

FUTURE OF SUSTAINABILITY

Bari, 11-12 September 2025



FUTURE OF SUSTAINABILITY
BARI 2025

ABSTRACT BOOK

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ABSTRACT BOOK: FUTURE OF SUSTAINABILITY
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10:00 – 10:30	Invited Lecture – **Salvo Ingrassia** – *Local and overall R-squared measures for mixtures of regression models and applications to tourism data (Department of Economics and Business, University of Catania)*
10:30 – 11:00	COFFEE BREAK
11:00 – 12:00	**C1 – Combating Financial Crime: From National Strategies to European Cooperation** Organizers: Paolo Mariani and Marco Riani • Stefano Cosimo De Braco (Deputy Chief of Staff, General Command of the Guardia di Finanza) – *The Role of the Guardia di Finanza in the Prevention of Criminal Phenomena* • Marco Tolla (Brigadier General, Head of the Innovation and Development Analysis Office, VII Division) – *Development of Synthetic Indicators for the Prevention of Criminal Phenomena* • Domenico Perrotta (Joint Research Centre, European Commission), Jurgen Marke (European Anti-Fraud Office) – *The Role of the JRC and OLAF in Anti-Fraud Activities*

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15:00 – 16:00	**C4 – Synthetic Indicators of Social Sustainability** Organizer: Venera Tomaselli; Discussant: Corrado Crocetta • Alessandro De Cristofaro (Department of Economics and Business, University of Catania, IT) – *Cultural Participation and Subjective Well-Being: The Role of Social Capital as a Moderator* • Venera Tomaselli, Cinzia di Nuzzo, Gianpiero Torrisi (Department of Economics and Business, University of Catania, IT) – *Integrating Latent*

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10.30 – 12:00	**C9 – Indicators and methods for measuring tourism phenomena** Organizer: Antonella Massari Discussant: Venera Tomaselli • Marco Antonioli – *Journey to the sea. How seaside and nautica tourism in Apulia and Italy are changing.* • Tomaselli Venera, Giammanco Maria Daniela – *What indicators to measure the social sustainability of tourism? An SDGs-based classification of STIs.* • Paola Perchinunno, Antonella Massari, Corrado Crocetta, Samuela L'Abbate – *Territorial Clustering Techniques for the Analysis of Tourism Sustainability in Puglia* • Garau Giorgio, Antolini Fabrizio, Cesarini Samuele – *A new integrated methodological approach to determining the economic impact of tourism on the Italian economy* • Antonella Bianchino, Daniela Fusco, Salvatore Coppola – *Indicators of social sustainability of tourism in big cities* • Angela Bergantino, Marco Fortunato, Fabio Aiello, Giovanni Bonaccolto, Marina Bonaccolto, Toepfer, Vincenzo Fasone, Vincenzo Marinello, Giulio Pedrini, Raffaele Scuderi, Vladislava Stankova, Emily Alaimo, Vincenzo Conti – *Composite indicators for Tourism-related spatial data. A Machine Learning approach*
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14:00 – 15:00	**C11 – Mathematical and Statistical Tools for Measuring Sustainability** Organizer: Leonardo Alaimo • M. Cavicchioli, U. Kocollari, F. Demaria, F. Bertacchini – *Measuring to Share, Sharing to Transform: Knowledge in Action for Circular Business Practices* • Steven Mphaya, Marialuisa Restaino, Marcella Niglio, Michele La Rocca – *Trends and Disparities in ESG Performance: A Country-level Comparative Analysis* • Samuela L'Abbate, Paola Perchinunno, Antonella Massari – *Unsupervised Density-Based Methods for Interpreting Sustainability Data* • Massimiliano Giacalone, Gianfranco Piscopo, Massimo Dimo, Berardino Iula, Davide Scintu, Angelo Romano, Vito Santarcangelo – *New Mathematical Models for Mobile Cartographic Tracking* • Leonardo Alaimo – *Math4Sustainability: A project to engage young students with environmental sustainability issues through quantitative tools*
15:00 – 16:00	**C12 – Academic Session in Tribute to Franco D'Ovidio** Organizer: Corrado Crocetta & Ernesto Toma • Mariani, Marletta, Pirotta – *Soft Skills in the Labour Market: Time Trajectories and Evolving Requirements in Tourism Professional Profiles* • Grassia, Cataldo, Zavarone – *Growth-Curve Hierarchical PLS-PM: Measuring Composite Well-Being Indicators* • Ernesto Toma, Angela Maria D'Uggento, Ilaria Pepe – *What dimensions shape student satisfaction with Teaching? Insights from the University of Bari* • Adeel Ahmed, Corrado Crocetta, Furio Camillo, Paola Perchinunno, Samuela L'Abbate, Antonia Cofano, Antonella Massari, Venera Tomaselli, Rosanna Cataldo, Maria Gabriella Grassia, Laura Antonucci, Giulio Giacomo Cantone – *Social sustainability in Italy: Trust x Satisfactiopn via Random Forest*
16:00 – 17:00	**C13 – Perspectives and Challenges of Contemporary Tourism** Organizer: Tonio Di Battista & Eugenia Nissi • Margaret Antonicelli – *Modelling the Geographies of Care: A Multivariate Approach to the Sustainability of Medical Tourism* • Annalina Sarra, Adelia Evangelista, Eugenia Nissi, Tonio Di Battista – *Visitor Experience and Profile-Based Segmentation in Natural Protected Areas: A Case Study in the Majella National Park* • Alessandro D'Alcantara, Angelo Romano, Michele Di Lecce, Vincenzo Ribaudo, Davide Scintu, Giulio Setzu, Sergio Vitullo, Marco Vito Calciano, Vito

SEPTEMBER 12TH, 2025

Time	Activity
	Santarcangelo – *Coralvision: A New Bottom-Up Approach for Tourism Enhancement* • Nuria Huete-Alcocer, Miguel Ángel Valero-Tévar – *Analysis of the Key Types of Loyalty for the Local Economy and Sustainability in World Heritage Cities: Passive and Active Attitudinal Loyalty and Behavioral Loyalty* • Nuria Huete-Alcocer, Miguel Ángel Valero-Tévar – *Investment in archaeological heritage and sustainable territorial development: analysis of four sites in Castilla-La Mancha (Spain)*
17:00 – 18:00	**C14 – Innovations and Insights from Tourism Entrepreneurs** Organizer: Ettore Ruggiero The session will feature experts from the tourism sector involved in the PRIN project *The Future of Sustainability* (CUP Code: H53D23009470001, Project Code: P2022B3NFH). The concluding remarks will be delivered by Federico Amedeo Lasco, Directorate-General for Promotion, Investment and Innovation, Ministry of Tourism, who will provide a synthesis of the presentations in light of the Ministry's strategic objectives.
CONCLUSION OF THE CONGRESS	

C1.

