

FROM CHALLENGES TO COMPETITIVE ADVANTAGE: A MATRIX FOR RESOURCE OPTIMIZATION, MARKET ACCESS, POLICY COHERENCE AND TECHNOLOGICAL ADVANCEMENT IN ROMANIAN AGRICULTURE

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Abstract

The Romanian agri-food sector faces significant challenges related to economic resource allocation and policy formulation. The study aims to explore these issues through a comprehensive case study of Romania, highlighting the interplay between economic policies and agri-food market dynamics. Following a research approach centered on administering questionnaires to key stakeholders, our findings reveal persistent inefficiencies in resource allocation, influenced by historical legacies, market fragmentation, and inconsistent policy frameworks. In addition, there were identified critical deficiencies in infrastructure and technology adoption that are impeding market efficiency. Overall, the study emphasizes the need for integrated policy reforms to increase the efficiency of resource allocation, support sustainable agricultural practices, and improve farmers' market access. The findings suggest that addressing these challenges requires a coordinated effort between policymakers, industry stakeholders, and the farming community to promote a resilient and competitive agri-food sector in Romania. Moreover, the matrix of challenges and opportunities provides the basis for turning these obstacles into competitive advantages through strategic optimization of resources, improved market access, coherent policy frameworks, and technological advances.

Key words: agri-food sector, policy formulation, market dynamics, development matrix

INTRODUCTION

The Romanian agri-food sector presents a compelling paradox due to its dual role as both a cornerstone of the national economy and a domain fraught with challenges that impede its full potential. This sector, which plays a pivotal role in employment and contributes significantly to Gross Domestic Product (GDP), stands at a critical juncture [20]. On one hand, Romania benefits from fertile lands, a skilled agricultural workforce, and a deep-rooted tradition in food production. Conversely, enduring legacies of historical

events, market fragmentation, and inconsistent policy implementations have intertwined to create a complex maze of barriers that obstruct efficient resource management and market dynamism [28]. Recognizing the intricate interplay between resource allocation and policy formulation is crucial for nurturing sustainable growth and enhancing market efficiency within Romania's agri-food sector. The historical backdrop underscores how past developments have shaped the current landscape, where the legacy of land collectivization followed by privatization has resulted in a fragmented pattern of land

ownership. This fragmentation poses substantial challenges to contemporary farming practices, constraining economies of scale and impeding the widespread adoption of advanced agricultural methodologies. In essence, the Romanian agri-food sector embodies both promise and predicament [6], embodying potential for growth alongside systemic hurdles that necessitate strategic interventions and cohesive policy frameworks to unlock its full economic and agricultural potential.

Market fragmentation further complicates the sector's efficiency and competitiveness. The Romanian agri-food market, characterized by numerous small-scale producers operating independently [14], struggles with barriers that prevent small farmers from accessing broader markets. The role of cooperatives, or the absence of such entities, significantly exacerbates these issues, resulting in the inefficient allocation of resources and severely limiting the dynamism of the market. These structural inefficiencies serve as substantial barriers, hindering the sector's ability to effectively integrate into global supply chains and compete on a larger, more competitive scale. Additionally, the inconsistent implementation of policies and the frequent changes in regulations create an environment characterized by uncertainty [8], [37]. This pervasive uncertainty deters long-term investments, thereby stymying growth and preventing the sector from achieving its full potential. The existing policy frameworks, marked by inconsistencies and short-term focus, fail to provide the necessary support for sustainable development [20], [17], [25]. This policy instability not only impacts resource distribution but also affects market dynamics, further entrenching the sector's challenges.

Addressing these multifaceted challenges requires a comprehensive approach that takes into account the intricate interplay between historical legacies, market structure, and policy decisions. Understanding this interplay is essential for formulating effective solutions. Potential policy reforms must concentrate on creating a stable and supportive policy environment, which is crucial for fostering investor confidence and encouraging long-

term investments [34]. Simultaneously, enhancing market integration is vital for ensuring that the agri-food sector can compete on a larger scale, facilitating smoother entry into global supply chains [9]. Furthermore, fostering technological adoption and infrastructure development is key to modernizing the sector, improving efficiency, and increasing productivity [35]. By holistically addressing these core issues, Romania can unlock the full potential of its agri-food sector, transforming it into a vibrant and competitive force within the global agricultural landscape.

