Data-Driven AI Approach to Address Territorial Strategies. Why Investing in Agri-Food Sector to Enhance the Valsesia Inner Area

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Abstract. In recent years, data-driven artificial intelligence (AI) approaches have gained prominence in territorial planning and economic development, enabling policymakers to analyse large datasets and formulate evidence-based strategies. This study aims to develop and apply a data-driven AI approach to analyse past funded projects to support decision-making processes and the development of strategic actions in Italy's inner territories, focusing on the Valsesia SNAI Inner Area and the enhancement of the Agri-food chains and rural development sector. The study employs data mining techniques such as Latent Dirichlet Allocation (LDA) topic modeling and clustering to analyse thematic and financial data from the "OpenCoesione projects" dataset. Findings highlight that while infrastructure investments are substantial, funding for research, innovation, and business competitiveness in the agri-food sector remains underdeveloped. The study underscores the importance of private-public financing mechanisms and strategic investment to enhance regional development. Conducted within the Branding4Resilience (B4R) project by the Politecnico di Torino Research Unit, this research can contribute to optimizing SNAI strategy implementation and broader territorial policies, fostering the competitiveness of agri-food SMEs and supporting sustainable socio-economic growth in Valsesia.

Keywords: Inner Areas · Data-driven AI approach · SNAI strategy

1 Introduction

In recent years, the use of data-driven artificial intelligence (AI) approaches has gained increasing attention in the field of territorial planning and economic development [9, 15]. These methodologies enable policymakers and local authorities to analyse large datasets, extract meaningful insights, and formulate evidence-based strategies. The integration of AI-driven analyses with participatory governance models is particularly relevant in

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the context of inner territories, where economic and social challenges require tailored interventions. Inner territories across Italy face significant socio-economic challenges [24], including demographic decline, limited access to essential services, and economic stagnation [1, 7]. Traditional development policies often fail to address these issues effectively due to fragmented data, limited stakeholder engagement, and suboptimal allocation of financial resources. A key problem lies in the lack of systematic, data-driven evaluation mechanisms that can guide funding decisions and policy interventions [2]. Without a structured approach to assessing past projects and their impacts, there is a risk of inefficient resource allocation and missed opportunities for sustainable growth.

While previous studies have explored regional development policies in rural economies [10–12, 14], few have integrated AI-based methodologies to systematically evaluate the effectiveness of past interventions. The research aims to bridge this gap by leveraging AI-driven analyses to support informed decision-making and optimize territorial development strategies. In this scenario, thematic and financial analyses on funded projects can highlight (good) lessons learnt and represent effective drivers for local development of inner territories; therefore, the availability of open data and accessible national databases plays a crucial role in supporting data-driven analyses able to address territorial strategies.

This study focuses on the Valsesia Inner Area, recently recognized as part of the Italian National Strategy for Inner Areas (SNAI), which represents a valuable case study for assessing the potential of data-driven approaches in guiding territorial strategies. This research was conducted by the Politecnico di Torino Research Unit (RU) in the context of the Branding4Resilience (B4R) research project of national interest (PRIN 2017—Young Line), which was funded by the Italian Ministry of University and Research (MUR) for a four-year duration (2020–2024) [7]. In accordance with the goals of the B4R project, the Polito RU triggered a collaboration-based approach between Academia and the Valsesia Mountain Union, which has been constantly involved and consulted during the first phases of the B4R project focused on understanding and analyzing local territorial challenges, as well as on developing co-design activities [13, 18, 19, 21, 22]. In 2023 the Polito RU participated to six thematic Focus Groups organized by the Valsesia Mountain Unions in the context of the SNAI strategy definition process, finalized to identify priority actions and interventions around which the SNAI strategy can be oriented. The Focus Group on the Agri-food chains and rural development sector stimulated a very effective dialogue with stakeholders and highlighted the high potential and crucial role of SMEs in fostering local development, as they could contribute to employment, innovation, and the sustainable use of natural resources. In this context, quantitative and qualitative data were collected, and data-driven analyses were performed in order to support Valsesia Mountain Union in this important decision-making process. Particular attention was focused on the "OpenCoesione projects" dataset, which allowed interesting thematic and financial analyses on funded projects at national and regional levels, which highlighted the "Competitiveness of companies" and "Research and Innovation") as the less considered thematic scopes in Piedmont Region in the past [25, 26].

This research aims to develop and apply a data-driven AI approach to analyse past funded projects to support decision-making processes and the development of strategic actions in the context of the Valsesia SNAI Inner Area, with a specific focus on the Agri-food chains and rural development sector. The main objectives are to analyse categories, typologies, costs, and funding of past funded projects, as well as the detailed descriptions of each project, identifying the Key Strategic Actions (KSA) used to develop and/or enhance the Agri-food chains and rural development sector, along with the related public and private funding.

Through data mining techniques such as Latent Dirichlet Allocation (LDA) topic modelling and clustering [6, 17], the research identifies key investment patterns and funding gaps. The findings reveal that while significant resources have been allocated to infrastructure, investments in research, innovation, and business competitiveness in the agri-food sector remain limited. The study also highlights the role of private-public financing mechanisms in shaping regional development trajectories. By drawing insights from past experiences and ongoing strategic planning, the study seeks to provide recommendations for optimizing not only the SNAI strategy implementation but also other territorial development policies able to enhance the competitiveness of agri-food SMEs and contribute to the socio-economic growth of Valsesia.

The paper is structured as follows: Sect. 2 presents the methodological approach adopted, while Sect. 3 introduces the case study and explains the data sampling process. Section 4 discusses the results achieved by analysing 2 subsamples ("Competitiveness of companies" and "Research and Innovation") and Sect. 5 provides concluding remarks.

