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THEORETICAL APPROACH ON SUSTAINABLE COMPETITIVENESS OF AGRICULTURE

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Agriculture faces the dual challenge of achieving higher productivity while preserving the ecosystems on which it depends. Traditionally, competitiveness has been understood in terms of short-term outcomes, with little attention given to environmental degradation or long-term resilience. This creates a gap in how competitiveness of agriculture is framed under increasing ecological pressures. The aim of this paper is to develop a theoretical concept of sustainable competitiveness of agriculture by synthesizing insights from agricultural economics, sustainability science, and strategic management. The study contributes by (i) clarifying how sustainable competitiveness differs from related concepts such as green competitiveness and environmentally adjusted productivity, and (ii) identifying key determinants of sustainable competitiveness in agriculture using an adapted Porter's Diamond Model. The presented determinants of sustainable competitiveness highlight the shift from short-term efficiency toward long-term resilience, where resource regeneration, sustainability-driven demand, supportive networks, strategic innovation, and policy alignment together define the ability of farms to remain competitive under ecological and socio-economic pressures. The study relies on a review and synthesis of peer-reviewed literature, institutional reports, and policy documents. This contribution provides a foundation for empirical research in the field of sustainable competitiveness of agriculture.

Keywords: *sustainable competitiveness; agriculture; sustainability; farm competitiveness.*

INTRODUCTION

Competitiveness is a central topic in economics and a key concern for economic actors. The Draghi report (2024) on future of European competitiveness has renewed attention among policymakers and stakeholders, underlining the fundamental importance of this topic. The report adopts a long-term perspective, emphasizing productivity, resilience, innovation, and security as foundations of future competitiveness (Draghi, 2024). Competitiveness, often seen as the ultimate indicator of performance in relation to rivals and confirmed by market outcomes, is shaped by a mix of firm-specific, industry-specific, and broader factors, with competitive advantage at its core. To achieve and maintain competitiveness over the long term, businesses must continually strengthen and preserve this advantage - a task that has become increasingly critical in today's volatile and uncertain global environment (Şerban et al., 2023). Aiginger & Vogel (2015) have also explained how price competitiveness is too narrow and should be evaluated by looking at competitiveness outcomes that cover beyond GDP goals, income pillar, social pillar, ecological pillar, life expectation, happiness and work-life balance.

At the same time, pressures from international organizations, national institutions and customers are making sustainability question highly relevant to businesses. From the Rio Summit in 1992, establishing sustainability indicators to the European Green Deal, launched by President von de Leyen in 2019, that reflected in national legislation. Meanwhile, conscious consumers increasingly demand sustainable products and services, placing value on new attributes such as environmental protection, social equity, and economic viability (De Luca et al., 2018). These combined pressures are reshaping how businesses compete, as sustainability is no longer treated as a voluntary practice or reputation-building exercise but as a requirement tied to market access, investment flows, and long-term competitiveness. Businesses are expected to track sustainability performance, adjust supply chains, and develop low-carbon, socially responsible offerings, turning regulatory pressure into both a compliance challenge and a potential source of competitive advantage.

These considerations are highly relevant to agriculture, where farms face the pressure to produce more without compromising the ecosystems and tackling other sustainability challenges (Nowak & Kasztelan, 2022). To tackle these challenges, Common Agriculture Policy (CAP) reform for 2021-2027 supports agriculture in making a stronger contribution to climate, biodiversity, environment and improving farms' competitiveness (Liberati et al., 2021). Although competitiveness is widely discussed, and supported financially, the means to evaluate its long-term sustainable competitiveness is limited as the definitions vary and research often relies on traditional measures like productivity, efficiency and costs. As Nowak & Kasztelan (2022) notices, specifically "agricultural competitiveness studies are usually limited to assessing selected features of agriculture".

While the term of sustainable competitiveness is still relatively uncommon, especially in reference to the competitiveness of single economic entities (Salimova et al., 2018), there are some studies that aim at evaluating sustainable competitiveness: Zhang et al. (2012) proposed a two-dimensional evaluation of construction companies that considers both the overall level of enterprise competitiveness and the degree of its fluctuation, Herciu & Ogrean (2018) developed the concept of business sustainable competitiveness by leveraging productivity, profitability, effectiveness and sustainability, at firm level, Salimova et al. (2018) proposed and tested a sustainable competitiveness of enterprise model, Ćurčić & Miletić (2020) assessed "selected factors relevant to creating sustainable competitiveness of industrial and agro-industrial products" in Serbia, Şerban et al. (2023) identified and analysed the key factors of sustainable competitiveness at company level and searched for sector-related (Consumer Cyclicals, Energy, Health Care, and Technology) discrepancies regarding the identified factors.