By providing a detailed and evidence-based analysis, this research aims to contribute to the formulation of policies that ensure the Romanian agri-food sector's growth and sustainability in the years to come. Understanding the sector's complexities and addressing its challenges head-on can lead to the development of a robust and resilient agri-food industry [19]. Such an industry would be capable of significantly contributing to Romania's economic prosperity and ensuring food security for its population [22]. By taking a comprehensive approach to reform and modernization, this research seeks to offer valuable insights and practical recommendations that can guide policymakers in creating an environment where the agri-food sector can thrive. This will ultimately result in a more dynamic, competitive, and sustainable agri-food industry that can stand strong in the face of global challenges and opportunities [3]. This paper undertook a comprehensive investigation into the challenges hindering Romania's agri-food sector [27] by employing a mixed-methods approach. This approach combined qualitative and quantitative analyses to provide a holistic understanding of the sector's current state. By examining stakeholder perceptions, the research aimed to identify key issues and gaps that are impeding progress. The study pinpointed problems such as inefficient resource allocation, market fragmentation, inconsistent policy frameworks, and deficiencies in infrastructure and technology.

The ultimate purpose of this research is to utilize these findings to formulate evidence-

based policy recommendations. These recommendations are designed to address the identified challenges and lay the groundwork for transformative changes within the sector. By implementing these strategic policies, the Romanian agri-food sector can be steered towards a path of enhanced competitiveness and sustainable growth. This involves creating a stable policy environment, fostering market integration, promoting technological adoption, and developing robust infrastructure.

In essence, this research aspires to contribute significantly to the formulation of effective strategies that will bolster the long-term development and resilience of Romania's agri-food industry. By addressing these complex challenges head-on, the sector can evolve into a vibrant and competitive force within the global agricultural landscape, ultimately contributing to Romania's economic prosperity and food security.

MATERIALS AND METHODS

The primary objective of this study was to explore and understand the perceptions of active participants within the agri-food sector regarding the phenomena [7]. Specifically, it aimed to gather field data that could sustain the development of policies destined to promote agri-food products.

Given this goal, this research work is deliberately focused on capturing real-world insights and perspectives directly from stakeholders rather than engaging in a legislative or regulatory analysis. This methodological choice was grounded in the necessity to bridge the gap between theoretical insights and practical policy formulation [10], [16].

Justification of the Methodological Approach

The decision to center this study on field data collection and stakeholder perceptions stems from several foundational considerations. First and foremost, policy development in the agri-food sector necessitates a deep understanding of how industry stakeholders perceive existing challenges and opportunities [4]. By engaging directly with these stakeholders through the questionnaire method, the study aimed to uncover nuanced perspectives that legislative

analyses might overlook. Moreover, this research sought to prioritize the experiences of those actively involved in the agri-food sector. These individuals possess invaluable firsthand knowledge that is indispensable for crafting effective and contextually relevant development policies. Through qualitative inquiry, the study aimed to elucidate the complex interplay of factors influencing the sector, including economic dynamics, consumer behavior trends [31], technological advancements, and environmental considerations.

Research Design and Data Collection

To achieve the research objectives, it was employed a qualitative research design characterized by the distribution of structured questionnaires to stakeholders across various segments of the agri-food sector. This methodological approach aimed to comprehensively understand stakeholder perspectives on critical issues impacting the sector's development.

In order to gather data from an assortment of stakeholders, including legislators, agricultural specialists, farmers, and business representatives, we developed a questionnaire especially for the study on Romania's agri-food sector. In order to guarantee a balanced representation of all groups, we proceeded by asking demographic details to divide participants by role, experience, geography, and age.

Significant issues such as resource allocation and land fragmentation were the primary objectives of the questionnaire, that asked respondents to rate the degree of fragmentation and mention issues like poorer productivity, greater operating costs, and diminished economies of scale. We additionally asked for recommendations for possible adjustments, such as cooperative arrangements or land consolidation.

After examining market fragmentation and access constraints, we questioned about issues including inadequate infrastructure, expensive transportation, a lack of market knowledge, and a lack of negotiating position and improvement suggestions were requested from the respondents.

Evaluating the effectiveness of current agricultural policies was the goal of the policy framework and implementation part. Participants evaluated the coherence of policies and identified issues such as poor coordination, bureaucratic inefficiencies, and insufficient budget. We also gathered recommendations for improving policy by asking about the efficacy of support and subsidy programs.

We also looked at the adoption of technology and infrastructure, asking participants to provide feedback on the level of technology adoption in the rural areas and the infrastructure in those regions. Respondents offered ways of addressing the barriers to technology adoption, such as high costs, ignorance, and aversion to change.

We were able to collect both quantifiable data and in-depth insights by combining quantitative and qualitative questions in the questionnaire. The findings were significant in enabling us to create targeted policy suggestions that would improve the competitiveness, efficiency, and sustainability of Romania's agri-food industry.