2 Methodological Approach

The Politecnico di Torino B4R Research Unit developed a data-driven AI approach to analyse past funded projects and support Local Authorities in addressing territorial strategies in the Valsesia Inner Area. The methodological approach is developed in 5 phases (Fig. 1).

A. Goal Definition
Once a specific territorial context is selected as case study, data-driven analyses are performed to identify gaps and opportunities to be assumed as objectives. This approach builds on lessons learned from strategies implemented in the past that can contribute to identifying strategic gaps in the lacking thematic scopes allocate resources effectively and designing development. This phase also combines data-driven analysis with listening and debate with stakeholder who can contribute to identify the lacking thematic scopes and to define strategic priorities for the formulation of new action proposals.

B. Data Collection and Dataset Import
After the identification of lacking thematic scopes, it is fundamental to collect data on the projects previously financed in the areas of interest identified in line with the set objectives and validated by the competent institution. Open data and national databases can represent great support to perform thematic and financial analyses on funded projects, to be used as (good) lessons learnt.

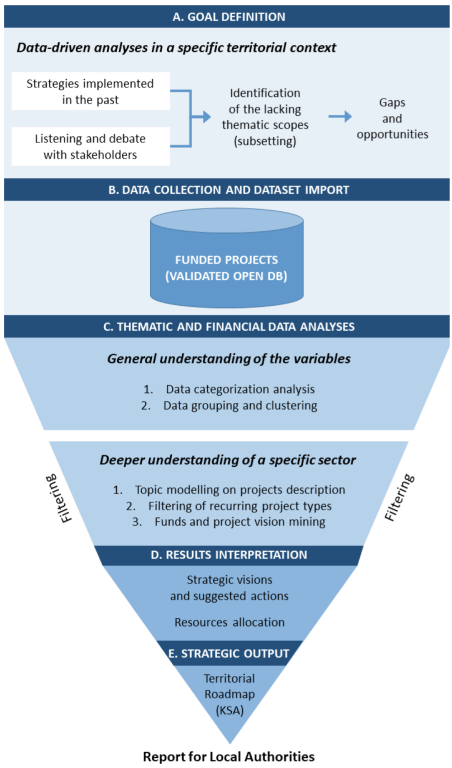


Fig. 1. Methodological approach developed and applied by the Polito RU to analyse past funded projects alongside the Valsesia SNAI Strategy definition process (Source: Authors' elaboration)

C. Thematic and Financial Data Analyses

The analyses conducted starting from the selected database are based on the integration of existing technologies in the field of project management, data analysis and artificial intelligence, that can be further developed as a Project Intelligence System [23]. In particular, the insights derived from Pivot Table data analyses are further enhanced by specific analyses performed with AI support.

First, a general understanding of the funding distribution of projects and actions is pursued through:

1. Data categorization analysis: analysis of the number of funded projects and the related invested amount of public funds;
2. Data grouping and clustering: aggregation of data through thematic grouping, reducing redundancy and improving clarity, focusing on specific development actions.

Secondly, 3 subsequent analyses contribute to a deeper understanding of the funding distribution and strategic focus of the funded projects, particularly filtering data on a specific sector, resulting from the data-driven analyses performed in the selected territorial context:

1. Topic modeling on project descriptions: Latent Dirichlet Allocation (LDA) [6, 17] a statistical model that discovers hidden thematic structures in large text collections by treating documents as mixtures of topics and topics as distributions of words, is applied to identify latent topics within project descriptions. This approach helps uncover thematic patterns and categorize projects based on their textual content;
2. Filtering of recurring project types: the most frequently occurring project types are identified by analysing textual descriptions, allowing for the grouping of projects into meaningful categories that reflect common investment themes.
3. Funds and project vision mining: the main strategies employed in the selected specific sector are examined, determining their prevalence and significance within the dataset. Identified strategies are linked to their respective funding amounts, enabling a quantitative assessment of financial allocation per strategy. The distribution of public and private funding across different strategies is then calculated, providing a clear comparative view of investment patterns.

D. Results Interpretation
The analysis of results provides strategic visions and suggested actions to drive decision-making. Key insights help optimize resource allocation, ensuring socio-economic growth and territorial enhancement of the selected geographic area, guiding decisions on infrastructure, economy and sustainability.

E. Strategic Output
Through this framework, Local Authorities and their consultants are equipped with the tools and insights needed to enhance decision-making and drive impactful development initiatives. The achieved results can be shared with stakeholders through a report containing a Territorial Roadmap, outlining Key Strategic Actions (KSA), goals, and public and private funding allocation.

3 Case Study and Data Sample

In June 2022, the Valsesia and the Biellese Orientale Mountain Unions achieved the important goal of being identified as "Valsesia Inner Area", funded in the context of the second SNAI programming cycle. Since December 2022, the two Mountain Unions organized six thematic Focus Groups to engage in dialogue with local actors and stakeholders, aiming to identify and share key challenges and opportunities related to the Valsesia territory. Due to the close collaboration between Academia and local actors during B4R project, the Valsesia Mountain Union involved the Polito RU as a technical expert in both field activities and in the meetings organized by the Control Room which coordinates policy implementation across institutional levels and ensures alignment among actors. This collaboration aimed to consolidate dispersed knowledge (internal RU team meetings), share insights from the B4R project and contribute to discussions with stakeholders, to support Local Authorities in addressing territorial strategies in the Agri-food sector which, based on the findings of the thematic Focus Groups, represents a strategic sector for the enhancement of the Valsesia SNAI area.

