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Review

Italian FADN-Based Research: A Systematic Literature Review and Future Research Directions

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Abstract

This paper provides a comprehensive literature review of studies based on the Italian Farm Accountancy Data Network (FADN) over the period 2015–2026. Following a PRISMA-informed review process, 112 peer-reviewed articles retrieved from Scopus were qualitatively analysed. The review identifies six main research domains, ranging from farm economic performance and efficiency to environmental sustainability, policy analysis, diversification, and social-territorial dimensions. The results show that Italian FADN-based research is characterised by a well-established body of work on income dynamics, farm efficiency, and the impacts of the Common Agricultural Policy (CAP), alongside the rapidly growing literature on environmental sustainability, climate change, resource use, and agroecological transitions. The main gaps concern the reliance on proxy-based environmental indicators, the fragmented and weakly conceptualised treatment of social sustainability, the limited analysis of trade-offs and synergies across sustainability dimensions, the limited understanding of farmers' decision-making processes and behavioural responses, the marginal treatment of farm-level innovation, and the limited and fragmented analysis of circular economy initiatives and their impacts on farms and territories. These gaps point to the need for more integrative approaches, improved environmental and social indicators, stronger longitudinal and comparative designs, and greater attention to territorial, innovation, and circular economy dynamics. The review's scientific contribution lies in consolidating a fragmented evidence base into a coherent analytical framework that clarifies the thematic evolution, structural imbalances, and methodological priorities of Italian FADN-based research. From this perspective, the transition from FADN to the Farm Sustainability Data Network (FSDN) is interpreted as a chance to extend farm-level analysis beyond economic monitoring and towards a more integrated assessment of agricultural sustainability.

Keywords: farm accountancy data network; farm sustainability data network; farm-level data; agricultural sustainability; systematic review; PRISMA; farm-level analysis; CAP evaluation

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1. Introduction

The Farm Accountancy Data Network (FADN), established in 1965, has long represented the main microeconomic source for monitoring farm income and supporting the evaluation of the Common Agricultural Policy (CAP). However, its original design was

primarily oriented towards economic and accounting dimensions, while environmental and social aspects remained only partially observable and often had to be reconstructed through indirect proxies [1]. Over time, however, the analytical role of FADN has progressively expanded beyond its original accounting function. The evolution of the CAP, together with the increasing emphasis on environmental performance, climate resilience and social sustainability, has transformed farm-level data into a key infrastructure for evidence-based agricultural governance. This shift is particularly relevant because policy evaluation increasingly requires information capable of linking farm income, production choices, resource use and territorial conditions within a common analytical framework. This creates a tension between the historical strengths of FADN as an economic accounting database and the contemporary demand for multidimensional sustainability indicators.

This has become increasingly important in the context of the European Green Deal and the Farm to Fork strategy, which require integrated assessments of farm sustainability, including resource use, biodiversity, climate performance, labour conditions, and generational renewal.

In recent years, this tension between the original economic orientation of FADN and the growing demand for multidimensional sustainability assessment has become visible in empirical research. In this context, reviewing Italian FADN-based research is particularly relevant because it helps identify both the strengths of the existing literature and the knowledge gaps that motivate the transition toward the Farm Sustainability Data Network (FSDN). The FSDN Implementing Regulation EU 2024/2746 introduces in the accounting network additional parameters related to sustainability, thereby expanding the scope for future policy evaluation, increasingly oriented to analysing the environmental and social aspects of farming practices. Although the survey continues to be primarily focused on economic analysis (around 65% of variables come from FADN, and three more tables contain economic parameters), 35% of FSDN information is devoted to environmental and social aspects. The FADN structure has never undergone such a substantial transformation. Previous CAP reforms that impacted the survey framework resulted in limited changes and did not require the addition of new tables.

Therefore, this transition is more than a reform: it can be interpreted not only as a technical enlargement of the database, but also as a broader methodological reorientation of farm-level information systems (whose topics are defined for the first time in the legislation, Annex 1 of the FSDN Basic Act, Regulation EU 2023/2674). This new approach is clearly reflected in the Commission's request for Member States to enhance interoperability among administrative databases, with the aim of providing the system with a wider array of data while reducing the burden on both data collectors and farms. Member States are implementing these requirements in line with their respective administrative and technical infrastructures.

Italy represents a particularly significant case: the national FADN system has historically provided a rich and detailed empirical basis, combining accounting information with technical and structural variables that have supported a wide range of economic, environmental and policy-oriented analyses. Compared to the core FADN, the Italian system collects information on farming practices, farmers' family characteristics (regardless of the involvement in the farm), off-farm incomes, types of fertilisers and pesticides, workers' citizenship, certifications, use of water, sales channels, etc. From the methodological point of view, the Italian FADN provides the gross margins for crop and livestock, allocating the specific costs among the production processes. However, the greater level of detail required in FSDN and the additional tables represent a challenge for the Italian system, together with the need to improve the current limited interoperability among administrative databases.

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In this light, this paper provides a structured review of the literature based on Italian FADN data over the period 2015–2026. The review aims to identify the main thematic domains addressed by this body of research, assess how FADN has been used in empirical analyses, and discuss its analytical potential and limitations also in relation to the transition toward the Farm Sustainability Data Network (FSDN).

The strong heterogeneity of Italian agriculture, in terms of farm structures, production specialisations, regional contexts and territorial constraints, makes the country a particularly valuable case for examining how FADN data have been used across different empirical settings and policy questions. This country-specific focus also improves analytical coherence since it allows the review to examine thematic and methodological patterns within a relatively homogeneous institutional and data collection framework.

To date, no systematic reviews have specifically examined research based on Italian FADN data. This study addresses this gap by reviewing 112 peer-reviewed articles published between 2015 and 2026 and pursuing three interconnected objectives. First, it develops an integrated classification of recurrent research domains, thereby organising the fragmented body of literature within a coherent analytical framework. Second, it identifies structural imbalances and cross-domain research gaps. Third, it translates these findings into a research agenda explicitly linked to the transition from FADN to FSDN, demonstrating how the expanded data infrastructure can support more integrated, comparable, and policy-relevant assessments of farm-level sustainability.

2. Materials and Methods

2.1. Sample Selection

This review was conducted through a structured literature search and reported according to a PRISMA-informed approach [2], with the aim of improving transparency in the identification, screening and inclusion of studies. The use of PRISMA is intended here as a reporting and transparency framework for evidence synthesis rather than as a meta-analytical protocol, since the reviewed studies are heterogeneous in terms of objectives, methods, sectors and territorial scales.

The literature search was performed in the Scopus database on 29 May 2026 considering the period 2015–2026. The search strategy was developed iteratively through preliminary tests using different keyword combinations, with the aim of identifying a comprehensive but coherent set of studies explicitly focused on the use of Italian FADN data. The study selection process followed three stages. First, various keyword combinations were examined. In particular, alternative queries included “FADN AND Italy” (89 records), “Farm Accountancy Data Network AND Italy” (79 records), “Italian Farm Accountancy Data Network” (82 records) and “Italian FADN” (82 records) within the “Article” classification. However, a detailed screening of titles revealed a substantial overlap across the retrieved records, with most studies appearing consistently across all queries.

