Constraints to Green and Digital Transition in the Greek Agri-Food Sector

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Abstract: The European Union's Green Deal and the United Nations' 2030 Agenda are key strategic frameworks that aim to transform all nations towards a climate-neutral continent. At the heart of achieving this ambitious goal is the need for greater policy coherence, particularly concerning the digital Green Deal. The adoption of digital technologies in green sustainability initiatives requires a comprehensive update of existing policies to properly exploit all the opportunities offered by digitalisation. This study focuses on identifying constraints to environmental and digital advancement in the agri-food sector. In particular, it examines existing policies and those that need to be implemented to facilitate the green and digital transition of agri-food enterprises. The research methodology comprises in-depth, semi-structured interviews with fifteen (15) policymakers at the national, regional, and local levels in Greece, all of whom are responsible for decision-making in the agri-food sector. The findings underline the need for a substantial reform of the current institutional framework to make it more favourable to agri-food enterprises, especially for very small enteprises and SMEs, for whom the barriers are even greater. Improving access to financial support is also highlighted as a critical need. To ensure a smooth twin transition towards environmental sustainability and digitalisation, the study advocates improving the educational background and promoting digital literacy among stakeholders. These measures are considered necessary to increase the competitiveness of agri-food enterprises in today's global landscape. The study essentially highlights the central role of a strong policy framework for the environmental and digital transition of the agri-food sector. By addressing the barriers identified in the study through the implementation of appropriate policies, agri-food entrepreneurs can adopt sustainable practices and harness the transformative potential of digital technologies.

Keywords: Agri-food sector, Policies, Sustainability, Green transition, Digitalisation

1. Introduction

Alongside the exceptional crises, it is imperative to acknowledge the pivotal role of climate change and its tangible, particularly evident impacts across the globe in recent times. Furthermore, the rapid advances in technology and the subsequent digital transformation brought about by the 4th Industrial Revolution need to be taken into account (Apostolopoulos et al, 2021; Pistikou et al, 2023). The European Green Deal is an ambitious initiative by the European Union (EU) to achieve climate neutrality by 2050 in full compliance with the 17 United Nations Sustainable Development Goals and the Paris Climate Agreement (European Commission, 2017; Castillo-Díaz et al, 2023). This agreement has promoted the transition to a sustainable and circular economic model, supporting the use of clean energy sources and the adoption of green practices in all sectors of the economy (Agoraki et al, 2023; Apostolopoulos et al, 2023; Paris et al, 2023), including the agri-food sector. The integration of digital technologies in agriculture, such as precision agriculture and production monitoring systems, have been central elements of this strategy (European Commission, 2019).

The green and digital transformation of the agri-food sector has been a key issue in efforts to ensure sustainable and resilient agri-food systems (Saviolidis et al, 2020). However, this transition is not without challenges and obstacles that affect the effectiveness and efficiency of the initiatives involved. Despite the recognition of the importance of digitalisation, access to advanced technologies has remained limited in many areas, particularly in rural areas (Ferrari et al, 2022). This weakness is due to a number of factors. First, the financial difficulties especially of very small and small-medium agri-food enterprises make it difficult to invest in new technologies (Klerkx et al, 2019). Funding is therefore a critical factor. Despite increased investment in Research and Development (R&D), the financial resources available to support agri-food enterprises toward green and digital transformation has been insufficient (Cao et al, 2021). The lack of investment incentives and

the high cost of the initial investment required for digitalisation and the implementation of sustainable practices act as a deterrent.

The institutional framework has been an equally important barrier (Apostolopoulos et al, 2020; Liargovas et al, 2017). In many cases, regulations are not in line with the needs of modern agriculture and technological progress. The lack of coherent policies and control mechanisms and the complexity of bureaucratic procedures make it difficult to implement innovative solutions (Long et al, 2016; Apostolopoulos et al, 2021; Makris et al, 2024). The role of the new Common Agricultural Policy (CAP) is to support the agri-food sector towards environmental sustainability, climate change mitigation, and increased digitalisation. By incorporating practices that reduce greenhouse gas emissions and increase resource efficiency, the CAP aims to create a more sustainable and resilient agri-food sector (European Commission, 2021; European Commission, 2023). However, a shift from traditional to contemporary techniques necessitates not just financial resources for procuring new equipment but also the provision of adequate education and training in its application. The traditional culture and established habits of many farmers have acted as a barrier to the adoption of new practices, as they are unfamiliar to them (Apostolopoulos et al, 2023; Gemtou et al, 2024).

By examining the perspectives and experiences of 15 policymakers in the agri-food sector, we add knowledge and strengthen the academic literature on the challenges faced by agri-food enterprises in adopting green and digital practices in Greece. Although the global interest in this topic is huge, there is a lack of research in the literature considering the policymakers' side. The question that this research aims to answer is the following:

- What are the challenges faced by agri-food enterprises in their green and digital transition efforts?

