

SUSTAINABLE AGRICULTURAL MANAGEMENT: THE CASE OF AMORPHOUS DOLOMITE FROM DELNIŢA, ROMÂNIA

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Abstract: *Sustainable agriculture is becoming a strategic priority given the high dependence on chemical fertilizers and the pressures arising from ESG policies. This paper examines the potential for integrating natural alternatives by studying the case of amorphous dolomite from Delniţa, Romania. The research is based on a qualitative approach, combining a review of the literature with an exploratory case study of the amorphous dolomite from Delniţa, Romania. The results highlight the existence of economic and environmental pressures driving the transition toward natural inputs, as well as a supportive framework shaped by European policies such as the Green Deal, the "Farm to Fork" initiative, and ESG standards, along with the demand for sustainable solutions. At the same time, the analysis confirms that the amorphous dolomite from Delniţa, Romania, represents a strategic resource due to its potential for conversion into fertilizer for agricultural use, its low costs, and the significant size of the deposit, despite certain limitations related to infrastructure and investment. The study concludes that, by adopting appropriate management strategies, external pressures can be turned into opportunities, thereby supporting the integration of natural resources into agriculture, and proposes a conceptual model for sustainable agricultural transition.*

Keywords: *sustainable agriculture, strategic management, ESG, natural inputs, amorphous dolomite of Delnita, sustainable transition*

1. Introduction

In the context of the European Green Deal and the integration of ESG (Environmental, Social, and Governance) principles into economic and environmental policies, agricultural sustainability has become a strategic priority for the European Union, with a focus on ensuring food security and the sustainable use of natural resources.

Agriculture is one of the most important sectors for ensuring food security and for the development of member states.

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Currently, the agricultural sector in the European Union is dependent on the use of fertilizers. These fertilizers help combat climate change by yielding higher crop harvests in changing conditions. However, repeated use can have negative effects on the soil over time, gradually causing it to become desertified.

The fertilizer market has been affected by numerous economic and geopolitical factors that have led to significant price increases and heightened supply volatility. This crisis intensified between 2021 and 2023, driven by rising energy prices, disruptions in global supply chains, and geopolitical tensions in Russia and Ukraine that affected the global production and distribution of fertilizers. Nearly half of the fertilizers used in the European Union are imported from Russia and Belarus.

The issue of chemical fertilizer supply stands in opposition to the strategic objectives outlined in the European Green Deal and by the European Environment Agency (European Commission, 2019), as well as to the ESG (Environmental, Social, and Governance), which promote reducing environmental impact and the responsible use of local natural resources as an alternative to imported chemical inputs. Thus, at least 25% of the European Union's agricultural land must be converted to organic farming by 2030. This commitment involves reducing the use of synthetic chemical fertilizers and transitioning to environmentally friendly alternatives, without compromising the food security of European citizens.

There is a need to make use of locally available natural resources in order to reduce dependence on external supplies and increase sustainability in agriculture. A relevant example in this regard is the amorphous dolomite from Delniţa, Romania, which has the potential to be used as a natural input in agriculture.

Current research focuses primarily on the European Union's dependence on chemical fertilizers, examining the issue from the perspective of supply chains and geopolitical vulnerabilities. However, the managerial aspect of the transition to sustainable natural alternatives has not been sufficiently explored in the scientific literature.

The aim of this research is to demonstrate how strategic management tools applied to the case study of amorphous dolomite in Delniţa, Romania, contribute to the integration of natural alternatives in agriculture, in order to reduce dependence on chemical fertilizers and increase the sustainability of agri-food systems.

The study's methodology is based on an analysis of the relevant literature and an exploratory case study of amorphous dolomite from Delniţa, Romania. By applying specific strategic management tools such as the STEPLE and SWOT analyses, external and internal factors will be identified, highlighting their influence on the utilisation of this natural resource and its integration into agriculture as a sustainable alternative to chemical fertilizers.