To ensure consistency and specificity, the final search was based on the combined use of the queries “Italian FADN” and “FADN AND Italy”. The methodological quality and analytical relevance of the selected studies were assessed through a rigorous full-text appraisal, considering their alignment with the objectives of the review and their effective use of FADN data in the empirical analysis. Records were excluded if they were duplicates or did not fall within the Scopus “Article” document category. The search initially retrieved 171 records. After duplicate and overlapping results across the two queries had been removed, the final corpus consisted of 112 studies that met the eligibility criteria. The complete list of included studies is reported in Appendix A.

The Scopus database was used as the sole search engine because it provides broad and consistent coverage of the peer-reviewed literature, together with standardised bibliographic information. The use of a single database also ensured consistency in record

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retrieval, indexing and screening across the review corpus. This final search strategy was selected because it provided the most targeted identification of studies explicitly aligned with the scope of the review, reducing the inclusion of peripheral or loosely related contributions while maintaining full coverage of the relevant literature, although studies indexed in other databases or not captured by the selected keywords may have been excluded. Nevertheless, the selected corpus displays substantial internal coherence in terms of the research domains examined, thereby providing a robust basis for analysing the thematic structure of Italian FADN-based research and future research directions.

2.2. Review Framework

The review adopts a qualitative evidence synthesis approach. More specifically, the analysis focused on three dimensions: (i) the identification and analysis of the main research domains addressed in the literature; (ii) the detection of structural imbalances, underexplored dimensions and key research gaps in the empirical use of Italian FADN data; and (iii) the future research directions opened by the transition from FADN to FSDN. This approach is consistent with the role of systematic reviews in analysing the state of knowledge in a field and in identifying priorities for future research.

The exclusive focus on Italian FADN studies should not be interpreted as a limitation of scope, but as a deliberate strategy to enhance internal coherence. Analytically, the Italian case represents a particularly rich context for investigating farm-level dynamics because of its strong regional, structural and sectoral heterogeneity (Italian FADN collects more data than those required by EU regulations). Methodologically, a country-specific focus improves comparability across studies by keeping constant the institutional setting, the national implementation of FADN and the broader policy environment in which farm-level data are collected and interpreted. This choice therefore reduces the heterogeneity that would emerge from combining studies based on different national FADN systems and allows a more coherent identification of thematic patterns, methodological approaches and research gaps.

Figure 1 summarises the conceptual workflow adopted in this review. The process starts with paper selection, which includes bibliographic search, a screening procedure and the definition of the final corpus of studies. The selected papers are then examined through qualitative full-text analysis, based on systematic reading and content analysis [3]. To improve transparency, each paper was analysed by considering its main research objective, empirical focus, variables used and substantive contribution to the literature. The subsequent stage consists of detecting research gaps, understood as underexplored dimensions and limitations in the existing knowledge base. Finally, these gaps are translated into FSDN-oriented future research directions, linking the evidence emerging from the review to the transition from FADN to FSDN and to the need for more integrated farm-level sustainability assessment.

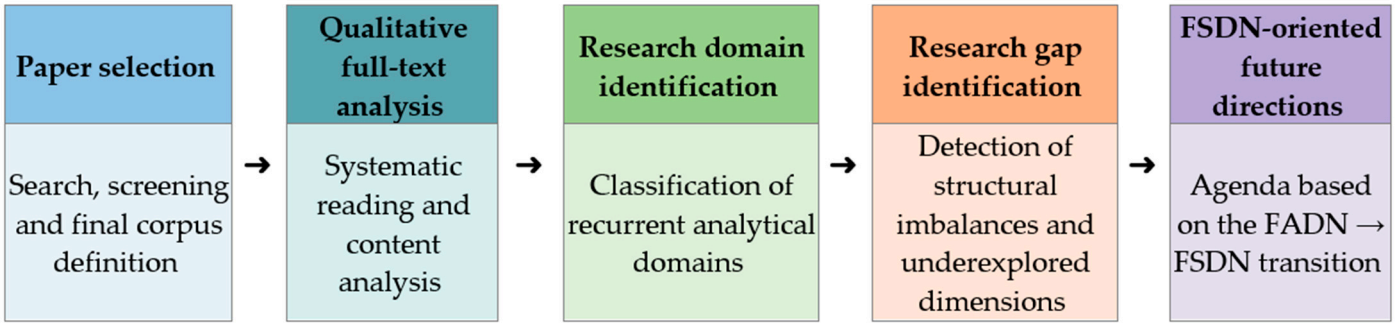

Figure 1. Conceptual workflow of the review process.

Research domains were identified through a combined deductive–inductive coding procedure: preliminary categories were derived from the review objectives and then refined through systematic reading of the selected papers. Final assignment was based on each study's main objective, empirical focus and substantive contribution.

This procedure led to the identification of six recurrent research domains (RDs): farm performance and economic outcomes (RD1); productivity, efficiency and structural drivers (RD2); climate change and environmental sustainability (RD3); agricultural policy and institutional framework (RD4); farm strategies, diversification and multifunctionality (RD5); and social and territorial dimensions (RD6). The six research domains were not treated as mutually exclusive categories since several studies addressed more than one analytical dimension. More information is provided in Appendix B.

The annual distribution of the studies collected for the literature review is reported in Figure 2. A pronounced peak occurred in 2021, with 19 studies. Publication output subsequently increased again, rising from 10 studies in 2023 to 11 in 2024 and 15 in 2025.

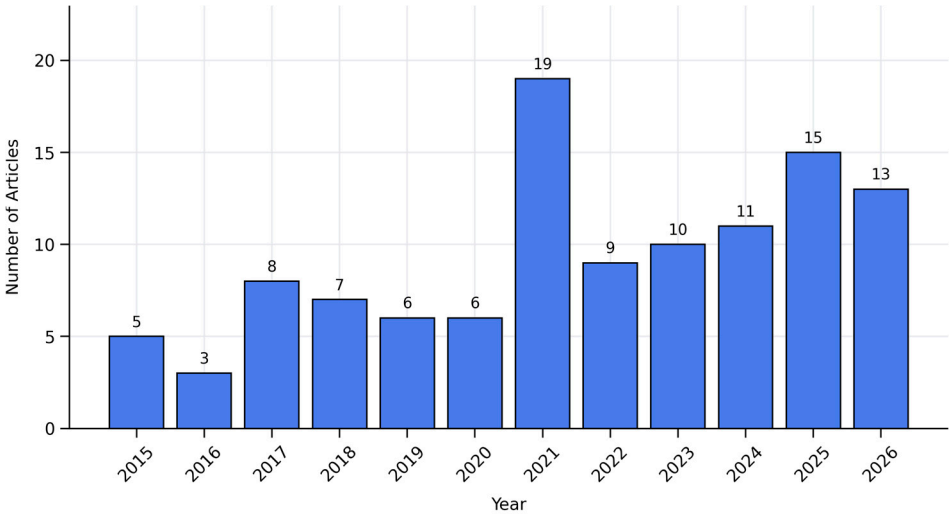

Figure 2. Annual distribution of the reviewed studies (2015–2026).