Starting from the lessons learnt from the past, a national open-source database containing all the information related to projects funded at the national level since the programming cycle 2000–2006 was selected. It was downloaded from the OpenCoesione portal (www.opencoesione.gov.it), that is an open government initiative on cohesion policies in Italy and promotes a widespread civic participation by monitoring the effectiveness of interventions with the publication of data on funded projects. This dataset (accessed in December 2024) contains around 1,049M funded projects described by 199 variables; The variables selected for this research are illustrated in Table 1.

4 Results

The proposed data-driven AI approach for analysing funded projects and supporting Local Authorities in addressing territorial strategies was applied in the context of the Valsesia SNAI strategy definition process by analysing the strategies implemented in the past SNAI programming cycle and participating to the six thematic Focus Groups organized by the two Mountain Unions since December 2022. The data-driven analyses and the dialogue with local actors and stakeholders highlighted key challenges and opportunities related to two thematic scopes, which in the past have been less considered in Piedmont Region.

The first thematic scope ("Competitiveness of companies") includes financial engineering instruments such as guarantee funds, loan funds, credit access mechanisms, co-guarantees, and counter-guarantees. It also includes more traditional business support measures, such as fostering new business creation (e.g., under Legislative Decree No. 185/2000), establishing new production plants, expanding and modernising existing facilities, and improving the functionality of production areas. Other measures within this theme include program contracts to support investments by large enterprises and Integrated Facilitation Packages (PIA), which can cover productive investments, business support services, and corporate training.

The second thematic scope ("Research and Innovation") encompasses support for the demand for research and innovation by businesses, including financial engineering tools, through funding for companies engaged in industrial research and experimental development projects, often in collaboration with universities and public research centres. Additionally, funding is provided to support research supply by universities and research centres, including the enhancement of research infrastructure and laboratories, technology transfer to businesses (such as technology districts and innovation hubs), and advanced business services for research and innovation.

According to these selected thematic scopes, two datasets were extracted from the "OpenCoesione projects" dataset and thematic and financial data analyses were performed. The first analysis (Sect. 4.1) critically examines and cross-references some variables (categories, typologies, costs, and funding), while the second analysis (Sect. 4.2) focuses on the detailed descriptions of each project, identifying the Key Strategic Actions (KSA) used to develop and/or enhance the Agri-food chains and rural development sector, along with the related public and private funding.

Table. 1. Data sample main variables (Source: Authors' elaboration)

Data structure		Data content	Data value	
Field acronym	Field name		Vocabulary	Field type
OC_SINTESI_PROGETTO	Project summary	Detailed description of the project	Open	Text
OC_DESCR_CICLO	Programming Cycle	Description of the programming cycle	Closed: 2000–2006; 2007–2013; 2014–2020; 2021–2027)	Text
OC_TEMA_SINTETICO	Thematic scope	Summary description of the thematic scope (Aggregation of EU priority topics into summary scopes)	Closed: Environment, Administrative capacity, Competitiveness of companies, Culture and Tourism, Energy, Social Inclusion and health, Education and training, Employment and work, Digital networks and services, Research and innovation, Transport and mobility	Text
OC_DESCR_CATEGORIA_SPESA	Expenditure category	Description of the expenditure category	Closed: 27 different categories of expenditure (ref. metadati_progetti_tracciato_esteso.xls)	Text
CUP_DESCR_TIPOLOGIA	Project typology	Description of the type of project according to the CUP (Italian Unique Project Code)	Closed: 45 different typologies of project (ref. metadati_progetti_tracciato_esteso.xls)	Text
CUP_DESCR_CATEGORIA	Project category	Description of the category of project according to the CUP	Closed: 139 different categories of project (ref. metadati_progetti_tracciato_esteso.xls)	Text
FINANZ_PRIVATO	Private funds	Amount of financing from private source	Open	Number in Euros
FINANZ_TOTALE_PUBBLICO	Total public funds	Total public funding sources	Open	Number in Euros
COSTO_REALIZZATO	Implemented cost	Value of the works and project activities carried out	Open	Number in Euros

4.1 Data Categorization, Grouping and Clustering

Competitiveness of Companies (Dataset 1)

The analysis started with the identification of the first subset, consisting in 31.976 records related to a total amount of public funds of about 7.500M€. The chart (Fig. 2) shows the distribution of the number of interventions by type (CUP_DESCR_TIPOLOGIA) and their related average values. Four main typologies account for 44% (*new construction*), 26% (*other typology*) 8% (*modernization*) and 7% (*expansion*) of total programmed interventions; the remaining part (about 15% of the total) is divided into 24 typologies. The overall average amount is about €235.000 with the highest values recorded for 'work incentives' (10 interventions funded at €30 million each), 'Applications and web platforms' (2 interventions, each funded at €19 million), and 'Liquidity shortage' (2 interventions, each receiving €15 million). Conversely, the lowest values are associated with expenditure categories related to supply/purchase (average values between 0,01 and 0,08M€. In terms of total public funding (Fig. 3), three categories (*other*, *new construction*, *expansion*) account for approximately 75% of the total allocation, leaving 25% for the remaining typologies. Interestingly, although physical interventions on buildings or new construction account for the majority of projects, they represent only a third of the total funded amount.

