sustainability

MDPI

Article

Determining Factors on Green Innovation Adoption: An Empirical Study in Brazilian Agribusiness Firms

Alexandre Rodrigues da Silva, Claudia Brito Silva Cirani, Fernando Antonio Ribeiro Serra, Angélica Pigola *, Priscila Rezende da Costa, Isabel Cristina Scafuto, Roberto Lima Ruas and Marcos Rogério Mazieri

Postdoctoral and Master Program in Administration, Vergueiro Campus, Nove de Julho University, São Paulo 01525-000, SP, Brazil

* Correspondence: a_pigola@uni9.edu.br

Abstract: Green innovation has become one of the mainstream concepts to address environmental issues. However, research on green innovation, especially at the firm level, is still evolving. Building upon the natural resource-based view (NRBV) and resource-based theory (RBT) lenses, this study proposes a research framework to explore determining factors of green innovation adoption (GIA) in the Brazilian cassava agribusiness sector. The research design from the semi-structured interviews method was employed in firms associated with ABAM (Brazilian Association of Starch and Cassava Producers) and SIMP (Union of Cassava Producers in Paraná). The findings suggest that behavioral factors for GIA, such as collaborative behaviors, productivity, safety behaviors, and green behaviors, are directly associated with other determining factors, such as knowledge, operating costs, stakeholder pressure, economic benefits, information access, customer assessment, organizational compatibility, and business support. Furthermore, GIA can lead to the effective implementation of sustainable practices to enhance economic performance and effective environmental management. The originality of this work stems from including behavioral factors for managers' decision-making regarding resource allocation for GIA. It also includes a guideline to increase competitiveness in active green markets. It also contributes to a vision of GIA to evolve NRBV and RBT theories.

Keywords: determining factors; green innovation; economic performance; environmental management; behavioral factors

Citation: da Silva, A.R.; Cirani, C.B.S.; Serra, F.A.R.; Pigola, A.; da Costa, P.R.; Scafuto, I.C.; Ruas, R.L.; Mazieri, M.R. Determining Factors on Green Innovation Adoption: An Empirical Study in Brazilian Agribusiness Firms. *Sustainability* **2023**, *15*, 6266. https://doi.org/10.3390/su15076266

Academic Editors: Jerzy Rosłon, Mariola Książek-Nowak, Aleksander Nicał and Paweł Nowak

Received: 3 March 2023
Revised: 30 March 2023
Accepted: 4 April 2023
Published: 6 April 2023

1. Introduction

Green innovation tends to improve a firm's overall image as it meets socioenvironmental appeals by reducing negative environmental impacts. Therefore, green innovation can lead to better performance [1]. However, economic performance based on green innovation may vary according to the industrial sector [2] or depend on firm resources [3,4]. According to [5–7], the positive reputation associated with green innovation increases the firm's value by facilitating new market opportunities and improves the firm's brand or prestige, in addition to customer loyalty as a sales effort. On the other hand, the success of green innovation depends on the effective reduction of the environmental impact [8]. Even though green innovation ensures the efficient use of materials and the reduction of pollutants to promote less environmental impacts [7,9], some authors [10,11] argue that the growth rate of green innovation efficiency differs based on environmental issues and organizational factors. Considering these differences, the literature on green innovation provides much evidence about its impact on economic and environmental performance [12,13]. However, there is little evidence about the organizational factors that enhance green innovation adoption (GIA) and how they are organized in the literature. Thus, understanding what these factors and their effects on GIA are to determine firm performance can be quite promising for further theoretical and practical development in this research field [14].

Agribusiness is a significant sector for green innovation given its impact on greenhouse gas (GHG) emissions. This sector has faced pressure to reduce these emissions [15].

The 6th Climate Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) reveals that land use from agribusiness is responsible for a quarter of global GHG emissions [16]. It contributes 11% of emissions according to the Emissions Gap Report 2020 from the United Nations Environment Program [17]. Agribusiness is a sector of extreme importance in the Brazilian economy [18] as it participates in the generation of income and employment, giving the country a privileged role in world trade. Brazil is the third largest exporter of agricultural products in the world and leads the export ranking of products such as sugar, chicken meat, beef, coffee, orange juice, tobacco, and alcohol. Currently, the sector is responsible for 21.6% of the gross domestic product (GDP) in the country [19].

In this vein, there are challenges to stimulating the growth and reduction of GHG emissions in Brazilian agribusinesses that are looking for green innovation to be incorporated by farmers into the production process. The use of new agricultural management practices and sustainable technologies has contributed to overcoming problems caused by climatic extremes, such as defending against frosts that affect the coffee sector or the adoption of more drought-tolerant crops in nonirrigated crops. The development of green innovation, in addition to promoting the reduction in greenhouse gas emissions, promotes increased green total factor productivity [20]. Nevertheless, firms' decision to adopt green innovation (GIA) and their efforts to implement and sustain it (i.e., the determining factors) depend on a number of external influences [21]. Therefore, building upon the natural resource-based view (NRBV) and resource-based theory (RBT) lenses, the following research question is raised in this study: what are the main determining factors in green innovation adoption to achieve economic performance in Brazilian agribusiness firms?

To answer this research question, determining factors for GIA among thirteen firms associated with ABAM (Brazilian Association of Starch and Cassava Producers) and SIMP (Union of Cassava Producers in Paraná) were the units of this empirical analysis to understand the reasons behind the determining factors that enhance GIA [22]. A solid understanding of the determining factors that influence pro-environmental strategies among firms is also relevant to the role of green innovation in the agribusiness sector [23,24]. Therefore, in this study, we applied a qualitative method within an inductive multiple-case approach [25,26]. Thus, the determining factors in GIA are identified based on reports of key actors who had practical experiences through semi-structured interviews. In addition, the support of other information available on firms' websites, news, and environmental regulator releases, among other documents, was analyzed in two dimensions: the influence of economic performance and the determining factors in GIA.

Among the determining factors analyzed, the following stand out: (1) knowledge, (2) operating costs, (3) relationships with specific stakeholders, (4) economic and environmental benefits, (5) institutional pressure, (6) information access, (7) customer assessment, and (8) organizational compatibility and support. These factors are organized into technological, organizational, environmental, and behavioral factors that constitute the determining factors in GIA. This study contributes to the green innovation literature by showing that green behaviors are crucial to enhancing GIA. Furthermore, it reveals that green behaviors induce a collaborative environment that supports farmers in making green decisions based on benchmarks and practical evidence adopted by other farmers in the network of agribusiness. The behavioral factors are also great evidence that GIA demands relational performance to have an effective impact on economic and environmental performance in Brazilian agribusiness firms. This is a relevant contribution to the green innovation literature and practitioners in this research field. It also adds guidelines to a broader vision of behavioral aspects in GIA.

The structure of the study is as follows: the literature review of the determining factors in green innovation adoption is presented in Section 2. Section 3 presents the research methods used in the study. The empirical findings are presented in Section 4. The discussion for the study is captured in Section 5. The final section captures the conclusion alongside the implications, limitations, and future research directions.

2. Literature Review

2.1. Green Innovation

The green innovation concept according to [27] does not need to reduce the entire environmental burden. However, it must produce significant environmental benefits. The authors of [28] define green innovation as hardware or software innovation related to green products or processes, including innovation in technologies in energy saving, pollution prevention, waste recycling, green product design, or corporate environmental management. Green innovation is divided by the literature into green products, green processes, and green management innovations [29]. Product innovations include modifying existing user features and packaging goods and services in response to environmental concerns. Process innovation includes changes in methods, processes, and equipment to produce environmentally friendly products that meet ecological goals. Innovation in green management includes a new method of management in business practices and firms' external relations.

Green innovation improves both environmental and economic dimensions. Promoting environmental benefits produce any economic impact can increase firms' performance [30]. However, green innovation presents different challenges that can reduce the chances of its adoption. GIA depends on costs and benefits, expected performance, and a firm's ability to adopt an innovation [31]. The predominant arguments to support the view that green innovation has a positive effect on economic performance include increased sales and cost reduction [32]. A firm that adopts green innovation can reduce costs due to value-added activities such as recycling materials that reduce waste and better use of input resources that contribute to profitability [33]. This may explain why researchers consider studying firms that adopt green innovation for greater efficiency [34–36] and higher returns on assets and equity [30,37,38]. Regardless of the approach adopted to invest in green innovation toward economic performance, green innovation may have a significantly positive effect on [39] labor and productivity [20,40]. In this way, labor productivity can increase due to the satisfaction of better working conditions [41].

2.2. Theoretical Arguments Related to Green Innovation

The relevant theoretical lenses employed for this study are the resource-based theory (RBT) and natural resource-based view (NRBV) frameworks. RBT is the most recognized and frequently used theory in green innovation research. RBT is used in studies to explain variations in firms' performance and green innovation efforts [1]. RBT considers that firms with unique, nonimitable resources and capabilities are likely to function better and maintain a sustainable competitive advantage [42]. However, RBT has been criticized in the literature for ignoring the changes and constraints imposed by the natural environment. According to [43], given the growing magnitude of green problems, omission (scarcity of natural resources, loss of biodiversity, climate change, and growth in energy demand, for instance) made RBT theory inadequate as a basis for identifying important sources to emerge competitive advantage. In Ref. [43], the NRBV is proposed as a theory that advocates the acquisition of sustainable competitive advantage based on firms' association with the natural environment.

According to [44], "the NRBV framework maintains that superior competitiveness and performance improvement can be obtained from the exploitation of rare resources that guarantee product stewardship, pollution prevention and sustainable development". NRBV is predominantly focused on protecting the natural environment by considering ecological strategies as competent capabilities to enrich performance and gain competitiveness [44,45]. Based on the logic of the NRBV, GIA can maximize firms' performance and green differentiation advantage [44]. Even though the NRBV highlights the connection between ecological policies, firms' green capabilities, and competitiveness [46], it does not explore in depth whether firms achieve and sustain competitive advantage using unique, nonimitable resources and capabilities because most of the literature focus is restricted to resource commitment.