Table 1 shows that the reviewed studies are distributed across a diverse set of journals. Economia agro-alimentare/Food Economy, Land and Sustainability record the highest number of publications (8), followed by Agriculture and Bio-based and Applied Economics (7). The presence of both agricultural economics journals and multidisciplinary sustainability outlets reflects the progressive broadening of Italian FADN-based research from its traditional economic and policy focus towards environmental and sustainability-oriented themes.

Table 1. Most frequently represented journals in the reviewed Italian FADN-based literature.

Journal	No. of Publications
Economia agro-alimentare/Food Economy	8
Land	8
Sustainability	8
Agriculture	7
Bio-based and Applied Economics	7
Italian Review of Agricultural Economics	5
Agricultural and Food Economics	4
Bulgarian Journal of Agricultural Science	4
Land Use Policy	4
New Medit	3

3. Results and Discussion

3.1. The Main Research Domains of Italian FADN-Based Research

Building on the classification described in the review framework, Figure 3 introduces the six research domains identified in the Italian FADN-based literature.

Figure 3. Research domains (RDs) of Italian FADN-based research.

Overall, the domains should be interpreted as interdependent analytical dimensions rather than as separate thematic clusters. Consequently, the following analysis considers the interrelations among them as they emerge from the reviewed literature. The first major area of research concerns farm performance and economic outcomes (RD1), which represents the most consolidated body of literature and closely reflects the original economic accounting purpose of FADN. Studies in this domain analyse income levels, financial sustainability, profitability and income distribution across farms. Although several contributions examine these outcomes in relation to CAP support, their primary focus remains on economic performance rather than on policy evaluation itself. This creates an important analytical connection with the agricultural policy and institutional framework domain (RD4), without implying that the studies belong exclusively to that domain. Empirical evidence shows, for example, how direct payments affect income stability and inequality [4,5], while more recent contributions broaden the analysis of farm economic sustainability by combining efficiency, profitability and income comparability indicators [6]. Additional work further highlights how CAP-related measures may shape income disparities and farm viability across territories, farm sizes and structural conditions [7,8].

Closely connected to this core domain is the extensive body of work on productivity, efficiency and performance heterogeneity (RD2). This area represents one of the most methodologically advanced applications of FADN data, focusing on technical efficiency,

total factor productivity and the determinants of farm performance. Studies using stochastic frontier analysis, DEA models and spatial econometrics show the relevance of structural characteristics, management practices and technological choices in explaining performance differentials [9,10]. Research also highlights sectoral and territorial heterogeneity as well as the role of organisational structures in shaping productivity outcomes [11,12]. More recent contributions extend this perspective by integrating environmental and policy variables, such as the impact of pesticide reduction on efficiency or the interaction between productivity and climate conditions [13,14]. This confirms that efficiency analysis remains central while progressively incorporating broader system dynamics. This domain therefore acts as a methodological bridge between RD1 and RD3: productivity and efficiency indicators are used not only to explain economic outcomes, but also to assess how environmental constraints, input use restrictions and climate-related shocks reshape farm performance.

The rapidly expanding body of literature focuses on climate change, environmental sustainability and agroecological transition (RD 3), which represents an increasingly integrated domain within FADN-based research. This strand combines the analysis of climate variability, environmental stress and ecological processes within a unified framework. Empirical studies document how extreme weather events, temperature changes and climate variability affect farm-level productivity and input use [15,16]. At the same time, a growing body of studies investigate broader environmental dimensions, including agroecological transition, biodiversity and ecosystem services [17,18]. FADN data are also used to estimate environmental indicators, such as CO_2 abatement costs and ecological footprints, often relying on proxy-based approaches due to data constraints [19,20].

This integrated perspective is closely linked with the analysis of water use and resource efficiency, particularly in Mediterranean agricultural systems where climate pressures directly interact with water availability. Several contributions examine irrigation efficiency, water productivity and the economic value of water, highlighting strong heterogeneity across farms and regions [21,22]. Additional research focuses on drought conditions, water scarcity and alternative resource management strategies, including wastewater reuse [23,24].

Another central research area concerns agricultural policy (RD4). FADN data are widely used to assess both the economic effects of policy instruments and the ways in which farmers adapt to policy changes. Empirical evidence highlights the redistributive effects of direct payments on farms [25,26]. Further research examines the adoption of agri-environmental measures, the role of risk management tools and the behavioural responses to policy incentives [27,28]. More recent studies also address emerging policy frameworks, such as the Farm to Fork strategy, analysing their potential implications for input use and sustainability outcomes [29,30]. This literature confirms the strong policy orientation of FADN-based research and its relevance for understanding both outcomes and behavioural dynamics. RD4 is also the domain through which several interconnections become visible: CAP instruments influence farm income and viability (RD1), condition productivity and efficiency trajectories (RD2), incentivize or constrain environmental practices (RD3), and shape diversification and territorial development pathways (RD5 and RD6).

The literature also identifies a well-developed stream focused on diversification and multifunctionality (RD5). In this case, FADN data are used to analyse how farms respond to economic pressure by expanding beyond traditional agricultural activities. Studies show the importance of diversification strategies for income stability and resilience [31,32]. Research on agritourism further highlights the role of non-agricultural activities in supporting rural development and farm income [33,34]. More recent contributions extend this perspective to integrated supply chains and multifunctional agriculture,

emphasising the role of coordination and territorial linkages [35,36]. This strand underscores the diversification of farm functions and income sources within evolving agri-food systems.

A sixth research stream (RD6) concerns social and territorial dimensions of agricultural systems. While not always explicitly framed as a distinct thematic area, several contributions implicitly address social sustainability through the analysis of rural development, territorial disparities and structural inequalities. These studies highlight persistent differences between regions, particularly the North–South divide, as well as issues related to farm abandonment, demographic dynamics and unequal access to resources and opportunities [37–42]. This domain is particularly cross-cutting because social and territorial issues are often embedded within economic, policy and diversification analyses rather than treated as autonomous research objects.

3.2. Gaps and Future Research Directions

The research gaps emerging from the reviewed literature do not simply reflect the absence of specific topics but rather reveal structural imbalances in how Italian FADN-based research has conceptualised and measured farm-level sustainability. The following gaps therefore identify the main limitations of the current knowledge base and, at the same time, indicate directions through which the transition from FADN to FSDN can support a more comprehensive and policy-relevant research agenda.