This paper is structured as follows. The first section provides the introduction, the second section reviews the relevant literature, the third section presents the research methodology, the fourth section includes the results and discussion, covering the conceptual framework, the case study analysis, and the STEPLE and SWOT analyses, while the final section presents the main conclusions, limitations, and directions for future research.

2. Literature Review

Agricultural production in the European Union is characterised by a dependence on chemical fertilizers, particularly those based on nitrogen, phosphorus, and potassium. This vulnerability is amplified by dependence on imports, particularly from the Russian Federation and Belarus, which are major players in the chemical fertilizer market (Kee et al., 2023). In the context of recent crises, this dependence represents a vulnerability that affects the European Union's agri-food security (Williams et al., 2025). The concentration of supply in the hands of a limited number of suppliers generates power imbalances and reduces the European Union's ability to ensure its strategic autonomy in the agricultural sector (Sandström et al., 2024). Thus, asymmetrical trade relations can give rise to systemic security risks (OECD, 2025). This situation can be explained by the concept of economic interdependence (Hirschman, 1945), as well as by the theory of imperfect markets (Stiglitz, 1989). In the case of fertilizers, these mechanisms lead to high price volatility (Garske et al., 2024) and expose farmers to external risks over which they have no direct control, such as the energy crisis (Gritz and Wolff, 2024). The intensive use of chemical fertilizers generates external costs, such as soil degradation, water pollution, and biodiversity loss, thereby undermining long-term sustainability (Atanda et al., 2025). Thus, dependence on imported fertilizers is no longer merely an economic issue, but a challenge to the sustainability of the European agri-food system.

The transition to sustainable agriculture is a strategic priority for the European Union, supported by the European Green Deal and the Farm-to-Fork Strategy (European Commission, 2020). These policies aim to reduce the environmental impact and adapt agri-food systems to climate and sustainable development goals (Padovan and Cusimano, 2025). Integrating ESG principles into agriculture involves transitioning to a sustainable and efficient model. However, the literature highlights difficulties in implementation due to differences between countries and a lack of uniform support (Rodríguez-Pose and Bartalucci, 2024).

In recent literature, strategic management is being increasingly analysed in the context of sustainable agriculture and the green transition. Strategic management in agriculture is essential for adapting to an uncertain environment and for increasing long-term efficiency and resilience (Flora et al., 2016). The literature highlights the need to use multi-criteria strategic and decision-making tools that allow for the integration of economic, environmental, and social factors into the agricultural decision-making process (Cicciù et al., 2022). Furthermore, farm performance depends on adaptive strategies and the efficient use of resources (Yamashita and Hoshino, 2018).

In this context, the use of amorphous dolomite from Delnița could represent a strategic decision to value a local resource, which simultaneously contributes to reducing dependence on chemical fertilizers and increasing the sustainability of agricultural systems. The literature highlights the fact that amorphous dolomite can be used as a natural soil amendment (fertilizer), helping to regulate pH, improve soil structure, and provide essential nutrients (such as calcium and magnesium) that are necessary for plant growth. Studies conducted in Romania show that the application of amorphous dolomite from Delnița to degraded soils has had a positive effect on soil physicochemical indicators

and crop growth, acting as a fertilizer and highlighting its role in the ecological restoration of affected land (Rădulecu et al., 2013). On the other hand, the use of this type of dolomite helps immobilize heavy metals and restore degraded soils, making it relevant not only for agriculture but also for the environment, as part of strategies for land restoration and sustainable land use (Vrînceanu et al., 2017). However, the adoption of these alternatives remains limited at the European level due to a lack of strategies and uncertainties (Frick et al., 2025). In this context, the amorphous dolomite from Delniţa could serve as a strategic resource that supports sustainability and reduces dependence on imported chemical fertilizers.

However, the literature offers limited coverage of the integration of strategic management into the analysis of alternatives to chemical fertilizers. Most studies focus either on the economic and geopolitical impact of fertilizer dependence or on the agronomic benefits of alternative solutions, without offering a strategic perspective.