In this sense, the availability of natural resources, technological advances, and expressive domestic demand for consumption in international markets are indicators to expand GIA, especially in emerging countries such as Brazil. Environmental issues and the reduction of GHG emissions are fundamental needs in emergent countries. Therefore, this study contributes to the RBT and NRBV for improvements in the use of resources for firms' economic and environmental performance.

2.3. Determining Factors in Green Innovation

Recent empirical studies [47,48] confirm a positive relationship between green innovation and firms' performance. Green innovation is closely associated with corporate environmental management and objective ecological achievements. Therefore, green innovation is widely believed to drive performance. Green product and process innovation not only reduce negative environmental impacts but also increase firms' economic and social performance through waste and cost reduction [32,49]. Furthermore, green products improve market position, affirm the brand, outperform competition, create breakthroughs, and attract new customers [50]. Therefore, three types of performance, namely, environmental, social, and economic, are considered to be the benefits and outcomes for GIA.

In recent decades, the empirical literature has investigated several factors that influence firms' green innovation and environmentally friendly practices [8,24,32,49,51]. Among them, individual, organizational, and contextual factors have a greater impact on GIA. Likewise, some internal factors (knowledge, firm growth, manager skills, human capital, and cost) and external factors (stakeholder pressure, environmental regulation, and networking) frequently appear in the literature as influential factors of GIA [51,52]. Furthermore, some authors [50,53] have suggested that firms' cooperation is more relevant for GIA and that regulatory and customer pressure promotes green responses to enhance green innovation performance. However, other determining factors for GIA have been proposed in previous studies analyzed in this literature review and are presented in Table 1.

Table 1. Focus of prior literature on green innovation adoption.

Authors	Contribution	Methodology
[32]	Identified cost reduction and government support as the most important drivers motivating green innovation adoption in the manufacturing industry.	Fuzzy Delphi, interpretive structural modeling, and cross-impact matrix multiplication
[54]	Performance expectancy, effort expectancy, hedonic motivation, social influence, facilitating conditions, and innovation cost predict green behavioral intention that has a strong direct and mediating effect among integrated constructs toward GIA *.	Survey (Structural equation modeling and Artificial Neural Network)
[55]	It founds a lack of focus on the consumer aspects in GIA * studies, highlighting the need for more research regarding what motivates consumers to adopt these new environmental products.	Literature Review
[56]	Confirm that green innovation, clean energy investment, and education improve environmental sustainability in the long run, while short-run estimates are diverse.	Autoregressive distributed lag model.
[57]	Show how the interventions of regulatory quality and green innovations enhance the effects of other regressors to substantially moderate the surge in GHG * emissions.	Quantitative research (Econometric Model)
[58]	Demonstrate that pro-green leaders, green human capital, and green market orientation significantly influence GIA *, which are, in turn, influenced by absorptive capacity. GIA * and green market orientation significantly influence marketing performance.	Survey (Structural equation modeling)

Table 1. *Cont.*

Authors	Contribution	Methodology
[52]	Internal and external stakeholders involving green technology adoption, when under the pressure of public opinion, influence the operational green technology adoption.	Interpretive structural-modeling
[59]	Farmers' participation in training programs on better cotton was a common factor for higher adoption of sustainable practices across all production stages, highlighting the need for training of nonadopters to improve eco-innovation adoption.	Multivariate Probit Analysis
[30]	Green innovation increases both environmental performance and economic performance. It also positively affects firm performance, but environmental uncertainty reduces this effect.	Survey (Multiple Regression)
[51]	Various external factors such as environmental regulation, government R&D * subsidy, and region are found to significantly influence the GTI * intention.	Quantitative research (Secondary data)
[22]	Investigates the determinants of farmers' decisions to adopt IT * in arid Tunisia	Survey (Logistic Regression)
[60]	A holistic examination of the determinants that affect the propensity of firms to innovate	Quantitative research (Econometric Model)
[61]	Identifies and verifies the nature of the green innovation process at multiple stages of adoption by identifying various predictors for each stage.	Survey (Structural equation modeling)
[62]	Discusses and analyzes the structure of TOE * in technological, organizational, and environmental contexts with a positive impact on the adoption of broadband mobile applications.	Survey (Structural equation modeling)
[63]	It measures the size of the impact of technological factors on the adoption of green innovations in SMEs * and tests the moderating role of government intervention between technological factors and the adoption of green innovations.	Survey (Multiple Regression)
[50]	Investigates the most influential external (collaboration) and internal (Human Resources) factors for the adoption of eco-innovation.	Survey (Exploratory Factor analysis and Regression Model)
[13]	Show that FinTech adoption significantly influences green finance, green innovation, and sustainability performance.	Survey (Structural equation modeling)
[12]	Green innovation was observed to positively influence environmental performance and partially mediate the relationship between FinTech adoption, green finance, and the environmental performance of banks.	Survey (Structural equation modeling)
[64]	Legal barriers were the most critical obstacles in GIA. Information barriers were the second one, followed by technical barriers, managerial barriers, economic barriers, and market barriers.	Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)
[65]	Stakeholders with not-contractual ties with SMEs affect green innovations, the workforce being the only strong stimulus to innovate. Public administrations exert a negative influence to hinder SMEs approach toward GIA.	Survey (Structural equation modeling)

* GHG = Greenhouse Gas; GIA = Green Innovation Adoption; GTI = Green Technology Innovation; IT = Information Technology; R&D = Research and Development; SMEs = Small and Medium Enterprises; TOE = Technology-Organization-Environment.

This evidence from the literature highlights the multidimensional aspects that affect GIA, such as cost adoption [32], public administration and regulation [64,65], and consumer influence [55], among others, demonstrating that there are many determining factors that may influence GIA. Therefore, these determining factors were grouped for the sake of findings interpretation and conduct to build a framework of determining factors into technological, organizational, and environmental contexts based on the mindful adoption

of green innovation suggested by [66]. Figure 1 illustrates the research structure applied in this study. Technological factors include the cost of adoption, complexity, compatibility, and relative advantage of green innovation. Organizational factors include the quality of human resources and organizational support. Environmental factors include environmental uncertainty, government support, regulatory pressure, customer pressure, biodigester supplier pressure, and first adopters. These determining factors are explored in the next subsections.

Figure 1. Determining factors in green innovation adoption. Source: Adapted from [66].

2.3.1. Technological Factors

Characteristics of technological factors such as adoption costs, compatibility, complexity, and relative advantage can affect their diffusion [66,67]. Adoption costs include financial and human resources requirements to implement and use green innovation. Seminal authors [68,69] argued that high adoption costs may motivate green innovation adopters to take it more seriously and implement it more actively to make it more cost-effective.

Complexity is the degree to which a green innovation is perceived as relatively difficult to understand and use. Green innovation incorporates tacit and explicit knowledge, which can lead to ambiguity in green practices and is a major obstacle to knowledge transfer [70]. According to Ref. [71], the benefits of broad knowledge and green innovation has an inverted U shape. The diminishing returns of knowledge breadth on green innovation are present for smaller firms and disappear as firms become larger. High complexity in green innovation contains high tacit knowledge, which requires laborious efforts to learn and spread. The difficulty in learning and sharing tacit knowledge makes it relatively difficult to diffuse a green innovation [72].

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, experiences, and firms' needs [66,73]. According to Ref. [66], "Compatibility is relevant because several green practices are additions to firms' current technologies and processes, adopting green innovation is not a single event but can be described as a process of knowledge accumulation and integration".

Finally, the relative advantage is the perception that an innovation is more advantageous, and its perceived benefits can be measured in economic and social terms such as convenience and satisfaction. Firms are more likely to implement technology capable of delivering better performance and greater economic gains. Therefore, the relative advantage is positively related to green innovation diffusion [68,74].

2.3.2. Organizational Factors

Organizational factors imply processes and attributes that restrict or facilitate green innovation. Organizational resources and capabilities are two relevant characteristics of GIA [66,74]. These organizational resources are understood in the literature as organizational and management support, learning capacity, and human resources [66,75]. Organizational support is a set of measures that a firm uses to help employees adopt green innovation. Encouraging green innovation diffusion and ensuring financial and technical resource availability have positive effects on the implementation process [67,76]. In addition, top management plays an essential role in organizational support [77].

On the other hand, qualified human resources are useful for spreading green innovation due to organizational learning capacity to mediate its operationalization [78]. The implementation of green innovation is a complex process that requires interdisciplinary coordination and significant changes in existing firms' operational management [79]. Green innovation requires the collaboration and coordination of different departments and divisions to ensure successful diffusion. Green initiatives are generally endorsed and encouraged by senior management [47,50]. The central task of top management is to obtain resources for the firm to be able to implement necessary changes and obtain an environmental competitive advantage [80].

2.3.3. Environmental Factors

The influences of environmental factors are environmental uncertainty, government support, stakeholder pressure (regulatory bodies, customers, and suppliers), and first adopters of green innovation [66]. Environmental uncertainty refers to relevant frequent and unpredictable changes in customer preferences, technological development, and competitive behavior perceived by managers [81,82]. Some authors [81] have noted that uncertainty positively moderates the effect of the level of green process innovation on profitability. The seminal authors of [83] also highlighted that under high environmental uncertainty, firms will try to collect and process information more frequently and quickly to deal with unpredictability.

Government support is relevant because it influences technical innovation. Governments can promote technical innovation through various public policies, such as financial incentives, technical resources, pilot projects, and tax incentives [84]. Governments can increase munificence by providing government subsidies or tax breaks for alternative green technologies, bank financing at lower rates, and lower insurance premiums for environmental risks [85]. Government behavior affects green innovation quality [86]. Stakeholders' pressure is also considered an influential factor for GIA [52,87–89]. Research reveals positive relationships between firms' environmental activities and regulatory and customer pressure [48,87,90].