But research on sustainable competitiveness in agriculture (especially on farm level) remains limited, despite broader efforts to evaluate sustainability in agriculture. Agriculture is distinct in its dependence on natural resources and ecosystem services, which makes these factors critical for competitiveness. While scholars acknowledge that productivity generates not only positive outputs but also negative externalities, existing approaches - such as environmentally adjusted productivity, total factor productivity, and efficiency measures - remain partial and do not capture the broader complexity of farm-level sustainable competitiveness.

Current research provides fragmented insights across disciplines. In agricultural economics, studies emphasize environmentally adjusted productivity metrics and the role of green growth in balancing ecological limits with economic development (Bureau & Anton, 2022; Liberati et al., 2021; Vitunskienė & Lauraitienė, 2025). Sustainability science highlights ecological resilience, ecosystem services, and soil as natural capital (de Olde et al., 2018; Meul et al., 2008). Business and innovation research focuses on how firms build sustainable competitive advantage through resource-based capabilities, adaptive strategies, and long-term value creation (Cabrera-Flores et al., 2020; Matyja, 2016). Yet these advances are not integrated into a coherent concept tailored for agriculture. These disciplines conceptualize sustainable competitiveness in agriculture differently: (i) agricultural economics focuses on productivity, efficiency, and income, defining competitiveness as the ability to generate output and income from inputs, while often excluding environmental and social externalities; (2) sustainability science emphasizes ecosystem resilience and natural capital, viewing competitiveness as long-term viability within ecological limits, but with a relatively weak market and competitive orientation; (3) strategic management centres on competitive advantage and capabilities, defining competitiveness as the ability to sustain an advantage over rivals, yet remaining largely firm-centric with limited ecological consideration.

Scholarly views also diverge on how sustainability influences competitiveness. Some argue that environmental regulation constrains performance and increases costs (Kanter et al., 2018). Others show how sustainability practices, such as resource efficiency, soil regeneration, and ecosystem service integration, can generate new competitive advantages (Karman & Savanevičienė, 2021; Kucher et al., 2021; Popescu et al., 2017). The rise of carbon farming, sustainability certifications, and payments for ecosystem services reflects a shift toward environmental value as a competitive asset, though challenges remain in measurement, implementation, and equity (Coderoni & Vanino, 2022; Henriksen et al., 2018; *Strategy for Mainstreaming Carbon Farming in Central Europe*, 2024).

The aim of this paper is to develop a theoretical concept of sustainable competitiveness of agriculture. This paper addresses the mentioned gaps by synthesizing literature from agricultural economics, sustainability science, and business strategy to develop a concept for understanding sustainable competitiveness of agriculture. It reviews theoretical foundations including sustainable productivity growth, green growth, and sustainable competitive advantage, and uses Porter's Diamond model to address the different aspects of sustainable competitiveness drivers. The paper also explores how emerging mechanisms like carbon farming and environmental certification and support schemes fit into a broader competitiveness paradigm.

RESEARCH METHODS

This study investigates the sustainable competitiveness of agriculture. After analysis of theoretical perspectives from agricultural economics, sustainability science and strategic management fields in peer-reviewed literature, institutional reports, the study presents determinants of sustainable competitiveness of agriculture.

Relevant sources were identified using targeted keyword searches in academic databases including Scopus, Web of Science, and Google Scholar. The search strategy focused on literature published between 2015 and 2024 (supplemented by earlier research where relevant), incorporating terms such as: *sustainable competitiveness, green growth, green competitiveness, environmentally adjusted total factor productivity, farm competitiveness, sustainable competitive advantage*. Keywords were combined using Boolean operators (e.g., "sustainable competitiveness" and agriculture; "green competitiveness" or "environmentally adjusted productivity" and farm). Studies were selected based on relevance to competitiveness, sustainability dimensions, and applicability to agriculture or closely related sectors. Conceptually overlapping studies without explicit relevance to competitiveness were excluded. Complementary materials from international institutions (e.g., FAO, OECD, European Commission) were reviewed to provide policy context.

The analytical process followed a narrative synthesis method, based on a structured literature search. While the review was not systematic in a meta-analytic sense, it followed a structured and transparent selection process focused on conceptual relevance rather than exhaustive coverage. This process made it possible to align definitions, identify conceptual links, and present the determinants.