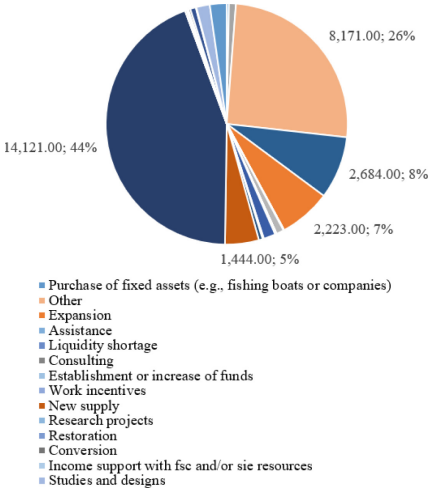


Fig. 2. DATASET 1 - Number of intervention (and related average values) per intervention's typology (Source: authors' elaboration)

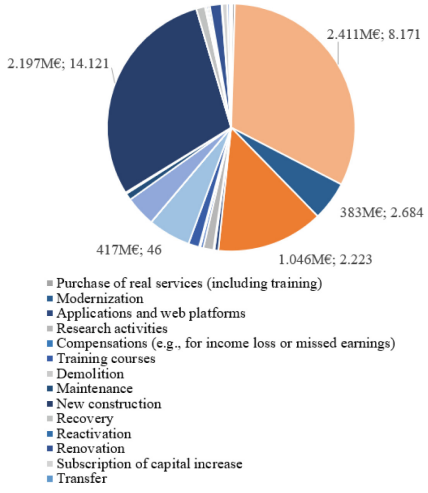


Fig. 3. DATASET 1 - Total public funding and number of interventions per typology (Source: authors' elaboration)

As shown in the financing mix (Appendix, Fig. 8), since 2000, public resources have consistently dominated, covering about 75% of total funding, with 12 expenditure types relying entirely on public support. Private contributions were most significant in 'New supply' (70%) and 'Conversion' (55%), with over one-third of total private investment—amounting to €7.5 billion—dedicated to new constructions. To better support the development of the Valsesia strategy, the analysis shifted focus toward local economic

enhancement. Standard Excel tools proved inadequate for this purpose, leading to the use of artificial intelligence to regroup funding categories. This reclassification improves data readability and clarifies the allocation of resources across infrastructure, activities, and technology transfer (Appendix, Tables 2 and 3).

Research and Innovation (Dataset 2)

Starting with the identification of the second subset, we selected 10.442 records related to a total amount of public funds of about 6.150M€. The chart (Fig. 4) shows the distribution of the number of interventions by type (CUP_DESCR_TIPOLOGIA) and their related average values. Three main typologies account for 40% (*research activities*), 32% (*research projects*) and 22% (*other typology*) of total programmed interventions; the remaining part (1/3 of the total) is divided into 14 typologies, with less than 100 interventions each. The overall average amount is just under €590,000 with the highest values recorded for 'establishing or increasing a loan fund' (a single intervention funded at €270 million), 'new supply' (26 interventions, each funded at €6.3 million), and 'technical assistance' (5 interventions, each receiving €5 million). Conversely, the lowest values are associated with expenditure categories more linked to intangible actions, such as 'conversion' (24 interventions with an average value of approximately €70,000), 'expansion' (87 interventions averaging €115,000 each), and 'work incentives' (2 interventions, each funded at €150,000). In terms of total public funding (Fig. 5), the same three categories account for approximately 88% of the total allocation, leaving just over 10% for the remaining typologies. Interestingly, physical buildings intervention (e.g., renovation and expansion) do not dominate either in terms of funding or the number of interventions. Instead, the funds have been primarily directed towards research projects and the purchase of equipment.

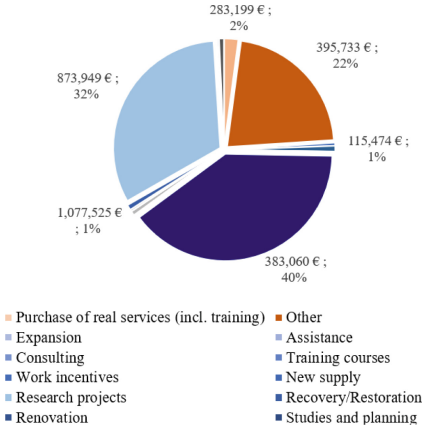


Fig. 4. DATASET 2 - Number of intervention (and related average values) per intervention's typology (Source: authors' elaboration)

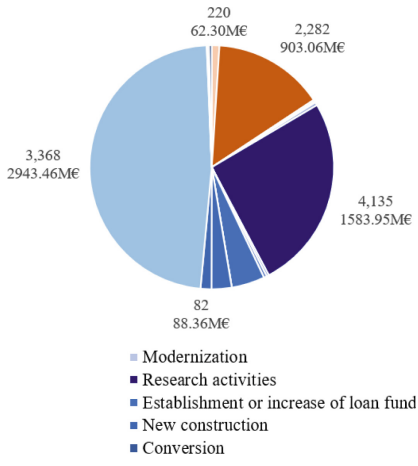


Fig. 5. DATASET 2 - Total public funding and number of interventions per typology (Source: authors' elaboration)

In terms of the financing mix (Appendix, Fig. 9), it can be seen that analyzing all the programming cycles since 2000 without distinction, private and public resources

were activated in relationship 30%–70%; in some typologies of expenditure the funding was only public. The typologies most financed by private money were Expansion and Conversion (68% of the amount of their interventions), followed by 'Research activities' (48% of the amount was financed by private capitals).

'Research projects', on the other hand, were financed by private funds for less than a quarter of the entire amount, 23%. However, if we look at the total private funding, which amounts to almost 2,700M€, about 54% has been invested specifically in research activities. For this subset too, it was decided to use artificial intelligence to group similar elements (categories); in this case, the new classification allows for the distinction between infrastructural and/or productive investments for SMEs and, for example, the development and promotion of the tourism and cultural sector (see Appendix, Tables 4 and 5).