Inserted in a dynamic and constantly changing environment, contemporary firms need to keep up to date to respond strategically to institutional pressures. For this, the initial adopters or early adopters have the profile of being opinion leaders. Its approval aims to bridge the gap between a new green product and consumers, avoiding major barriers with suppliers. By acting ahead, early adopters establish pioneering cost and service improvements in green innovation, enabling them to realize greater performance gains. In practice, this means that these early adopters enjoy greater benefits for their pioneering green innovations [66,73,91].

At the end of this literature review, we can ask ourselves how these determining factors truly impact GIA to achieve economic performance if these factors have been shared among different firms evolving within the same environment and not solely among members of the same organization.

3. Method

A qualitative approach helped to answer our research question and gain deeper insights into determining factors of GIA. Using semi-structured interviews, firm records and data sources [92] supported an investigation of how Brazilian agribusiness firms associated with ABAM (Brazilian Association of Starch and Cassava Producers) and SIMP (Union of Cassava Producers of Paraná) manage determining factors to enhance GIA to achieve economic performance. We chose an inductive multiple-case study approach as our research design. According to the literature [92–94], multiple case study analyses hold the potential to compare and contrast data. Therefore, this study enriches the literature on green innovation and its impact on firms' economic performance. To enhance comparability, we aimed for a sample consisting of firms in the same sector, such as a management system for residual organic material (liquid residue from the industrialization of cassava, bagasse from bark, fibers, etc.) that resulted in emissions of GHG, including methane. These firms are highly insightful considering the dominance of quantitative research methods in this research field [94].

Because Brazilian agribusiness firms have played a relevant role in Brazilian economic development and due to regulatory aspects for environmental protection, the selection of our sample took place through a partnership signed with a supplier responsible for the construction and installation of biodigester technology. The addressed firms are in the Brazilian cassava agribusiness sector, and they were able to provide data on biodigester projects that aimed at green products and services. We compiled semi-structured interviews conducted from August 2018 to November 2018 with 13 professionals from 13 different Brazilian firms. We ensured that our sample did not only contain fully successful cases, including project goals that were not reached or were not completed successfully. Following [94], by doing so, the comparability among firms may enhance the differences in determining factors of green innovation and their effects on the economic performance of these firms.

A semi-structured interview script was prepared that contained the initial questions based on the literature review, as presented in Appendix A. The questions established prior validity and a relationship between the findings and theory [25]. In other words, we associated the constructs with the theoretical framework (Figure 1). The main types of questions were descriptive, structural, and comparative with the literature [95]. Descriptive questions allow for the identification of the interviewee's language. Structural questions allow us to discover how the interviewee organizes his knowledge. The contrast questions make it possible to distinguish the meaning that the interviewee employs to differentiate objects and events in their world.

The interviews were conducted by telephone and transcribed verbatim [96]. The interviews lasted approximately 30 to 60 min each, and notes were taken during the interviews. Table 2 presents the list of participants and firms' description. A reassessment was carried out within a period of 24 h to complete details and verify additional inputs from the recording, notes, or secondary data. This process allows the researcher to assess their personal biases and feelings and understand their influence on the research [97,98]. The transcripts of interviews were content-analyzed by the technique of coding dividing relevant information into categories of different themes as suggested by [99]. However, during the transcription, more attention to coding the identity of the interviewee and the interviewer facilitated literal word transcription [98]. Expressions of displeasure, pleasure, etc., are perceived, for instance [100]. In all, there were 176 pages of transcription and 21 pages of notes, for a total of 197 pages.

Table 2. Description of the 13 case studies.

Case	Position of Interviewee	Firm Size	Firm Type	Governance	Market Share
Firm 1	Starch Manager	Large	Cooperative	Corporate	N/I
Firm 2	Environmental engineer	Large	Cooperative	Corporate	N/I
Firm 3	Production Supervisor	Large	Cooperative	Corporate	N/I
Firm 4	Owner	Medium	Private	Family Business	N/I
Firm 5	Owner	Medium	Private	Family Business	N
Firm 6	Quality Control Supervisor	Medium	Private	Family Business	N
Firm 7	Industrial Manager	Large	Private	Corporate	N/I
Firm 8	Maintenance supervisor	Medium	Private	Family Business	N
Firm 9	Production manager	Large	Subsidiary	Corporate	N/I
Firm 10	Industrial Manager	Large	Subsidiary	Corporate	N/I
Firm 11	Administrative manager	Large	Subsidiary	Corporate	N/I
Firm 12	Owner	Medium	Private	Family Business	N/I
Firm 13	Owner	Large	Private	Family Business	N/I

Note. N = National; I = International.

We structured each case using cyclical reading to allow substantial within-and-cross-case analysis [93,101]. Getting greater insight, the selected firms had a certain ability to react to their changing environment, had at least once communicated on green innovation practices, and had internal process flexibility, systems in place, and products or services delivered. On the other hand, they have various sizes and ages. By considering these various profiles, this study tends to be more relevant.

Data Analysis

Data were initially analyzed from individual summaries of each case—inductive case research [26], synthesizing and comparing the transcripts of the interviews with the notes collected. Next, we applied a critical review based on questions in both internal and external validity (the validity of process and method) [102]. Internal validity establishes causal relationships—one condition can lead to another—and external validity verifies whether the study findings can be generalized or replicated [92,101]. From the literature, ideas emerged [92] and similar constructs were used to create tables and figures facilitating comparisons [26]. We conducted multiple readings to develop a data structure and interactive coding using MAXQDA software. First-order categories were considered emerging categories, and second-order categories were considered aggregated dimensions [25], which helped to identify the determining factors of green innovation to achieve firms' economic performance from the perspective of the interviewees. At this point, we developed a situational model for the cassava agribusiness sector.

Figure 2 presents the links between the codes indicating the occurrence of the relationships between them. For example, there is a strong relationship between the cost of adoption (expenditure on firewood during the implementation of biodigester and initial phase of operation) and the time for the return on investment. The thicker lines indicate that, during coding, more relevance was given to certain factors due to the emphasis given by the interviewees. Another example is the relationship between government support and the lack of incentives. Dashed links indicate nondirect relationships between codes. The thicker the dashed line, the greater the indirect relationship between the factors observed during the interviews. Thicker links indicate other important relationships considering the degree of importance made to each code. All determining factors and their respective terms have connections with each other, indicating that to a greater or lesser extent, they are related. We will explore these relations in the next section.

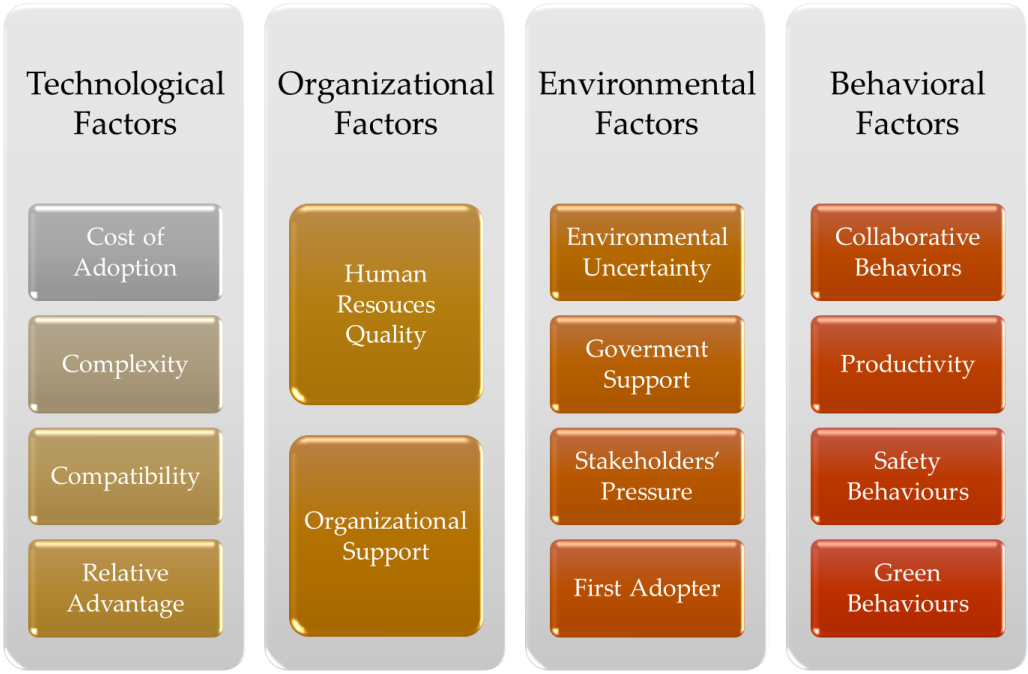

Figure 2. Determining the factors in the green innovation adoption framework. Source: Adapted from [66].

4. Results

In the following sections, the results show how the determining factors analyzed impact green innovation in Brazilian cassava agribusiness firms. First, we identify how the interviewees perceive technological factors. Second, the study illustrates how Brazilian firms adopt green innovations despite organizational factors. Third, the empirical results show why and how environmental factors impact green innovation. Finally, we identify how these determining factors affect firms' economic performance. The subsections aim to highlight and discuss the insights acquired from the cross-case analysis.

4.1. Technological Factors on Green Innovation

It seems that technological factors fostered green innovation practices. Indeed, this dimension does seem to influence GIA. The firms interviewed support the vision that cost adoption induces the use of green innovation, regardless of the firms' size or type. However, all interviewees agree that the return on investment is relevant to the speed of green innovation practices.

> *[. . .] the point is that in addition to lowering my production cost, and the product price, I spent less biomass . . . we are saving much more than we thought [. . .]*
>
> (Starch Manager, Firm 1).
>
> *[. . .] in our case, the biodigester paid for the entire structure in two months [. . .] At the time, firewood was chosen because the investment cost was much lower [. . .] the return was more interesting [. . .]*
>
> (Environmental engineer, Firm 2).
>
> *Acquiring biodigesters was a way to reduce costs.*
>
> (Quality Control Supervisor, Firm 6).