RESEARCH RESULTS AND DISCUSSION

Already in 1990s, Weiss (1993) wrote that "sustainable competitiveness means concern for the whole life cycle of the production process and the internalization of the full costs of production, as expressed in the polluter pays principle". But now this understanding should be much broader. To understand sustainable competitiveness in agriculture, it is beneficial to look at the longer existing concepts in the field of competitiveness. That way it is possible to reveal the gaps and lay ground for filling them up.

Starting from total factor productivity (TFP) growth, it has been used to evaluate agricultural performance and competitiveness for a long time (Kryszak et al., 2023). However, it fails to account for negative externalities such as greenhouse gas emissions, biodiversity loss or nutrients leaching (Bostian & Lundgren, 2020; Vitunskienė & Lauraitienė, 2025). Therefore environmentally-adjusted measures of TFP growth has been introduced to include the environmental outcomes, "considering a reduction in pollution or emissions as a productivity gain, but the increased use of natural capital as a productivity loss" (Bureau & Anton, 2022) as well as ecosystem services (Bostian & Lundgren, 2020). Yet aggregate TFP indicators mask substantial heterogeneity across sectors and firms (Block, 2022). They may show whether productivity rises or falls, but not why, limiting their usefulness for evaluating competitiveness at the meso- or micro-level.

Closely connected to these adjustments of TFP is the macroeconomic paradigm of green growth, which seeks to decouple economic progress from environmental degradation (OECD, 2014). Rather than rejecting growth, it emphasizes resource efficiency and innovation. In agriculture, green growth relies on emission reduction (Huang et al., 2022), technological innovation, investments in produced capital (Vitunskienė & Lauraitienė, 2025). They translate to agricultural practices: nitrogen use efficiency practices (Govindasamy et al., 2023), diversification and biodiversity preservation practices (Tamburini et al., 2020), improving energy efficiency by "reducing fossil energy inputs through more efficient machinery, reduction of agrochemicals, precision farming, the use of renewable energy or energy retention, and by increasing yields" (Chmelíková et al., 2024).

Green growth is also embedded in broader policy frameworks, including the European Green Deal and the United Nations Sustainable Development Goals (SDGs), where sustainability is framed as a strategic driver rather than a constraint. Farms aligning with these trajectories increasingly gain access to environmental subsidies, sustainability-linked finance, and climate-conscious markets. Under the post-2022 Common Agricultural Policy, a fixed share of direct payments is reserved for eco-schemes, ensuring that farms adopting climate- and environment-friendly practices receive targeted support (Pe'er et al., 2022). Meanwhile, sustainability-linked loans tie financing costs to the achievement of environmental or social targets, with borrowers able to secure reduced margins when sustainability performance is demonstrated (Muižniece et al., 2024). Finally, consumer markets show a consistent willingness to pay substantial premiums of around 30% on average for products labelled as sustainable, creating direct economic incentives for farms that integrate sustainability attributes into production and marketing strategies (Li & Kallas, 2021).

The concept of green competitiveness emerges at the industry and firm levels to evaluate how enterprises (including farms) can maintain or enhance their competitive advantage through existing environmental potential and ability to manage it sustainably (Nowak & Kasztelan, 2022). It is closely aligned with what has been termed the "Porter Hypothesis," which states that well-designed environmental regulations can spur innovation and ultimately enhance firm performance (Porter & Linde, 1995). Transition toward green competitiveness involves the environmental innovation (Wang et al., 2022), adoption of sustainable agricultural practices (Nowak & Kasztelan, 2022), investment in human capital and organizational capabilities (Yang et al., 2021) and compliance with policy frameworks and leveraging incentives (Pe'er et al., 2022). The environmentally oriented practices serve not only ecological ends but can yield cost savings (Mgendi, 2024), access to premium markets (Smith et al., 2019), and long-term risk mitigation (Sánchez et al., 2022).

Nonetheless, reaching green competitiveness depends on several conditions, such as how strict and well-designed environmental policies are, the level of market demand for sustainable products, and the farm's ability to adopt and use new innovations. Literature suggests that small and medium-sized farms often lack the financial, technical, and institutional capacity to adopt green technologies without external support. For example, Dhillon & Moncur (2023) note that advanced agricultural technologies are often not economically viable for small farms (due to costs, infrastructure, information gaps). Similarly, Da Silva Barbosa et al. (2024) identify financial constraints and limited access to technical expertise as major barriers. This underscores the importance of enabling environments that reduce barriers to eco-innovation and support inclusive green transitions.

While green competitiveness focuses on environmental performance as a driver for competitive advantage (Nowak & Kasztelan, 2022), sustainable competitiveness broadens the understanding of competitiveness focusing on long-term ability to compete by integrating economic, environmental and social dimensions simultaneously (Aiginger & Vogel, 2015; Doyle & Perez Alaniz, 2020). But, as mentioned in the introduction, research of sustainable competitiveness on micro level is limited (especially in agriculture). Table 1 presents the overview of discussed relevant concepts that are used in context of competitiveness.