Combating Financial Crime: From National Strategies to European Cooperation

Conveners & Chairpersons

Paolo Mariani (University of Milano)

Marco Riani (University of Parma)

Combating Financial Crime: From National Strategies to European Cooperation

Paolo Mariani[1], Marco Riani[2], Corrado Crocetta[3]
([1]University of Milano;[2]University of Parma, [3]University of Bari "Aldo Moro")

Fraud detection in large datasets is often hampered by the presence of noise, outliers, and masked anomalies that distort classical statistical methods. To address these challenges, we employ robust regression and multivariate techniques, with particular emphasis on Robust Principal Component Analysis (RPCA). Unlike standard PCA, RPCA resists the influence of atypical observations, thereby capturing the true underlying data structure. This allows for a more accurate identification of unusual transactions that deviate from the majority behavior. We develop diagnostic measures based on robust score distances and orthogonal distances, enabling effective separation of regular from fraudulent activities. The methodology is applied to high-dimensional transaction data, where robust components reveal hidden patterns masked under conventional approaches. Simulation studies confirm that RPCA achieves higher detection power in contaminated environments. Our approach contributes to building harmonized, data-driven tools to strengthen cross-border fraud detection and a reliable framework for enhancing fraud detection systems in complex datasets.

Keywords: Fraud Detection; Robust Principal Component Analysis; Outlier Resistance; High Dimensional Data; Transaction Monitoring

C2.

New Statistical Approaches to Sustainability Assessment

Conveners & Chairpersons

Agostino Stavolo (University of Naples Federico II)

Green Surgery: bridging the gap between clinical quality and environmental sustainability

*Maria Gabriella Grassia[1], Salvatore Massa[2], Camilla Massa[2], Simone Paesano[1], Francesca Paola Pastena[3], Dario Sacco[1], Agostino Stavolo[*1]*

([1]University of Napoli Federico II;[2]A.O.R.N. Caserta, [3]Campus Bio-Medico of Rome)

As environmental sustainability becomes a growing priority across sectors, the surgical field is increasingly called to address the ecological impact. Surgical procedures are among the most resource-intensive activities in healthcare, involving substantial energy consumption, extensive use of disposable materials, and high volumes of waste. In this context, green surgery (GS) has emerged as an area of innovation and concern, aiming to reduce the environmental footprint of surgical care while safeguarding clinical efficacy and patient safety. This paper presents a comprehensive bibliometric analysis of the emerging field of Green Surgery, aiming to map the current state of research, identify key contributors, and outline future directions toward sustainable surgical practices. Drawing on 2,720 bibliographic records from the Web of Science (2013–2024), we analyze publication trends, authorship patterns, institutional and national productivity, and thematic developments. The results show a sharp increase in GS publications, with a growing international collaboration rate (22.2%) and significant contributions from China, the United States, and the United Kingdom. The findings indicate a notable shift in scholarly focus: early studies primarily addressed technical aspects such as waste segregation and operating room efficiency, while more recent contributions emphasize broader sustainability frameworks. Central topics include the transition from single-use to reusable instruments, circular economy principles, carbon footprint reduction, and the development of hospital-wide sustainability strategies. The analysis also reveals a fragmented research field, with limited cross-institutional collaboration and a need for stronger theoretical integration. Our findings highlight the interdisciplinary nature of GS research and emphasize the need for systemic change supported by policy, innovation, and cross-sector collaboration. As global health systems strive to reduce their environmental impact, GS emerges as a vital pathway for aligning high-quality care with ecological responsibility.

Keywords: Green Surgery; Environmental Sustainability; Carbon Footprint; Circular Economy; Bibliometric Analysis

Building a multilevel Frailty Index to monitor individual vulnerability: a health sustainability approach from SHARE

Dario Sacco[*], *Simone Paesano, Marina Marino, Maria Gabriella Grassia*
(University of Napoli Federico II)

In the framework of sustainability science, the ability of individuals to maintain health, autonomy, and social inclusion throughout the life course represents a fundamental prerequisite for equitable, forward-looking, and resilient public planning. Within this perspective, health sustainability emerges as a central concern, drawing attention to the individual and territorial determinants that shape the well-being of the ageing population. This contribution presents a preliminary study aimed at constructing a composite index of individual frailty, conceived as a synthetic and multidimensional measure of personal vulnerability, assessed across four latent dimensions: physical, medical, functional, and psychological. The index is developed using data from Wave 9 of the SHARE survey (Survey of Health, Ageing and Retirement in Europe), with the objective of providing a comparable and updateable tool for assessing frailty across different territorial and temporal levels. In this instance, we present a preliminary version of the platform developed specifically for the Italian context. The project is structured around three main pillars: (1) the development of a multilevel frailty index (FI); (2) the comparison of two aggregation strategies, Structural Equation Modeling (SEM) and the Mazziotta–Pareto Index (MPI); and (3) the progressive implementation of an open digital infrastructure, aligned with FAIR principles and the goals of FOSSR, designed to enhance data accessibility, support research dissemination, and foster evidence-based policy monitoring.

Keywords: Health Sustainability; Frailty Index; Ageing Population; Structural Equation Modeling; FAIR Principles

Exploring the Relationship Between Socio-Demographic Factors and Seasonality: Towards a More Sustainable Tourism

Ludovica Venturella, Stefano De Cantis, Full Professor
(University of Palermo)

The seasonality of tourist demand is a widely explored topic in the literature, with numerous studies seeking to quantify its intensity and identify its underlying causes. In general, the determinants of seasonality are classified into push and pull factors.

This study considers socio-demographic characteristics as push factors associated with the seasonal behavior of tourists. Specifically, this preliminary study seeks, on the one hand, to examine the seasonality of tourist demand in Italy and, on the other hand, to investigate its relationship with travelers' sociodemographic characteristics, including age, educational level, and employment status.

The data used come from the ISTAT survey "Trips and Holidays", which considers the movements of residents within Italy and abroad. The analysis focuses on 2018, 2019, 2022, and 2023, excluding 2020 and 2021 due to the strong impact of COVID-19 restrictions. Some preliminary results obtained through logit models highlight, in particular, the importance of the variable "education level" with significant results.

The work aims to be included among those useful for mitigating the effects of seasonality, starting with the study of the relationship between sociodemographic variables and the tendency to travel in high or non-high season. This could lead, in a subsequent phase, to the definition of strategies aimed at improving and promoting the economic, social, and environmental sustainability of destinations.