Firms 7, 8, 9, 10, 11, 12, and 13 carried out a feasibility study that confirmed cost reduction and time for return on investments.

> *When we calculated the time, it would pay for itself, six months, and the investment in it, and how much we would reduce the expenditure on firewood, almost 100% . . . we concluded that it was totally feasible.*

(Administrative manager, Firm 11).

Complexity aspects are related to difficulty, resistance, bureaucracy, and training with regard to the implementation and operation of the biodigester. All managers unanimously state that it is very easy to operate the biodigester. They also note that the basic training provided by the supplier of the biodigester was important for the employees. Maintenance is cheap, as well.

It Is easy [. . .] the staff has to understand what they have to do to adjust the pH [. . .] all the technical assistance was given, and the staff learned quickly and today it is working [. . .] very cool.

(Industrial Manager—Firm 10).

The biodigester is quiet [. . .] it is the employee who turns it on, off [. . .] but the training was done through the people who supplied the equipment.

(Owner, Firm 12).

The Biodigester is easy to operate [. . .] we had training with the people who built the biodigester [. . .] the most correct handling possible [. . .] with training and everything to guarantee maximum safety for workers.

(Owner, Firm 13).

In terms of compatibility, organizational structure, supply chain, and organic load were pointed out when asked if the biodigester was compatible with the firm structure capital. Interviewees highlighted that it was easy to integrate the biodigester into the supply chain without causing drastic changes for the firms. We highlight that the biodigester is built based on the firm's size, which means that larger firms have greater production and therefore larger biodigesters. Smaller firms, due to small supply chains, have smaller biodigesters or do not have them at all, as the local legislation does not oblige the producer to have a biodigester, despite obliging firms to carry out an adequate treatment of the effluents.

The advantage of the biodigester in cassava is that the organic load of the effluent is quite high in relation to the others, you know? Therefore, the great advantage of cassava is the organic load of the effluent, which is much higher than the others.

(Starch Manager, Firm 1).

In fact, here the biogas is methane gas [. . .] both in cassava and corn it is the same with the difference that in cassava you have a much higher production [. . .] cassava has enormous power in terms of production of gas.

(Production Supervisor, Firm 3).

Economic and environmental benefits, image, reputation and legitimacy of the firm, new markets, better performance, profitability, and cost reduction were mentioned as relative advantages when using green innovation. All respondents were unanimous in stating that GIA through biodigester has no association with access to new markets. All firms already had a customer base. Many comments and testimonials emerged, so we only report those that represent the general opinion.

For us, the cost of the biodigester and the return it gave was, by far, the best [. . .] for the environment, I think it was good [. . .] because before, when it was firewood, we took an average of two, three carts of ash a day and there was nowhere to throw it, so we threw it anywhere there, all day long black smoke rising [. . .] And today you cannot see anything, everything is clean.

(Owner, Firm 5).

The best benefit is the economic one, a 100% reduction in the use of expensive firewood [. . .] you have two environmental benefits [. . .] it reduces the burning of wood [. . .] and it does not emit methane gas into the atmosphere [. . .] with the treated effluent

> *that I use for fertigation [. . .] another economic benefit is that I do not spend more on fertilizers and our image has improved [. . .] many customers praised our initiative and the community itself because of the bad smell that comes out of the pond [. . .] Now, it does not come out anymore because the lagoon is covered, and the gas goes straight to the pipe to burn in the boiler.*
>
> (Maintenance supervisor, Firm 8).

Regarding firms' image, reputation, and legitimacy, interviewees highlight the following:

> *It changes the image toward the community [. . .] they see that we are adopting some environmental practices [. . .] and, in this sense, the environmental agencies also see it with good eyes.*
>
> (Environmental engineer, Firm 2).
>
> *It does improve [. . .] there are competitors who admire us [. . .] for our initiative and even end up respecting our unit slightly more.*
>
> (Owner, Firm 12).
>
> *This improves the firm's image [. . .] And we work so to everything that brings good resources, we will invest.*
>
> (Owner, Firm 13).

The lessons learned from the case studies show that technological factors on GIA are strongly associated with economical aspects ahead of environmental ones. The success of a green innovation, such as the biodigester, is associated with a technology most adapted to a firm's existent structure capital that could offer a good time for the return on investment. Thus, the cost for adoption and compatibility are the most precursor to GIA for technological factors. Even though environmental benefits may cause a good reputation, they are not the driving spring to GIA.

4.2. Organizational Factors on Green Innovation

Problem solving, new ideas, new technologies, knowledge transfer, and improvements appear as relevant organizational factors in GIA for human resources aspects. The great impact of knowledge transfer on biodigester management also impacts the adoption of new green technologies that can be implemented to solve several problems that already exist after biodigester deployment.

> *Then, we thought: Why do we not take this gas and transform it into thermal energy? Therefore, we started designing this project [. . .] We no longer thought about carbon credits [. . .] Only about thermal energy.*
>
> (Starch Manager, Firm 1).
>
> *Of course, you gain experience [. . .] so you end up changing your thinking too [. . .] trying new things [. . .] we purchased the membrane gel, the supplier carried out the work to solve anchoring and sizing issues [. . .] and we decided to acquire this new technology.*
>
> (Owner, Firm 4).

Safety, green behavior, and resources for new projects were associated with organizational support for GIA. When asked if top management encouraged employees and offered rewards or resources to understand environmental practices and green behavior, the interviewees pointed to the issue of safety as an ally to green behavior. Regarding the resources for projects, all interviewees built biodigesters with their own resources without funding.

> *We had the issue of safety . . . we already had the pressure control system in place, the valve, protection and the biodigester lagoon itself, all fenced and grassed to control the height of water.*
>
> (Quality Control Supervisor, Firm 6).

Every Monday, they do trainings in terms of production involving everything that is inside our factory. Always with the conscience of preserving the environment and safety in production. Mainly the part of losses and residues.

(Owner, Firm 13).

According to our findings, safety factors can also lead to a significant failure of knowledge sharing and an increase in an individual's reluctance to share knowledge in an organizational context. To mitigate this barrier, adopting a culture of safety within organizational boundaries encourages employees to learn continuously from each other about green safety behaviors. Furthermore, individuals may adapt their information needs to new changes in business safety. Safety is an area rarely explored in green innovation.

A firm's commitment to providing learning to acquire new knowledge and skills not only improves its competitiveness but also promotes less cost spending with employee injuries. Firms looking for economic performance must consider devoting significant effort to employees' learning behaviors. Brazilian cassava agribusiness firms are more willing to manage safety aspects than the production of new green innovations.

4.3. Environmental Factors on Green Innovation

Questions of uncertainty for Brazilian cassava agribusiness firms are related to the level of sales competitiveness. It is an issue that can influence GIA positively. Indeed, external triggers, which include technological shifts, changes in government policy, and industry innovations, may affect the timeline of GIA. Interviewees pointed out the relevance of being competitive against competitors who already have green innovations in place due to the unbalanced price between green products and nongreen products commercialized.

I can compete in the market [. . .] those who have not adopted biodigester will have a higher cost in the final product [. . .] If I continued with firewood, maybe I would lose a sale to someone who can sell it cheaper than me [. . .] He would have more profit than me [. . .] is the competition.

(Owner, Firm 5).

Everyone had to run after the biodigester to stay in the market, of course.

(Industrial Manager, Firm 7).

[. . .] adopting the biodigester was a way for us to remain active in the market [. . .] you reduce the cost and keep your product competitive.

(Maintenance supervisor, Firm 8).

Government support is related to incentives offered by public agencies. Firms' testimony dealt with the limited financial support and fiscal incentives from the government in GIA.

A firm that goes to all the trouble to produce recyclable plastic pays the same tax as the one that uses oil to make plastic [. . .] what incentive does the firm have? The firm that does recycling would have to have a differentiated taxation.

(Environmental engineer, Firm 2).

We went looking for resources, some attractive rate [. . .] you need to innovate, you need to invest in what is environmentally correct, ecofriendly, but in practice it does not happen that way, you go after a specific line of credit and find a lot of bureaucracy and we end up doing everything for own account.

(Maintenance supervisor, Firm 8).

Regulatory pressures also had different perspectives among interviewees because some firms never had environmental penalties or regulatory pressure, since they complied with current legislation about effluent treatment despite the constant inspections from the environmental regulatory bodies.

> *[. . .] we have to do self-monitoring and once a month I have to send this effluent to an outsourced laboratory and then my result has to match the outsourced result [. . .] and then we present it to the Agency Regulatory Inspector [. . .] from time to time they carry out an inspection.*
>
> (Industrial Manager, Firm 7).

> *Regarding the environmental area, they come periodically, sometimes every 30 days, sometimes a little longer, but always to the eviction for the water resource. They analyze the water that comes out of the effluent and the soil where it is being dumped, in addition to what is the load of pollutants that is being infiltrated.*
>
> (Production Manager, Firm 9).

Regarding stakeholder pressures, firms report different perspectives related to any pressure for audits, green seals, and green practices from customers or suppliers, although all firms confirm the positive influence of suppliers on biodigester implementation.

> *We have this awareness about this type of customer who searches for firms that have an environmental concern, but it was never taken further in the sense of being perceived through a marketing campaign, some positioning of the brand in this regard to be serving a specific client [. . .] our client is more the traditional one.*
>
> (Owner, Firm 4).

> *Customers ask in the audit to go to the rural producer and see the entire supply chain. They do these audits to determine if we are following environmental and good standards manufacturing practices [. . .] more and more people have been charged in this regard [. . .] It does not matter to offer just a good product, it has to be a product from a firm that respects the environment.*
>
> (Quality Control Supervisor, Firm 6).

Considering the different levels of external pressures faced by the cases studied, the influence of the first adopter of biodigester technology proved to be relevant compared to other competitors. Case 1, which was the first adopter, was visited by all other firms as a benchmark for this type of green innovation.