The first gap relates to the measurement of environmental sustainability. The evidence synthesised in Figure 4 indicates that environmental applications are expanding rapidly, particularly around climate change, water scarcity, irrigation efficiency, greenhouse gas emissions, biodiversity, agroecological transition and resource use efficiency. Yet these studies often rely on indirect or proxy-based variables because FADN was not originally designed to collect detailed environmental information. The transition to FSDN can therefore strengthen this research area by providing more direct, harmonised and farm-level indicators, allowing future studies to move from partial environmental approximations towards more robust sustainability assessment. One of the most promising applications of FSDN is the assessment of greenhouse gas emissions at farm level that requires the collection of manure storage and management-based activity data at farm level. The introduction of two tables (NM1 and NM2 in the Implementing Regulation EU 2024/2746) will permit the implementation of specific calculators or the improvement of existing models (like in Italy).

The second and particularly relevant gap concerns the social dimension of sustainability. Social issues are present in the literature mainly through studies on labour and territorial disparities. However, they are rarely treated as a coherent and autonomous analytical field. This confirms that social sustainability remains fragmented and weakly conceptualised compared with the economic and environmental dimensions. In this respect, FSDN could have played a crucial role by making social variables more explicit, comparable and empirically usable, especially for analysing topics such as labour quality, generational renewal, and gender inclusion. Conversely, the transition to FSDN has not improved significantly the set of social variables: compared to the initial ambitions, the amount of information has been scaled down because social aspects often require the collection of confidential data. Around 10% of the new variables falls within the scope of social analysis (training, safety, social inclusion, services accessible to the farmers, generational renewal). Some of them are already collected in Italy and used in specific analysis.

The third gap concerns the limited analysis of interactions, trade-offs and synergies among sustainability dimensions. Although several studies increasingly combine economic and environmental variables, the three pillars of sustainability are still often examined separately. This limits the capacity of the literature to explain whether improvements

in one dimension reinforce or constrain outcomes in another. Future research should therefore move beyond parallel assessments and investigate the causal mechanisms, for example, linking farm profitability, environmental performance, policy incentives and social conditions at farm level.

The fourth gap concerns the limited understanding of farmers' decision-making processes and behavioural responses. Most Italian FADN-based studies explain observed outcomes through structural, economic or policy variables but devote less attention to the mechanisms through which farmers perceive risks, form expectations, respond to incentives and decide whether to adopt new practices. Consequently, similar farms facing comparable economic and environmental conditions may follow different trajectories that remain difficult to explain using accounting data alone. Future research should therefore combine FADN/FSDN information with data on attitudes, risk preferences, managerial objectives, access to advice, knowledge networks and perceived constraints. This would make it possible to distinguish between capacity to change and willingness to change, improve the explanation of heterogeneous responses to CAP instruments, and support the design of behavioural, advisory and policy interventions tailored to different farmer profiles. Agent-based models based on FADN have already started to be implemented in Italy [43,44].

The fifth gap concerns innovation, which remains only marginally and unevenly addressed in the Italian FADN-based literature. Although some studies refer to innovation indirectly through diversification strategies, knowledge systems, farm modernisation, supply chain coordination or sustainability transitions, innovation is rarely treated as a central analytical object. The literature therefore provides limited evidence on how innovation processes emerge at farm level, which constraints hinder their diffusion, and how technical, organisational, digital or advisory innovations can support sustainability transitions across different territories, sectors and farm types.

The sixth gap concerns the limited and insufficiently explicit treatment of the circular economy in Italian FADN-based research. Although some studies address related topics, including agrivoltaic systems, renewable energy, resource efficiency, wastewater reuse, and waste reduction or management, these issues are generally examined within broader environmental, diversification, or innovation perspectives rather than through a coherent circular economy framework. Consequently, the literature provides limited evidence on how circular practices affect resource flows, farm economic viability, environmental performance, and the quality of life of farms and territories. Future research should therefore identify, monitor, and evaluate circular economy initiatives more systematically at both farm and territorial levels, assessing their economic, environmental, and social impacts as well as the factors that enable or constrain their adoption. In this respect, the transition to FSDN, especially when combined with data on energy use, waste generation and management, material flows, and territorial characteristics, could support the development of farm-level circularity indicators and more robust analyses of initiatives such as agrivoltaics, waste prevention, reuse, recycling, and nutrient recovery. One of the key features of national FSDN systems is the possibility to be applied to satellite samples aimed at analysing specific issues through the methodological rigour of a harmonised microeconomic survey framework. In Italy, agrivoltaics is set to be incorporated into the FSDN in order to generate evidence on how the integration of crops and photovoltaic systems can impact farm profitability, mitigate land-use conflicts, and enhance the environmental and economic sustainability of farms.

Reviewed evidence		Structural gap		FSDN-enabled research opportunity
Research increasingly addresses climate, water use, emissions, biodiversity and agroecological transition.	→	Environmental performance is still frequently estimated through indirect, heterogeneous or proxy-based indicators.	→	Develop direct, harmonised farm-level indicators, and test their comparability across sectors, territories and years.
Social issues appear mainly through studies of labour, gender, generational renewal and territorial disparities.	→	Social sustainability lacks a coherent framework, consistent variables and systematic measurement.	→	Build operational indicators of labour quality, inclusion, generational renewal, rural vitality and territorial cohesion (with additional variables depending on national needs).
Economic, environmental and social outcomes are generally examined in separate analytical streams.	→	Trade-offs, synergies and causal mechanisms across sustainability dimensions remain underexplored.	→	Model multidimensional interactions (or multicriteria analysis) linking profitability, resource use, policy incentives and social conditions.
Farm outcomes are mainly explained through structural, economic and policy variables.	→	Farmers' perceptions, expectations, risk preferences and decision-making mechanisms remain insufficiently understood.	→	Link FSDN data with information on attitudes, managerial objectives, advisory access, knowledge networks and perceived constraints. Application of agent-based models.
Innovation is addressed indirectly through modernisation, diversification, knowledge systems and supply chain coordination.	→	The adoption, diffusion, barriers and sustainability outcomes of farm-level innovation remain insufficiently explained.	→	Assess technical, organisational, digital and advisory innovations indicators across farm types, sectors and territories.
Circular economy topics include renewable energy, agrivoltaics, wastewater reuse, resource efficiency and waste management.	→	Circular practices and their farm-level and territorial effects are fragmented and lack a common assessment framework.	→	Develop circularity indicators, and evaluate economic, environmental, social and territorial impacts, adoption drivers and barriers. Application of FSDN methodology to separate samples (i.e., agrivoltaics farms) for sustainability analysis.

Figure 4. Evidence gaps and FSDN-enabled future research opportunities in Italian FADN-based research.