Understanding sustainable competitiveness in agriculture requires exploring the strategic and structural dimensions that condition performance. Porter's (1990) Diamond Model is a useful framework for identifying systemic determinants such as factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry. In agriculture, factor conditions must include not only labour, capital, and infrastructure (built capital), but also natural capital with focus on water resources, soil quality and biodiversity (Azad et al., 2016; Kenny, 2017). Kenny (2017) also emphasizes social capital, which is defined as combination of networks and common norms, values, and understandings that support cooperation among groups, as important for long-term farm performance.

Table 1. Concepts, used to understand and evaluate competitiveness in agriculture

Concepts	Underlying idea	Application in agriculture	Strengths and contributions	Gaps and limitations
Total Factor Productivity (TFP) growth	Measures efficiency of converting inputs into outputs.	Long-used to evaluate agricultural performance and competitiveness.	Provides broad indicator of productivity change.	Ignores negative externalities (greenhouse gas emissions, biodiversity loss, nutrient leaching). Does not explain why productivity rises or falls.
Environmentally adjusted total factor productivity growth	Extends TFP to include environmental outcomes and ecosystem services.	Treats pollution reduction as productivity gain; natural capital depletion as productivity loss.	Captures ecological costs/benefits in productivity measures.	Aggregate indicators mask heterogeneity across farms/sectors; limited explanatory power for competitiveness.
Green growth	Paradigm aiming to decouple economic progress from environmental degradation.	Promotes emission reduction and resource efficiency that relies on technological innovation and investments in produced capital.	Links productivity with ecological regeneration; embedded in major policies (EU Green Deal, CAP, SDGs).	Oriented at macro-level; difficult to translate into actionable farm-level strategies without intermediaries.
Green competitiveness	Evaluates how firms or farms maintain or enhance competitiveness through environmentally oriented strategies.	Adoption of sustainable farming practices, eco-innovation, human capital investment, compliance with environmental standards.	Connects environmental performance with competitive advantage; aligns with Porter Hypothesis.	Benefits depend on policy design, market demand, and absorptive capacity. SMEs face barriers (finance, skills, technology). Focuses only on environmental performance as a driver for competitive advantage.
Sustainable competitiveness	Long-term capacity to compete while integrating economic, environmental, and social dimensions.	Frames agriculture's ability to sustain performance across productivity, resilience, ecosystem regeneration, and social contribution.	Offers a holistic perspective beyond short-term efficiency; links competitiveness with sustainable development.	Rarely applied at micro level; definitions vary.

Soil quality emerges as a key strategic asset within this framework. As a provider of ecosystem services, carbon sequestration, and nutrient cycling, soil directly affects both productivity and ecological resilience (Davis et al., 2023). Investments in soil health can thus contribute simultaneously to sustainability goals and competitive differentiation. This is particularly evident in emerging mechanisms like carbon farming, where land management practices such as biochar application, agroforestry, or cover cropping can generate carbon credits or qualify farms for incentive schemes (Springer, 2023).

Demand conditions in agriculture are increasingly shaped by consumer preferences and public procurement standards that reward environmental responsibility. Certification schemes such as organic, animal welfare, and carbon-neutral labels serve as market signals for sustainable practices and enable farms to capture price premiums or secure long-term supply contracts (Li & Kallas, 2021). Related and supporting industries, such as agri-tech startups (Chaudhary & Suri, 2024), advisory services, and digital monitoring platforms (Panda et al., 2023), provide farmers with access to tools and knowledge essential for sustainable transitions. Farms that have access to such innovation ecosystems are better positioned to adopt climate-smart technologies and meet regulatory expectations.

The fourth determinant - firm strategy, structure, and rivalry - relates to how farms make decisions, organize operations, and position themselves competitively. Here, the concept of Sustainable Competitive Advantage (SCA) is particularly relevant. Rooted in the resource-based view, SCA arises from capabilities that are valuable, rare, inimitable, and organizationally embedded. For farms, SCA rises from activities, related to local resources, marketing activities, farm services, infrastructure and management, product or technological research and development, human resource management (Lee, 2012).

Sustainable competitiveness of agriculture refers to the ability to maintain or improve economic performance and market position over time while simultaneously preserving environmental resources, ensuring social equity, and adapting to changing conditions without compromising the productive capacity of future generations. Adapting Porter's Diamond Model to sustainable competitiveness of agriculture allows us to see its sources as an interplay between internal capabilities, ecological assets, and external market and policy forces. To consolidate these and previously discussed insights drawn from total factor productivity growth, green growth and green competitiveness, table 2 presents determinants of conventional and sustainable competitiveness in agriculture.

