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Influencing Factors of The Innovation Power in the Adoption of Sustainability Strategies

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Abstract: The study aimed to analyze which are the best corporate environmental strategies to foster the innovation power of companies in the mining sector. The methodology used was the quantitative approach through multiple linear regression analysis were used to analyze the power of innovation and to see how the interrelationship between pressures and incentives can influence companies in the implementation of the sustainability strategy which resulted in five different models. The results show that different environmental strategies foster, in different ways, the power of innovation of companies in the analyzed mineral sector. Therefore, it became evident that cost reduction and adaptation to a strong regulatory environment are strategies capable of promoting external guidance and the transparency of innovation processes. Second, the search for reducing environmental impacts and adapting to a strong regulatory environment are strategies that strengthen knowledge of the business environment. In addition, the results show that leadership in products and processes can be optimized through strategies to reduce costs and environmental impacts. Finally, Autonomy and market leadership in relation to innovative initiatives can be achieved via cost reduction, incorporation of social and environmental guidelines, and adaptation to a strong regulatory environment. Thus, this study contributes to the theory and practice of innovation as it reveals to be the best corporate strategy capable of fostering the innovation power of companies in the mineral sector.

Keywords: power of innovation; strategies for sustainability; mineral sector



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1. Introduction

The importance of innovation for business competitiveness is growing and recognized. In order for the company to be successful and continue in the market, it is necessary to innovate efficiently and effectively [1–3]. Innovation is an extremely important factor for the survival of modern organizations (Saura et al. [4]) since they contribute to growth and, at the same time, to organizational success, and is still considered the main driver of economic development [5,6]).

In the 1930s, one of the first concepts of innovation emerged, developed by Schumpeter in 1934 [7], who described innovation as being an idea that has potential for commercial exploitation. For Schumpeter 1961 [8], the real advantage of the company as a holder of innovation is not only in the opportunity to operate as a monopolist, but also in the time it takes to develop a long-term plan. However, whatever the marketing, technological, and social conditions involved, the key to maintaining and creating competitive advantage are those organizations that constantly innovate [9].

However, Schumpeter [10] describes innovation as a combination of productive reasons, such as the application of inventions that introduces new services, products, methods,

new sources of raw material, technological knowledge, and new ways of industrial organization, generating an imbalance in the Marketplace. For the author, the imbalance ends up providing the market with economic development, being its main agent the innovative entrepreneur [10].

In this context, the Oslo Manual [11], expands the concept of innovation, in addition to technological innovation, this encompassing marketing innovation and organizational innovation, defining marketing as the development of a new marketing method with significant changes in the product development or packaging, promotion or pricing, and product positioning. Organizational innovation, on the other hand, is the implementation of a new organizational method, in the organization of the workspace or in external relations and business practices [12].

With society increasingly demanding, there is a need to offer better products and services, making the environment competitive. However, it is not enough just to innovate, for organizations to remain in the market and launch new products, they need to manage innovation [13]. There is no formula for the innovation management process, the innovation process must be adjusted according to the organization, considering the factors of type of organization, stages, and scope of innovation [13–15].

Innovation management is the use of new ideologies, which differentiate products or services and improve processes [16]. However, it is necessary to have more than new ideas, they need to reflect on the business of organizations [17]. In addition, innovation management activities go beyond universities, laboratories, large companies, and the technology center; in order to have an effect, it is necessary to practice and investigate it [18]. However, the Brundtland report, mentions that the development of innovations that seek to implement technologies focused on sustainability is a great challenge for organizations [11]. Therefore, sustainable innovation in products, services, and processes, can improve the environmental performance of companies [1,19], since there is a high profile in the international and national scenarios with regard to the environmental issue.

Since, what determines the strategy used (y), is the power of innovation (characteristics of innovation (x)) [1]. The focus of the strategy focused on sustainable innovation can be demonstrated in three ways: focus on the process, focus on the product, and focus on the product/process, so the choice of the focus of the strategy may depend on different internal and external reasons for the organization [20]; the internal factors are the organization's competence in learning about the natural business environment and putting knowledge into practice in the organization's strategy [1,20].