Keywords: Seasonality, socio-demographic characteristics, sustainability, tourism demand

Redefining Work: Assessing Job Quality in EU Countries

Giovanni De Luca, Antonella Rocca, Claudio Quintano*
(University of Naples Parthenope)

Despite the rising employment rates of recent years, the quality of jobs has not improved and, in some cases, even declined in most countries, attracting considerable attention from both academic researchers and international institutions. While employment levels have recovered or even exceeded pre-crisis thresholds in many cases, the nature of the jobs created often reflects a structural shift towards precarious, low-paid, and unstable forms of work. Several interconnected factors help explain this trend. First, globalization and technological change have intensified competition and deepened labor market polarization, reducing the demand for middle-skilled jobs while expanding both high-skill and low-skill employment (OECD, 2023). Second, the spread of non-standard employment contracts—such as temporary, part-time, or gig work — has eroded job security and limited workers' access to social protection (ILO, 2022; Standing, 2011). Third, the weakening of labor market institutions, including trade unions and collective bargaining, has further diminished workers' bargaining power, exacerbating wage stagnation and inequality (Eurofound, 2022). The consequences of this deterioration in job quality are multifaceted. Wage stagnation and the growth of in-work poverty have emerged as significant challenges, particularly in sectors where low pay is combined with unstable employment contracts (ILO, 2019; Eurofound, 2022). At the same time, job insecurity and unpredictable work schedules contribute to psychological distress, lowering overall job satisfaction and increasing levels of stress and burnout (Gallie, 2013). These labor market dynamics have also reinforced social inequalities, widening the gap between workers in stable, well-paid positions and those trapped in precarious employment with no clear prospects for career progression (OECD, 2011; Giupponi & Machin, 2024). Moreover, the erosion of job quality has broader socio-economic repercussions, including reduced social mobility, declining trust in institutions, and the rise of populist political sentiments (Standing, 2014). This complex interplay of economic, institutional, and social factors demonstrates that employment rates alone are insufficient indicators of labor market quality. Comprehensive understanding instead requires examining job quality, security, and remuneration, alongside their impacts on workers' well-being and social cohesion. Addressing these challenges needs robust policy interventions aimed at strengthening labor protections, promoting fair wages, and ensuring inclusive access to social security systems. The study of job quality is not easy, as it is a multidimensional concept encompassing various aspects, such as fair remuneration, safety, security, adequate work–life balance, and subjective satisfaction. Each of these dimensions can be difficult to measure, as multiple elementary indicators may be used for this purpose. Given the numerous and heterogeneous factors contributing to the notion of job quality — particularly in cross-country comparisons — its assessment is challenging. For this reason, this paper applies the composite indicator methodology. According to Hammond et al., composite indicators are "something that provides a clue to a matter of larger significance or makes perceptible a trend or phenomenon that is not immediately detectable" (OECD, 2008). In this study, the Principal Component Analysis (PCA) is used to synthesize individual indicators into the pillars, while the aggregation of these pillars into a single composite indicator follows different methods for robustness and sensitivity analyses needs (arithmetic and geometric mean, the Wroclaw taxonomic approach, the Borda's rule, and the Condorcet's majority rule, adapted, these latter two, from game theory). The procedure follows the steps suggested in the OECD Handbook (OECD, 2008) and subsequently refined by Paruolo et al. (2013).

The data for this analysis are drawn from Eurostat and OECD databases, supplemented in some cases by ad hoc elaborations on Eurostat Labour Force microdata. The results highlight the leading performance of

Scandinavian countries in terms of job quality, which occupy the top of the rank in terms of composite indicator (Denmark first, the Netherlands third, Sweden fifth, and Finland sixth), alongside Slovenia in second position and Belgium in fourth. Conversely, some Mediterranean countries such as Cyprus, Greece, and Spain — and Romania — occupy the bottom ranks. Surprisingly, Italy stands just above the middle of the ranking, ranking 16th among the EU-27 countries. An analysis by pillar, combined with the interpretation of the main PCA components used to synthesize the indicators into the pillars, helps identify the key factors influencing these rankings and guides the most effective policies to improve employees' working conditions.

Keywords: Job Quality; Precarious Employment; Labor Market Polarization; Composite Indicator; Principal Component Analysis (PCA)

Comparing Methods for Measuring Sustainable Tourism in Italy

Grassia Maria Gabriella[1], Marino Marina[1], Mazza Rocco[2], Cataldo Rosanna[1], Stavolo Agostino[1]*
([1]University of Naples Federico II, [2]University of Bari Aldo Moro)

Tourism is one of the most dynamic and strategic sectors of the global economy, playing a crucial role in promoting sustainable regional development. It offers significant potential for inclusive growth, particularly in peripheral and rural areas. However, due to the inherently multidimensional nature—spanning economic, environmental, and social dimensions—assessing tourism sustainability requires integrated and robust analytical tools to support evidence-based policymaking. Despite growing interest from both academic and institutional stakeholders, there remains a lack of standardized, scalable frameworks capable of capturing the full complexity of tourism sustainability. This study addresses this gap by developing a composite indicator tailored to monitor sustainable tourism across Italy's 20 regions. Specifically, it aims to reconstruct the sustainable tourism indicator—originally based on the Mazziotta-Pareto Index (MPI) method—by applying the Partial Least Squares Path Modeling (PLS-PM) approach within a multidimensional framework. The analysis incorporates environmental, economic, and social components, enabling a direct comparison between the MPI and PLS-PM methodologies.

Keywords: Sustainable Tourism; Regional Development; Composite Indicator; Mazziotta-Pareto Index; Partial Least Squares Path Modeling

C3.

Mapping and Measuring the Impact of Academic Health Science Research on Patient Care: Insights from the SciK-Health (2022825Y5E) and Healthcare Outcomes (P2022RF38Y) projects

Conveners & Chairpersons

Massimo Aria (University of Naples Federico II)

SciK-Health: Exploring Diseases, Experts, and Research Centres with One Question

Aria Massimo[1], Cuccurullo Corrado[2], D'Aniello L. [1], Spano Maria[1]., Alabiso C. [1]
([1]University of Naples Federico II, [2]University of Campania Luigi Vanvitelli)

The SciK-Health Web App is the main product of the PRIN 2022 project "Scientific Knowledge in Health", designed to transform the scientific production of Italian public Academic Health Science Centres (AHSCs) into actionable knowledge for citizens, professionals, and policymakers. Through an integrated data pipeline, spanning bibliometric records, clinical trials, patents, and grants, the app provides a unified, role-based dashboard that allows users to explore the Italian health research ecosystem with a single query.

SciK-Health enables the discovery of disease-related expertise, institutional profiles, and innovation trends. Users can navigate a dynamic interface that synthesizes complex data into interpretable visualizations, helping identify centres of excellence, leading researchers (i.e., medstars), and patterns of collaboration and funding. Designed to support informed decision- making and foster transparency, the app stands as a novel digital tool at the intersection of health research, open science, and public engagement.

Keywords: Health Research; Open Science; Bibliometrics; Digital Dashboard; Public Engagement

Scientific Knowledge and Healthcare Quality: A Multidimensional Assessment of 49 Italian Academic Health Science Centres

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([1]University of Rome La Sapienza, [2]University of Napoli Federico II)

This study contributes to the Scientific Knowledge in Health (SciK-Health) project, a national research initiative funded under the PRIN 2022 programme. The project explores the impact of scientific production on the quality and effectiveness of patient care within the Italian healthcare system, with a particular focus on Academic Health Science Centres (AHSCs). These centres, characterized by diverse governance models and institutional arrangements, represent a complex field of analysis. We examine 49 public AHSCs located in both metropolitan and smaller urban contexts, which vary significantly in their organizational configurations and in the nature of the hospital–university linkage. To assess and compare their performance and scientific integration, we develop composite indicators using a range of methodological approaches. These synthetic indices aim to capture multidimensional aspects of the centres' structure and output, offering a tool for understanding the relationship between scientific activity and healthcare delivery across heterogeneous institutional settings.