The sampling strategy was meticulously designed to ensure representation from farmers, processors, distributors, policymakers, and consumer advocacy groups. By targeting a diverse range of participants, we sought to capture a broad spectrum of viewpoints and experiences, thereby enhancing the robustness and applicability of our findings to policy formulation.

The sample of 56 participants was specifically purposefully selected to ensure representation from key stakeholders in Romania's agri-food sector, including policymakers, agricultural scientists, farmers, and industry. Although the sample might seem small when first considered, it should be interpreted in light of the primary goal of our study, to obtain richly contextualized insights into challenges and perspectives of these stakeholders, rather than perform wide statistical generalization.

They were purposively sampled to adequately represent each of the seven major stakeholder groups. Policymakers, agricultural experts, farmers, and industry representatives all bring different and valuable perspectives, so the

sample was fielded to capture this diversity. Given that 36% of those that attended were farmers, who form the backbone of the agri-food sector, followed by 27% being policymakers, we consider the distribution to be very well placed to provide a holistic insight on the challenges the sector faces. Given the nature of this sample, we do not claim full generalizability to the population of those working in these domains, but we do believe this is a sufficiently large and representative subset of stakeholders from which to derive meaningful conclusions about the sector. A diverse sample provides a holistic understanding of issues, reducing biases toward any demographic, providing insights covering many spectrums. Furthermore, the results provide a solid foundation for identifying systemic problems and patterns, that can subsequently direct future research with potentially larger sample sizes or influence recommendations for policy. Finally, the quality of insights gathered is arguably more important than the number of participants who took part in studies like this one, including when the objective is to inform the development of policy and the improvement of sector-specific strategies. Hence, although the sample is relative small, it is representative for a core range of stakeholders involved in Romania's agri-food sector and the qualitative insights this brings are valuable for understanding the fundamentals.

Ethical Considerations

Throughout the research process, ethical guidelines were strictly adhered to, with measures implemented to protect participant confidentiality and ensure informed consent. Clear instructions were provided to participants regarding the purpose of the study, voluntary participation, and the use of data solely for research purposes. Ethical considerations also included the respectful representation of stakeholder perspectives in the analysis and reporting of findings.

Limitations

While questionnaires provided valuable quantitative data on stakeholder perceptions, it is important to acknowledge inherent limitations. Responses may be influenced by respondent bias or limited to the scope of

questions asked, potentially constraining the depth of qualitative insights compared to more interactive methods like interviews. Despite these constraints, the structured nature of questionnaires facilitated efficient data collection and analysis, offering valuable insights into stakeholder viewpoints on agri-food sector issues.

Proposal for a Matrix Supporting Agro-Food Product Development Policy

The questionnaire aimed to explore and analyze the current state of economic resource allocation [24] and policy challenges within Romania's agri-food sector, gathering comprehensive data on critical aspects such as resource allocation, market fragmentation, policy frameworks, and infrastructure and technological adoption [5], [11], [29], [36]. These aspects were identified as pivotal for their relevance and importance in understanding the sector's dynamics and obstacles. This initiative aligns with the proposed research goal of developing a robust matrix to support the creation of effective policies aimed at promoting Romania's agri-food products.

1. Resource Allocation

Efficiency and Productivity

Understanding how resources are currently allocated is crucial for identifying inefficiencies that could be hindering productivity [23] and profitability for Romanian agriculture. Fragmented land ownership, for example, it can limit economies of scale and access to resources.

Targeting Support

Examining resource allocation helps to ensure that support programs and subsidies reach the farmers who need them most [32]. Misallocated resources can have a limited impact on overall sector development.

2. Market Fragmentation

Market Access

A fragmented market with limited access to larger markets for small-scale farmers can stifle their growth and competitiveness. Analyzing this aspect helps identify barriers like poor infrastructure, high transportation costs, and lack of market information [33].

Fairness and Equity

Market fragmentation can create an uneven playing field, disadvantaging small-scale farmers [18]. Examining this aspect helps ensure fair access to markets and opportunities for all stakeholders within the sector.

3. Policy Frameworks

Effectiveness of Policies

Analyzing policy frameworks helps to determine if the existing policies are achieving their intended goals [12], [15]. Inconsistency and incoherence in policy design can lead to confusion and hinder implementation [2].

Targeted Interventions

Understanding policy frameworks allows for the development of more targeted interventions that address specific challenges faced by the sector. Policies need to be clear, well-communicated, and efficiently implemented to be successful [21].