Thus, innovation and sustainability are consequences of an organizational learning process [20]. For Senge [21] and Barbieri-Rosa [20], the fundamental resources used in the process involve information (about markets, advances in technology, regulations and competitors), and knowledge (Know-how, skills), in a favourable organizational space.

Due to business competition, it is not enough for the organization to just innovate, for the company to continue competing in the market, it must be accompanied by a strategy that seeks sustainable development. For this, Bowonder et al. [22] describe that innovation strategies are used to interpret choices when talking about innovation, and from them, the organization develops new experiences or products, allowing the market position in front of its competitors.

According to the authors, the strategies can be defensive, offensive, imitative, traditional, opportunistic and dependent [22], resigned, defensive, offensive [1,2], prospective, defensive, reactive, and analytical. However, the corporate strategy for sustainability can be based on resource productivity, and environmental cost leadership, in addition to legal compliance or eco-oriented products [3].

Therefore, organizations that have implemented strategies aimed at sustainability, can benefit themselves by increasing their competitiveness, resulting in benefits [19,20]. Thus, entrepreneurs seek social, environmental, and economic goals, through products, and processes of superior quality without harming the environment [23]. Bearing in mind

the importance of innovating with a focus on sustainability, to preserve the environment for future generations.

Thus, the objective of the study is to analyse which factors influence the power of innovation in the choice of strategies for sustainability.

In the next chapter, the theoretical contribution of the study will be addressed.

2. Theoretical Support of the Study

2.1. Innovation and Its Concepts

There is a difference between the results of innovation for economists and organizational theorists, who measure the first results of innovation in products, processes, or practices for the industry, and the second results that occur at the company level [24]. In the economic sphere, innovation, in a Schumpeterian view, can be presented as a result of entrepreneurial motivations, intrinsic to the capitalist system, with the objective of generating creative destruction of historical competencies and its concept sent to the first half of the 20th century [25]. An innovation changes the economic policies within the industry, a process that is not allowed to create something new from the constant dismantling of current rules [26]. In other words, innovation refers to new combinations that are more economically viable, when compared to the old way of doing things, whose diffusion occurs through imitation, since success is perceived by other entrepreneurs. Entrepreneurship, therefore, breeds innovation [7,27,28].

The concept of innovation involves five domains. The first one refers to the insertion of a new quality or a new good, called product innovation. Second, there is the creation of a new method of production and marketing, known as process innovation. Then, there is an opening for a new market. In the fourth place, there is an innovation of inputs, through the use of new sources of supply of raw materials. Finally, there is an organizational innovation, characterized by the modelling of a new form of industrial organization [7].

It should be noted that innovation does not only involve radical or unpredictable changes, but there are also important roles of the cumulative nature of knowledge, since real revolutions take place in discrete changes, with a difference between innovation and invention, since the first has and second. [29–32] indicates that innovation develops an invention intended for consumption on a large scale. According to OECD [11], innovation is the implantation of a new or substantially better product (goods or services). To be configured as an innovation, it is essential that, the product or service has been implemented, that is, introduced in the market, or that processes and methods are used in practices in organizational operations.

Innovation strategies are those adopted by companies for the development of new products, services, procedures, management strategies, and technology inherent to the rapidly changing environment in the competitive market. Such strategies determine the configuration of resources, products, systems, and processes that guide the organization in decision-making [33].

In addition to product delivery, the speed of innovation is important for organizational success. The speed of innovation is related to the timely development of products and services to obtain a competitive advantage and is based on team-based competence [34–36]. However, it is not enough to present speed in the introduction of innovative aspects if the company does not present quality of innovation [37,38]. The quality of innovation refers to the performance of processes involved in innovation and the results obtained, which depends on adequate knowledge management. The speed and quality of innovation are essential in complex, turbulent, and constantly changing business environments [39–41]. Therefore, innovation is a critical organizational element with a great capacity to influence performance [42].