> *Starch growers only believe when they see it. The businessman only invested from the moment he saw the return by seeing the competitor, which served as an experience.*
>
> (Production Manager, Firm 9).

> *Influence for sure. Because as the first to adopt it was firm 1 who at that time was vice-president of ABAM [. . .] people were very much in contact with him [. . .] they exchanged information and visualized the benefit of the business. That ended up influencing for sure. There are many who are afraid to take a risk right away and are waiting for someone to do it and then do it.*
>
> (Owner, Firm 12).

We emphasized, in environmental factors, that green innovations for Brazilian cassava agribusiness firms are still a source of profitability or a way to attend to market demands. For example, it is clear that for almost all cases in which green innovation projects were implemented, the main reason was to keep up to date against other competitors or to have better product prices. The reasons behind GIA in this context presented a strong economic perspective rather than an environmental one. Even with government support, bureaucracy seems to be a huge barrier to incentivizing firms to engage in green innovation. In this sense, Brazil has a long journey ahead to become more familiar with the environmental relevance that green innovation may produce for generations.

Considering these results, our contribution in this subsection reveals that all types of environmental factors convey various outputs related to green innovation implementation. However, the business consciousness in sharing knowledge as the first adopter positively impacted the green innovation process among other firms. Thus, the problem for Brazilian

firms involved in green innovations is not only how to access resources but also how to make a good combination of external and internal knowledge. Our contribution emphasizes the need for the identification of different integrative perspectives of green innovation beyond those that are economical.

5. Determining Factors Discussion

At the end of each interview, after discussing the determining factors involved in the GIA, a last question was asked about the most relevant aspect of GIA, environmental or economic, and its reasons. The determining factor for GIA in all cases was economic. However, Table 3 reflects the perceptions and behaviors of the firms after GIA, that it was relevant to reduce the environmental impact, and brought benefits to economic performance. Firms recognize that the use of biodigesters destroys pathogenic organisms and parasites that would be released into the soil and rivers, in addition to transforming gases that would be harmful to the planet's atmosphere. However, the impact on economic performance is also recognized by the reduction in material costs, energy consumption, and waste. In particular, reducing organic waste has the benefit of complying with environmental regulations as well as avoiding fines. Interviewees also had a positive impact on firms' sales and cash flow. These statements seem to indicate, despite the recognized environmental benefits, that focusing only on economic performance reflected the application of fines and even the threat to operations.

Table 3. Ex post GIA perception from case studies.

Ex-Post GIA Perceptions	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
GIA for the environment	X	X	X			X		X	X		X		
GIA on economic performance			X	X		X				X		X	
Corporate image				X									X
Involvement of all employees		X		X	X	X	X	X		X			X
Other practices and systems for green management		X		X	X	X	X				X	X	
Improvement of corporate image		X		X	X	X	X	X		X			X
Cost reduction and profit increase				X		X	X		X	X	X	X	X
Increased efficiency	X	X	X	X	X	X	X	X	X	X	X	X	X
Access to new markets				X		X	X		X	X	X	X	X
Increase in market share				X		X	X		X	X			X

Note. F = Firm. X = presence of the Ex-Post GIA Perception item.

Recognized impact occurs on corporate image, both due to internal and external legitimacy, since firms declared that workers recognize the benefits for the environment and quality of life. Legitimacy in the market seems to be important, not only because of the firms' image in relation to the reduction of the environmental impact but also because a significant part of the firms serves international markets, as well as others belonging to cooperatives and corporate groups.

The cases studied caused not only soil pollution (since the residual organic material was discarded on the land itself) but also water pollution (decomposing organic material flowed into nearby rivers, streams, and lakes). The strong putrefied odor spreads through the region's neighboring firms, reaches nearby communities, attracts rodents and insects, and causes serious environmental problems such as the destruction of renewable natural resources, especially water. The most important fact is that the complaints from the surrounding communities to the Brazilian cassava agribusiness firms ceased after the GIA.

Regardless of the eventual determination of economic factors, the realization of the benefits of GIA led to the search for new green behaviors toward preservation practices. In particular, firms began to seek the reuse of water, which is an abundantly used input

in the production of cassava, and the reuse of returnable or biodegradable packaging (for example, in firms 3, 4, 6, and 10). Workers' awareness of actions regarding internal practices, and the need for environmental preservation also increased their productivity. Interviewees highlight cost reduction, improved financial results, and increased efficiency. Some managers declared the financial evaluation of the return on investment in less than one year (for example, firms 1, 2, 3, 4, 5, 8, and 10). Despite the use of biodigesters, some firms still keep a reserve of firewood for eventualities (for example, firms 1, 2, 5, 7, 8, and 9).

Finally, we conclude this analysis by extending the GIA framework proposed by [66], considering our findings from Brazilian cassava agribusiness firms (Figure 2). The new framework is composed of perceptions and behavioral factors that have a positive impact on GIA, such as collaborative behaviors (provided by the first adopter and supplier contributions), productivity (provided by employee engagement in new green practices), safety behaviors (provided by increasing safety awareness from adopters), and green behaviors (provided by those involved in the process of looking for new information about biodigesters for solutions that would keep firms competitive in the market).

6. Conclusions

6.1. Theoretical Contributions

The main objective of this study was to investigate, through interviews, the determining factors of GIA and economic performance in the Brazilian cassava agribusiness sector. A literature review on topics concerning green innovation, sustainability in agribusiness, adoption of innovation, and determining factors for GIA was necessary. The resource-based theory (RBT) and natural resource-based view (NRBV) were applied as theoretical foundations, which allowed us to present the relevance of the theme and its peculiarities for the development of green innovation literature. Thus, this study contributes to the RBT and NRBV literature by identifying which resources are essential to allow firms involved in the Brazilian agribusiness context to identify, develop, and profit from GIA (Hart and Dowell, 2011). Special attention was given to relational capabilities as behavioral factors to sustain GIA.

Behavioral factors have a positive impact on GIA, especially collaborative behaviors provided by the first adopter and suppliers' contributions. Other authors [54,81] also provided evidence that behavioral factors sustain GIA. Information sharing among farmers to create knowledge about green practices appears to be an antecedent of GIA in this study. It has also been considered by other authors [50,103] to be relevant to green innovation. In the case of Brazilian agribusiness, collaborative behavior seems to reduce uncertainty because accepting uncertainty requires recognition that it is the norm and not the exception [104] in this research field. It should be noted that while the risk is always dealt with in the area of costs, involving studies of economic viability, payback, and return on investment, uncertainty in relationships is normally not modeled. The safety behaviors provided by increasing safety awareness from adopters improved the benefits perception and the diffusion and adoption of the innovation by firms, corroborating other authors' approaches [65]. The green behaviors also provided by those involved in the process of looking for new information about biodigesters kept the firms competitive in the market. Green behavior can have effects on changing or strengthening the organization's environmental culture, but this study did not delve into this direction, which could be explored in future studies.

Therefore, the theoretical contributions focus on pollution prevention through a green technology (the biodigester), which has great potential to identify additional determining factors that affect the relationship between green innovation and economic performance but also adds three behavioral factors related to green innovation adoption. Discovering which resources and capabilities can spread green innovation, as well as providing firms' performance (environmental and economic), were the key areas of investigation. This work contributed to adding scientific knowledge and management practices to GIA. It also provided scientific contributions to RBT and NRBV theories enhancing green innovation,

green technology, pollution prevention, and determining factors (resources and capabilities) in the Brazilian agribusiness sector.

6.2. Practical Implications

The results obtained through interviews allowed the identification of the determining factors for GIA and the generation of new energy sources (thermal and electrical) based on biogas as a new green product after biodigester adoption. Behavioral factors developed during GIA support firms to achieve economic performance through the reduction of costs in the consumption of firewood. Furthermore, behavioral factors help firms become aware of new green innovations. It reveals that green behaviors induce a collaborative environment that supports firms in making green decisions based on benchmarks and practical evidence adopted by other actors in the network of agribusiness. The behavioral factors are also great evidence that GIA demands relational performance to have an effective impact on economic and environmental performance.

This study demonstrates that behavioral factors are primordial to GIA in Brazilian cassava agribusiness firms. Implications include providing behavioral guidelines to managers to increase their competitiveness in the current market, providing a government landscape that needs improvements in environmental policies, and contributing to a vision of the potential of GIA in building safety, greater productivity, and new sources of green innovations. The relevance was also evidenced by demonstrating that environmental management brings economic benefits often unknown by those involved during the GIA process.

6.3. Limitations and Future Studies

This qualitative research provides some insights into how Brazilian cassava agribusiness firms achieve economic performance through GIA. Therefore, this study has limitations that must be highlighted. The biggest criticisms of qualitative studies are the validity and generalizability of findings, as each observation is unique, depending on the object, researchers, and participants' profile. Both researchers and participants are agents, which implies the risk of loss of objectivity due to a certain degree of subjectivity. In addition, there may be a reduction in the understanding of inputs arising from reality, that is, to an introspective understanding (familiarity/strangeness) about the phenomenon. The representativeness of individual speech in relation to a larger collective may also occur (checking what is said with what is done, celebrated, and/or crystallized).

In addition, regarding the search string, keywords vary because of GIA definitions found in the literature. There is a difference between the adoption of sustainable innovation (sustain*), the adoption of eco-innovation (eco*), and the adoption of green innovation (green*); even so, there is a risk of omitting articles related to the topic during the literature review. On the other hand, the occurrence of respondent bias may affect the results by limiting their generalizability. Different countries and industry sectors may come to different conclusions. The results of this research are not a finished model since the dynamism with which theories evolve ends up excluding such a possibility.

Given the above, for future studies, the scope of the unit of analysis can be expanded using larger samples to create complementary quantitative analyses, combining quantitative and qualitative techniques. Additionally, comparing the cassava sector with other sectors within agribusiness would be another possibility. For instance, the pig and poultry sectors used a new sampling method with experience in biodigester technology. Future studies may compare the adopters to the nonadopters of green innovation.