4. Infrastructure and Technological Adoption

Modernization and Efficiency

The adoption of modern technologies and infrastructure improvements are critical for enhancing productivity and promoting sustainable agricultural practices [13]. Analyzing this facet facilitates the identification of sectors requiring investment for modernization.

Knowledge and skills

For farmers to effectively embrace new technologies, training and knowledge development are frequently necessary [30]. With the help of this research, support initiatives may be established in place to provide farmers the tools they need to make the most of these developments.

A matrix was created to rigorously assess the crucial elements that were determined to be the basic foundations in the creation of food products. Together, these four interrelated elements provide a thorough analytical framework that is essential for analyzing the potential and difficulties facing Romania's agri-food industry. By focusing on these aspects, this study hopes to provide important information for decision-makers. These understandings will be essential in formulating successful plans to encourage the industry's expansion and raise the level of competition for its goods.

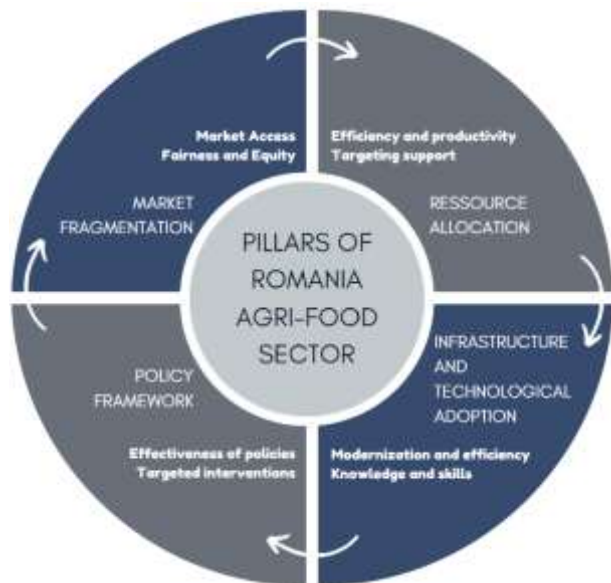


Fig. 1. Interrelated connections in the agri-food sector in Romania

Source: Authors' own work.

The relationships and reciprocal effects between these four elements are illustrated in Figure 1. Better market access, well-informed policy, and technical breakthroughs are all driven by efficient resource allocation. Fair possibilities are guaranteed for all farmers by tackling market fragmentation, and important information is obtained for the creation of infrastructure and policies. In turn, efficient policy frameworks influence the allocation of resources and aid in modernization initiatives. Technology adoption and infrastructure development, which are influenced by resource allocation and policy, increase sustainability and productivity. Developing comprehensive strategies to promote the Romanian agri-food sector requires an understanding of these interdependencies.

The hypothesis of the research

To establish the credibility of the matrix outlined earlier, there were formulated several hypotheses. These hypotheses are designed to be validated through the in-depth analysis of the questionnaire results. By scrutinizing the data gathered from the survey, we aim to substantiate the accuracy and reliability of the matrix we have put forward. This approach allows us to systematically test and confirm the theoretical framework we have proposed, ensuring that it effectively reflects the real-world phenomena under investigation.

(1) Resource Allocation - Land fragmentation in Romania's agri-food sector leads to inefficient resource allocation.

(2) Market Fragmentation - Poor infrastructure and high transportation costs significantly hinder market access for small-scale farmers.

(3) Policy Framework - Inconsistent and poorly designed policy frameworks hinder the effectiveness of subsidy and support programs.

(4) Infrastructure and Technological Adoption - Inadequate infrastructure and low technological adoption impede the efficiency and productivity of Romania's agri-food sector.

RESULTS AND DISCUSSIONS

The agri-food sector in Romania holds a crucial position within the national economy, contributing significantly to food supply, employment generation, and rural development. Despite its importance, the sector encounters various challenges that impede its efficiency, productivity, and sustainability.

To address these issues, it was employed the questionnaire method which is the most effective approach for obtaining pertinent information for our research. This method will facilitate the collection of relevant data, enabling a thorough analysis and informed recommendations to enhance the sector's performance.

Demographic Considerations of Participants

The study successfully garnered responses from a diverse range of stakeholders within Romania's agri-food sector, with a total of 56 participants.

Policymakers comprised the largest group, representing 27% (15 respondents) of the sample. This significant participation ensures a strong foundation for understanding policy perspectives and challenges. Agricultural experts formed the second-largest group at 21% (12 respondents), providing valuable insights into technical aspects and best practices within the sector. Farmers, the backbone of the agri-food sector, constituted 36% (20 respondents) of the participants, offering firsthand experiences and perspectives on the ground-level realities. Industry

representatives rounded out the sample at 16% (9 respondents), contributing their knowledge of market dynamics and value chain operations. This well-balanced distribution of participants across stakeholder groups fosters a comprehensive understanding of the challenges faced by the Romanian agri-food sector from various vantage points.