2.2. Dimensions of Innovation

Studies by Van Bommell [1], and Barbieri [2], demonstrate that some characteristics may demonstrate the ability to satisfactorily implement sustainability strategies. The six

characteristics involve: (I) External orientation and transparency in innovation processes. The company focuses on differentiation and competition with other organizations; (II) Cooperation between departments—the company provides synergy and facilitates the smooth functioning of work between departments; (III) Knowledge about the business environment and adapting that knowledge to the reality of the company. The company seeks to know the competitive environment of organizations and adapt to the reality of each company; (IV) Leadership in the introduction of new products and new processes in the market. The development of new products is the great competitive goal achieved by the company in the search for new markets; (V) Market autonomy and leadership in relation to innovative initiatives. The company seeks to be attentive to the search for new technologies, being the first to create products or process improvements; and (VI) orientation towards innovation results.

The company seeks to obtain profits or some type of result, focusing on innovation.

The demands of customers and markets have influenced companies to adapt, incorporating new strategies in order to obtain a greater competitive advantage. The adoption of appropriate organizational strategies can provide a more adequate implementation of corporate environmental management practices and activities while reducing the impacts caused by industrial activity [43]. Innovation is defined as the main driver for the growth of companies, so that they adapt and seek to increase their competitive advantage, adding to the creation of value and profitability [44,45].

2.3. Sustainability Strategies

According to Powell, Lovallo and Fox [46], the three pillars of the strategy are the monopoly barriers, the advantages of resources marked by the scarcity of factors, and the Schumpeterian patterns of innovation fostered by entrepreneurship and technology. For Porter [47], the formulation of the strategy has as its primary scope to deal with five microeconomic forces and to manage threats from competitors, customers, suppliers, new entrants, and substitute products. Competition is affected by the congruence of the five basic forces, which define the maximum possible profit potential for an industry, a crucial issue for organizational strategy.

The field of strategy has numerous strands. The first, based on microeconomics, study the differences in performance of industrial organizations, the development of clusters, the failures of the market, as well as the strengths and barriers to competitiveness [47,48]. Still, in the microeconomic field, the resource-based view returns to the market of factors and strategic resources, highlighting the importance of resources for the heterogeneity and differentiation of performance between companies, and to increase competitive advantage and greater value creation [45,49]. In this sense, value creation is a concatenated process in which value comes from all players in the vertical chain as a whole, that is, it depends on suppliers, firms, and buyers [50–52] who point out that business performance is part of a subset of a larger concept of organizational effectiveness, in which the broader concept must include, in addition to financial indicators, the so-called operational indicators.

A second important aspect in strategy studies involves strategy and psychological and behavioural aspects, with a focus on dynamic, absorptive, and adaptive intelligence, as well as the differentiation between exploration and exploitation [46,53–55].

Thirdly, the field of studies on strategy is marked by the extensive use of institutional theory and its interrelationships with the economy, with a view to unveiling the institutional conditions of the strategy [56]. Institutions are conceived as the rules established in a society or, from a formal point of view, refer to restrictions capable of shaping and delineating human interaction. In other words, institutions can be defined as normative and regulatory cognitive structures that provide stability and a certain meaning to social behaviours. Informal, as well as formal, institutionalization of sustainability in laws, standards, or even through the adoption of social responsibility practices, is an important institutional aspect that influences the performance of organizations with regard to sustainability [57–59].

Finally, another important area of research in strategy relates to diversification and vertical integration, in which the strategies of alliances (relational view) stand out [60], characterized by building collaborative relationships and establishing alliances in the supply chain [61,62]. In this study, the third strand of the aforementioned strategy will be used, related to the theoretical and practical implications of the strategy, institutional theory and economics, with a focus on sustainability.

For an institutional understanding of the environmental strategy, organizations must be seen as systems that work and integrate their environments, as well as organized entities whose management must be linked to the broader products, people, resources, and context, marked by economic and political relations that they create standards of conduct and power [63].

Orsato [3] demonstrates the types of strategies capable of optimizing a company's return on investment. As shown in Table 1, factors such as the sector or industry in which the company operates, types of market, and organizational competencies will determine the most appropriate competitive focus—the processes and services as well as the potential source from which competition will emerge—cost or differentiation.

Table 1. Corporate Environmental Strategy. Source: Adapted from Orsato ([3], p. 7).

| | | |
|-----------------------|---|--|
| Cost | (I) Productivity in Resources | (III) Leadership of Environmental Cost |
| Competitive advantage | (II) Besides the Legal compliance | (IV) Products Eco-Oriented |
| Differentiation | Process | Products and Services |
| | Competitive Focus | |

With regard to the first quadrant, Productivity in Resources, the guiding element of organizational competitiveness is labour and capital productivity, through the reduction in manufacturing costs and the final price of products. Companies that pursue innovation can be more profitable in economic terms since the (re)use of raw materials and inputs can generate productivity gains while causing less impact on the environment [3].