Author Contributions: Conceptualization, A.R.d.S., C.B.S.C. and F.A.R.S.; methodology, A.R.d.S., C.B.S.C. and F.A.R.S.; software, A.R.d.S.; validation, A.R.d.S., C.B.S.C. and F.A.R.S.; formal analysis, A.R.d.S., C.B.S.C. and F.A.R.S.; investigation, A.R.d.S.; resources, C.B.S.C. and F.A.R.S.; data curation, A.R.d.S.; writing—original draft preparation, A.P.; writing—review and editing, A.P. and M.R.M.; visualization, P.R.d.C., I.C.S., R.L.R. and M.R.M.; supervision, C.B.S.C. and F.A.R.S.; project adminis-

tration, A.R.d.S.; funding acquisition, C.B.S.C. and F.A.R.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES), grant number 001.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

SEMI-STRUCTURED INTERVIEW SCRIPT

Firm Name; Interviewee Name; Interviewee's Position; Interviewee's Position Experience; Interviewee's Experience in the firm.

TECHNOLOGICAL FACTORS

1. Cost of adoption

1.1. What was the total cost of the biodigester? Is it worth it?
1.2. How much time was spent to implement the biodigester? It was hard?
1.3. How fast was the payback?
1.4. There were cost reduction with the biodigester?

2. Complexity

2.1. Does biodigester operation require many learning processes? Why?
2.2. Does biodigester operation require much experience?
2.3. Does using the biodigester require difficulty sharing knowledge?

3. Compatibility

3.1. Is the biodigester compatible with the firm's existing production? In which way?
3.2. Is the biodigester consistent with the firm's values?
3.3. Was it easy to integrate biodigester into the firm's supply chain?
3.4. Does biodigester implementation cause any change in the structure of the firm?

4. Relative advantage

4.1. What economic and environmental benefits did the biodigester provide?
4.2. Do these benefits improve the firm's image?
4.3. Did these benefits bring reputation and legitimacy to the firm?
4.4. There was access to new markets after biodigester adoption? In which way?
4.5. What were the benefits obtained by the firm with firm image improvements and access to new markets?

ORGANIZATIONAL FACTORS

1. Quality of human resources

1.1. Are employees able to use new technologies to solve problems easily?
1.2. Are employees able to provide new ideas for the firm?
1.3. Are employees able to learn new technologies easily?
1.4. Are employees able to share knowledge with each other?
1.5. What were the improvements noted by the employees after biodigester implementation?

2. Organizational support

2.1. Does senior management encourage employees to learn about preserving the environment?
2.2. Does the firm offer rewards for employee green behavior?
2.3. Can senior management help employees deal with environmental issues?
2.4. Does the firm provide resources for employees to learn green knowledge?

ENVIRONMENTAL FACTORS

1. Environmental uncertainty

1.1. Was adopting the biodigester a decision to remain active in the market? Why?

1.2. Do you consider any firm that operates in the market to be your competitor? Which ones? Why? Do they adopt a biodigester? Did they adopt before your firm?
1.3. Did competitors influence the decision to adopt the biodigester? In which way?

2. Government support

2.1. Has the government provided any financial support or incentives to adopt the biodigester?
2.2. Does the government help to train a workforce with green innovation skills?
2.3. Does the government provide technical assistance to adopt green innovation?

3. Regulatory pressure

3.1. Does the government set environmental regulations for green innovation?
3.2. Do industry associations require the firm to comply with environmental regulations?
3.3. There was pressure from the government to adopt biodigester? Which ones? Why?
3.4. There was pressure from the surrounding community for the firm to comply with environmental standards?

4. Customer pressure

4.1. Do customers oblige the firm to improve environmental performance?
4.2. Is caring for the environment an important consideration for customers?
4.3. Did customers influence the decision to biodigester adoption? In which way?

5. Biodigester supplier pressure

5.1. Why did the firm adopt biodigester? How was it adopted?
5.2. Where did the idea come from?
5.3. How did the firm determine about the biodigester?
5.4. Did biodigester suppliers influence adoption?
5.5. Is it important to be the first adopter?

References

1. Tariq, A.; Badir, Y.F.; Safdar, U.; Tariq, W.; Badar, K. Linking Firms' Life Cycle, Capabilities, and Green Innovation. *JMTM* **2019**, *31*, 284–305. [CrossRef]
2. Ngniatedema, T.; Li, S.; Illia, A. Understanding the Impact of Green Operations on Organizational Financial Performance: An Industry Perspective: Impact of Green Operations on Organizational Financial Performance. *Environ. Qual. Manag.* **2014**, *24*, 45–59. [CrossRef]
3. Christmann, P. Effects of "Best Practices" of Environmental Management on Cost Advantage: The Role of Complementary Assets. *Acad. Manag. J.* **2000**, *43*, 663–680. [CrossRef]
4. Awan, U.; Nauman, S.; Sroufe, R. Exploring the Effect of Buyer Engagement on Green Product Innovation: Empirical Evidence from Manufacturers. *Bus. Strategy Environ.* **2021**, *30*, 463–477. [CrossRef]
5. Majumdar, S.K.; Marcus, A.A. Rules versus Discretion: The Productivity Consequences of Flexible Regulation. *Acad. Manag. J.* **2001**, *44*, 170–179. [CrossRef]
6. Chen, Z.; Hao, X.; Chen, F. Green Innovation and Enterprise Reputation Value. *Bus. Strategy Environ.* **2022**, *1*, 3213–3240. [CrossRef]
7. Ambec, S.; Lanoie, P. Does It Pay to Be Green? A Systematic Overview. *Acad. Manag. Perspect.* **2008**, *22*, 45–62.
8. Triguero, A.; Moreno-Mondéjar, L.; Davia, M.A. Drivers of Different Types of Eco-Innovation in European SMEs. *Ecol. Econ.* **2013**, *92*, 25–33. [CrossRef]
9. Li, Y. Environmental Innovation Practices and Performance: Moderating Effect of Resource Commitment. *J. Clean. Prod.* **2014**, *66*, 450–458. [CrossRef]
10. Bönte, W.; Dienes, C. Environmental Innovations and Strategies for the Development of New Production Technologies: Empirical Evidence from Europe: Environmental Innovations and Strategies for New Production Technologies. *Bus. Strategy Environ.* **2013**, *22*, 501–516. [CrossRef]
11. Luo, X.; Zhang, W. Green Innovation Efficiency: A Threshold Effect of Research and Development. *Clean Technol. Environ. Policy* **2021**, *23*, 285–298. [CrossRef]

