resource constraints, information gaps, and institutional barriers more effectively to mitigate the negative impacts on sustainability. Moreover, the moderating role of environmental munificence indicates that agribusiness firms operating in resource-abundant environments may be better positioned to overcome the obstacles of frugal business modelling and maintain sustainable practices. This underscores the importance of understanding the local context and leveraging available resources to support sustainable development.

The policy implications of this conclusion highlight the need to implement measures that improve access to funding, enhance information dissemination, and strengthen institutional frameworks to address the challenges faced by agribusiness firms. This could involve providing financial incentives, facilitating knowledge sharing, and developing regulatory frameworks that are conducive to sustainable agricultural practices. Additionally, policymakers should consider policies that enhance environmental munificence, such as investments in infrastructure, natural resource management, and the promotion of sustainable agriculture. By fostering a more supportive and resource-abundant environment, policymakers can help agribusiness firms overcome the challenges of frugal business modelling and achieve greater sustainability.

6.0 Recommendations

The research findings demonstrate that the challenges inherent in frugal business modelling, such as resource constraints, information gaps, and institutional barriers, have a statistically significant negative influence on the level of sustainability exhibited by agribusinesses. This underscores the complex and nuanced relationship between the pursuit of cost-effective and resource-efficient solutions and the long-term viability of agricultural enterprises.

Interestingly, the study also found that the moderating effect of environmental munificence, or the abundance of resources in the local context, only partially mitigates the negative impact of frugal business modelling challenges on sustainability. Even in resource-rich environments, the obstacles posed by frugal business modelling continue to exert a statistically significant adverse influence on the sustainability of agribusiness operations.

These findings have important implications for both agribusiness leaders and policymakers. From a strategic management perspective, agribusiness firms must develop comprehensive strategies to address the challenges associated with frugal business modelling. This may involve identifying and leveraging available resources more effectively, enhancing knowledge sharing and collaborative partnerships, and engaging with policymakers to advocate for a more supportive regulatory framework. This imperative is not only crucial for the long-term viability of individual agribusiness firms but also for the broader global goals of food security, environmental protection, and social well-being.

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