In relation to the second quadrant, which deals with actions Beyond Legal Compliance, Orsato [3] demonstrates that the implementation of environmental practices can foster the company's differentiation from industry competitors, optimizing the corporate image in the customer's view. Companies that are pioneers in differentiating themselves from other companies may have a greater competitive advantage and greater customer loyalty. In this way, the competition promotes differentiation that goes beyond legal compliance.

In the third quadrant, Environmental Cost Leadership, Orsato [3] shows a market share that is much desired by companies; at the same time, it is the most daring strategy among those listed. In this scenario, it is possible to satisfy customers' needs for products with less environmental impact with the concomitant reduction in costs in the production process or increase in organizational skills.

Finally, in the fourth quadrant, Ecologically Oriented Products, the competitive advantage comes from differentiation through ecological attributes of products and services. According to Orsato [3], it is the most evident strategy among the other four. Achieving this competitive advantage may involve the need for radical innovations, and differentiation through capacities and resources that are difficult to imitate, with the high willingness to pay from consumers [64].

In this study, the first two quadrants of the environmental strategy model proposed by Orsato [3] apply. Such disaggregation was necessary due to the non-inclusion of the third and fourth quadrants in the study objective of Van Bommell [1] and Barbieri [2]. Through the proposed model, it will be possible to identify the mitigating activities of companies

in the mineral sector, as well as the classification of the strategic environmental posture adopted, whether defensive or offensive in relation to the exploitation of mineral resources. Notably, the organization's choice of the best strategy may favour the increase in corporate environmental management practices, restricting the impacts caused by industrial activities. Sacconmano Neto and Truzzi [20] argue that strategy establish a framework for a progressive evolution of the company and aims to provide information and guidelines for managers to define their roles and help their organization to maintain competitiveness.

The theoretical model of Van Bommel [1] and Barbieri [2] suggests that the choice of the environmental strategy is influenced by environmental activities. For the authors, environmental activities represent the basis for implementing corporate sustainability, so that the definition of specific activities can determine the type of environmental strategy chosen.

Thus, environmental certification activities depend, to a large extent, on the existence of an environmental management system in order to assess, prevent, or mitigate adverse environmental impacts, which can engender offensive environmental strategies, should the company wish to position itself strategically and obtain competitive advantage based on environmental differentiation [65,66].

In this way, sustainable practices are an essential condition for the survival of the business model and the company, while offering a long-term competitive advantage [63,67]. Adequate environmental strategies with the correct allocation of dynamic capacities are capable of generating a sustainable performance for the result of the triple bottom line, that is, for the economic, environmental, and social aspects within and between organizations [68–70]. The prospect of strategy development in small and medium-sized companies for sustainability and increased value creation has been the subject of studies, especially given the importance of these companies for economic development, since they represent the majority of all companies [71–73].

Although it is widely known that the formulation of the sustainability strategy within the company is of salutary relevance, it is necessary to return to the real implementation of the strategy, as it is necessary to adopt concrete measures for the conversion of the sustainability strategy in practice. Therefore, knowing and working on the gaps between the formulation and implementation of the corporate sustainability strategy is essential for companies that wish to obtain a competitive advantage and create value [74,75].

3. Methods

The quantitative phase was conducted through survey research, with the application of a structured questionnaire in industrial companies in the Brazilian mineral sector. According to Beuren (p. 93) [76], this procedure [. . .] is concerned with the general behaviour of events. Hair, Jr., et al. [77] compliment that “it offers summary information about various characteristics, being useful for mapping trends”.

To carry out this research, the universe of the study was made up of companies belonging to the Brazilian mineral sector. The choice of these companies as the object of investigation was due to the fact that this sector has a large representation in the Brazilian economy. In addition, the mining sector can represent damage to environmental sustainability if there are no preventive environmental management actions. The registration base of this study was composed of companies belonging to the Brazilian Mining Institute—IBRAM. The choice of this population was due to its representativeness and the fact that the institute represents the activities of the mineral sector in Brazil.