Figure 5 highlights this analytical shift by framing the transition from FADN to FSDN not merely as an extension of the existing data infrastructure, but as a transformation in the analytical function of farm-level data. This transition entails a move from the monitoring of economic accounts and CAP-related outcomes towards the support of multidimensional sustainability assessment. From this perspective, FSDN may act as an enabling infrastructure for a new generation of empirical research in which economic viability, environmental pressures and social conditions are examined within a common analytical framework.

The figure therefore provides a conceptual bridge between the evidence gaps discussed in this section and the research opportunities enabled by the transition to FSDN. On the one hand, it illustrates how the limitations of FADN-based research, particularly the predominance of economic indicators, the proxy-based measurement of environmental outcomes and the weak conceptualisation of social sustainability, are partly rooted in the original structure of the database. On the other hand, it highlights how the FSDN transition can support more direct indicators, enhanced data integration and more comprehensive analyses of sustainability interactions. The central challenge is therefore not simply to incorporate additional variables, but to use them to reconsider the relationships

among farm performance, environmental resource use, policy design and territorial cohesion.

The social dimension should also be examined through a broader governance perspective. This includes ethical conduct, transparency and accountability, as well as the risk of greenwashing, the governance and activities of producer groups, labour standards, worker protection and the fairness of relationships along agri-food value chains. These aspects are essential for determining whether sustainability commitments translate into credible and socially responsible farm and supply chain practices. Future research should also investigate the role of voluntary sustainability reporting at farm and producer group level. Although such reporting is not mandatory for most agricultural holdings, it could make visible the full range of environmental and social services they provide, strengthen accountability and reduce information asymmetries. In connection with the expanded environmental and social information collected through FSDN, sustainability reporting could therefore support the development of verifiable indicators, improve communication with stakeholders and policymakers, and help distinguish substantive sustainability performance from merely declarative claims.

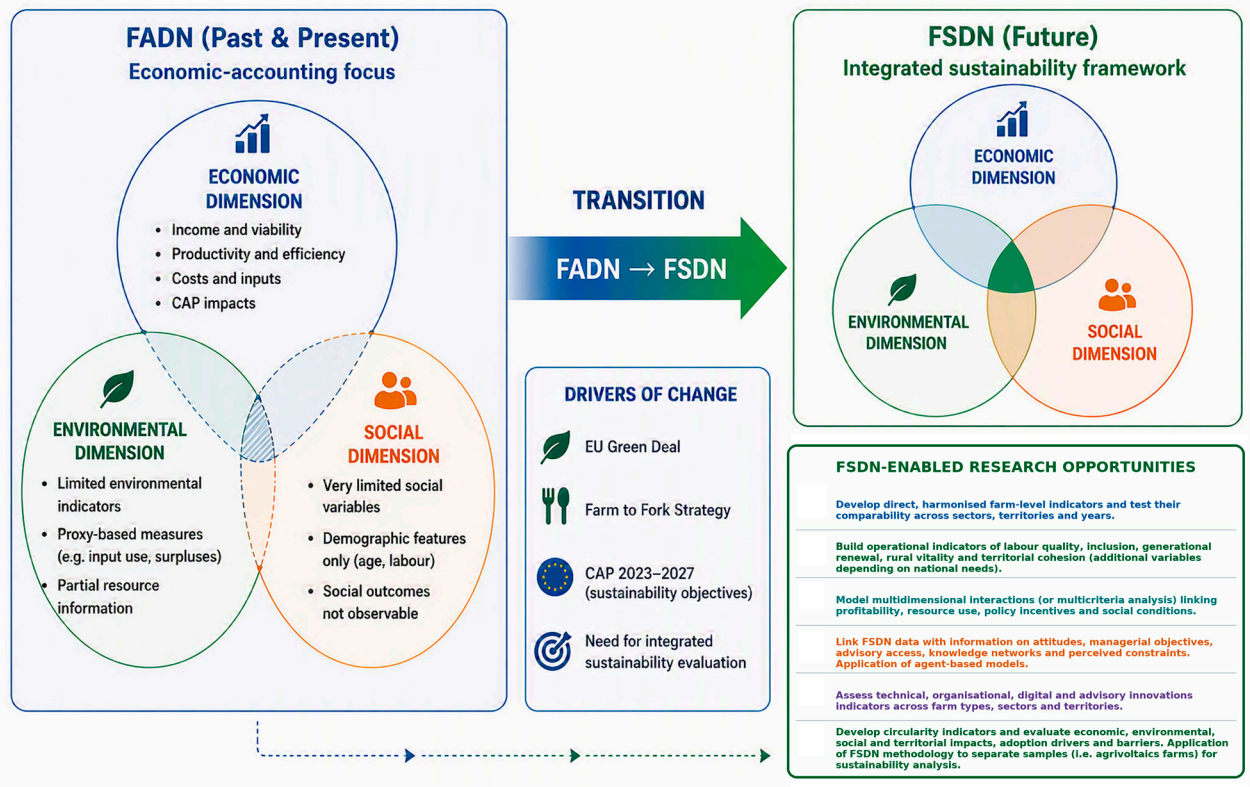

Figure 5. Evolution from FADN (gaps) to FSDN and future research opportunities.

4. Conclusions

This paper set out to provide a structured review of the Italian FADN-based literature and to assess how this body of research has contributed to farm-level analysis and future research needs. The findings show that this literature has developed around recurrent analytical domains that reflect both the original economic and policy-oriented function of FADN and its gradual extension towards broader sustainability issues.

First, the analysis confirms the dominant role of economic performance and policy evaluation as the core pillars of FADN-based research. Income, profitability, productivity, and efficiency remain the most extensively studied dimensions, reflecting the original accounting and policy support function of FADN. This strong economic orientation is

complemented by the well-developed literature on CAP impacts, which further reinforces the centrality of policy analysis within the field.

Second, the review shows a significant expansion of environmental research, particularly in relation to climate change, resource use, and agroecological transitions. Environmental considerations are no longer treated as exogenous factors but increasingly integrated into analyses of farm performance and decision-making. This reflects both the growing policy relevance of sustainability and the adaptability of FADN data to support more complex analytical frameworks, despite the continued reliance on proxy indicators.

Third, the social dimension emerges as the weakest and least structured component of the literature. While issues such as territorial disparities, rural development, structural inequalities, and farm abandonment are present, they are rarely conceptualised as a distinct analytical domain. Instead, they tend to appear as by-products of economic or policy analyses. This confirms that social sustainability remains not only underrepresented, but also conceptually underdeveloped compared to economic and environmental dimensions.