12. Guang-Wen, Z.; Siddik, A.B. The Effect of Fintech Adoption on Green Finance and Environmental Performance of Banking Institutions during the COVID-19 Pandemic: The Role of Green Innovation. *Environ. Sci. Pollut. Res.* **2022**, *30*, 25959–25971. [CrossRef]
13. Yan, C.; Siddik, A.B.; Yong, L.; Dong, Q.; Zheng, G.-W.; Rahman, M.N. A Two-Staged SEM-Artificial Neural Network Approach to Analyze the Impact of FinTech Adoption on the Sustainability Performance of Banking Firms: The Mediating Effect of Green Finance and Innovation. *Systems* **2022**, *10*, 148. [CrossRef]
14. Berrone, P.; Fosfuri, A.; Gelabert, L.; Gomez-Mejia, L.R. Necessity as the Mother of 'Green' Inventions: Institutional Pressures and Environmental Innovations: Necessity as the Mother of 'Green' Inventions. *Strat. Mgmt. J.* **2013**, *34*, 891–909. [CrossRef]
15. Kolk, A.; Levy, D.; Pinkse, J. Corporate Responses in an Emerging Climate Regime: The Institutionalization and Commensuration of Carbon Disclosure. *Eur. Account. Rev.* **2008**, *17*, 719–745. [CrossRef]
16. Arias, P.; Bellouin, N.; Coppola, E.; Jones, R.; Krinner, G.; Marotzke, J.; Naik, V.; Palmer, M.; Plattner, G.-K.; Rogelj, J. Technical Summary. In *Climate Change 2021: The Physical Science Basis*; Contribution of Working Group14 I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2021; Volume 996, pp. 113–119.
17. Rogelj, J.; den Elzen, M.; Pereira, J.P.; Höhne, N.; Huppmann, D.; Luderer, G. *The Emissions Gap—Emissions Gap Report 2020*; Chapter 3; United Nations Environment Programme: New York, NY, USA, 2020.
18. Nunes, B.; Gholami, R.; Higón, D.A. Sustainable Farming Practices, Awareness, and Behavior in Small Farms in Brazil. *J. Glob. Inf. Manag.* **2021**, *29*, 31. [CrossRef]
19. CEPEA. *CNA PIB Do Agronegócio No Brazil*; Universidade de São Paulo, Esaq/USP: Piracicaba, Brazil, 2022; pp. 1–19.
20. Wu, J.; Xia, Q.; Li, Z. Green Innovation and Enterprise Green Total Factor Productivity at a Micro Level: A Perspective of Technical Distance. *J. Clean. Prod.* **2022**, *344*, 131070. [CrossRef]
21. Greenhalgh, T.; Robert, G.; Macfarlane, F.; Bate, P.; Kyriakidou, O. Diffusion of Innovations in Service Organizations: Systematic Review and Recommendations. *Milbank Q.* **2004**, *82*, 581–629. [CrossRef]
22. Dhraief, M.Z.; Bedhiaf-Romdhania, S.; Dhehibib, B.; Oueslati-Zlaouia, M.; Jebali, O.; Ben Youssef, S. Factors Affecting the Adoption of Innovative Technologies by Livestock Farmers in Arid Area of Tunisia. *FARA Res. Rep.* **2018**, *3*, 22.
23. Horbach, J.; Rammer, C.; Rennings, K. Determinants of Eco-Innovations by Type of Environmental Impact—The Role of Regulatory Push/Pull, Technology Push and Market Pull. *Ecol. Econ.* **2012**, *78*, 112–122. [CrossRef]
24. Zailani, S.; Iranmanesh, M.; Nikbin, D.; Jumadi, H.B. Determinants and Environmental Outcome of Green Technology Innovation Adoption in the Transportation Industry in Malaysia. *Asian J. Technol. Innov.* **2014**, *22*, 286–301. [CrossRef]
25. Gioia, D.A.; Corley, K.G.; Hamilton, A.L. Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organ. Res. Methods* **2013**, *16*, 15–31. [CrossRef]
26. Miles, M.B.; Huberman, A.M. *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd ed.; [Nachdr.]; Sage: Thousand Oaks, CA, USA, 1994; ISBN 978-0-8039-5540-0.
27. Driessen, P.H.; Hillebrand, B. Adoption and Diffusion of Green Innovations. *Mark. Sustain. Towards Trans. Policy-Mak.* **2002**, *1*, 343–355.
28. Chen, Y.-S.; Lai, S.-B.; Wen, C.-T. The Influence of Green Innovation Performance on Corporate Advantage in Taiwan. *J. Bus. Ethics* **2006**, *67*, 331–339. [CrossRef]
29. Chen, Y. Green Organizational Identity: Sources and Consequence. *Manag. Decis.* **2011**, *49*, 384–404. [CrossRef]
30. Meidute-Kavaliauskiene, I.; Çiğdem, Ş.; Vasilis Vasiliauskas, A.; Yıldız, B. Green Innovation in Environmental Complexity: The Implication of Open Innovation. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 107. [CrossRef]
31. Forbes, S.L.; Cullen, R.; Grout, R. Adoption of Environmental Innovations: Analysis from the Waipara Wine Industry. *Wine Econ. Policy* **2013**, *2*, 11–18. [CrossRef]
32. Ullah, S.; Khan, F.U.; Ahmad, N. Promoting Sustainability through Green Innovation Adoption: A Case of Manufacturing Industry. *Env. Sci. Pollut. Res.* **2022**, *29*, 21119–21139. [CrossRef]
33. Fraj-Andrés, E.; Martinez-Salinas, E.; Matute-Vallejo, J. A Multidimensional Approach to the Influence of Environmental Marketing and Orientation on the Firm's Organizational Performance. *J. Bus. Ethics* **2009**, *88*, 263–286. [CrossRef]
34. Zhao, N.; Liu, X.; Pan, C.; Wang, C. The Performance of Green Innovation: From an Efficiency Perspective. *Socio-Econ. Plan. Sci.* **2021**, *78*, 101062. [CrossRef]
35. Sun, H.; Edziah, B.K.; Sun, C.; Kporsu, A.K. Institutional Quality, Green Innovation and Energy Efficiency. *Energy Policy* **2019**, *135*, 111002. [CrossRef]
36. Du, J.; Liu, Y.; Diao, W. Assessing Regional Differences in Green Innovation Efficiency of Industrial Enterprises in China. *Int. J. Environ. Res. Public Health* **2019**, *16*, 940. [CrossRef]
37. Aguilera-Caracuel, J.; Ortiz-de-Mandojana, N. Green Innovation and Financial Performance: An Institutional Approach. *Organ. Environ.* **2013**, *26*, 365–385. [CrossRef]
38. Gómez-Bezares, F.; Przychodzen, W.; Przychodzen, J. Bridging the Gap: How Sustainable Development Can Help Companies Create Shareholder Value and Improve Financial Performance. *Bus. Ethics A Eur. Rev.* **2017**, *26*, 12135. [CrossRef]
39. Aldieri, L.; Carlucci, F.; Cirà, A.; Ioppolo, G.; Vinci, C.P. Is Green Innovation an Opportunity or a Threat to Employment? An Empirical Analysis of Three Main Industrialized Areas: The USA, Japan and Europe. *J. Clean. Prod.* **2019**, *214*, 758–766. [CrossRef]

40. Song, M.; Peng, L.; Shang, Y.; Zhao, X. Green Technology Progress and Total Factor Productivity of Resource-Based Enterprises: A Perspective of Technical Compensation of Environmental Regulation. *Technol. Forecast. Soc. Chang.* **2022**, *174*, 121276. [CrossRef]
41. Song, M.; Wang, S. Market Competition, Green Technology Progress and Comparative Advantages in China. *Manag. Decis.* **2018**, *56*, 188–203. [CrossRef]
42. Amores-Salvadó, J.; Castro, G.M.; Navas-López, J.E. Green Corporate Image: Moderating the Connection between Environmental Product Innovation and Firm Performance. *J. Clean. Prod.* **2014**, *83*, 356–365. [CrossRef]
43. Hart, S.L. A Natural-Resource-Based View of the Firm. *Acad. Manag. Rev.* **1995**, *20*, 986. [CrossRef]
44. Afum, E.; Agyabeng-Mensah, Y.; Baah, C.; Agyapong, G.K.Q.; Lascano Armas, J.A.; Al Farooque, O. Prioritizing Zero-Waste Performance and Green Differentiation Advantage through the Prism of Circular Principles Adoption: A Mediated Approach. *J. Clean. Prod.* **2022**, *361*, 132182. [CrossRef]
45. Agyabeng-Mensah, Y.; Tang, L.; Afum, E.; Baah, C.; Dacosta, E. Organisational Identity and Circular Economy: Are Inter and Intra Organisational Learning, Lean Management and Zero Waste Practices Worth Pursuing? *Sustain. Prod. Consum.* **2021**, *28*, 648–662. [CrossRef]
46. Hart, S.L.; Dowell, G. Invited Editorial: A Natural-Resource-Based View of the Firm: Fifteen Years After. *J. Manag.* **2011**, *37*, 1464–1479. [CrossRef]
47. Fontoura, P.; Coelho, A. How to Boost Green Innovation and Performance through Collaboration in the Supply Chain: Insights into a More Sustainable Economy. *J. Clean. Prod.* **2022**, *359*, 132005. [CrossRef]
48. Singh, S.K.; Del Giudice, M.; Chiappetta Jabbour, C.J.; Latan, H.; Sohal, A.S. Stakeholder Pressure, Green Innovation, and Performance in Small and Medium-sized Enterprises: The Role of Green Dynamic Capabilities. *Bus. Strategy Environ.* **2022**, *31*, 500–514. [CrossRef]
49. Wong, C.Y.; Wong, C.W.Y.; Boon-itt, S. Effects of Green Supply Chain Integration and Green Innovation on Environmental and Cost Performance. *Int. J. Prod. Res.* **2020**, *58*, 4589–4609. [CrossRef]
50. Bossle, M.B.; De Barcellos, M.D.; Vieira, L.M. Why Food Companies Go Green? The Determinant Factors to Adopt Eco-Innovations. *Br. Food J.* **2016**, *118*, 1317–1333. [CrossRef]
51. Yan, X.; Zhang, Y.; Pei, L.-L. The Impact of Risk-Taking Level on Green Technology Innovation: Evidence from Energy-Intensive Listed Companies in China. *J. Clean. Prod.* **2021**, *281*, 124685. [CrossRef]
52. Xia, D.; Xia, N.; Zhang, Y.; Xiong, J.; Zhu, R. Diffusion Path Identification of Public Opinion Involving Enterprise Green Technology Adoption: An Interpretive-Structural-Modeling-Based Approach. *Int. J. Environ. Res. Public Health* **2022**, *19*, 2817. [CrossRef]
53. Huang, X.; Hu, Z.; Liu, C.; Yu, D.; Yu, L. The Relationships between Regulatory and Customer Pressure, Green Organizational Responses, and Green Innovation Performance. *J. Clean. Prod.* **2016**, *112*, 3423–3433. [CrossRef]
54. Shahzad, M.; Qu, Y.; Rehman, S.U.; Zafar, A.U. Adoption of Green Innovation Technology to Accelerate Sustainable Development among Manufacturing Industry. *J. Innov. Knowl.* **2022**, *7*, 100231. [CrossRef]
55. Flores, P.J.; Jansson, J. SPICe—Determinants of Consumer Green Innovation Adoption across Domains: A Systematic Review of Marketing Journals and Suggestions for a Research Agenda. *Int. J. Consum. Stud.* **2022**, *46*, 1761–1784. [CrossRef]
56. Li, L.; Li, G.; Ozturk, I.; Ullah, S. Green Innovation and Environmental Sustainability: Do Clean Energy Investment and Education Matter? *Energy Environ.* **2022**, *1*, 0958305X2211150. [CrossRef]
57. Ibrahim, R.L.; Ozturk, I.; Al-Faryan, M.A.S.; Al-Mulali, U. Exploring the Nexuses of Disintegrated Energy Consumption, Structural Change, and Financial Development on Environmental Sustainability in BRICS: Modulating Roles of Green Innovations and Regulatory Quality. *Sustain. Energy Technol. Assess.* **2022**, *53*, 102529. [CrossRef]
58. Najib, M.; Fahma, F.; Abror, A.; Suhartanto, D. Organizational Capability, Market Perspective, and Green Innovation Adoption: Insight From Indonesian Food Processing Small and Medium-Sized Enterprises. *J. Small Bus. Strategy* **2022**, *32*, 51–66. [CrossRef]
59. Zulfiqar, F.; Datta, A.; Tsusaka, T.W.; Yaseen, M. Micro-Level Quantification of Determinants of Eco-Innovation Adoption: An Assessment of Sustainable Practices for Cotton Production in Pakistan. *Sustain. Prod. Consum.* **2021**, *28*, 436–444. [CrossRef]
60. Petridis, N.E.; Digkas, G.; Anastasakis, L. Determinants of ICT Innovation and Imitation in the Agrifood Sector. In Proceedings of the CEUR Workshop Proceedings, Chania, Greece, 21–24 September 2017; 2030, pp. 104–115.
61. Khan, S.A. Consumer Innovation Adoption Stages and Determinants. *SSRN J.* **2017**, *3*, 1–52. [CrossRef]
62. Chiu, C.-Y.; Chen, S.; Chen, C.-L. An Integrated Perspective of TOE Framework and Innovation Diffusion in Broadband Mobile Applications Adoption by Enterprises. *Int. J. Manag. Econ. Soc. Sci. (IJMESS)* **2017**, *6*, 14–39.
63. Kousar, S.; Sabri, P.S.U.; Zafar, M.; Akhtar, A. Technological Factors and Adoption of Green Innovation: Moderating Role of Government Intervention: A Case of SMEs in Pakistan. *Pak. J. Commer. Soc. Sci. (PJCSS)* **2017**, *11*, 833–861.
64. Fahad, S.; Alnori, F.; Su, F.; Deng, J. Adoption of Green Innovation Practices in SMEs Sector: Evidence from an Emerging Economy. *Econ. Res. Ekon. Istraživanja* **2022**, *35*, 5486–5501. [CrossRef]
65. Thomas, A.; Scandurra, G.; Carfora, A. Adoption of Green Innovations by SMEs: An Investigation about the Influence of Stakeholders. *Eur. J. Innov. Manag.* **2022**, *25*, 44–63. [CrossRef]
66. Lin, C.-Y.; Ho, Y.-H.; Wu, Y.-L.; Yu, I.-C. Determinants of Mindful Adoption of Green Innovation. *Int. J. Res. Bus. Soc. Sci.* **2019**, *8*, 79–89. [CrossRef]
67. Jeyaraj, A.; Rottman, J.W.; Lacity, M.C. A Review of the Predictors, Linkages, and Biases in IT Innovation Adoption Research. *J. Inf. Technol.* **2006**, *21*, 1–23. [CrossRef]
68. Rogers, E.M. *Diffusion of Innovations*; The Free Press: New York, NY, USA, 2003; ISBN 978-0-7432-5823-4.