In this context, this study presents an analysis of an exploratory case study on the amorphous dolomite from Delniţa, using strategic management tools such as the STEPLE analysis and the SWOT analysis, to analyse whether this deposit can be considered a natural alternative to imported chemical fertilizers.

3. Methodology

The objectives of this study are as follows:

- O1: *An analysis of the current situation regarding the dependence of agriculture on chemical fertilizers;*
- O2: *Identifying the external and internal factors that influence the use of natural resources in agriculture;*
- O3: *Assessment of the potential of amorphous dolomite from Delniţa as a natural input in agriculture;*
- O4: *Formulating strategic guidelines for integrating natural alternatives into agricultural systems.*

Given the established objectives, the chosen methodology is based on an exploratory qualitative approach, which is well-suited to the analysis of complex phenomena that have not been sufficiently explored from a theoretical perspective. Qualitative research is well-suited to studying phenomena that are context-dependent, as it requires an examination of the relationships between economic, environmental, and institutional factors (Patton, 2002). At the same time, this approach falls within the interpretive paradigm, in which reality is analysed in its natural environment and in relation to the economic and social context (Walsham, 1995).

The research design combines a review of the literature with an exploratory case study, applied to the amorphous dolomite mining career in Delniţa, Romania, which is licensed to Winfor Trade S.R.L. Thus, the research is based on an integrated methodological framework that allows for a differentiated approach to the research objectives. A literature review is used to understand the broader context and identify relevant factors, while a case study allows for the analysis of a natural resource. The case study is considered an appropriate method for analysing contemporary phenomena in real-world

contexts, contributing to the development of theoretical explanations and to an understanding of the relationships between variables (Ridder, 2017; Yin et al., 2018).

The methodology begins with a review of the relevant literature, which is necessary to establish the basis for research objectives O1 and O2. This process involves selecting, synthesising, and interpreting information from relevant studies in order to highlight the current context of the dependence of agriculture on chemical fertilizers and to identify the main external and internal factors influencing the use of natural resources in agriculture. In the next step, the framework developed through the literature review is applied to the exploratory case study on amorphous dolomite from Delnița, Romania, to assess the potential of this resource as a natural input in agriculture, in line with Objective O3. To achieve this objective, specific strategic management tools are used. The STEPLE analysis enables an investigation of the external environment of the mining activity and the possibility of integrating amorphous dolomite into agriculture by highlighting social, technological, economic, political, legislative, and environmental factors. In addition, a SWOT analysis allows for an assessment of the internal and external environment of the career, by identifying strengths and weaknesses, as well as opportunities and threats associated with the exploitation of amorphous dolomite in Delnița. Based on the results obtained from the literature review and the application of the STEPLE and SWOT tools to the case study, a strategic direction is formulated regarding the integration of a natural alternative, such as amorphous dolomite, into agricultural systems, in line with Objective O4.

The data used in this research consists of both secondary data, drawn from the specialised literature, scientific articles, and reports relevant to the field under analysis, and technical and economic sources specific to the case study, such as technical documents and information, chemical analyses, and internal reports on the operations of the amorphous dolomite quarry in Delnița, Romania. Market studies were also used to analyse the economic potential of the deposit, its usefulness in agriculture, and its commercial prospects. The data were selected based on their relevance to the research objectives. The data analysis was conducted in correlation with the relevant legislative framework and public policies at the national and European levels, in order to highlight the compatibility of the use of amorphous dolomite with sustainability objectives and the strategic directions promoted at the European Union level.

4. Results and Discussion

4.1. Conceptual and Contextual Framework

Based on a review of the relevant literature, a systemic relationship has been identified between dependence on chemical fertilizers and the functioning of the agricultural system, a relationship that generates multiple pressures and necessitates a transition toward sustainable alternatives. Based on these findings, the conceptual framework of the study was developed, as summarised in Figure 1.