The directors of each organization were invited to answer the electronic questionnaire. The questionnaires were sent through institutional emails after telephone contact was made by the researchers. Thirty-two companies in the Brazilian mineral sector participated in the research.

Multiple linear regression was applied due to the existence of two or more independent variables, seeking to analyse which factors influence the power of innovation in choosing strategies for sustainability, in order to meet the assumptions of the technique. According

to Hair et al. [77], multiple regression aims to use the independent variables whose values are known to predict the values of the dependent variable. In addition, the regression analysis proved to be adequate due to the existence of dependent and independent metric variables [77].

As this is an exploratory study, its main goal is to build models through the identification of a useful subset of predictors, by using a sequential stepwise search method. The stepwise method is capable of estimating regression equations considering a set of previously defined variables, selected selectively. Thus, there is the maximization of the forecast with the smallest possible number of variables in each model [77].

Thus, from the concepts and information reviewed in the theoretical foundation and based on the studies of Van Bommell [1], Barbieri [2], and Orsato [3], the conceptual research model was built.

In order to analyse the innovation power that differentiates companies regarding sustainability strategies of the companies surveyed, the multivariate regression technique was applied. The linear regression analysis technique consisted of five dependent and nine independent variables. The initial model of analysis is shown in Table 2.

Table 2. Variables used in the regression models.

| Construct | Variable | Item |
|--|----------|---|
| Power of Innovation [1,2] | y1 | External orientation and transparency in innovation processes |
| | y2 | Cooperation between departments |
| | y3 | Knowledge about the business environment and adapting that knowledge to the company's reality |
| | y4 | Leadership in introducing new products and new processes in the market |
| | y5 | Autonomy and market leadership in relation to innovative initiatives |
| Independent variables | | |
| Corporate Environmental Strategies [1,3] | x1 | Strategies that incorporate social and environmental aspects in the production process |
| | x2 | Reduction in costs and environmental impacts in the production process from external pressures (legislation, public policies) |
| | x3 | Incorporation of social and environmental aspects in its production process involving its stakeholders |
| | x4 | Reduction in environmental impacts in the production process, seeking to go beyond compliance with environmental legislation |
| | x5 | Consumers and customers |
| | x6 | Business actions |
| | x7 | Dialogue |
| | x8 | New measurement concepts |
| | x9 | A new regulatory environment |

The results obtained allow the specific analysis of the characteristics and behaviour of the studied companies. For each dependent variable (y1, y2, y3, y4, and y5), a multiple linear regression was performed using the stepwise method, resulting in five distinct models, with the objective of verifying the best fit between the predictive relationships of the power of innovation from the adoption of sustainability strategies.

In the next section the results of the study will be presented and discussed.

4. Results and Discussion

Regarding the estimation of the regression models, the ANOVA results showed a p -value less than 0.05, for the five models, showing that the adjusted models are highly significant. The regression premises were met, namely, normality, homoscedasticity, linearity, and independence of the residues [77].

Table 3 shows that the only variable with a significance level of $\alpha = 0.05$ to explain the dependent variable (y_1 = external orientation and transparency in innovation processes) are the independent variables x_2 —cost reduction and environmental impacts—in the productive process from external pressures (legislation, public policies) and x_9 —a new regulatory environment.

Table 3. Results of stepwise regression—Model 1.

| Model | Dependent Variable | Independent Variables Included | Excluded Variables |
|-------|--|--|-------------------------------------|
| 1 | y_1 —External orientation and transparency in innovation processes | x_2 —Cost reduction x_9 —A new regulation environment | $x_1, x_3, x_4, x_5, x_6, x_7, x_8$ |
| | R | R ² | R ² adjusted |
| | 0.625 | 0.391 | 0.222 |
| | | | Standard error of estimate |
| | | | 0.326 |

Through Table 3, the determination coefficient $R^2 = 0.391$ indicates that 39.1% of the variability of outcome question 1 can be explained by the variable independent of the adjusted model. The correlation coefficient $R = 0.625$ indicates that the independent variables have a moderate correlation with the dependent variable.