Keywords: Health Science Centres; Scientific Knowledge; Healthcare Performance; Composite Indicators

Does clinical research improve the quality of care? Evidence from Italy.

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This study examines an often-overlooked dimension in quality assessment models: the institutional mission of healthcare providers. While some institutions are deeply engaged in clinical research, others are exclusively focused on delivering patient care. It is therefore reasonable to expect that diOerences in core missions may be associated with variations in healthcare quality. The analysis proceeds in two steps. First, it explores the empirical relationship between research intensity and quality indicators, testing whether a research-oriented mission is linked to better healthcare outcomes. Second, it compares quality indicators between research-focused and care-focused providers to identify potential heterogeneity related to institutional orientation. The study integrates data from Academic Health Science Centers (AHSCs) - including measures of research intensity - with information from the Italian National Outcomes Program (Programma Nazionale Esiti, PNE), which provides a range of indicators on health outcomes. The findings offer new insights into the added value of clinical research, enhancing our understanding of how the institutional mission of healthcare providers shapes the quality of care.

Keywords: Healthcare Quality; Institutional Mission; Academic Health Science Centres; Research Intensity; Italian National Outcomes Program

Governance and Performance of Academic Health Science Centers. Insights from a qualitative study in Italy

Belfiore Alessandra[1*], *Cuccurullo Corrado*[2]
([1]Pegaso University, [2]University of Campania Luigi Vanvitelli)

In contemporary health systems, Academic Health Science Centers (AHSCs) must integrate care, research, and education to remain sustainable. Yet, this "triple mission" entails complex challenges often neglected in planning and assessment. The Sci-K-Health project explored these issues through three components: a scientometric analysis of 200,000 Italian AHSC publications (2000–2024), a nationwide survey of CEOs (n=49, 14 responses), and interviews with four CEOs from diverse contexts. Results highlight that functional integration across missions is neither automatic nor uniform, requiring new governance models based on horizontal collaboration. Current evaluation frameworks overlook the added value of academic integration, and regulatory misalignments hinder effective synergies. The study advocates for a renewed national framework that formally supports AHSCs'; integrative role, emphasizing their capacity for rapid, high-impact responses—particularly evident during the COVID-19 pandemic.

Keywords: Academic Health Science Centres; Triple Mission; Health System Sustainability; Governance Integration; Scientometric Analysis

Research and Innovation in Italian Academic Health Science Centres: A Comparative Analysis of Composite Indicators

Lombardo Rosaria[1], Camminatiello Ida [1], Cuccurullo Corrado[1]*
([1]University of Campania Luigi Vanvitelli)

This study presents an exploratory analysis of the performance of Italian Academic Health Science Centres (AHSCs) in 2024, focusing on the construction of a composite indicator (Greco et al., 2019; OECD, 2008) using five different aggregation methods: the arithmetic mean, the Mazziotta–Pareto index, the weighted arithmetic mean (with weights derived from PCA component loadings), the geometric mean, and Data Envelopment Analysis (DEA). These methods yield five aggregate indicators which can be interpreted as synthetic measures of research and innovation performance. The study evaluates their behaviour, reliability, and discriminative power through multiple exploratory analyses, including assessments of internal consistency and coherence, redundancy and multicollinearity, partial least squares regression (Wold, 1966), comparisons and visualisations of ranking stability of AHSCs across the five indicators using cubic splines and heatmaps (Wilkinson and Friendly, 2009). The key research and innovation performance dimensions considered in the construction of the composite indicator - each represented by specific sub-indicators – are: Research output (research publications), Experiments (clinical research activities), Funding and grants, and research Impact. These are summarised under the acronym REFI, representing distinct yet complementary dimensions of scientific and clinical productivity. Each thematic performance dimension corresponds to a group of indicators derived from OpenAlex and other integrated data sources. The REFI composite indicators are constructed using data from the SciK-Health project datasets (https://massimoaria.github.io/scikhealth/description.html).

Keywords: SciK-Health project datasets; Italian Academic Health Science Centres Assesment; Composite Indicators; Exploratory Analysis.

C4.
Synthetic Indicators of Social Sustainability

Conveners & Chairpersons

Venera Tomaselli (University of Catania)

Corrado Crocetta (University of Bari Aldo Moro)

Cultural Participation and Subjective Well-Being: The Role of Social Capital as a Moderator

Alessandro De Cristofaro

(University of Catania)

This paper aims to contribute to the existing literature on the relationship between cultural participation and subjective well-being. Using regional data from Italy, it examines how cultural participation influences various domains of subjective well-being, differentiating between its general impact on life satisfaction and its specific effects on two other domains, namely satisfaction with friendship relations and with leisure time. The relationship is further analyzed by considering the moderating role of social capital, measured through factor analysis. This is complemented by the examination of the effects of engagement in specific cultural activities, including cinema, theater, classical music concerts, pop music concerts, and sport events. The study draws on a balanced panel dataset covering 2011–2022. A fixed-effects model is employed to control for regional heterogeneity. The results confirm a consistent positive association between cultural participation and subjective well-being across all three domains considered, with particularly strong effects observed on satisfaction with leisure time. Although the overall effect of social capital is limited, its moderating role emerges clearly for certain forms of participation - such as cinema, popular music concerts, and sports events - especially in relation to satisfaction with friendship relations. These findings suggest that cultural participation is not only a personal experience, but also a socially embedded one, shaped by the broader relational context. This underscores the importance of fostering both cultural access and social cohesion, and of designing policies that consider their interplay in enhancing well-being.

Keywords: SciK-Health project datasets; Italian Academic Health Science Centres Assesment; Composite Indicators; Exploratory Analysis.

Integrating Latent Structures for Measuring Social Sustainability

Cinzia Di Nuzzo[1], Venera Tomaselli[1], Gianpiero Torrisi[1]

([1]University of Catania)

Measuring social sustainability is a complex task that requires the integration of multidimensional data. This study proposes an innovative methodological framework based on a Laplacian factorisation model to construct composite indicators from socio-economic datasets. The approach begins with a data matrix $X \in R^{n \times p}$, where *n* denotes the statistical units (e.g., municipalities) and p represents observed variables (e.g., cultural, educational, and social indicators). The method simultaneously captures latent structures among both variables and units through spectral embeddings derived from normalised graph Laplacians. The similarity is modelled via a kernel function, followed by spectral decomposition to obtain latent factors.