Key findings of resource allocation

Overwhelming Consensus on Fragmentation: A staggering 80% of respondents (45 out of 56) indicated that land ownership in Romania's agri-food sector is "very fragmented." This is further supported by the minimal representation of those who perceive fragmentation as moderate (18%, 10 respondents) or slight (2%, 1 respondent).

Challenges Observed:

The severe fragmentation of land ownership translates into a multitude of challenges, as reported by the participants:

(i)Reduced Economies of Scale: The most prevalent challenge identified by 70% of respondents (39 respondents) is the limitation of economies of scale. Small, fragmented farms struggle to compete with larger operations in terms of cost efficiencies, hindering their ability to invest in advanced machinery, negotiate better prices for inputs, and access lucrative markets.

(ii)Lower Productivity: Land fragmentation can lead to inefficiencies in land use practices and pose obstacles to adopting modern agricultural technologies. As noted by 66% of respondents (37 respondents), this translates into lower overall productivity for the sector.

(iii)Higher Operational Costs: Fragmented landholdings often incur higher operational costs due to the logistical complexities of managing scattered plots. This challenge was reported by 59% of respondents (33 respondents).

(iv)Resource Management Difficulties: Scattered landholdings pose significant challenges in managing resources effectively. Half of the respondents (28 respondents) highlighted this difficulty, which can encompass issues like coordinating labor, equipment usage, and irrigation practices across fragmented plots.

The overwhelming consensus on land fragmentation, coupled with the observed challenges, underscores the significant impact this issue has on inefficient resource allocation within the Romanian agri-food sector. Historical legacies and the resulting land fragmentation create a scenario where small and fragmented landholdings severely limit economies of scale. This, in turn, reduces productivity and profitability for Romanian agriculture. Addressing land fragmentation through policy interventions aimed at promoting land consolidation or cooperative structures is crucial to optimize resource allocation and enhance the sector's competitiveness.

Key findings of market fragmentation

Barriers to Market Access: The research identified several significant barriers hindering small-scale farmers' access to larger markets within Romania's fragmented agri-food sector. A concerning 75% of respondents (42 respondents) highlighted poor infrastructure, such as inadequate roads and storage facilities, as a major obstacle. This sentiment is echoed by the 68% (38 respondents) who identified high transportation costs as a significant barrier. (i)Limited access to efficient and affordable transportation due to poor infrastructure directly translates into higher costs for farmers, further squeezing their profit margins.

(ii)Furthermore, a lack of market information emerged as a critical challenge, reported by 63% of respondents (35 respondents). Without access to reliable information on market prices, trends, and potential buyers, small-scale farmers struggle to make informed decisions and secure profitable opportunities. (iii)Adding to these challenges, 55% of respondents (31 respondents) pointed to their limited bargaining power as a disadvantage. (iv)Fragmented markets with a multitude of small producers often leave them vulnerable to lower prices dictated by larger players in the market chain.

Impact of Logistical Challenges: The combined effect of these barriers manifests in the significant impact logistical challenges have on market access, as reported by the participants. A resounding 64% of respondents

(36 respondents) stated that logistical challenges significantly affect market access for small-scale farmers. This highlights the urgency of addressing these issues to ensure a more level playing field and empower smaller producers to reach wider markets. While a quarter of respondents (14 respondents) felt the impact was moderate, and a small portion (6 respondents) perceived a slight effect, it's noteworthy that no participants indicated no impact.

The findings paint a clear picture of a highly fragmented agri-food market in Romania, characterized by limited access to larger markets for small-scale farmers. Poor infrastructure, high transportation costs, lack of market information, and weak bargaining power all contribute to logistical challenges that significantly hinder market access and reduce competitiveness. Addressing these issues through targeted policies and infrastructure development initiatives is crucial to creating a more efficient and equitable market environment for all stakeholders within the Romanian agri-food sector.

Key findings of the policy framework

Consistency and coherence of policies: The research exposes a critical issue within Romania's agri-food sector: policy frameworks that lack consistency and coherence. A staggering 82% of respondents (46 respondents) rated existing policies as "not consistent or coherent." This highlights a significant disconnect between policy design and implementation, potentially leading to confusion and inefficiencies for stakeholders. Concerns over policy coherence were further accentuated by the fact that only a small percentage of participants thought that policies were either fairly consistent (14%, 8 respondents) or moderately consistent (4%, 2 respondents). Surprisingly none of the respondents believed that the policies were "very consistent and coherent."