The variables of greatest influence present in the model are the variables of cost reduction and a new regulatory environment. The F value is 27.31, significant at the level of $p < 0.03206$. The VIF (variance inflation factor) of this model was less than 2, and therefore, there are no multicollinearity problems.

Model 1 resulting from the regression analysis was defined as follows:

$$y_1 = -0.79 + 0.53 x_2 + 0.93 x_9 + \varepsilon \quad (1)$$

Thus, the model proposed in this study sought to evaluate the variables capable of explaining variations in the power of innovation. According to the results, it is evident that two variables were significant and entered the model. Thus, it is possible to affirm that the companies who reduce costs the most [78] have a better adaptation to environmental legislation [79], and present higher levels of external orientation and transparency in innovation processes. In other words, the power of innovation of the companies in the sample can be positively increased with adequate cost management and compliance with external environmental standards. Since, during the stepwise estimation, the variables act in isolation, other variables were removed from the model ($x_1, x_3, x_4, x_5, x_6, x_7, x_8$).

With regard to Model 2, two explanatory variables were identified about the cooperation between the departments in favour of innovation, are (x_4)—reduction in environmental impacts in the production process, seeking to go beyond compliance with environmental legislation—and (x_9)—a new regulatory environment. Thus, the model is defined as follows in Table 4.

Table 4. Results of stepwise regression—Model 2.

| Model | Dependent Variable | Independent Variables Included | Excluded Variables |
|-------|------------------------------------|--|----------------------------|
| 2 | y2—Cooperation between departments | x4—Reduction in environmental impacts in the production process x9—A new regulation environment | x1, x2, x3, x5, x6, x7, x8 |
| | R | R ² | R ² adjusted |
| | 0.672 | 0.452 | 0.300 |
| | | | Standard error of estimate |
| | | | 0.308 |

The coefficient of determination $R^2 = 0.452$ indicates that 45.2% of the variability of y2 can be explained by the independent variables of the fitted model. The model variables are moderately correlated ($R = 0.672$). The variables x1, x2, x3, x5, x6, x7, and x8 were excluded from the model, in view of their low contribution to the explanation of the regression model. The F value is 29.73 significant at the level of $p < 0.001$. The VIF was less than 2, which reflects the non-collinearity of the model. Model 2 resulting from the regression analysis was defined as follows:

$$y2 = 0.58 x4 + 0.79 x9 + \varepsilon \quad (2)$$

From this, it can be said that the adjusted model is highly significant. It was found that these results are in line with Souza and Faria [80] when emphasizing that cooperation is an indicator present in the formulation of competitive and innovative strategies. In other words, the reduction in environmental impacts in the production process and a strong regulatory environment may be able to strengthen the culture and organizational unit in favour of innovation [81]

As for the third model, y3 (knowledge about the business environment and adapting that knowledge to the company's reality) was considered as the dependent variable. As shown in Table 5, the explanatory variables which remained in the model were: (x4) reduction in environmental impacts in the production process, seeking to go beyond compliance with environmental legislation; and (x9) a new regulatory environment.

Table 5. Results of stepwise regression—Model 3.

| Model | Dependent Variable | Independent Variables Included | Excluded Variables |
|-------|--|--|----------------------------|
| 3 | y3—Knowledge about the business environment and adapting that knowledge to the company's reality | x4—Reduction in environmental impacts in the production process x9—A new regulation environment | x1, x2, x3, x5, x6, x7, x8 |
| | R | R ² | R ² adjusted |
| | 0.737 | 0.544 | 0.418 |
| | | | Standard error of estimate |
| | | | 0.277 |

The coefficient of determination $R^2 = 0.544$ indicates that 54.4% of the variability of y3 can be explained by the independent variables of the fitted model. The correlation coefficient $R = 0.737$ shows that there is a strong correlation between the variables that make up the model, but this does not imply collinearity issues.

The variables x1, x2, x3, x5, x6, x7, and x8 were excluded by the stepwise method, which means that they do not contribute significantly to the knowledge of scenarios, necessary to increase the innovation power of companies.