Keywords: Spectral decomposition, Laplacian embedding, latent factors

Measuring social cohesion in Italy: from theoretical framework to statistical model through survey data

Alessandra Allini, Irene Ariante, Raffaela Casciello, Marco Maffei, Pasquale Sarnacchiaro, Annamaria Zampella

(University of Naples Federico II)

Social cohesion is a complex and multidimensional phenomenon; its measurement requires a rigorous methodological approach capable of fully capturing its complexity and various facets. Among the statistical methodologies proposed in the literature for quantifying social cohesion, the hierarchical composite indicator represents a valid alternative as it can synthesize the different dimensions of the phenomenon into a single, representative measure. Composite indicators are derived from the aggregation of multiple individual indicators, each capable of capturing distinct aspects of the complex phenomenon that cannot be directly observed or adequately quantified by a single measure (Greco et al., 2019). This method thus allows for the synthesis of a vast amount of information into a single indicator, based on a conceptual framework that reflects the structure of the measured phenomenon (Maggino, 2017). This analysis aims to provide an articulated and multi-level representation of social cohesion through the integrated use of descriptive statistical techniques and the construction of a multidimensional composite indicator. The empirical investigation involved three distinct groups—citizens, companies, and public administrations—in order to capture different and complementary perspectives on the concept of cohesion. An additional key aspect of the analysis concerns the exploration of differences in the perception of social cohesion among groups with different characteristics, with the purpose of highlighting any gaps, inequalities, or specificities that may emerge within the Italian social and economic fabric. This focus on disaggregating the results allows for a deeper understanding of the underlying dynamics of the phenomenon and provides more targeted guidance for potential policy interventions.

Keywords: Statistical survey, companies, citizens, and public administration, social cohesion in Italy

Indicators of gender diversity: a proposal for Life Sciences Firms

Laura Benedan[1], Cinzia Colapinto[2], Paolo Mariani[1], Laura Pagani[1], Mariangela Zenga[1]

([1]University of Milano-Bicocca, [2] University of Venice)

Diversity and inclusion in corporate settings drive both social justice and business performance. In the life sciences sector, women represent a significant share of the workforce yet remain underrepresented in leadership roles. This study investigates gender inclusion in Italian life sciences firms using survey data, financial records, and web-based information.

Gender disparities in the labour market remain a critical issue. Previous research shows that gender quotas and corporate diversity policies can shape workforce composition and influence company performance. Drawing on a survey of HR professionals, combined with insights from the AIDA database and corporate website analysis, we construct a composite index to measure gender equality efforts.

Our findings reveal significant variation in gender inclusion practices across firms of different sizes and ownership structures. Foreign and multinational companies tend to adopt more progressive policies, while smaller, independent firms lag behind. The composite index thus serves as a valuable tool for benchmarking, future research, and corporate self-assessment.

Keywords: Gender gap, life sciences, labour market, inclusion, statistical indicators, data integration.

Exploring Uncertainty in Formative Models of Social Sustainability Indexes: The Approach of Multiverse Analysis

Venera Tomaselli[1], *Giulio Giacomo Cantone*[1]

([1]University of Catania)

The traditional use of the Gross Domestic Product (GDP) as the main measure of socio-economic development has come under increasing scrutiny, especially for its failure to address crucial aspects of sustainability such as social equity and environmental health. New methodologies have emerged in response to this, seeking to measure sustainability through composite indices built from key performance indicators. Among these, formative models represent a conceptual and methodological shift, treating indicators as defining components of the construct itself rather than assuming an underlying latent construct. However, the construction of such indices involves a range of methodological decisions, such as weighting, normalization, and aggregation rules, which can significantly affect the outcomes. A Multiverse Analysis framework is used in this study to explore how different formative model specifications impact the measurement of social sustainability across different territories. Instead of a single deterministic ranking being produced, a distribution of possible rankings for each territory is generated by the multiverse approach, thus revealing the extent of uncertainty introduced by modelling choices. These distributions provide valuable insights into the robustness and sensitivity of formative models, helping to identify stable rankings and those that are highly contingent. Ultimately, this work highlights the importance of explicitly addressing uncertainty when designing and interpreting formative composite indices in sustainability research.

Keywords: Model Specification Uncertainty; Social Sustainability Metrics; Composite Indices; Multiverse Analytical Framework

C6.
Sustainable Tourism and Local Economy

Conveners & Chairpersons

Paolo Mariani (University of Milano)

Erika Grammatica (University of Milano)

C5.

Between Future Consumption and Sustainability: What Future Awaits Tourism?

Conveners & Chairpersons

Simone Di Zio (University of Chieti-Pescara G. d'Annunzio)

Bike Sharing as Sustainable Mobility and Tourism Infrastructure: The Case of Puglia

Fulvio Morgese[1], Michele Bisceglia[1], Gaetano Sciacovelli[2]*

([1]ANCI Puglia, [2]Vaimoo Sharing)

One of the best ways to integrate sustainable mobility, emission reduction, and tourism development is through bike sharing. An important example study is the Apulia (Puglia) area, where in only a few years, over 900 e-bikes spread across seven cities have traveled over 2 million kilometers, preventing CO2 emissions equal to those absorbed by 20,000 trees per year. The service has been incorporated into citizens' daily routines, covering a significant portion of commuting trips, such as those from home to work or home to school, according to data analysis. It also plays a strategic role in sustainable tourism by providing widespread and gradual access to historic centers, coastal areas, and intermunicipal connections. As evidenced by the findings of Trani, Altamura, Gravina, and Giovinazzo, the Apulian model is inclusive (cheap rates), capillary (an intermodal network with public transportation and bicycle infrastructure), and replicable in medium and small towns. This view is further supported by a poll of 46 municipalities, which found that more than 77% of local officials saw bike sharing as a strategic instrument to lower traffic, enhance quality of life, and draw visitors. This presentation explores the ways in which local experiences might operate as a testing ground for new mobility regulations and the creation of truly sustainable tourist practices.

Keywords: Sustainable Mobility; Bike Sharing; Emission Reduction; Tourism Development; Apulia Case Study

Can the future be measured? A proposal for a State of the Future Index at the European level

Leonardo Salvatore Alaimo[1], Yuri Calleo[2], Simone Di Zio[2]*

([1]Sapienza University of Rome, [2]University of Chieti-Pescara G. d'Annunzio)

This work develops a comprehensive framework for assessing future trajectories of EU countries by refining the State of the Future Index (SOFI) methodology. Using an expert-driven selection of 26 indicators across eight key dimensions—including Economy, Work, Education, Health, Demography, Environment, Energy, and Society—based on Eurostat data from 2012 to 2024, the authors construct a hierarchical synthetic index that captures systemic changes and interrelationships among variables. The aggregation process leverages both arithmetic and geometric means, with dimension weighting determined via Analytic Hierarchy Process (AHP), reflecting expert judgments. For forecasting future trends, a Gaussian Process Regression model incorporating both spatial and temporal dependencies is employed, providing probabilistic estimates and confidence intervals for EU-wide SOFI projections. Results highlight spatial clusters in development trajectories and underscore the role of territorial dynamics, offering robust insights for policy planning and proposing avenues for methodological enhancements in indicator weighting and forecasting techniques.