From a methodological perspective, the review also highlights the prevalence of advanced econometric and efficiency-based approaches, alongside a more limited adoption of integrative frameworks capable of modelling interactions across domains. This points to the need for future research to move beyond isolated analyses and toward multidimensional approaches that jointly consider economic viability, environmental performance, and social outcomes. In this context, the transition toward the Farm Sustainability Data Network (FSDN) represents a critical opportunity. By expanding the availability of environmental and social indicators and improving data integration, FSDN can enable a new generation of research capable of addressing the systemic nature of agricultural sustainability. The most evident interconnections emerge around the RDs. First, the economic–policy nexus links RD1 and RD4, since income, viability and redistribution are frequently analysed through the effects of CAP instruments. Second, the efficiency–environment nexus connects RD2 and RD3, as productivity and technical efficiency are increasingly evaluated in relation to climate stress, input reduction, water use and resource constraints. Third, the policy–sustainability nexus links RD4 with RD3 and RD6 because agri-environmental measures, greening requirements and rural development instruments shape both environmental outcomes and territorial inequalities. Fourth, the diversification–territory nexus connects RD5 and RD6, showing how agritourism, multifunctionality and supply chain strategies contribute not only to farm income, but also to rural development, territorial cohesion and the resilience of marginal areas. These interconnections confirm that Italian FADN-based research is gradually moving from single-domain analyses toward more integrated interpretations of farm-level sustainability.

These findings have direct practical implications. For researchers, FSDN should be used to build integrated indicators and to test causal links, trade-offs and synergies across economic, environmental and social outcomes rather than treating these dimensions as separate research areas. For decision-makers, the review indicates the need to translate farm-level evidence into more differentiated policy design, with interventions calibrated to farm type, sector, territory and vulnerability profile. For database administrators, the priority is to ensure that the transition from FADN to FSDN produces variables that are not only more numerous, but also more stable, comparable, documented and usable for longitudinal policy evaluation.

Several recommendations for the future development of the database follow directly from these findings. First, FSDN should strengthen the direct measurement of environmental outcomes and reduce reliance on proxies wherever feasible. Second, it should make the social component operational through harmonised information on labour quality, employment, gender, skills, generational renewal, advisory support and territorial

vulnerability. These recommendations would help transform FSDN into an operational infrastructure for sustainability monitoring, targeted CAP design and comparative assessment across farms, sectors and territories.

The review also has some limitations. First, the analysis is based on studies retrieved from Scopus and therefore may not include all the relevant grey literature, policy reports or national publications that use Italian FADN data. Second, the qualitative coding of research domains necessarily involves interpretative choices, especially because many studies address more than one analytical dimension. Third, the inclusion of comparative European studies was limited to cases in which Italy was clearly identifiable within the empirical analysis; nevertheless, future updates of the review could further distinguish between strictly national studies and cross-country comparative applications.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. List of Studies Included in the Review

Author/Year	Title	Journal
Baldoni et al., 2026	The impacts of seasonal weather anomalies on Italian farms' total factor productivity	European Review of Agricultural Economics
Biagini et al., 2026	Rethinking organic efficiency: A dynamic analysis of resource trade-offs in Italian agriculture through the FWEE nexus	Resources, Conservation and Recycling
Buttinelli et al., 2026	Analyzing Transition to Organic Farming in Italy Through a Dynamic Mathematical Programming Model: Impacts on Agricultural Area and Budget Allocations	Sustainability
Coughlan et al., 2026	Weather impacts and input adaptation: farm-level evidence on corn and wheat yields in Italy	Q Open
Fantechi et al., 2026	From productivity to abandonment: Sub-national evidence from the Italian farm sector in the context of EU agricultural policy	Journal of Rural Studies
Grazia et al., 2026	Too Hot to Profit? Climatic Stress and Farm-Level Performance in Italian Viticulture	Business Strategy and the Environment
Henke et al., 2026	Strategic Changes of the Farming System in Italian Rural Areas	German Journal of Agricultural Economics
Macaluso et al., 2026	Specialisation, Fragmentation, and Income Instability in Emerging Hop Production Systems: Microeconomic Evidence from Italian Farms	Agriculture
Martella et al., 2026	Sustainability in Swine Fattening Farming Systems in Italy: Looking Beyond Greenhouse Gas Emissions with the Ecological Footprint	Sustainability
Martinho, 2026	Combining Agriculture and Tourism: Ways to Promote the Interconnections Between Environment, Development and Sustainability	Agriculture

Parzonko et al., 2026	The Role of Direct Payments in Shaping the Production Potential and Financial Performance of Dairy Farms: An Assessment for 2014–2023 in the Dominant Milk-Producing EU Countries	Agriculture
Tamborrino et al., 2026	Harvests of solar light: Italian agriculture in the age of the photovoltaic era	Resources, Conservation and Recycling
Zadmirzaei et al., 2026	Are Italian farms achieving water-use efficiency in agriculture? Meta-frontier DEA analysis of efficiency gaps and farm-level disparities	Journal of Cleaner Production
Amato et al., 2025	Gender disparities in agricultural entrepreneurship: evidence from Italy using FADN data	Agricultural and Food Economics
Chiappini et al., 2025	Climate Crises and Agricultural Drought: Evolutions in Water Scarcity Context at the Farm Level	Earth
Cimino et al., 2025	Periurban Agriculture and Organic Farming: Investigating Synergies and Policy Implications	Land
D'Andrea et al., 2025	The Common Agricultural Policy and income disparities in Italian agriculture	Italian Review of Agricultural Economics
Dabkienė, 2025	Assessing of cereal production in Lithuania using sustainable economic competitiveness index	Bulgarian Journal of Agricultural Science
Forleo et al., 2025	The Efficiency of Poultry Farms: A Dynamic Analysis Based on a Stochastic Frontier Approach and Panel Data	Animals
Giarè and Vagnozzi, 2025	Policies for the Agricultural Knowledge and Innovation System in southern Italian areas: the state of the art	Italian Review of Agricultural Economics
Henke et al., 2025	Water management for agriculture in a Mediterranean area: The case of processing tomatoes in Italy	New Medit
Lombardi et al., 2025	Intensive vs. environmentally sustainable: The livestock dilemma	Livestock Science
Moino et al., 2025	Bridging the gap: the impact of compensatory measures on mountain farming in Piedmont	Bio-Based and Applied Economics
Muder & Staniszewski, 2025	Efficiency and technology gap in European apple production—A metafrontier model for Germany, Italy, and Poland	Agribusiness
Pawłowska, 2025	Has the "green" transformation of the Common Agricultural Policy affected the environmental sustainability of farms?	PLOS One
Pierangeli et al., 2025	The CAP direct payments reform 2023–2027 in Italy: A path to fairer redistribution?	Agricultural and Food Economics
Stempfle et al., 2025	Characterizing the agroecological transition of Italian farming systems using FADN database	Environmental and Sustainability Indicators
Vaquero-Piñeiro et al., 2025	Wine and tourism: An analysis of synergies in Italy	Tourism Economics
Arru et al., 2024	The economic and environmental sustainability dimensions of agriculture: a trade-off analysis of Italian farms	Frontiers in Sustainable Food Systems
Baldi et al., 2024	Predicting the effect of the Common Agricultural Policy post-2020 using an agent-based model based on PMP methodology	Bio-Based and Applied Economics
Bonfiglio, 2024	Unveiling innovation imperatives in agriculture: A data-driven framework for identifying latent needs and regional priorities	Sustainable Futures
Buttinelli et al., 2024	Irrigation water economic value and productivity: An econometric estimation for maize grain production in Italy	Agricultural Water Management
Cisilino et al., 2024	Empowering rural development in Italy: The Integrated Supply Chain Projects	Journal of Infrastructure, Policy and Development
Esposti, 2024	Non-monetary motivations of the EU agri-environmental policy adoption. A causal forest approach	Journal of Environmental Management
Manganiello et al., 2024	The use of purified wastewater for irrigation: Possible strategies in the Capitanata area (Apulia, Italy)	Agricultural Water Management