69. Cooper, R.B.; Zmud, R.W. Information Technology Implementation Research: A Technological Diffusion Approach. *Manag. Sci.* **1990**, *36*, 123–139. [CrossRef]
70. Szulanski, G. Exploring Internal Stickiness: Impediments to the Transfer of Best Practice within the Firm: Exploring Internal Stickiness. *Strat. Mgmt. J.* **1996**, *17*, 27–43. [CrossRef]
71. Martínez-Ros, E.; Kunapatarawong, R. Green Innovation and Knowledge: The Role of Size. *Bus. Strategy Environ.* **2019**, *28*, 1045–1059. [CrossRef]
72. Ho, Y.-H.; Lin, C.-Y.; Tsai, J.-S. An Empirical Study on Organizational Infusion of Green An Empirical Study on Organizational Infusion of Green Practices in Chinese Logistics Companies. *J. Econ. Soc. Stud.* **2014**, *4*, 65–78. [CrossRef]
73. Rogers, E.M. Lessons for Guidelines from the Diffusion of Innovations. *Jt. Comm. J. Qual. Improv.* **1995**, *21*, 324–328. [CrossRef]
74. Zhang, Y.; Sun, J.; Yang, Z.; Wang, Y. Critical Success Factors of Green Innovation: Technology, Organization and Environment Readiness. *J. Clean. Prod.* **2020**, *264*, 121701. [CrossRef]
75. Lee, S. Drivers for the Participation of Small and Medium-sized Suppliers in Green Supply Chain Initiatives. *Supply Chain Manag. Int. J.* **2008**, *13*, 185–198. [CrossRef]
76. Lee, H.Y.; Lee, Y.-K.; Kwon, D. The Intention to Use Computerized Reservation Systems: The Moderating Effects of Organizational Support and Supplier Incentive. *J. Bus. Res.* **2005**, *58*, 1552–1561. [CrossRef]
77. Karimi, J.; Walter, Z. The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry. *J. Manag. Inf. Syst.* **2015**, *32*, 39–81. [CrossRef]
78. Bhatia, M.S. Green Process Innovation and Operational Performance: The Role of Proactive Environment Strategy, Technological Capabilities, and Organizational Learning. *Bus. Strategy Environ.* **2021**, *30*, 2845–2857. [CrossRef]
79. Tseng, M.-L.; Wang, R.; Chiu, A.S.F.; Geng, Y.; Lin, Y.H. Improving Performance of Green Innovation Practices under Uncertainty. *J. Clean. Prod.* **2013**, *40*, 71–82. [CrossRef]
80. Sellitto, M.A.; Camfield, C.G.; Buzuku, S. Green Innovation and Competitive Advantages in a Furniture Industrial Cluster: A Survey and Structural Model. *Sustain. Prod. Consum.* **2020**, *23*, 94–104. [CrossRef]
81. Holzner, B.; Wagner, M. Linking Levels of Green Innovation with Profitability under Environmental Uncertainty: An Empirical Study. *J. Clean. Prod.* **2022**, *378*, 134438. [CrossRef]
82. Li, H.; Atuahene-Gima, K. The Adoption of Agency Business Activity, Product Innovation, and Performance in Chinese Technology Ventures. *Strat. Mgmt. J.* **2002**, *23*, 469–490. [CrossRef]
83. Gupta, A.K.; Govindarajan, V. Knowledge Flows and the Structure of Control within Multinational Corporations. *Acad. Manag. Rev.* **1991**, *16*, 768. [CrossRef]
84. Scupola, A. The Adoption of Internet Commerce by SMEs in the South of Italy: An Environmental, Technological and Organizational Perspective. *J. Glob. Inf. Technol. Manag.* **2003**, *6*, 52–71. [CrossRef]
85. Aragón-Correa, J.A.; Sharma, S. A Contingent Resource-Based View of Proactive Corporate Environmental Strategy. *Acad. Manag. Rev.* **2003**, *28*, 71–88. [CrossRef]
86. Wang, H.; Qi, S.; Zhou, C.; Zhou, J.; Huang, X. Green Credit Policy, Government Behavior and Green Innovation Quality of Enterprises. *J. Clean. Prod.* **2022**, *331*, 129834. [CrossRef]
87. Buysse, K.; Verbeke, A. Proactive Environmental Strategies: A Stakeholder Management Perspective. *Strat. Mgmt. J.* **2003**, *24*, 453–470. [CrossRef]
88. González-Benito, J.; González-Benito, Ó. The Role of Stakeholder Pressure and Managerial Values in the Implementation of Environmental Logistics Practices. *Int. J. Prod. Res.* **2006**, *44*, 1353–1373. [CrossRef]
89. Sharma, S.; Henriques, I. Stakeholder Influences on Sustainability Practices in the Canadian Forest Products Industry. *Strat. Mgmt. J.* **2005**, *26*, 159–180. [CrossRef]
90. de Oliveira Neto, G.C.; Tucci, H.N.P.; Correia, J.M.F.; da Silva, P.C.; da Silva, D.; Amorim, M. Stakeholders' Influences on the Adoption of Cleaner Production Practices: A Survey of the Textile Industry. *Sustain. Prod. Consum.* **2021**, *26*, 126–145. [CrossRef]
91. Zhu, Q.; Sarkis, J.; Lai, K. Green Supply Chain Management Innovation Diffusion and Its Relationship to Organizational Improvement: An Ecological Modernization Perspective. *J. Eng. Technol. Manag.* **2012**, *29*, 168–185. [CrossRef]
92. Eisenhardt, K.M. Building Theories from Case Study Research. *Acad. Manag. Rev.* **1989**, *14*, 532–550. [CrossRef]
93. Eisenhardt, K.M.; Graebner, M.E. Theory Building From Cases: Opportunities And Challenges. *Acad. Manag. J.* **2007**, *50*, 25–32. [CrossRef]
94. Ben Arfi, W.; Hikkerova, L.; Sahut, J.-M. External Knowledge Sources, Green Innovation and Performance. *Technol. Forecast. Soc. Change* **2018**, *129*, 210–220. [CrossRef]
95. Spradley, J.P. *The Ethnographic Interview*; Holt, Rinehart and Winston: New York, NY, USA, 1979; ISBN 978-0-03-044496-8.
96. Moran-Ellis, J.; Alexander, V.D.; Cronin, A.; Dickinson, M.; Fielding, J.; Sleney, J.; Thomas, H. Triangulation and Integration: Processes, Claims and Implications. *Qual. Res.* **2006**, *6*, 45–59. [CrossRef]
97. Emerson, R.M.; Fretz, R.I.; Shaw, L.L. Writing Ethnographic Fieldnotes. In *Chicago Guides to Writing, Editing, and Publishing*, 2nd ed.; The University of Chicago Press: Chicago, IL, USA, 2011; ISBN 978-0-226-20683-7.
98. Kvale, S.; Brinkmann, S. *InterViews: Learning the Craft of Qualitative Research Interviewing*, 3rd ed.; Sage Publications: Los Angeles, CA, USA, 2015; ISBN 978-1-4522-7572-7.
99. Krippendorff, K. Measuring the Reliability of Qualitative Text Analysis Data. *Qual. Quant.* **2004**, *38*, 787–800. [CrossRef]

100. Jaffe, A. Entextualization, Mediatization and Authentication: Orthographic Choice in Media Transcripts. *Text Talk-Interdiscip. J. Lang. Discourse Commun. Stud.* **2009**, *29*, 571–594. [CrossRef]
101. Yin, R.K. *Case Study Research: Design and Methods*, 5th ed.; SAGE: Los Angeles, CA, USA, 2014; ISBN 978-1-4522-7724-0.
102. Cho, J.; Trent, A. Validity in Qualitative Research Revisited. *Qual. Res.* **2006**, *6*, 319–340. [CrossRef]
103. Yin, S.; Yu, Y. An Adoption-Implementation Framework of Digital Green Knowledge to Improve the Performance of Digital Green Innovation Practices for Industry 5.0. *J. Clean. Prod.* **2022**, *363*, 132608. [CrossRef]
104. Bridge, S. Facing Uncertainty: An Entrepreneurial View of the Future? *J. Manag. Organ.* **2021**, *27*, 312–323. [CrossRef]