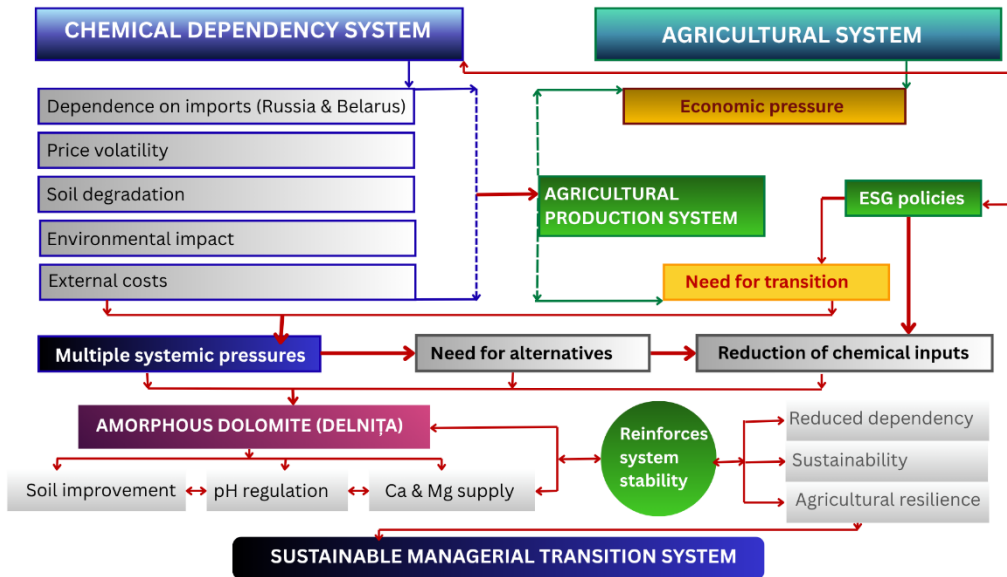


Fig. 1. *Conceptual Framework of Literature Review*

(source: author's own conceptualization based on literature review)

The conceptual model, based on the relevant literature, starts from the premise that the chemical fertilizer system generates interdependent effects at the European Union level, such as dependence on imports, price volatility, soil degradation, environmental impact, and external costs. These elements form a system of interdependencies that generates a series of systemic pressures, which are transmitted to the agricultural system and directly influence agricultural production. In this context, dependence on chemical fertilizers is reflected in the economic pressure faced by farmers, determined by rising costs and market instability, within the framework of a two-way relationship between agriculture and economic performance. At the same time, ESG policies serve as an institutional framework that guides the agricultural system toward sustainability goals, while being influenced, in turn, by the vulnerabilities arising from dependence on external inputs. The interaction between economic pressures and ESG requirements is creating a need for transition in agriculture. A combination of multiple systemic pressures is evolving, highlighting the need for alternatives and the need to reduce the use of chemical inputs. The conceptual model incorporates the amorphous dolomite from Delnița as a potential alternative identified in the scientific literature. According to existing studies, Delnița amorphous dolomite improves soil quality by regulating pH and providing essential nutrients, such as calcium and magnesium, which could help support agricultural production. The use of such alternatives is expected to help strengthen the stability of the agricultural system by reducing dependence on chemical fertilizers, increasing sustainability, and improving agricultural resilience. The model highlights the existence of a feedback mechanism, whereby reducing dependence can alleviate the initial pressures generated by the system of chemical dependence, giving the entire system a circular nature. The interaction between these components highlights a sustainable management

transition system, which describes the shift from an agricultural model dependent on chemical fertilizers to one focused on the use of local natural resources and the integration of ESG principles.