The framework of our survey is the following. The introduction of the environmental and digital framework in the agri-food sector follows the literature review based on the scientific papers on green and digital practices of agri-food enterprises. Then, we outline our methodological approach. Next, we analyse and discuss our findings, and finally, we present the conclusion, the limitations, and future research.

2. Literature Review

The existing literature has identified research conducted on policy measures designed to support agri-food enterprises in a green and digital transition in line with the Sustainable Development Goals and the European Green Deal (Apostolopoulos et al, 2018; Stein & Santini, 2022). However, further research is required to enhance support to the agri-food sector in this twin challenging transition. The present research examines the perspectives of various stakeholders, including state, regional, and local actors, on the challenges faced by agri-food enterprises in Greece in adopting digital technologies for environmental sustainability.

Enabling the introduction of digital technologies is one of the promising ways to ensure sustainable development (Bohnsack et al, 2022; Deirmentzoglou & Deirmentzoglou, 2022). The utilisation of digital technologies in the agri-food sector has the potential to significantly reduce environmental impacts. This can be achieved by decreasing the consumption of natural resources, lowering pollutant levels, and cutting CO2 emissions. This shift in approach fosters long-term sustainability of the agri-food enterprises in line with environmental and social advantages. Research emphasizes the positive contribution of digital technologies in achieving more sustainable production and consumption processes (Mäkitie et al, 2023). The successful adoption of these technologies depends on the socioeconomic context and the presence of policy support measures (Barrett et al, 2020; Carayannis et al, 2020; FAO, 2022).

The EU has incorporated digital measures into its agricultural policies in response to concerns about environmental impact (Venghaus & Hake, 2018). The recent CAP reform has allocated 40% of the budget for the promotion of climate- and environmentally-friendly agricultural practices for the period 2023-2027 (European Commission, 2023). Despite these efforts, EU agriculture continues to have negative impacts on the environment. Doukas et al. (2023) found that "green" payments incentivize agri-food enterprises to adopt new technologies like renewable energy sources (RES) and smart agriculture. However, Slätmo (2019) noted that more stringent environmental sustainability policies may hinder the economic development of rural agri-food enterprises. Meeting EU criteria for environmental, social, and governance (ESG) requirements can be stressful for agri-food small-medium enterprises, as highlighted by Jónsdóttir and Gísladóttir (2023). Despite the prevalence of initiatives aimed at promoting positive impacts, there is currently no compelling evidence that ESG-focused portfolios outperform traditional ones. The development of a unified sustainable economic classification framework remains a challenge (Zairis et al, 2024).

The Greek agri-food sector is currently unable to undergo the long-awaited transformation. This impediment can be described as the 'triangle of stagnation'. The three sides of the triangle correspond to three key factors: the low level of education that characterises the workforce, the low level of investment in the agri-food sector, and the slow transition to digitalisation compared to most European countries (Paris et al, 2023). In particular, the majority of Greek farmers and producers (approximately 97%) have gained their experience in the field, while a minority (approximately 3%) have received basic training from accredited organisations (Doukas et al, 2022). Only a small number have received full agricultural vocational training after successfully completing integrated training programmes of at least two years' duration. Furthermore, the transition towards digitalisation and innovative production processes is slow and cautious. For example, the European Knowledge and Innovation System (AKIS) has identified the Greek system as being characterised by a lack of coherence and fragmentation (O'Flynn et al, 2018). Another research by Tsilika et al (2020) has shown how Greek SMEs are using improvisation and creativity to innovate in a challenging environment.

3. Methodology

The main purpose of this study was to explore the perspectives and experiences of executives responsible for developing and implementing policies that support the viability and sustainability of the agri-food sector. The interaction between the researcher and the research participant plays a pivotal role in interpreting the participant's experience (Ponterotto, 2005). In light of the research objective, the phenomenological approach, which entails the detection of the perspectives of policymakers in the agri-food sector and the selection of an interpretative contour, namely an in-depth comprehension and interpretation of their personal perceptions, beliefs and experiences, serves to inform the choice of qualitative research (Fossey et al, 2002). Qualitative research enables an understanding of the entrepreneurial phenomenon within its specific context (Van Burg et al, 2020) while also elucidating and explaining the complexity of entrepreneurial actions (Drakopoulou-Dodd et al, 2014).

The purposive sampling technique was used to approach specific stakeholders relevant to the subject (Kenny & Duckett, 2003). The sample size was carefully chosen to ensure it accurately represented individual characteristics, based on the principles of relevance and adequacy (Polit & Hungler, 1999). We conducted semi-structured interviews to gather qualitative data from fifteen executives representing state, regional, and local authorities in 2023. The interviews, conducted in Greek, the native language of the participants. Both telephone and online interviews were used, as research indicates that data collected via these methods are as reliable as face-to-face interviews (Apostolopoulos et al, 2021). Before the interviews, the interviewees were fully informed about the research objectives and assured of their anonymity.