4.2 Topic Modelling, Filtering and Data Mining

Competitiveness of Companies (Dataset 1)
Based on the themes identified through Topic Modeling with LDA, five main KSA have emerged for the enhancement and development of the agri-food chains and rural development sector:

Technological Innovation and Digitalization of the Agri-Food Sector. This strategy focuses on integrating advanced technologies into the agri-food sector. It includes the use of artificial intelligence, IoT (Internet of Things), blockchain, and smart sensors to improve agricultural production, optimize resources, and ensure product traceability. Additionally, blockchain technology enables full transparency in the agri-food supply chain, ensuring product quality and origin. Companies investing in this strategy aim to reduce operational costs, increase sustainability, and enhance competitiveness in international markets.

Sustainability and Organic Farming. The growing focus on sustainability has led many companies to invest in organic and regenerative farming practices. This strategy involves reducing chemical inputs, implementing crop rotation, and promoting agricultural techniques that preserve soil fertility. Businesses adopt organic certifications to enhance product value and appeal to environmentally conscious consumers. Organic production is often linked to short supply chains and local markets, reducing the environmental impact associated with logistics and transportation.

Development of Short Supply Chains and Local Markets. Short supply chains are a key strategy for ensuring fair income for farmers and promoting a more sustainable consumption model. This approach encourages direct sales of agricultural products, eliminating intermediaries and allowing producers to achieve higher profit margins. Key tools include farmers' markets, solidarity purchasing groups (GAS), and digital platforms for direct sales. Consumers are increasingly favoring local products to minimize environmental impact while ensuring freshness and quality.

Promotion of Typical Products and Made in Italy. Italy's rich food and wine heritage represents a distinctive economic and cultural asset. This strategy focuses on promoting PDO (Protected Designation of Origin), PGI (Protected Geographical Indication), and

Slow Food Presidium products, with the goal of enhancing the international recognition of Made in Italy. Participation in trade fairs, events, and marketing campaigns is encouraged to increase the perceived value of these products. Agri-food companies are also investing in food and wine tourism, offering immersive experiences linked to the production and tasting of local specialties.

Circular Economy and Food Waste Reduction. The circular economy applied to the agri-food sector aims to reduce waste throughout the supply chain. Strategies may include the reuse of agricultural by-products, the transformation of surplus food into new products, and the adoption of biodegradable and compostable packaging. Innovative resource management models are being developed to minimize environmental impact and maximize efficiency. Leading companies are investing in biotechnologies to recover nutrients from waste, transforming them into natural fertilizers or biofuels. These strategies represent the main development pathways for the agri-food sector, with a strong focus on innovation, sustainability, and the promotion of Italy's agri-food heritage.

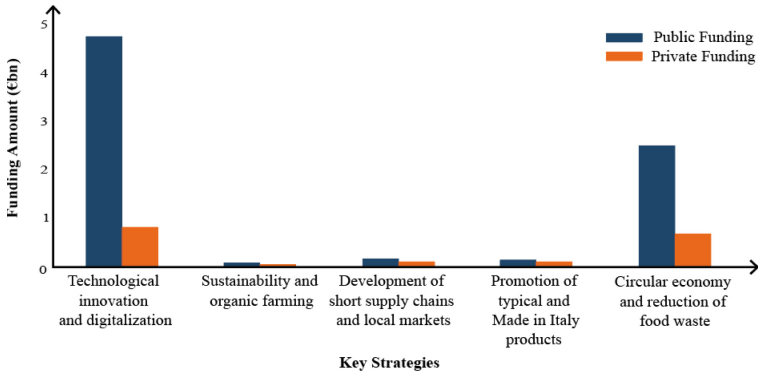


Fig. 6. "Competitiveness of companies" thematic scope: key strategies and related funding (Source: Authors' elaboration on OpenCoesione data consulted on February 2025, processed using AI)

Analyzing the aggregated public and private funding for each key strategy reveals (Fig. 6) that the majority of funds have been concentrated in Technological Innovation and Digitalization and Circular Economy and Food Waste Reduction, with a predominant share coming from public funding. In contrast, the funding allocated to the other key strategies (Sustainability and Organic Farming, Development of Short Supply Chains and Local Markets, and Promotion of Typical Products and Made in Italy) appears to be significantly more limited.

Research and Innovation (Dataset 2)

Based on the themes identified through Topic Modeling with LDA, three main KSA have emerged for the enhancement and development of the agri-food chains and rural development sector:

Production Optimization and Sustainability. This strategy focuses on enhancing agricultural efficiency while reducing environmental impact through precision farming,

circular production models, and renewable energy. Techniques such as crop rotation, organic farming, and IoT-based monitoring optimize resource use and improve sustainability. Digital tools like blockchain ensure supply chain transparency, while public and private investments accelerate the adoption of eco-friendly solutions. Public and private support for these projects is essential to accelerate the adoption of sustainable solutions and enhance the resilience of the agri-food sector.

Product Development and Market Expansion. Innovation in new food products and market expansion is driven by functional, organic, and plant-based foods, responding to changing consumer preferences. Companies may invest in alternative proteins, sustainable packaging, and AI-driven personalized nutrition. In addition, strategies like digital marketing, e-commerce, and international certifications support global competitiveness, with funding helping businesses enter emerging markets and scale innovative solutions. Thanks to public and private funding, agri-food businesses can test new solutions, enter emerging markets, and enhance sector competitiveness, addressing sustainability and global food security challenges.

Technology Integration and Food Safety. Advanced technologies like blockchain, AI, and IoT enhance food safety and quality, ensuring traceability and fraud prevention. Public and private funding enables large-scale adoption, reinforcing global food security. With public and private funding, these innovations can be implemented on a large scale, improving food quality and safety worldwide.