4.2. Case Study Analysis of Amorphous Dolomite from Delnița

This case study refers to the amorphous dolomite reserve located in Delnița, Harghita County, Romania, where mining operations began in the 1970s, initially to support the production of chemical fertilizers. Mining operations were conducted in an open-pit mine within a mining area located approximately 0.5 km north of the village of Delnița. The Delnița deposit is estimated to contain approximately 40 million tons of reserves, giving it significant economic and strategic importance. From a mineralogical standpoint, dolomite is a double carbonate of calcium and magnesium, and the peculiarity of this reserve consists in its semi-amorphous, cryptocrystalline structure with very fine grain size. This characteristic sets it apart from other types of dolomite and gives it properties that make it well-suited for agricultural use, particularly because it disperses more easily in the soil and provides calcium and magnesium. Dolomite from Delnița has been used in a variety of fields, such as the manufacture of chemical fertilizers, the construction industry, steelmaking, and the production of industrial materials. At the same time, research conducted between 2010 and 2015, in collaboration with agricultural and veterinary institutes, highlighted the potential of this resource for agriculture and animal husbandry. The results indicated beneficial effects on soil quality, pH regulation, increased agricultural production, and its use as a natural source of calcium and magnesium in animal feed. Given its geological characteristics, available resources, and the findings of existing research, the amorphous dolomite deposit at Delnița represents a relevant case study for analysing the utilisation of local natural resources in the context of sustainable agriculture.

4.3. STEPLE Analysis of Amorphous Dolomite from Delnița

The STEPLE analysis highlights a favourable framework for the exploitation of the amorphous dolomite at Delnița. From a social perspective, there is growing interest in sustainable agriculture and the use of natural inputs, but the downside is that farmers have limited knowledge about alternatives to chemical fertilizers. From a technological perspective, the existence of simple extraction and processing methods offers opportunities for value creation, but adaptation to the demands of modern agriculture is necessary. The economic environment highlights the vulnerabilities of the agricultural system, including price volatility and dependence on imports, but also the potential of a significant local resource. The political and legislative environment supports the transition to sustainable practices through European policies such as the European Green Deal, the Farm-to-Fork Strategy, and regulations aligned with ESG principles. Environmental factors highlight the negative impact of chemical fertilizers and the need for responsible use of local natural resources. An analysis of these factors is presented in Figure 2, highlighting a comparative analysis of the most important components of the external environment.

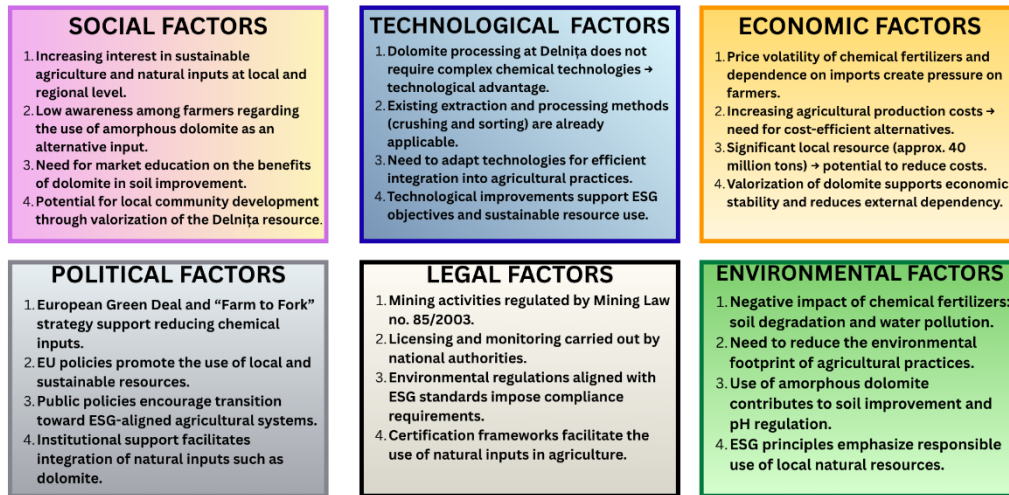


Figure 2. STEPLE Analysis of Amorphous Dolomite from Delnița (source: author’s own research)

4.4. SWOT Analysis of Amorphous Dolomite from Delnița

The SWOT analysis is presented in Table 1, highlighting both the potential for leveraging the resource through an analysis of strengths and opportunities, as well as the main associated constraints through an analysis of weaknesses and threats.