We used content analysis to examine the research data (Bengtsson, 2016). After reading the transcripts, we identified sub-themes and we produced a report for sub-theme interpretations. Saturation was reached when no new concepts were extracted (Guest et al, 2006). We identified three sub-themes related to a specific theme:

- Institutional framework
- EU & national support
- Educational background

4. Data Analysis

In accordance with the interpretative framework, our research question was formulated for the policymakers of the agri-food sector. The data analysis was conducted in the native language of the survey participants to avoid ambiguity (Temple & Young, 2004). The emerging sub-themes regarding the research question were recorded and captured in Table 1. Then, the creation of categories was specified in detail. Combining the interview results with previous literature added value, and validity to the research findings (Flick et al, 2004).

Table 1: Emerged sub-themes regarding the main theme

Theme	Sub-themes	Summary
Green and digital transition of agri-food sector	Institutional framework	Bureaucracy Environmental regulation
	EU & national support	Financial instruments
	Educational background	Re-skilling, up-skilling Lifelong learning

5. Findings

The findings were structured based on the three emerging sub-themes: i) institutional framework, ii) EU & national support and iii) educational background.

- Institutional framework

The institutional framework is often challenging, characterised by complex procedures and significant bureaucracy that discourage investment. Nevertheless, recent efforts to digitise public sector services are promising steps towards simplification. Although perfect environmental practices are still a work in progress, it is essential to implement and monitor the institutional framework through robust control mechanisms.

> *'… The necessity for a novel institutional framework, the streamlining and digitisation of procedures, the implementation of additional measures accompanied by financial instruments and incentives, and the prioritisation of environmental protection are all evident…' (R7)*

> *'I believe that the European Union has established a regulatory framework for the environmental framework, and that the directives adopted by national legislation are sufficient. Of course, it is not enough to have the institutional framework, but it must be implemented and there must be control mechanisms to confirm it…' (R9)*

- EU & national support

In light of the ongoing climate crisis and the European Green Deal's objective of achieving climate neutrality by 2050, it is of paramount importance that agri-food enterprises align themselves with this goal. The parallel increase in the world population calls for the agri-food sector to increase its production in the coming years in order to ensure food security. It is of the utmost importance that the increase in production is achieved through environmentally friendly practices, such as the prudent and sustainable management of resources and the reduction of energy and water consumption. This will ensure the sufficiency and quality of the product and protect the environment. The adoption of new technologies is key to achieving these objectives. The green and digital transition of the agri-food sector requires cooperation between the EU and the state to provide appropriate financial support.

> *'... The Common Agricultural Policy (CAP) represents the primary European policy initiative for the agri-food sector. In order to advance sustainability and environmental protection, the CAP should provide subsidies and funding for practices that promote these objectives…. The CAP and Rural Development Programmes place great emphasis on the role of investment in new technologies and agricultural innovations in facilitating the transition to a more digitised agricultural sector..' (R1)*

It is evident that each state must adapt European policies to its own needs and develop national action plans.

> *'… Careful planning and strategy are needed at national level, in line with the new CAP and green growth. So we will slowly move forward with careful steps towards innovative products, new technologies, innovation, and intelligent agriculture.' (R8)*

> *'… Two major regions of Greece (Macedonia and Peloponnese) are going to face significant challenges due to the closure of all lignite plants by 2030. In this direction, the Just Transition Programme has been created to support these regions through very high aid rates for green, digital, and just transition-oriented investments.' (R5)*

All global crises to date have had a significant impact on societies. The pandemic crisis, in particular, has compelled countries across the globe to accelerate the green and digital transformation of enterprises, with the aim of ensuring their long-term sustainability and competitiveness.

> *'... In the midst of a pandemic, the Recovery and Resilience Fund (RRF) was established a a pivotal financial instrument.... for the implementation of investments in the agri-food sector with a focus on green and digital transformation...' (R4)*

However, many times the financing environment for a prospective investor or entrepreneur of an agri-food enterprise is not friendly.

> *'It is recommended that the Greek state facilitate entrepreneurship by providing subsidies and loans for the implementation of sustainable practices and the development of digital infrastructure. It is unfortunate that many entrepreneurs encounter difficulties in accessing bank loans due to the high interest rates or the requirement of excessive collateral. This highlights the challenging financing environment that entrepreneurs face... There are a lot of delays in payments...' (R13)*

- Educational background

The fact that we are at the beginning of a very large and rapid transition means that it is important to implement a continuous programme of education and retraining for farmers-entrepreneurs so that they are able to meet the challenges of this transition and remain competitive at the international level.