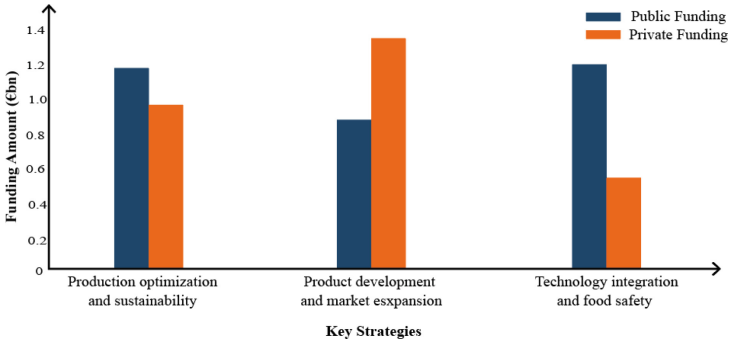


Fig. 7. "Research and Innovation" thematic scope: key strategies and related funding (Source: Authors' elaboration on OpenCoesione data consulted on February 2025, processed using AI)

Analyzing the aggregated public and private funding for each key strategy reveals (Fig. 7) that the most significant investments are directed toward Production Optimization & Sustainability and Product Development & Market Expansion. Notably, private funding plays a dominant role in Product Development & Market Expansion, highlighting strong market-driven interest in this field.

5 Conclusion

Assuming the challenge of shaping a stronger strategy for territorial enhancement—beyond the financing of projects—inner areas can greatly benefit from the support of Academia in multiple ways [2–4, 24]. Previous research [5, 8, 16, 20] demonstrated how academic institutions can effectively help these territories by: (i) addressing the lack of data and information at the municipal level; (ii) identifying opportunities and threats within the territorial context; (iii) developing and sharing coherent design concepts; and (iv) supporting local actors in making strategic decisions within complex frameworks. This study further explores how Academia can contribute to the Strategy-shaping process, especially during the participatory planning, helping local actors articulate actions, priorities and align strategic actions.

Within the "B4R research project", the Polito RU adopted a collaboration-based approach [20]: this not only enabled meaningful knowledge exchange with local actors in Alta Valsesia [13] but also provided a valuable contribution during the territorial engagement formulation of the Valsesia SNAI strategy. While in many cases, strategies and interventions are defined primarily at the political level, the collaborative method used in this context proved particularly effective in the initial stages of local actors' engagement. However, the process fell short of its potential: early drafts of strategic actions and related impacts (including economic effects) showed limited coherence between proposed initiatives, identified vulnerabilities, and actual territorial potential.

This paper focuses on the ongoing process of defining the Valsesia SNAI strategy. It highlights how, starting from lacking thematic scopes identified in Piedmont's 2014–2020 SNAI programmes, past national funding experiences can be analysed to identify relevant typology of interventions and potential financial allocations—thus informing and guiding Local Authorities in enhancing the competitiveness of SMEs in the Agri-food chains and rural development sector.

Despite the wide amount of available national-level data (more than one million records and about 200 variables), the analysis of funded projects cannot rely on open data. A cross-analysis with the underlying strategies is needed, particularly to examine the detailed content within individual project records.

Furthermore, the ministerial classifications used for reporting purposes are not effective in analysing the replicability of actions. Designed primarily for transparency and statistical reporting, they lack the depth needed for strategic insights.

In the two analysed thematic scopes (C*ompetitiveness of companies* and *Research and innovation*), key variables that would be crucial for scaling up actions—such as company size, industry sector, or level of internationalization—are not directly accessible through the existing database. This limitation was addressed using AI, which provided valuable strategic insights (KSA) from the two subsamples, that can effectively inform actions aimed at revitalizing local economies.

By providing a roadmap for evidence-based decision-making, the research demonstrates how AI-driven approaches can enhance policy effectiveness, ensuring that future funding programs align with local development needs. The insights generated from the case study offer valuable lessons for other inner areas facing similar challenges, ultimately contributing to a more strategic and impact-oriented approach to regional policy design.

Future research directions include:

- in the short term: further project-specific studies, particularly final degree projects emerging from the summer school initiative named "Socio-Economic Challenges for Inner Areas and Fragile Territories: a Bridge between Italy and Virginia";
- in the long term: a critical review of the final Valsesia SNAI strategy, followed by authors' methodological structuring of the entire process. This new structuring should move beyond reliance on individual consultants' expertise and instead draw on lessons learned from data, capitalizing on successful experiences already identified as strategic in other fragile areas.

Appendix

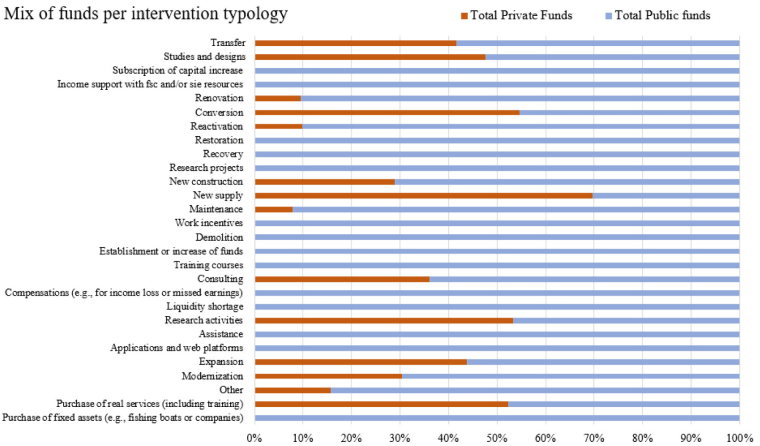


Fig. 8. Dataset 1 - Total public funding and number of interventions per typology (Source: authors' elaboration)