Marchini et al., 2024	Fair prices for fair wages in the agro-food chain: is farm production efficiency the missing link? Evidence from the processing tomato sector in Italy	Frontiers in Sustainable Food Systems
Miran, 2024	Assessing input efficiencies of specialised milk farms in the EU by using a non-radial DEA approach	Animal Production Science
Parzonko et al., 2024	Economic Competitiveness of Dairy Farms from the Top Milk-Producing Countries in the EU: Assessment in 2014–2021	Agriculture
Scatolini et al., 2024	Do Irrigation Water Requirements Affect Crops' Economic Values?	Water
Baldi et al., 2023	An impact assessment of GHG taxation on Emilia-Romagna dairy farms through an agent-based model based on PMP	Land
Biagini et al., 2023	The impact of CAP subsidies on the productivity of cereal farms in six European countries: A historical perspective (2008–2018)	Food Policy
Cardillo et al., 2023	The evolution of multifunctional agriculture in Italy	Sustainability
Cardillo et al., 2023	The farm's orientation towards sustainability: An assessment using FADN data in Italy	Land
Cecchini et al., 2023	Eco-efficiency and its determinants: The case of the Italian beef cattle sector	Agriculture
Cisilino et al., 2023	The Tuscany integrated supply chain projects 2014–2022: a new path to support the Agri-food industry	Land
Coderoni and Pagliacci, 2023	The impact of climate change on land productivity. A micro-level assessment for Italian farms	Agricultural Systems
Galluzzo, 2023	How does eliminating the use of pesticides affect technical efficiency in Italian farms?	Bulgarian Journal of Agricultural Science
Henke and Vaquero-Piñeiro, 2023	Measuring agro-biodiversity through leverage factors: Land use, farmer practices and public policies	Land
Sardone et al., 2023	The new CAP and the challenge of sustainability: a synthetic indicator for the Italian wine sector	Wine Economics and Policy
Bełdycka-Bórawska et al., 2022	Factors Shaping Performance of Polish Biodiesel Producers Participating in the Farm Accountancy Data Network in the Context of the Common Agricultural Policy of the European Union	Energies
Cardillo and Cimino, 2022	Small farms in Italy: What is their impact on the sustainability of rural areas?	Land
Cesaro et al., 2022	Italian farms during the COVID-19 pandemic: main problems and future perspectives. A direct analysis through the Italian FADN	Bio-Based and Applied Economics
Coppola et al., 2022	Measuring the economic sustainability of Italian farms using FADN data	Agricultural Economics/Zemědělská Ekonomika
Cortignani et al., 2022	Farm to Fork strategy and restrictions on the use of chemical inputs: Impacts on the various types of farming and territories of Italy	Science of The Total Environment
Dono et al., 2022	Financial performance of connected Agribusiness activities in Italian agriculture	Bio-Based and Applied Economics
Esposti, 2022	The co-evolution of policy support and farmers behaviour. An investigation on Italian agriculture over the 2008–2019 period	Bio-Based and Applied Economics
Galluzzo, 2022	Analysis of Specialisation and Management in Italian Farms Through a Partial Least Square-Structural Equation Modelling Approach	European Countryside
Henke et al., 2022	The role of diversification in the revenue composition of Italian farms	Italian Review of Agricultural Economics
Baldoni and Esposti, 2021	Agricultural Productivity in Space: an Econometric Assessment Based on Farm-Level Data	American Journal of Agricultural Economics

Bazzani and Spadoni, 2021	Generating cropping schemes from FADN data at the farm and territorial scale	Economia agro-alimentare
Bazzani et al., 2021	Using FADN data to estimate CO2 abatement costs from Italian arable crops	Sustainability
Borsotto et al., 2021	Modeling change in the ratio of water irrigation costs to farm incomes under various scenarios with integrated FADN and administrative data	Economia agro-alimentare
Buttinelli et al., 2021	Financial sustainability in Italian Organic Farms: An analysis of the FADN sample	Economia agro-alimentare
Cagliero et al., 2021	Ten years after: Diffusion, criticism and potential improvements in the use of FADN for Rural Development assessment in Italy	Economia agro-alimentare
Cimino et al., 2021	Income diversification strategies of Italian Peri-urban farms: A structural equation Modeling approach	Land
D'Oronzio & De Vivo, 2021	Organic and conventional farms in the Basilicata region: A comparison of structural and economic variables using FADN data	Economia agro-alimentare
Dono et al., 2021	Financial sustainability in Italian farms: an analysis of the FADN sample	Agricultural Finance Review
Forleo et al., 2021	Analysing the efficiency of diversified farms: Evidences from Italian FADN data	Journal of Rural Studies
Marongiu et al., 2021	Use and users of FADN data in Italy	Economia agro-alimentare
Miglietta et al., 2021	Crowding out agricultural insurance and the subsidy system in Italy: Empirical evidence of the charity hazard phenomenon	Agricultural Finance Review
Raimondo et al., 2021	Organic farming increases the technical efficiency of olive farms in Italy	Agriculture
Romagnoli et al., 2021	Highlighting the drivers of Italian diversified farms efficiency: A Two-stage DEA-panel Tobit analysis	Sustainability
Tantari and Cardillo, 2021	The concentration of agricultural land in Italy: an analysis through the FADN database	Italian Review of Agricultural Economics
Toscani et al., 2021	Assessing the significance of forestry for the economy of combined agricultural-forest enterprises–experiences from Austria and Italy	Austrian Journal of Forest Science
Turchetti et al., 2021	Enhancing the Italian FADN for Sustainability Assessment: The State of Art and Perspectives	Economia agro-alimentare
Vaccaro et al., 2021	The use of FADN methodology to support the evaluation of business development plans in the RDP Sicily 2014–2020	Economia agro-alimentare
Varia et al., 2021	The adoption of landraces of durum wheat in Sicilian organic cereal farming analysed using a system dynamics approach	Agronomy
Bassi et al., 2020	Alpine Agriculture Today: Evidence from the Italian Alps	Quality-Access to Success
Biagini et al., 2020	The role of the common agricultural policy in enhancing farm income: a dynamic panel analysis accounting for farm size in Italy	Journal of Agricultural Economics
Coppola et al., 2020	Income levels and farm economic viability in Italian farms: An analysis of FADN data	Sustainability
Martinho, 2020	Comparative analysis of energy costs on farms in the European Union: a nonparametric approach	Energy
Salvioni et al., 2020	The impact of non-agricultural diversification on financial performance: Evidence from family farms in Italy	Sustainability
Vergamini et al., 2020	Evaluating the potential contribution of multi-attribute auctions to achieve agri-environmental targets and efficient payment design	Ecological Economics
Cisilino et al., 2019	Rural development programs' impact on environment: An ex-post evaluation of organic faming	Land Use Policy