The third model is represented as follows:

$$y_3 = -0.78 + 0.95 x_4 + 0.80 x_9 + \varepsilon \quad (3)$$

In this model, it appears that the search for the reduction in environmental impacts and respect for environmental regulations favours the company to know the surrounding reality while adapting to it. However, the selection and identification of opportunities require specific skills from organizations. These results corroborate the model of Van Bonmell [1] and Barbieri [2], showing the organization's ability to learn about its environment, and apply knowledge in the organization.

Model 4, on the other hand, presented a single explanatory variable for y_4 (leadership in introducing new products and new processes in the market), namely: x_2 —reduction in costs and environmental impacts in the production of external pressures (legislation, public policies). Table 6 shows the results of stepwise regression for Model 4.

Table 6. Results of stepwise regression—Model 4.

| Model | Dependent Variable | Independent Variables Included | Excluded Variables |
|-------|---|---|--|
| 4 | y_4 —Leadership in introducing new products and new processes in the market | x_2 —Reduction in costs and environmental impacts in the production process | $x_1, x_3, x_4, x_5, x_6, x_7, x_8, x_9$ |
| | R | R² | R² adjusted |
| | 0.624 | 0.390 | 0.390 |
| | | | Standard error of estimate |
| | | | 0.350 |

The determination coefficient $R^2 = 0.390$ indicates that 39% of the question's variability can be explained by the independent variables of the adjusted model. The correlation coefficient shows that the model variables share about 62.4% of the correlation.

The variables $x_1, x_3, x_4, x_5, x_6, x_7, x_8,$ and x_9 were excluded from the model using the stepwise method, considering their low contribution to the explanation of the regression model. The F value is 23.06 significant at the level of $p < 0.05$. From this, it is possible to define the adjusted model as highly significant. Because there is only one independent variable, collinearity is not an issue in this model.

The fourth model is represented as follows:

$$y_4 = 0.60 x_2 + \varepsilon \quad (4)$$

In view of the results, it is evident that the reduction in costs and environmental impacts seems to be an essential condition for the company to exhibit leadership in the innovative process, being able to introduce new products and processes. In fact, innovating is a high-cost process, which requires investment in research and development [82], in human and material resources, and in the development of new capabilities [83]. So, the company that carries out the innovation process with cost reduction is most suitable to conquer the market leadership.

Model 5 presents explanatory variables of y_5 (autonomy and market leadership in relation to innovative initiatives), namely: x_2 —cost reduction and environmental impacts in the production process; x_3 —incorporation of socio-environmental aspects; and (x_9)—new regulatory environment. The coefficient of determination $R^2 = 0.455$ indicates that 45.5% of the variability of the y_5 can be explained by the independent variables of the adjusted model. The correlation coefficient $R = 0.674$ denotes a moderate correlation between the

variables. The variables x1, x4, x5, x6, x7, and x8 were excluded from the model during the application of the stepwise method. Thus, the results are defined as follows in Table 7.

Table 7. Results of stepwise regression—Model 5.

| Model | Dependent Variable | Independent Variables Included | Excluded Variables | |
|-------|---|--|-------------------------|----------------------------|
| 5 | y5—Autonomy and market leadership in relation to innovative initiatives | x2—Reduction in costs and environmental impacts in the production process x3—Incorporation of social and environmental aspects x9—A new regulation environment | x1, x4, x5, x6, x7, x8 | |
| | R | R ² | R ² adjusted | Standard error of estimate |
| | 0.674 | 0.455 | 0.304 | 0.316 |

The F value is 30.10 significant at the level of $p < 0.001$. From this, it can be said that the adjusted model is highly significant. In this case, the VIF was less than 3, therefore, there are no serious collinearity problems. The fifth model is represented as follows:

$$y5 = -0.81 + 0.69 x2 - 0.66 x3 + 0.89 x9 + \varepsilon \quad (5)$$

This finding corroborates the theoretical assumptions of the Orsato [3] and Van Bommel [1] model, according to which financial investments should generate environmental returns and become sources of competitive advantage. Therefore, as organizations implemented strategies aimed at sustainability, they can be favoured, through the increase in their promotion, resulting in benefits [19,20].

Therefore, organizations that implement sustainability-oriented strategies can be favoured by increasing their promotion, resulting in benefits [19,20]. In addition, the autonomy and market leadership related to innovation initiatives can be fostered through cost reduction and incorporation of social and legal aspects inherent to sustainability. This is in line with studies that emphasize the importance of stakeholder management for innovation [83–85].