Table 2. Dataset 1 - Interventions and funds split by harmonized category (Source: Authors' elaboration using AI)

CUP_DESCR_CATEGORIA[a]	Total Private funding (M€)	Total Public funding (M€)	Total implemented costs (M€)	Average Funded Amount (€)
Other structures, works, and infrastructures	545 €	1.519 €	908 €	422.143,50 €
Other services for businesses and the community	113 €	679 €	444 €	310.368,90 €
Technologies and innovation (ICT, new materials, energy, good practices, transfer, etc.)	209 €	1.117 €	485 €	264.671 €
Cultural, tourism and recreational services/infrastructures	93 €	525 €	393 €	349.494 €
Agricultural and forestry investments (production, energy, aquaculture, irrigation, etc.)	236 €	952 €	597 €	281.134 €
Health, social, and education services/infrastructure	39 €	168 €	142 €	217.489 €
Training and employment support	24 €	94 €	70 €	178.171 €
Administrative support, governance, technical assistance	6 €	29 €	26 €	141.588 €
University and research	- €	30 €	30 €	30.544.882 €
Environmental protection and energy transition	41 €	217 €	120 €	224.985 €

(*continued*)

Table 2. (*continued*)

CUP_DESCR_CATEGORIA[a]	Total Private funding (M€)	Total Public funding (M€)	Total implemented costs (M€)	Average Funded Amount (€)
Transport and logistics	38 €	453 €	399 €	1.799.569 €
Commerce and industrial support structures	407 €	953 €	1.038 €	166.719 €
Total	**2.574 €**	**7.506 €**	**5.650 €**	**234.740 €**

[a]The following list identifies the new classification, which is more effective than the ministerial one, and specifies which associations have been made to reduce the range of the field CUP_DESCR_CATEGORIA:
Other structures, works, and infrastructures: includes miscellaneous infrastructures, urban furniture, non-specific public works | *Other services for businesses and the community*: groups various support services to SMEs, local authorities, and the public; | *Technologies and innovation*: includes ICT, energy, new materials, transfer of best practices, smart systems; |*Cultural, tourism and recreational services/infrastructures*: combines investments in tourism, culture, leisure, and related infrastructure; | *Agricultural and forestry investments*: covers aquaculture, irrigation, protected crops, forestry, etc.; | *Health, social, and education services/infrastructure*: includes schools, hospitals, social housing, and public health;| *Training and employment support*: all measures for education, training, lifelong learning, and labor market access; | *Administrative support and technical assistance*: includes public administration, evaluations, and institutional transparency; | *University and research*: kept distinct as a strategic sector; | *Environmental protection and energy transition:* includes green infrastructure, renewable energy, environmental protection;
Transport and logistics: roads, ports, rail, logistics and connected infrastructure; | *Commerce and industrial support structures*: investments supporting commerce, industrial areas, business equipment.

Table 3. Datatset 1 - Interventions and funds split by harmonized expenditure category (Source: Authors' elaboration using AI)

OC_DESCR_CATEGORIA_SPESA[a]	Total Public funding (€)	Number of interventions	Average Funded Amount (€)
Other (miscellaneous expenditures and unspecified investments)	2.521 M€	6.555	384.608,30 €
Infrastructure and development for SMEs (including commercial infrastructure, social infrastructure, and urban regeneration projects)	236 M€	82	2.882.386,06 €
Productive investments in SMEs (including energy efficiency, research, and business support services)	1.107 M€	1.421	779.371,41 €

(*continued*)

Table 3. (*continued*)

OC_DESCR_CATEGORIA_SPESA[a]	Total Public funding (€)	Number of interventions	Average Funded Amount (€)
Research, innovation, and entrepreneurship support for SMEs	1.626 M€	1.037	1.568.415,13 €
Investments in enterprises directly connected to research and innovation	497 M€	32	15.539.726,40 €
Cluster and business network support (mainly for SMEs)	73 M€	200	364.146,81 €
Support for environmentally sustainable production processes in SMEs	1 M€	4	365.284,72 €
Self-employment and entrepreneurship support	104 M€	1.316	78.824,55 €
Development and promotion of tourism, cultural, and creative industries	203 M€	1.945	104.318,05 €
Total	**7.506 M€**	**31.976**	**234.739,64 €**

[a]The following list identifies the new classification, which is more effective than the ministerial one, and specifies which associations have been made to reduce the range of the field OC_DESCR_CATEGORIA_SPESA:
Support for research, innovation, and SMEs: included incentives, support measures, and innovation-related assistance; | *Research and innovation activities*: combined R&D activities from public and private research centers, including networking; | *Research and innovation infrastructures*: merged public and private research infrastructures, including science parks and healthcare facilities; | *Investments in research infrastructure and equipment*: unified investments in research-related infrastructure for SMEs and large enterprises; | *Productive investments and technology transfer*: combined investments in productive activities and technology transfer initiatives; | *Research and innovation processes*: merged innovation activities in SMEs and large enterprises, including technology transfer and cooperation; | *Support for clusters and business networks*: consolidated all measures related to business clusters and networks; | *Higher education and skills development*: grouped all initiatives aimed at improving education and workforce skills; | *Urban and rural regeneration*: kept as a distinct category.