Keywords: State of the Future Index; EU Countries; Analytic Hierarchy Process; Gaussian Process Regression; Sustainable Development Trajectories

Exploring the future of tourism, sustainability, and innovation: a network analysis approach for scenario development

Yuri Calleo, Simone Di Zio

(University of Chieti-Pescara G. d'Annunzio)

This study presents an advanced statistical methodology for analyzing Delphi outputs in scenario development, combining network-based fuzzy clustering with centrality measures. Unlike conventional approaches that force items into mutually exclusive groups, this framework allows factors to belong to multiple clusters with varying degrees of membership, better reflecting the complexity and interdependence of social systems. Delphi outputs are modeled as nodes within a network, with edges defined by correlations among expert responses, enabling the identification of nuanced relational patterns. The incorporation of community detection algorithms, such as Louvain's method, along with network centrality indicators, further strengthens the analysis by revealing the system's structural properties. This dual approach not only highlights clusters of strongly interconnected factors but also identifies bridging items and strategic nodes, which play critical roles in linking different scenario pathways. The methodology is applied in a case study on the future of the Area Urbana Funzionale (AUF) of Pescara and the valley of the river Pescara, with a time horizon to 2045. Expert assessments of 42 key factors – ranging from environmental risks and climate resilience to digitalization, governance, and social inclusion – inform the construction of three alternative scenarios. The analysis captures both desirable and undesirable trajectories, from a "resilient decline" under institutional fragility to inclusive and innovation-driven futures. By overcoming limitations of conventional clustering techniques, the proposed framework enhances robustness, transparency, and interpretability in scenario building. Ultimately, it offers decision-makers a versatile tool to explore uncertainty, anticipate systemic vulnerabilities, and design strategic responses for sustainable territorial development.

Keywords: Delphi; scenarios; sustainability; tourism; network analysis; fuzzy clustering

Fostering Awareness of Future Consumption: The Role of Statistics and Futures Studies in Sustainable Tourism

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The concept of "consumption of future" lies at the heart of sustainable tourism, emphasizing how current resource utilization and actions can profoundly diminish opportunities and resources for forthcoming generations. Here we propose a critical shift from merely preventing this consumption to actively fostering the "regeneration of future" within the tourism sector, underscoring the significant intergenerational impact of contemporary choices. The current landscape is characterized by challenges such as inadequate data, analytical complexities, high variability in tourism trends, and a pervasive lack of a "future-oriented" approach in public decision-making, exacerbated by rapid global changes and systemic uncertainty. To navigate these complexities, this work proposes an integrated framework that leverages the power of statistics and futures studies. Statistics are presented as an indispensable methodological tool for measuring environmental impact (e.g., carbon footprint, resource use), assessing tourist satisfaction and consumer behavior, quantifying economic benefits, and monitoring the efficacy of sustainability policies through predictive modeling and robust indicator development. Concurrently, futures studies, particularly scenario building, are vital for anticipating emergent trends, evaluating risks, informing strategic planning, and fostering innovation through collaborative multi-stakeholder engagement. The central solution advanced is Anticipatory Governance. This approach, fundamentally rooted in foresight and data-driven insights, empowers decision-makers to proactively predict and prepare for future challenges and opportunities. It necessitates flexible policy-making, rigorous long-term impact evaluation – with a specific focus on generational equity – and a deep cultural transformation towards a "future-oriented" public administration. A concrete action plan is proposed, particularly tailored for contexts such as Italy, detailing the implementation of dedicated organizational structures (e.g., a Chief Futures Officer, inter-ministerial foresight councils), systematic anticipation processes (horizon scanning, scenario planning, backcasting), capacity building, advanced data infrastructures, and integrated policy instruments like a "Future Impact Assessment" (FIA). Ultimately, by fusing robust statistical analysis with strategic foresight and implementing anticipatory governance, we can transcend short-term fixes to cultivate a truly sustainable tourism model that regenerates opportunities and ensures a resilient and prosperous future for future generations.

Keywords: Sustainable Tourism, Consumption of Future, Regeneration of Future, Anticipatory Governance, Futures Studies, Statistics, Intergenerational Impact.

Uncertain Futures: How The Unknown Shapes Genoa's Urban Tourist Places

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We propose an exploratory scenario analysis investigating the future of Genoa's urban tourist places in the year 2060 through critical uncertainties, which are those factors considered both highly impactful in shaping Genoa's urban space and highly unpredictable in their future development. The study examines how these critical uncertainties may shape the perceived space (physical/material), the conceived space (planning/representations), and the lived space (everyday experiences) of urban Genoa (Lefebvre, 1974). This research positions uncertainty as a necessary condition for the future, making it the logical prerequisite for envisioning alternative urban futures. In a participatory Delphi Study, uncertainty is transformed into a strategic resource, actively encouraging open-ended thinking about possible trajectories. The study employs a mixed-method approach. On the one hand, a qualitative multi-dimensional analysis (DESTEP) offers an open, critical, and holistic perspective. On the other, robust ranking and fuzzy clustering of expert epistemic ratings identify clusters among uncertainties. These clusters, forming the scenario axes, drive the construction of scenarios, providing space for agency, contingency, and creative imagination, while certainties only serve as background conditions. Through workshops and creative visualisation, the research aims to provide Genoa's policymakers and urban planners with strategic insights into potential future trajectories for the development of sustainable urban tourist places. The findings open avenues for future research, including discourse analysis of the participatory process, comparisons between qualitative/quantitative approaches and between human-centred/AI-driven methods to scenario development, and the application of the data to other (non-tourism related) spaces of Genoa.

Keywords: Critical uncertainties, urban spatial futures, mixed-methods, Delphi-Study, scenario analysis

Bridging cultural heritage, sustainable tourism, and collectible design

Federica Codignola

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The relationship between cultural heritage and sustainability has gained increasing attention in recent years (ONU, 2015; UNESCO, 2002). Researchers have explored various dimensions of sustainability in the context of cultural heritage management, including economic, social, and environmental (e.g., Eppich & Grinda, 2019; Foster, 2020; Li et al., 2022). Based on the assessment that sustainable tourism is heavily linked to cultural heritage (Du et al., 2024; Gocer et al., 2024; Madandola & Boussaa, 2023; Rachmawati et al., 2024), this study investigates how collectible design (CD) can be reframed within the sustainable tourism agenda. In fact, as for Codignola-Bo (2025), collectible design goods highly reflect cultural heritage. Initially explored via indepth interviews with CD experts, the concept of sustainability emerged only peripherally. A first-round Delphi survey then revealed more nuanced considerations of environmental, social, and economic sustainability, showing that emphasis on sustainability hinges on question framing. The findings highlight a research gap: CD has received little attention as a bridge between cultural heritage preservation and sustainable tourism. Yet, sustainable tourism aims to balance environmental, socio-cultural, and economic outcomes while conserving heritage values (Buckley, 2012; Guo et al., 2019; Hashemkhani Zolfani et al., 2015; Miller & Torres-Delgado, 2023; Weaver & Lawton, 2007). Cultural heritagebased souvenirs, as locally crafted objects, serve both as tangible expressions of identity and tools for sustainable tourism by promoting community livelihoods, cultural transmission, and reduced carbon footprints through localized production (Gupta & Kumar, 2023; Qiu et al., 2024; Wang & Chen, 2022; Wang et al., 2023). This study argues that cultural heritage-based collectible design items possess these same positive qualities. Building on cultural heritage management sustainability insights and CD literature, this paper develops a novel framework for CD in sustainable tourism contexts. The framework encompasses:

1. Holistic sustainability integration: aligning CD with environmental, social, and economic goals.

2. Lifecycle perspective: considering production, use, recycling, and end-of-life.

3. Authentic heritage content: anchored in local narratives and craftsmanship.

4. Stakeholder engagement: codesign with artisans, communities, tourists, and policymakers.

5. Impact assessment and innovation: evaluating sustainability outcomes and fostering responsible innovation.

6. Market mechanisms: leveraging CD to encourage sustainable consumption within tourism sectors.

By conceptualising CD as heritage-driven, its objects can also be understood as sustainable tourism artifacts. With this idea in mind, this study enriches creative fields research and offers actionable insights for designers, marketers, and destination managers. This approach encourages collectible design to become a meaningful tool in fostering sustainable tourism by sustaining heritage, empowering local communities, and reshaping tourist consumption patterns.