SWOT Analysis of Amorphous Dolomite from Delnița

Table 1

<p><u>STRENGTHS</u></p> <ul style="list-style-type: none"> • Significant local resource, 40 million tons • Simple, straightforward processes without complex technologies • Beneficial properties, such as soil improvement and the supply of calcium and magnesium • Much lower production costs and price compared to chemical fertilizers 	<p><u>WEAKNESSES</u></p> <ul style="list-style-type: none"> • Limited infrastructure → in need of modernisation • Operation → affected by weather conditions • Access to the site is not ideal due to the hilly terrain • The need for initial investments to resume the production of natural fertilizers
<p><u>OPPORTUNITIES</u></p> <ul style="list-style-type: none"> • EU policies, ESG, and the principles of the circular economy support the reduction of chemical fertilizers • Strong interest in natural solutions in agriculture • Accessing European development funds • Valuing the resource in foreign markets 	<p><u>THREATS</u></p> <ul style="list-style-type: none"> • Competition with conventional chemical fertilizers • Rising energy costs • Economic instability and price fluctuations • Increasingly strict environmental regulations • Potential administrative or legislative obstacles

(source: author’s own research)

In the case of the amorphous dolomite from Delnița, Romania, the key strengths include the availability of a significant local resource, its natural origin, and its favourable agronomic properties, as well as the potential for low costs and the simplicity of the mining processes. The weaknesses include limited infrastructure, poor accessibility to the site, dependence on weather conditions, the need for initial investments, and a shortage of specialised personnel. These opportunities stem from the favourable context created by European policies focused on sustainability and ESG, growing interest in natural solutions in agriculture, access to European funding, and the potential for expansion into foreign markets. The threats include competition from conventional chemical fertilisers, economic volatility, rising energy costs, increasingly stringent environmental regulations, and potential administrative bottlenecks.

4.5. Conceptual Framework for Sustainable Agricultural Transition Based on Amorphous Dolomite Valorisation

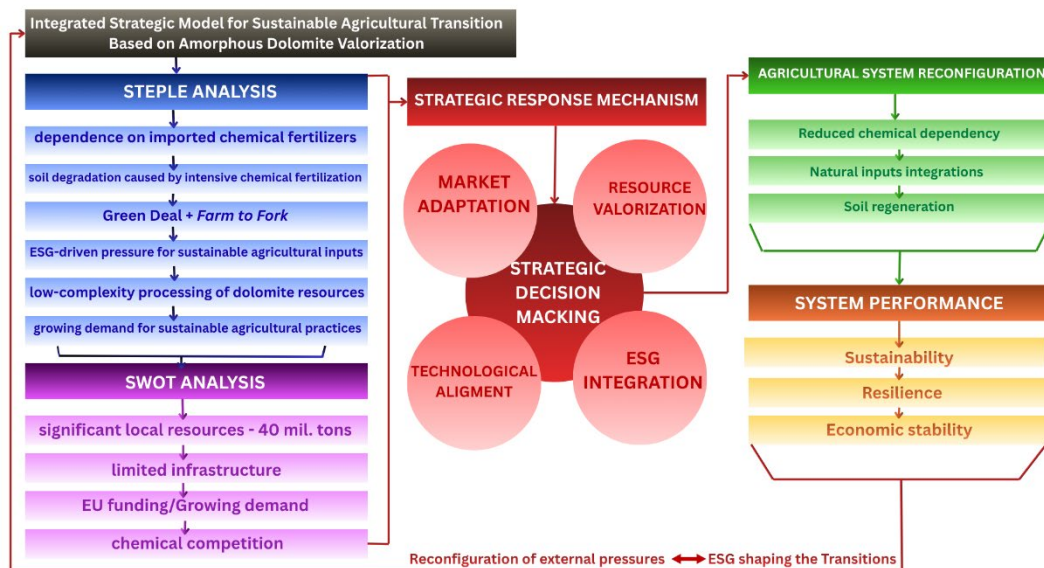


Fig. 3. *Integrated Strategic Model for Sustainable Agricultural Transition Based on the Valorisation of Amorphous Dolomite*