Implementation difficulties: According to the participants, the lack of consistency in the policy results in specific difficulties during implementation. The most significant barrier was found to be bureaucratic inefficiencies, which were mentioned by 71% of respondents (40 respondents). Potential beneficiaries may

be deterred from accessing support programs by the time-consuming nature of navigating intricate bureaucratic procedures. 66% of respondents (37 respondents) expressed serious concern about inadequate funding for policy initiatives, suggesting a possible discrepancy between the goals of policy and the resources at hand. Additionally, 31 respondents, or 55% of the sample, mentioned that personnel in charge of carrying out policies needed proper training. This may result in misunderstandings and inconsistent application, which would ultimately reduce the programs' effectiveness. In addition to these challenges half of the respondents (28 respondents) noted a lack of coordination between government agencies involved in agriculture, which could lead to inconsistent signals and duplication of effort.

Effectiveness of subsidies and support programs: The study analyzed in further detail the effectiveness of particular policy tools, such as subsidies and support programs. The results show that 39 respondents, or 70% of the sample, believe that current initiatives are ineffective at reaching their stated objectives. The low percentage of respondents who believe these initiatives are just moderately effective (7%, 4 respondents) or somewhat effective (23%, 13 respondents) supports this view even further. Once again, none of the respondents thought they were "very effective."

The research provides compelling evidence that inconsistent and poorly designed policy frameworks are a significant challenge hindering the Romanian agri-food sector. The lack of coherence in policy design coupled with implementation challenges such as bureaucratic red tape, inadequate funding, and insufficient training all contribute to a scenario where subsidy and support programs fall short of their intended impact. Addressing these issues through policy reforms that prioritize consistency, clear communication, and efficient implementation is crucial to ensure that policy frameworks effectively support the growth and competitiveness of the Romanian agri-food sector.

Key findings of infrastructure and technological adoption

State of rural infrastructure: A stark picture emerges regarding rural infrastructure, with 64% of respondents (36 respondents) rating it as "poor." This highlights a critical gap in essential infrastructure that hinders efficient operations and market access, particularly for farmers in rural areas. Only a small fraction of participants found rural infrastructure to be fair (27%, 15 respondents), good (7%, 4 respondents), or excellent (2%, 1 respondent).

Technological adoption: The level of technological adoption within the sector remains concerning. A significant majority (57%, 32 respondents) indicated a "very low" level of adoption, further corroborated by 30% (17 respondents) reporting a "low" level. While a small portion observed moderate adoption (11%, 6 respondents) and only 2% (1 respondent) noted a high level, it's clear that the sector lags in embracing modern technologies.

Barriers to technological adoption: The research identified several key barriers hindering the widespread adoption of modern agricultural technologies:

(i)*High Cost:* The perceived high cost of technology was a major concern for 75% of respondents (42 respondents). Limited financial resources can act as a significant barrier for farmers, particularly those in small-scale operations.

(ii)*Lack of Knowledge and Training:* A significant knowledge gap emerged as another critical obstacle, with 66% of respondents (37 respondents) highlighting the lack of training and knowledge as a major deterrent to adopting new technologies. Farmers may be hesitant to invest in technologies they don't fully understand or lack the skills to operate effectively.

(iii)*Limited Access:* Physical limitations in accessing new technologies were also a concern for 55% of respondents (31 respondents). This could encompass issues like lack of local vendors, limited distribution networks, or inadequate infrastructure hindering access to these technologies.

(iv)*Resistance to Change:* A more intangible barrier identified by 50% of respondents (28 respondents) is the resistance to change among some farmers. Traditional mindsets and established practices can create inertia and

reluctance to embrace new technological advancements.

The findings reveal a critical need to address the substantial gaps in infrastructure, particularly in rural areas. Additionally, a major obstacle in improving productivity and encouraging sustainable practices in the Romanian agri-food sector is the poor adoption of contemporary agricultural technologies. Targeted interventions are required to address the high prices of technology, provide farmers access to information and training opportunities, increase their affordability, and promote an open attitude toward accepting innovations in order to overcome these obstacles. By addressing these problems, the manufacturing sector may reach its maximum potential and advance toward a future that is more productive, efficient, and sustainable.