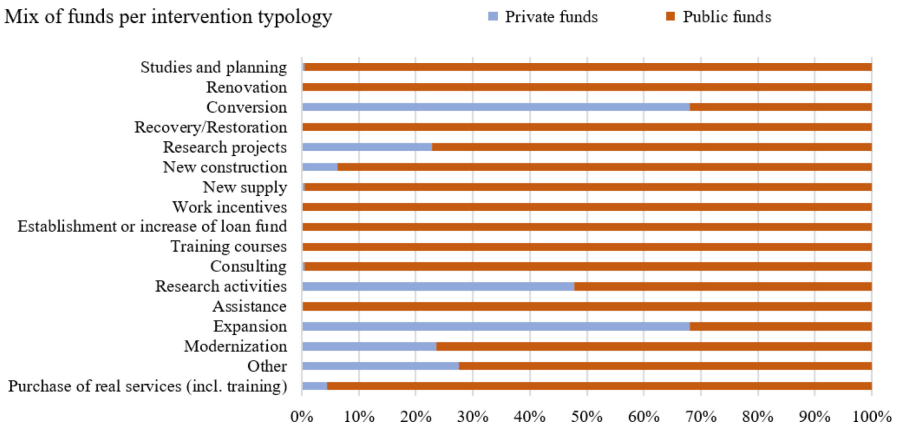


Fig. 9 - Dataset 2 - Percentage of private and public funds per intervention's typology (Source: authors' elaboration)

Table 4. Dataset 2 - Interventions and funds split by harmonized categories (Source: Authors' elaboration using AI)

CUP_DESCR_CATEGORIA[a]	Total Private funding (M€)	Total Public funding (M€)	Total implemented costs (M€)	Average Funded Amount (€)
Other research and technologies (chemical, mechanical, general)	1.950 €	3.983 €	2.946 €	534.929 €
Biotechnologies and health (human health, medical research, healthcare innovation)	134 €	435 €	90 €	647.057 €
Environment and territory (protection, exploration, planning)	93 €	282 €	62 €	881.136 €
Innovation, production, and technology transfer	254 €	864 €	474 €	351.023 €
Industrial, agricultural, and energy production technologies	154 €	665 €	288 €	1.080.764 €

(*continued*)

Table 4. (*continued*)

CUP_DESCR_CATEGORIA[a]	Total Private funding (M€)	Total Public funding (M€)	Total implemented costs (M€)	Average Funded Amount (€)
Experimentation, diversification, and product validation	30 €	72 €	19 €	507.455 €
Advanced technologies (aerospace, materials, telecommunications, IT)	222 €	562 €	104 €	703.396 €
Total	**2.697 €**	**6.150 €**	**3.722 €**	**588.948 €**

[a]The following list identifies the new classification, which is more effective than the ministerial one, and specifies which associations have been made to reduce the range of the field CUP_DESCR_CATEGORIA:
Other research and technologies: grouped chemical, mechanical, and general research technologies; | *Biotechnologies and health*: merged biotechnology, general health, and healthcare innovation; | *Environment and territory*: combined protection, exploration, and environmental planning.; | *Innovation, production, and technology transfer*: unified innovation processes and technology transfer activities; | *Industrial, agricultural, and energy production technologies*: consolidated production technologies related to industry, agriculture, and energy; | *Experimentation, diversification, and product validation*: grouped activities related to product experimentation and development; | *Advanced technologies*: integrated aerospace, materials, telecommunications, and IT technologies.

Table 5. Dataset 2 - Interventions and funds split by harmonized expenditure category (Source: Authors' elaboration using AI)

OC_DESCR_CATEGORIA_SPESA[a]	Total Public funding (€)	Number of interventions	Average Funded Amount (€)
Support for research, innovation, and SMEs	438.341.284 €	1.063	412.362 €
Research and innovation activities in public and private centers (including networking)	3.026.802.632 €	3.838	788.641 €
Research and innovation infrastructures (public and private, including science parks and healthcare)	388.878.991 €	161	2.415.397 €
Investments in research-related infrastructure and equipment (SMEs and large enterprises)	436.627.900 €	1.015	430.175 €

(*continued*)

Table 5. (*continued*)

OC_DESCR_CATEGORIA_SPESA[a]	Total Public funding (€)	Number of interventions	Average Funded Amount (€)
Productive investments and technology transfer for SMEs and enterprises	435.807.277 €	902	483.157 €
Research and innovation processes in SMEs and large enterprises	879.855.964 €	2.242	392.442 €
Support for clusters and business networks (mainly benefiting SMEs)	591.233.222 €	803	736.280 €
Improving higher education to increase participation and education levels	38.698.818 €	111	348.638 €
Urban and rural regeneration	915.049 €	2	457.525 €
Total	**6.149.796.392 €**	**10.442**	**588.948 €**

[a]The following list identifies the new classification, which is more effective than the ministerial one, and specifies which associations have been made to reduce the range of the field OC_DESCR_CATEGORIA_SPESA:
Support for research, innovation, and SMEs: included incentives, support measures, and innovation-related assistance; | *Research and innovation activities*: combined R&D activities from public and private research centers, including networking; | *Research and innovation infrastructures*: merged public and private research infrastructures, including science parks and healthcare facilities; | *Investments in research infrastructure and equipment*: unified investments in research-related infrastructure for SMEs and large enterprises; | *Productive investments and technology transfer*: combined investments in productive activities and technology transfer initiatives; | *Research and innovation processes*: merged innovation activities in SMEs and large enterprises, including technology transfer and cooperation; | *Support for clusters and business networks*: consolidated all measures related to business clusters and networks; | *Higher education and skills development*: grouped all initiatives aimed at improving education and workforce skills; | *Urban and rural regeneration*: kept as a distinct category.

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