Galluzzo, 2019	An assessment of rurality in Italian farms using a quantitative approach	Bulgarian Journal of Agricultural Science
Migliore et al., 2019	A Ricardian analysis of the impact of climate change on permanent crops in a Mediterranean region	New Medit
Monda & Tantari, 2019	The economic convenience of GMO cultivation in Italy: an analysis of a sample of farm from the Italian Farm Accountancy Data Network (FADN)	Italian Review of Agricultural Economics
Severini et al., 2019	Modeling agricultural risk management policies–The implementation of the Income Stabilization Tool in Italy	Journal of Policy Modeling
Tantari et al., 2019	Assessing the impact of direct payments convergence on farm income inequality: The case of Italian farms	Journal of International Food & Agribusiness Marketing
Ciliberti and Frascarelli, 2018	The CAP 2013 reform of direct payments: redistributive effects and impacts on farm income concentration in Italy	Agricultural and Food Economics
Ciliberti and Frascarelli, 2018	The income effect of CAP subsidies: implications of distributional leakages for transfer efficiency in Italy	Bio-Based and Applied Economics
Galluzzo, 2018	Preliminary findings in Italian farms part of FADN dataset by the PLS-SEM	Bulgarian Journal of Agricultural Science
Giaccio et al., 2018	Do rural policies impact on tourism development in Italy? A case study of agritourism	Sustainability
Giaccio et al., 2018	Explaining determinants of agri-tourism income: Evidence from Italy	Tourism Review
Guastella et al., 2018	The capitalisation of CAP payments into land rental prices: a panel sample selection approach	Journal of Agricultural Economics
Salvioni and Sciulli, 2018	Rural development policy in Italy: the impact of growth-oriented measures on farm outcomes	Agricultural Economics (Czech Republic)
Baldoni et al., 2017	Immigrant workforce and labour productivity in Italian agriculture: a farm-level analysis	Bio-Based and Applied Economics
Carillo et al., 2017	Do durum wheat producers benefit of vertical coordination?	Agricultural and Food Economics
Cesaro and Marongiu, 2017	Economic performance and profitability of agricultural holdings in Inner Areas	Italian Journal of Planning Practice
Cortignani et al., 2017	Complying with greening practices in the new CAP direct payments: An application on Italian specialized arable farms	Land Use Policy
Esposti, 2017	The heterogeneous farm-level impact of the 2005 CAP-first pillar reform: A multivalued treatment effect estimation	Agricultural Economics
Galluzzo, 2017	Technical and economic efficiency in some Italian farms: An analysis in two Italian islands	Agricultural Economics Review
Lupi et al., 2017	Exploring the features of agritourism and its contribution to rural development in Italy	Land Use Policy
Siad et al., 2017	Durum wheat cover analysis in the scope of policy and market price changes: A case study in Southern Italy	Agriculture
Galluzzo, 2016	An analysis of the efficiency in a sample of small Italian farms part of the FADN dataset	Agricultural Economics/Zemědělská Ekonomika
Solazzo and Pierangeli, 2016	How does greening affect farm behaviour? Trade-off between commitments and sanctions in the Northern Italy	Agricultural Systems
Vidoli et al., 2016	Spatial nonstationarity in the stochastic frontier model: An application to the Italian wine industry	Regional Science and Urban Economics
Capitanio et al., 2015	Italian agriculture in the context of climate change: the role of irrigation for sustainable development of rural areas	RIVISTA DI STUDI SULLA SOSTENIBILITA'
Cimino et al., 2015	The effects of CAP greening on specialised arable farms in Italy	New Medit

La Notte et al., 2015	Livestock and ecosystem services: An exploratory approach to assess agri-environment-climate payments of RDP in Trentino	Land
Mastronardi et al., 2015	Is agritourism eco-friendly? A comparison between agritourisms and other farms in Italy using farm accountancy data network dataset	SpringerPlus
Solazzo et al., 2015	CAP towards 2020 and the cost of political choices: the case of Emilia-Romagna region	Land Use Policy

Appendix B. Research Domains and Coding Framework

Research Domain	Recurrent Thematic Words and Concepts	Coding Rationale and Interpretative Meaning
RD 1. Farm performance and economic outcomes	income, farm income, viability, profitability, payments, subsidies, economic sustainability	Articles were assigned to this domain when their main objective focused on income, profitability, financial viability or economic sustainability; collectively, this domain captures the economic accounting core of FADN-based research and its role in assessing farm viability and support instruments.
RD 2. Productivity, efficiency and structural drivers	productivity, efficiency, performance, technical efficiency, DEA, stochastic frontier, heterogeneity, farm size	Articles were assigned to this domain when their main objective focused on productivity, efficiency measurement, performance heterogeneity or structural determinants; collectively, this domain reflects the methodological use of FADN for farm-level efficiency analysis and the study of structural drivers of performance.
RD 3. Climate change and environmental sustainability	climate, water, irrigation, drought, emissions, biodiversity, agroecology, sustainability, resource use	Articles were assigned to this domain when they explicitly focused on climate stress, environmental indicators, resource use, biodiversity or agroecological transition; collectively, this domain identifies the growing use of FADN data to address environmental sustainability, often through proxy-based or integrated indicators.
RD 4. Agricultural policy and institutional framework	CAP, direct payments, greening, policy, subsidies, agri-environmental measures, reform, rural development programmes	Articles were assigned to this domain when their main objective focused on CAP instruments, policy evaluation, institutional change or farmer response to policy incentives; collectively, this domain confirms the strong policy orientation of FADN-based research and its relevance for evaluating CAP effects.
RD 5. Farm strategies, diversification and multifunctionality	diversification, agritourism, multifunctionality, tourism, supply chains, other gainful activities, rural development	Articles were assigned to this domain when their main objective focused on diversification strategies, multifunctionality, agritourism, supply chains or non-agricultural income sources; collectively, this domain captures farm adaptation strategies and the diversification of farm functions within evolving rural economies.
RD 6. Social and territorial dimensions	labour, small farms, mountain areas, abandonment, territorial disparities, rurality, North–South differences, inner areas	Articles were assigned to this domain when they focused on labour, territorial disparities, rural development, marginal areas, small farms or social sustainability issues; collectively, this domain identifies social and territorial issues as cross-cutting but comparatively less consolidated dimensions of the literature.

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