(source: author's own research)

To highlight how strategic management can facilitate the integration of amorphous dolomite from Delnița, Harghita, Romania, into the agricultural system, the author proposes a conceptual framework that captures the main managerial mechanisms involved in this transition, as well as the interdependencies among them. Thus, the initiative is based on the idea of developing an integrated management system geared toward sustainable agriculture, based on the utilisation of local amorphous dolomite resources. In this regard, a STEPLE analysis was applied to the amorphous dolomite from Delnița, revealing that systemic pressures are primarily driven by economic factors,

specifically the high dependence on imported chemical fertilizers. This dependence directly affects environmental factors through soil degradation caused by the intensive use of chemical fertilizers. Furthermore, political factors, represented by initiatives such as the European Green Deal and the „*Farm to Fork*” strategy, are driving the transition toward sustainable agricultural practices and leading to the emergence of legislative frameworks aligned with ESG principles, which are putting pressure on the agricultural system to adopt alternative solutions. These factors, in turn, influence the technological aspect, where the low complexity of dolomite processing allows it to be transformed, through simple operations such as grinding, into agricultural amendments capable of partially replacing chemical fertilizers. The technological dimension subsequently influences social factors, as reflected in the growing interest in sustainable agricultural practices and the use of natural inputs. Overall, the STEPLE analysis describes how the external environment creates pressures and opportunities for the exploitation of amorphous dolomite in Delniţa. These external influences are then linked to the SWOT analysis, which highlights the internal characteristics of the resource. From this perspective, the strengths include the presence of a significant deposit of approximately 40 million tons, while the main limitations are related to underdeveloped infrastructure. At the same time, opportunities arise from access to European funding and growing demand for sustainable agricultural solutions, while the main threats come from competition with conventional chemical fertilizers, which are characterised by rapid results but have a negative long-term impact on the soil. Based on these analyses, an integrated strategic management response is outlined, focused on leveraging resources, technological alignment, market adaptation, and the integration of ESG principles. The implementation of this strategy leads to a restructuring of the agricultural system by reducing dependence on imported chemical fertilizers, integrating natural inputs, and regenerating the soil, in accordance with the principles of sustainable development. Ultimately, the performance of the proposed system is reflected in increased sustainability, strengthened resilience, and the assurance of long-term economic stability. The conceptual framework also highlights the need for an ongoing process of adapting to external pressures, in close alignment with developments in ESG policies, to ensure the effectiveness of the strategies implemented.

4.6. Results and Discussion

Based on the conceptual framework relying on the scientific literature (*Figure 1*), which highlights the relationship between dependence on chemical fertilizers and the pressures generated on the agricultural system, this study was conducted with the aim of identifying sustainable alternatives in line with the objectives promoted by the European Green Deal and the „*Farm to Fork*” strategy. The results obtained through the application of STEPLE and SWOT analyses highlight the fact that the amorphous dolomite from Delniţa aligns with this transition strategy.

The analysis of the external environment made using the STEPLE model (*Figure 2*) reveals the existence of systemic pressures stemming from dependence on imported chemical fertilizers, soil degradation, and constraints imposed by European policies. The

internal analysis conducted using the SWOT model (Table 1) highlights both the potential of the resource, due to its natural and agronomic properties and the existence of significant deposits, and the limitations related to infrastructure, market integration, and the need for initial investments.

By correlating these results with the conceptual model presented in the scientific literature (*Figure 1*), it becomes evident that dependence on chemical fertilizers leads to a combination of economic, environmental, and institutional pressures, which necessitates a transition in agriculture. In this context, the conceptual framework proposed by the author (*Figure 3*) constitutes the main contribution of this research, highlighting how these pressures not only explain the problem but can also be transformed, through strategic management, into an operational mechanism for agricultural transition. More specifically, the study's contribution lies in the development of an integrated model that directly links the external pressures identified through the STEPLE analysis, the internal characteristics of the resource highlighted by the SWOT analysis, and strategic managerial decisions, within a directly applicable framework that explains how a local natural resource can be integrated into agriculture.