Hypothesis demonstration and matrix validation

Our hypotheses, which are supported by empirical findings from a structured questionnaire distributed to stakeholders in Romanian agriculture, are thoroughly summarized in Table 1. The results reveal widespread problems that obstruct effective resource distribution, market integration, coherent policy, and technical development. These challenges are a reflection of larger systemic issues that impact the sustainability and competitiveness of the industry. This study offers insights into the complex nature of the challenges faced by small-scale farmers, governments, and industry stakeholders by methodically analyzing these variables.

Four important hypotheses have been confirmed by the thorough questionnaire research used to validate the Matrix Supporting Agri-Food Product Development Policy. This validation demonstrates the matrix's applicability in addressing important issues in the agri-food industry in Romania. First, the matrix's focus on resolving land fragmentation in relation to resource allocation is consistent with research showing its negative effects on efficiency. Proposed solutions include advocating for land consolidation and cooperative frameworks. Secondly, addressing market fragmentation, the matrix's recommendations, such as infrastructure

enhancements and improved transportation access, directly respond to identified barriers like inadequate infrastructure and high costs. Thirdly, regarding policy frameworks, the matrix advocates for reform to streamline bureaucratic processes and enhance program effectiveness, aligned with research revealing current inconsistencies. Lastly, tackling infrastructure and technological adoption challenges, the matrix promotes targeted investments in infrastructure and technological training, crucial for optimizing productivity.

These validated insights highlight pathways to enhance resource allocation, expand market access, improve policy implementation, and foster technological advancement within Romania's agri-food sector. By advocating for the matrix's adoption and crafting detailed action plans based on its recommendations, stakeholders can collaboratively drive positive change, ensuring a more competitive and prosperous future for Romanian agri-food products [1].

Table 1. Hypothesis demonstration and matrix validation

Analyzed Aspect	Hypothesis	True / False/ Not applicable	Demonstration
<i>Resource Allocation</i>	Land fragmentation in Romania's agri-food sector leads to inefficient resource allocation.	True	80% of respondents indicated land ownership is "very fragmented." Reduced economies of scale (70%). Lower productivity (66%). Higher operational costs (59%). Resource management difficulties (50%). The overwhelming consensus on fragmentation and the reported challenges demonstrate how land fragmentation leads to inefficient resource allocation in Romania's agri-food sector.
<i>Market Fragmentation</i>	Poor infrastructure and high transportation costs significantly hinder market access for small-scale farmers.	True	Poor infrastructure (75%). High transportation costs (68%). 64% of respondents stated that logistical challenges significantly affect market access. The identified barriers and their impact on market access indicate that poor infrastructure and high transportation costs are significant hindrances for small-scale farmers.
<i>Policy Framework</i>	Inconsistent and poorly designed policy frameworks hinder the effectiveness of subsidy and support programs.	True	Policies rated as "not consistent or coherent" by 82% of respondents. Bureaucratic inefficiencies (71%). Inadequate funding (66%). Lack of adequate training (55%). 70% of respondents view current programs as ineffective. The inconsistency and poor design of policy frameworks, coupled with implementation challenges, hinder the effectiveness of subsidy and support programs in the agri-food sector.
<i>Infrastructure and Technological Adoption</i>	Inadequate infrastructure and low technological adoption impede the efficiency and productivity of Romania's agri-food sector.	True	Poor rural infrastructure (64%). Very low technological adoption (57%). Barriers to Technological Adoption: High cost (75%); lack of knowledge and training (66%); limited access (55%); resistance to change (50%). The poor state of rural infrastructure and low levels of technological adoption, along with the identified barriers, show how these factors impede the efficiency and productivity of the sector.

Source: own elaboration based on the result of the questionnaire.

Policy Framework Proposal for Agro-Food Product Development

This analysis underscores the urgent need for targeted interventions and policy reforms aimed at addressing the identified barriers. Such initiatives are essential for fostering resilience, enhancing productivity, and promoting equitable growth within Romania's agri-food sector. Understanding these dynamics is crucial for developing strategies that can unlock the sector's potential and

contribute to its long-term viability in a globalized economy.

Based on the results of this research and the validation of the matrix, it was proposed a policy framework that aims to address the systemic challenges identified in Romania's agri-food sector, focusing on improving policy coherence, enhancing support mechanisms, and promoting sustainable development. This framework is designed to foster innovation, efficiency, and competitiveness across the sector (Table 2).