In the next chapter, the final considerations of the study will be explained.

5. Conclusions

The present study had as its main objective to analyse which factors influence the power of innovation in the choices of strategies for sustainability.

It is known that society is increasingly demanding, and there is a need to offer better products and services, making the environment competitive. However, it is not enough just to innovate, for organizations to remain in the market and launch new products, they need to manage innovation [13]. There is no formula for the innovation management process, the innovation process must be adjusted according to the organization, considering the factors of type of organization, stages, and scope of innovation [13,15].

Therefore, sustainable innovation in products, services, and processes can improve the environmental performance of companies [19]; Van Bommel [1], since there is a high profile in the international and national scenarios with regard to the environmental issue.

Since, what determines the strategy used (y), is the power of innovation (characteristics of innovation [1]), the focus of the strategy focused on sustainable innovation, can be demonstrated in three ways: focus on the process, focus on the product, focus on the product/process. Therefore, the choice of strategy focus may depend on different internal and external reasons for the organization [20].

Finally, we sought to propose five models in order to identify which variables could be used to explain the power of innovation with respect to the variables external orientation and transparency in innovation processes (Model 1), cooperation between departments (Model 2), knowledge of the business environment and adaptation of that knowledge to the company's reality (Model 3), leadership in the introduction of new products and new processes in the market (Model 4), and autonomy and leadership in the market in relation to innovative initiatives (Model 5). The ANOVA result showed a *p*-value less than 0.05 and 0.001 in the six models, showing that the adjusted models are highly significant.

Among the explanatory variables in Model 1 ($R^2 = 0.391$) are the variables of cost reduction and environmental impacts in the production process from external pressures (legislation, public policies) and a new regulatory environment. Model 2 ($R^2 = 0.452$) presented as explanatory variables: reduction in environmental impacts in the production process, seeking to go beyond compliance with environmental legislation and a new regulatory environment. The third Model 3 ($R^2 = 0.544$) has as explanatory variables a reduction in environmental impacts in the production process, seeking to go beyond compliance with environmental legislation and a new regulatory environment. With regard to Model 4 ($R^2 = 0.390$), it presented as explanatory variables for the outcome issue 4, which refers to the leadership in the introduction of new products and new processes in the market: reduction in costs and environmental impacts in the production process from external pressures (legislation, public policies). Model 5 ($R^2 = 0.455$) is presented as an explanatory variable for outcome issue 5, which is consistent with market autonomy and leadership in relation to innovative initiatives: reduction in costs and environmental impacts in the production process, incorporation of social and social aspects, and a new regulatory environment.

From the data evidenced in the study, the operationalization of the concept of innovation power and which variables can influence the choices of strategies for sustainability obtained different connotations. The conclusions of the study corroborate the propositions of the model proposed by Orsato [3], that the reduction in the environmental impact, with consequent increase in the yield of the process, among other practices, contributes to the adoption of strategies directed to a more sustainable economic system.

In the Mineral Industry, Brazil is an important player worldwide. Industrial companies in this sector have different levels of maturity and performance in the market, so it is essential, in the competitive environment, for the integration of concepts of innovation and business sustainability, relevant for the creation of new products and processes. In recent years this sector had vigorous growth due to factors such as socioeconomic and infrastructure changes that the country has experienced.

This study reflects the advantages of including innovation in the choices of sustainability strategies, in companies from the mineral sector, and the subsequent monitoring of sustainability indicators, reducing the impacts caused by industrial activity.

The limiting factors of this study refer to the number of companies that made themselves available to answer the questionnaire, making the sample lack representability in relation to the researched population. Thus, it is not possible to generalize the results found in relation to companies in the sector. The conclusions reported in this study, therefore, refer only to companies participating in the sample. Another limitation refers to the size of the companies surveyed in the survey, mostly small and medium-sized. The more effective presence of larger companies could bring other important elements to the analysis.

As a suggestion for future studies, in order to deepen the studies presented here, it is recommended to expand the number of companies surveyed, as well as to expand the analysis, seeking to compare the Brazilian sector with other countries.

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