The determinants of sustainable competitiveness are broader, responding to current environmental pressures. Their descriptions give a clearer view on what elements are important for sustainable competitiveness to be achieved in agriculture. Outlined determinants can give a foundation for future research and creation of evaluation models, to assess how farms perform across multiple dimensions and over time. It is important to notice the limitation - a stronger focus on environmental sustainability, which has been prioritized due to its immediacy and prominence among current challenges.

Table 2. Determinants of conventional and sustainable competitiveness in agriculture using Porter's Diamond model

Determinants	Conventional competitiveness	Sustainable competitiveness
Factor conditions	Emphasis on basic and advanced production inputs: natural resources, land, climate, labour availability, infrastructure, and access to capital. Competitiveness seen as efficiency in mobilizing these inputs.	Includes natural capital (soil health, biodiversity, ecosystem services), human and social capital, renewable energy, and advanced knowledge systems. Emphasis on regeneration and long-term resource quality.
Demand conditions	Focus on domestic market size and purchasing power. Competitiveness is tied to ability to serve large, growing and increasingly sophisticated consumer markets.	Importance of consumer demand for sustainable products, food safety, quality, traceability, and low-carbon attributes. Conscious markets drive eco-innovation.
Related and supporting industries	Strength derived from efficient supply chains and cost-effective suppliers. Value placed on low input costs and availability of supporting industries rather than environmental or social alignment.	Networks of sustainable suppliers, certification bodies, advisory services, and green finance institutions support eco-innovation and resilience.
Firm strategy, structure, and rivalry	Competitiveness driven by cost leadership, economies of scale, and rivalry that promotes efficiency and productivity improvements. Innovation seen mainly as technological upgrading for yield and cost reduction.	Firms compete by integrating sustainability into strategy: adopting circular practices, low-carbon innovation, and stakeholder value creation. Rivalry encourages both efficiency and ecological performance.
Government	Role of government as enabler of productivity: subsidies, trade policy, investment in infrastructure, R&D funding, education, and training to support economic growth.	Shapes enabling environments through sustainability standards, eco-schemes (e.g., CAP), green subsidies, carbon pricing, and SDG-aligned regulations.
Chance	Commodity price shifts, natural disasters, or technological breakthroughs treated as risks or opportunities for productivity and cost advantage.	Climate change, biodiversity loss, pandemics, and extreme weather seen as structural pressures that test resilience; shocks also catalyse sustainability transitions and innovation.

CONCLUSIONS

This paper examines how the concept of competitiveness can be reinterpreted considering sustainability challenges in agriculture. It is done by first revisiting traditional approaches toward competitiveness and integrating them with sustainability perspectives. The analysis shows that traditional concepts such as total factor productivity growth provide only a partial view, as they fail to capture environmental externalities and broader sustainability outcomes. Environmentally adjusted total factor productivity growth, green growth, and the emerging concept of green competitiveness offer valuable extensions, yet they lack full picture of sustainable competitiveness.

By using Porter's Diamond model as a blueprint, determinants of sustainable competitiveness of agriculture are framed around long-term resilience and multidimensional value creation. Factor conditions emphasize not only the availability but also the quality and regeneration of resources such as soil, water, biodiversity, and human capital. Demand conditions are shaped by consumer preferences for sustainability attributes such as eco-labels, traceability, and low-carbon production. Related and supporting industries include sustainable supply chains, advisory services, certification schemes, and green finance. At the firm level, competitiveness depends on embedding sustainability into strategies, innovating in low-carbon and circular practices, and competing on ecological and social performance rather than costs alone. Government assumes a stronger role through sustainability-linked policies, eco-schemes, and carbon pricing, while chance factors such as climate change, biodiversity loss, and extreme weather events act as external pressures that test resilience and accelerate sustainability transitions.

By introducing the concept of sustainable competitiveness of agriculture, authors seek to promote the broader discussion on how competitiveness should be defined and what are its determinants, to capture need to sustain both agricultural performance and ecosystem resilience over time. The outlined determinants of sustainable competitiveness can be used in future research to develop evaluation models both for sustainable competitiveness of agriculture as a sector and farm sustainable competitiveness. The concept has a limitation that it leans more heavily toward environmental sustainability, reflecting the urgency of current climate and biodiversity challenges. Future work should put more weight on the social dimension to give a fuller picture of what sustainable competitiveness in agriculture means.

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