Table 2. Policy framework proposal for agro-food product development

1. Enhancing policy coherence and alignment
<i>Objective: Improve consistency and coherence in policy frameworks to provide clarity and stability for stakeholders.</i>
<i>Activities:</i>
1. Conduct a comprehensive review of existing agricultural policies to identify inconsistencies and gaps.
2. Develop a unified policy approach that integrates agricultural, economic, and environmental objectives.
3. Establish mechanisms for regular stakeholder consultation to ensure policies meet sectoral needs and adapt to evolving challenges.
2. Strengthening support mechanisms
<i>Objective: Enhance the effectiveness of subsidy and support programs to better assist small-scale farmers and agri-food businesses.</i>
<i>Activities:</i>
1. Increase funding allocation for agricultural support programs while ensuring efficient utilization.
2. Simplify application procedures and reduce bureaucratic barriers to accessing subsidies and grants.
3. Provide targeted support for technology adoption, infrastructure development, and market access improvements.
3. Promoting sustainable practices and innovation
<i>Objective: Encourage the adoption of sustainable farming practices and foster innovation in agro-food production.</i>
<i>Activities:</i>
1. Implement incentives for farmers adopting sustainable agriculture practices, such as organic farming and integrated pest management.
2. Encourage research and development projects with the goal of enhancing agriculture yields, climate resilience, and resource efficiency.
3. Encourage partnerships between academic institutions, research centers, and businesses to speed up the spread of innovations and technology transfer.
4. Developing skills and competence
<i>Objective: Fill in the knowledge gaps and improve the abilities of farmers and other agri-food stakeholders.</i>
<i>Activities:</i>
1. Increase the number of workshops and vocational training programs to enhance technical proficiency in contemporary agriculture technology and practices.
2. Create networks and venues for knowledge sharing to promote information sharing about industry trends and best practices.
3. Encourage training in business management and entrepreneurship to provide farmers with the abilities necessary to produce and market value-added agro-food.
5. Market access and infrastructure development
Goal: Expand small-scale farmers' and rural communities' access to markets while enhancing rural infrastructure.
<i>Activities:</i>
1. To reduce transportation costs and improve market connectivity, invest in infrastructure projects like roads, storage facilities, and cold chain logistics.
2. To assist farmers make more informed choices and reach wider markets, improve digital infrastructure, and market information system accessibility.
3. Encourage agri-food clusters and cooperative structures to help small-scale farmers increase their market presence and negotiation leverage.

Source: author's elaboration.

In order to solve major issues and encourage resilience, competitiveness, and sustainable growth, the suggested policies for Romania's agri-food industry are needed. Promoting policy alignment and coherence promotes stability and clarity, enabling stakeholders to make well-informed choices and encouraging sustained investment in sustainable practices. Strengthening support mechanisms through increased funding and simplified procedures enhances accessibility to resources, promoting technological adoption and market competitiveness. Encouraging sustainable practices and fostering innovation not only boosts productivity but also enhances

resilience to climate change and environmental challenges [26]. Capacity building and skills development among farmers and stakeholders equip them with essential tools to adapt to modern agricultural practices and market demands. Additionally, investing in infrastructure development and enhancing market access connects farmers to broader markets, reduces logistical costs, and strengthens their bargaining power. These integrated efforts will unlock the sector's full potential, driving inclusive and equitable growth across Romania's agricultural landscape.

CONCLUSIONS

Based on the comprehensive analysis and findings obtained from our research, we are now in a position to summarize several key conclusions that are pertinent to the study. These conclusions are derived from the data collected, the methodologies employed, and the thorough examination of the results. They highlight significant insights, trends, and implications that have emerged throughout the research process. The validated Matrix Supporting Agri-Food Product Development Policy serves as a roadmap for policymakers and stakeholders to address key challenges. Land fragmentation, a significant barrier to efficient resource utilization, can be tackled through initiatives that encourage land consolidation or the formation of cooperatives. Similarly, the fragmented market environment hindering small-scale farmers can be addressed by targeted investments in rural infrastructure and improved transportation access. The research also underscores the need for clear and well-designed policy frameworks, achievable through streamlining bureaucratic processes and enhancing communication strategies. Finally, the identified gaps in infrastructure and technology adoption can be bridged by directing investments toward rural areas and developing comprehensive training programs for farmers. By implementing these pragmatic solutions, stakeholders can work collaboratively to unlock the immense potential of the Romanian agri-food sector. The proposed policies not only address immediate challenges but also lay the foundation for a more sustainable and prosperous future for Romanian agriculture, ensuring a thriving sector that produces high-quality agri-food products that can compete effectively on a global scale. This research also opens doors for future endeavors. A focus on policy coherence and alignment alongside strengthened support mechanisms and infrastructure development will create a stable environment for long-term investment and market competitiveness. By equipping farmers and stakeholders with the tools they need to succeed, we can unlock the full potential of Romania's agri-food sector, driving inclusive

and equitable growth for a prosperous agricultural future.

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