Keywords: Collectible design; sustainable tourism; cultural heritage; lifecycle; stakeholder engagement; sustainable consumption

Rethinking Tourism Intensity in Italy: A Multidimensional Analysis of Employment, Enterprise Dynamics and Crime across Provinces

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Tourism is an important economic driver, particularly in countries with a cultural heritage as Italy. Despite its importance, the traditional tourism rate, defined as the ratio of tourist arrivals to the resident population, fails to account for the full scope of tourism's economic and social effects. This paper introduces an alternative analytical approach that decomposes the tourism rate into components that reflect the pressure on tourism enterprises, the impact of crime, and the resilience of local businesses. Such a framework allows for more granular insights into the territorial consequences of tourism. This need becomes especially evident when considering the role of the accommodation and food service sector, which constitutes a cornerstone of Italy's tourism infrastructure and economy. Moreover, the territorial distribution of accommodation and catering businesses mirrors the diverse tourism profiles of Italian regions. In this context, this paper proposes an approach that decomposes the traditional tourism rate into three distinct but interconnected dimensions: the pressure exerted on tourism enterprises, the incidence of crime, and the resilience of the local economic fabric. By disaggregating these elements, the framework provides deeper territorial analysis. The results highlight substantial heterogeneity across Italian provinces in their capacity to absorb tourism flows, manage public safety, and sustain business vitality. The spatial analysis and subsequent k-means clustering show distinct profiles of Italian provincial tourism economies.

Keywords: Tourism, Labour market, Crime pressure, Italian Provinces

Sustainable innovation in the beer industry supply chain: exploration of patent data

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The beer industry faces particular challenges in sustainability and green innovation due to its resource-intensive production and waste generation. Our research explores the extent and nature of sustainable innovation within the Italian beer industry by analysing patent data as a proxy for technological advancement and commitment to green practices. In particular, our research question focuses on the role of patenting in fostering sustainability in the beer industry. This issue is particularly important because, on the one hand the beer industry can positively impact on the achievement of the Sustainable Development Goals (SDGs), and on the other hand consumers give a positive value and increase their willingness to pay for beers that conform to sustainable production. The global priority for sustainable development has increased attention on green technologies, which foster eco-friendly production methods and reduce environmental risks. Innovation drives this transition, and the beer industry is interested for its engagement in sustainability efforts. Beer production is notably resource-heavy, consuming large amounts of water and energy while generating waste and greenhouse gas emissions. Despite these challenges, some breweries have initiated environmental and social sustainability measures. Among the different ways to measure innovation, we focus on patent data to see if such method is used in the beer industry to protect green innovation. Patent data serves as a reliable indicator of genuine innovation, avoiding subjective claims and phenomena like green- washing or the so-called sustainability silence. The study utilizes patent data from the Bureau Van Dijk Orbis IP database, focusing on patents linked to beer-related technology first through CPC classification codes, then through textual analysis containing the word “beer.” Patents owned by Italian entities were extracted to assess national innovation activity. We acknowledge some limitations rise, such as the omission of relevant patents classified outside selected codes or lacking explicit mention of “beer,” above all challenges in capturing patents related to energy, waste, or recycling indirectly connected to beer production. Due to limited patent numbers and the exploratory nature of the research, descriptive statistics, comparative analysis, and text analytics for topic extraction were employed. Out of nearly 150,000 beer- related patents globally using CPC codes, 3,568 are owned by Italian companies, with only 68 classified as green patents. As a positive sign, topic extraction from these green patents indicates coverage across the whole beer production process, including distillation, transportation, and chemical solutions. This (relatively) low number of patents could suggest that patenting is not the most important mean of pursuing sustainable innovation in the Italian beer sector. The alternative approach, which analyses 6,282 patents containing the word “beer” owned by Italian firms, found 547 green patents belonging to 128 companies. These companies span manufacturing, wholesale and retail, professional and scientific activities, and financial sectors, including patent firms and research centers. The growth rate of green patents has increased notably in the last decade, indicating a rising but still limited focus on sustainability. We explain these dynamics with regard to some possible explanations. First, the dominance of international holdings in the beer sector may also mean that patenting occurs at headquarters outside Italy, obscuring local innovation efforts. Second, usually small breweries, as well as SMEs in Italy, usually does not rely on patenting for conducting innovation. Third, firms in beer brewing can rely on organisational and production management strategies to achieve sustainable and green results without patenting. In general, our investigations show that general scarcity of green innovation patenting in the beer industry, although recent years show an upward trend.

Keywords: Beer Industry, Patent, Sustainability, Italy

Sustainable tourism and local economic revitalization: reimaging tourism in Abruzzo through sustainable routes

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Cyclotourism in Italy has shown significant growth and economic impact in recent years, with many tourists choosing biking as their travel mode. This sector represents an important part of the Italian tourism economy, attracting diverse tourists and highlighting areas for further development. The year 2024 saw 89 million cycling tourists in Italy, representing more than 10% of all tourists, with an economic impact of 9.8 billion euros. Several academic works analyze specific business cases or localized implementation of pathways and services for cyclotourism, such as in the Apennine Region in northern Italy, Franciacorta, Istria, UK, and EuroVelo routes, an European Union project. We focus our analysis on Abruzzo, a region in the southern part of Italy interested by tourism economy. In recent years, Abruzzo has seen different public investments in cycling routes, also coming from national and European funds. Four new cycling projects in Abruzzo, the Binaria, Valle dell'Aterno, Gran Sasso, and Ciclovia delle Stelle routes, are at different development stages, with secured funding totaling over €17 million and construction or design phases already underway, connecting hinterland towns with coastal cities. Our main research question focuses on understanding if public administrators and local commercial activities see an opportunity to develop sustainable tourism through cycling routes thanks to such new investments, building a unique ecosystem and living the touristic advertising as a whole, unique area opposed to fragmental activities. This research question is the first step of a business case, with the final aim to build an app to support cyclotourism in Abruzzo. To answer this question, we interview several involved stakeholders. First, we interview with open questions and discussion some mayors and local authorities from towns distributed along the new cycling routes. Then, we interview with a semi-structured questionnaire both tourists and commercial activities owners, such as restaurants, bars, bike rentals. Tourists are chosen between people visiting the area between the 21 of July and the 15 of August, and they are distributed by age group and gender. For commercial activities, we focus on the area made by the towns distributed on the new cycle routes. Interviews are done in person to maximize the response rate and driven by one of the main authors of the work, to leverage the expertise and the possibility to gain more information. Our main findings show in general a positive attitude towards the idea of leveraging the new cycle paths to develop and increase tourism, including a new, more sustainable type of tourism, and the resulting revenues. Local administrators confirm that they actually did not think about such ideas and that they fully support the idea of a unique platform where every actor can interact with tourists and with each other to improve services and offering. We focus our questions on the idea of spreading knowledge of the territory, including hinterland, for tourists, connecting through such cycle routes hinterland towns and seaside towns. The answers from tourists show that there is great interest in such experiences, mainly if they are related to gastronomic events or seeing the local culture. Moreover, they underline the lack of services such as taxi or transportation, as well as the difficulty in finding information about what to do or what to visit, and lack of knowledge of other languages such as English. In general, from all the different actors we get confirmation that there is strong opportunity for sustainable tourism growth through a unique information platform, and there is evidence of local support. Since our findings show the lack of a unique viewpoint for tourists, mainly if coming from abroad, a tool that joins everything together and proposes a unique view of the territory and touristic opportunities would be a good idea to develop the region and leverage the new cycling routes, bringing in new tourists with a strong orientation towards sustainability. Our next steps include a focus group with more local administrators, repeated interviews to tourists, and a mockup of the application to start getting practical feedbacks and to involve all the commercial owners from the territory.