Unlike existing scientific literature, which addresses either the issue of fertilizer dependency or the agronomic benefits of natural alternatives separately, the proposed model highlights the mechanism through which this transition can be achieved via market adaptation, technological alignment, and the integration of ESG principles. In this way, amorphous dolomite is viewed not just as a natural agricultural input, but also as a strategic element in reshaping the agricultural system to increase sustainability.

From a managerial perspective, the results show that the integration of this resource depends on the ability to turn external pressures into strategic opportunities. Thus, the process is not spontaneous but requires a structured approach that includes infrastructure development, increasing market acceptance, and alignment with European policies, particularly the Green Deal and the Farm-to-Fork Strategy. In line with the research objectives, the results confirm the analysis of the context of chemical fertilizer dependence (O1), the identification of relevant external and internal factors (O2), the highlighting of the potential of amorphous dolomite as a natural input (O3), and, most importantly, the formulation of an integrated strategic model for agricultural transition (O4).

5. Conclusions and Limitations

The findings of this study highlight the importance of applying management tools in analysing the transition to sustainable agriculture, specifically in the context of reducing dependence on chemical fertilizers. By integrating the conceptual framework based on the scientific literature with the exploratory case study on amorphous dolomite from Delnița, the results show that the application of specific strategic management tools, such as the STEPLE and SWOT analyses, defines the conceptual framework and the limits within which the solution to the problem under study can be applied. The value of this deposit of amorphous dolomite in Delnița derives primarily from its impressive volume of 40

million tons, its natural composition, its favourable agronomic properties, and the low costs associated with starting production of natural fertilizer. Under these circumstances, the results confirm the findings of specialised studies, highlighting that the importance of utilising amorphous dolomite goes beyond its role as a simple agronomic alternative, as it serves as a strategic resource within a broader process of transforming the agricultural system into a sustainable one. The study confirms that traditional strategic management tools can be successfully applied beyond the traditional organisational setting, providing a relevant framework within the agricultural system for translating economic and environmental pressures into operational strategies.

Overall, the sustainability of the transition from chemical fertilizers to natural ones depends on strengthening the managerial aspect of the process of utilising this alternative natural resource. This involves developing strategies focused on infrastructure modernisation, technological alignment, adaptation to market demands, and the integration of ESG principles.

In this context, the contribution of this research consists in introducing a strategic managerial perspective on the use of natural alternatives in agriculture, highlighting not only the need for transition but also the concrete ways in which it can be achieved by harnessing a local natural resource, in line with European sustainability policies. This strategic management model focuses on leveraging negative factors from both the external and internal environments with the aim of transforming them into opportunities. These opportunities are being explored in the context of sustainable business transition; in this case, the proposed alternative is to replace imported chemical fertilizers with the natural deposits of amorphous dolomite found in Delniţa. The proposed alternative offers superior benefits compared to conventional chemical fertilizers, specifically in terms of preserving agricultural cultures and conserving soil. On the other hand, the significantly lower market price of Delniţa amorphous dolomite compared to chemical fertilizers is of considerable importance.

However, the research has certain limitations because the analysis is based on a single case study, which limits the generalizability of the results. In addition, the approach is primarily qualitative and conceptual, without including any quantitative analyses of economic feasibility.

This research could be expanded by further exploring the same case study and incorporating a consumer and market-oriented perspective. In this way, future studies could examine users' purchasing behaviour, perceptions, and level of acceptance of amorphous dolomite as an alternative to chemical fertilizers, as well as the factors that influence the decision to adopt it in practice. Second, future research could expand this analysis by conducting comparative studies on other natural resources with the potential to replace chemical fertilizers, using quantitative methods to assess their economic and technological feasibility. Particular attention should also be paid to studying the long-term impact on the environment and economic performance, which would help adapt the proposed strategic model and provide a more comprehensive perspective on its sustainability.

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