> *'...it is essential to link research with application in the production process. University curricula need to be updated and vocational training programmes for farmers and retraining increased'. (R1)*

> *'...strengthen the Young Farmers Programme so that more young people can join it, be trained in new farming practices and technologies and be able to participate in networks sharing knowledge and experience that promote the sustainable and digital development of the agri-food sector'. (R6)*

It is essential to ensure that this knowledge is kept up to date, which is a key aspect of lifelong learning.

'It is my opinion that farmers should engage in lifelong education and training in order to remain informed about new farming practices and modern production processes. This is essential for the sustainability of both production and the enterprise...' (R9). The integration of precision farming, for example, into the daily operations of agri-food entrepreneurs represents a significant challenge, given the constant emergence of new technological developments.

> *'... Modern production demands specialized knowledge and a highly skilled workforce. The transition to a new technological era necessitates up-skilling, re-skilling, and continuous education of human resources, with a focus on enhancing digital and green skills. Implementing effective human resource policies is crucial to ensure the creation of quality jobs in agri-food enterprises...' (R8)*

> *'....producers should seek education and specialisation, which presents a challenge for us as well as for ourselves, who prepare the background they need to know. There are fast-track specialised seminars, public schools, in cooperation with institutions such as the Regions, which cover a significant number of the current issues and challenges of the future...' (R2)*

6. Discussion

This research examines the challenges faced by agri-food enterprises in Greece in adopting green and digital practices in a constrained framework characterized by ongoing crises and climate change. Despite significant obstacles, the green and digital transition of the agri-food sector is necessary and, with the coherent European and national policies, will be possible. To facilitate this transition, governments, regional and local authorities must work together to develop a favourable institutional framework that support this twin transition. The current system suffers from dysfunctionality and excessive bureaucracy, hindering agri-food enterprises from pursuing innovative and further environmentally friendly development paths. This is in line with other previous research, like Liargovas et al (2017), Slätmo (2019), Apostolopoulos et al (2021), and Makris et al (2024). We emphasize the need to revise the institutional framework to better align environmental policies with the needs of the agricultural community. This is crucial with the upcoming European performance certification procedures for agri-food enterprises, requiring adherence to ESG criteria (Jónsdóttir & Gísladóttir, 2023). Additionally, our research indicates that it is essential to implement and monitor the institutional framework

through robust control mechanisms, to ensure compliance with the extra environmental standards (Saviolidis et al, 2020).

Concurrently, the implementation of financial incentives and the provision of financial instruments can facilitate the alleviation of economic constraints (Patsoulis et al, 2022). Our study highlights financial instruments in support of digital practices in agri-food enterprises. Despite available funding for environmental initiatives, they have not led to significant changes. De Schutter et al. (2020) suggested that the EU can provide financial support through the CAP, but support strategies are not comprehensive. Large producers receive priority, leading to issues in sustainable land management. Very small to medium-sized agri-food enterprises face difficulties in accessing subsidies due to the strict eligibility criteria in place. Overcoming technological barriers requires investment in education and training for farmers, as well as infrastructure development to support the adoption of new technologies. Research conducted by Ellis and Moarif (2015) indicated that enhancing education and up-skilling of entrepreneurs is of paramount importance for the cultivation of sustainable knowledge for green entrepreneurship in agriculture. Furthermore, it is vital to cultivate a green culture among citizens through information events, with the aim of increasing awareness of the polluting emissions associated with food production.

7. Conclusion

Our research contribution adds important insights to the literature on the emerging topic of the green and digital transition of the agri-food sector which is not only a technological or economic challenge but also a social challenge that requires the cooperation of all stakeholders. Incentives for this twin transition include policy measures to simplify procedures and reduce bureaucracy; financial support like subsidies, loans, tax exemptions; educational opportunities such us training, up-skilling and lifelong learning; and technological support for R&D and access to new technologies. The recent energy crisis has exploded the energy costs of agri-food enterprises prompting the search for alternative energy sources. The introduction of digital tools, automated systems and RES can increase the efficiency of crop and food production and reduce operating costs. In addition, social incentives to promote the circular economy and protect natural resources, are crucial. The coherent implementation of support policies can facilitate the twin transition, resulting in significant benefits for agri-food enterprises and contributing to their sustainability and environmental protection.

8. Limitations and Future Research

This research focused on the views of the policymakers regarding agri-food enterprises in Greece. Future research should involve cross-verifying data from agri-food entrepreneurs to ensure validity and take a holistic approach. It is important to understand how the sustainable practices will lead to a long-term viability and a resilient plan for the agri-food enterprises. Also, further research should include cross-country analysis taking into account the diverse cultural, socio-economic, and regulatory contexts.

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