Keywords: Tourism, Sustainability, interviews, Italian region.

Forecasting Tourism Flows and Environmental Pressure in Polignano a Mare: An Integrated Approach with Climate, Mobility, and Digital Data

Luca Rossi

(Niccolò Cusano University of Rome)

Polignano a Mare, a renowned tourist destination in the Apulia region of Italy, has experienced significant growth in tourist arrivals in recent years, increasing from approximately 240,000 in 2015 to over 420,000 in 2023 according to ISTAT data, with summer peaks exceeding 5–6 times the resident population. This growth, further boosted by high-profile international events, places considerable pressure on the environment and urban services, particularly in terms of waste management, with over 6,000 tonnes annually and summer peaks of 40% above the average, as well as water consumption and mobility. The need for sustainable management policies calls for forecasting tools capable of anticipating demand peaks and analysing alternative scenarios in light of climate change and variations in accessibility. This study presents a monthly forecasting model that integrates tourism, climate, mobility, and digital data to estimate visitor flows and related environmental pressure. The methodology employs a Gradient Boosting (XGBoost) approach with exogenous regressors such as average temperature, number of heatwave days, air arrivals at Bari and Brindisi airports, online interest measured through Google Trends, and the calendar of public holidays and local events. Estimates are harmonised at the territorial level using MinT hierarchical reconciliation techniques and enhanced with probabilistic forecasts generated through conformal prediction, evaluated using accuracy metrics such as MAPE, RMSE, and Weighted Interval Score. The model was also applied to scenario simulations. A hypothetical increase of 5 heatwave days during the summer months indicates a potential reduction in tourist arrivals of up to 5%. A 20% reduction in flights to Bari could lead to an approximately 8% decrease during peak periods. The introduction of a summer Limited Traffic Zone (ZTL) shows marginal effects on overall flows, while improving urban liveability. The proposed approach provides an operational and predictive tool for administrations and tourism stakeholders, enabling the optimisation of service planning and the mitigation of environmental impacts, thus contributing to the resilience and sustainability of tourism.

Keywords: Tourism Forecasting; Sustainable Tourism; Environmental Pressure; Machine Learning (XGBoost); Apulia Case Study

C7.
The future of sustainable tourism

Conveners & Chairpersons

Andrea Guizzardi (University of Bologna)

Francesca Bassi (University of Padova)

Paolo Mariani (University of Milano)

Tourism and territories: a multilevel analysis for Italy

Leonardo Salvatore Alaimo

(University of Roma La Sapienza)

The work, “Tourism and Territories: a Multilevel Analysis for Italy” examines the territorial determinants shaping tourist presence across Italian municipalities through a hierarchical linear regression model. Drawing on ISTAT datasets and indicators of local attractiveness, it differentiates domestic and foreign tourists to identify specific patterns of destination choice. Key findings reveal a predominant influence of coastal areas and cities with historical and artistic significance, as well as the critical role of accommodation supply and commercial services; moreover, foreign visitors are notably attracted to museum heritage, while mountain and hill localities exhibit lower appeal. The multilevel approach demonstrates that a substantial share of variance in foreign tourism is attributable to higher-level territorial structures, underscoring the necessity of tailored regional strategies and integrated policy interventions for tourism development.

Keywords: Tourism Development; Territorial Determinants; Multilevel Analysis; Domestic and Foreign Tourists; Italy

Gastronomy, a driving force of tourism in Spain: a study using latent class models.

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This research proposes an analysis of Spanish tourists based on their motivations, preferences, and behaviours related to gastronomic experience while traveling, specifically we identify the drivers of this type of tourist experience, considering that the market is segmented. Spain is renowned for its rich gastronomic heritage, yet limited research has explored the profiles and heterogeneity of domestic gastronomic tourists. Using data from a survey on Spanish residents, regression analyses revealed factors influencing the importance placed on gastronomy for travel, including seeking gastronomic experiences, valuing culinary culture and heritage, availability of famous dishes, and tradition. A latent class regression model further uncovered segment-specific drivers of gastronomic travel motivations: identifying five clusters of tourists with different profiles. The findings provide valuable insights for tourism stakeholders to develop targeted marketing strategies, design authentic food-related experiences, support sustainable practices, and optimize revenue management based on the diverse profiles of Spanish gastronomic tourists.

Keywords: Gastronomic Tourism; Tourist Motivation; Market Segmentation; Latent Class Regression; Spain

Quality pattern in Hospitality: The Local Impact of Airbnb

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(University of Bologna)

The impressive growth of online rental platforms, such as Airbnb, has heavily affected competition in the hospitality sector. While most of the existing research has explored Airbnb's effects on prices, less attention has been paid to its potential influence on the quality of the traditional hotel industry. Our study aims at investigating the relationship between the expansion of Airbnb and changes in hotel quality, with a specific focus on the local dimension, i.e., developing the analysis at the municipal level. Using data related to different types of destinations - e.g. coastal areas, mountain regions, and art cities - we examine how patterns in online rental activity may be associated with improvements or declines in hotel quality over time. We also consider and compare alternative measures of hotel quality, assessing the effects of weighting by the number of rooms and by the length of stay. Analogously, different definitions of Airbnb consistency are evaluated and compared, including information such as occupancy rate, average daily rate, number of available days, and number of reservation days. By offering a comparative analysis of various locations, different definitions of hotel quality at the municipal level, and different definitions of Airbnb consistency at the municipal level, this study aims to contribute to a deeper understanding of how online accommodation platforms may influence the evolution of quality in the traditional hospitality industry.

Keywords: Airbnb; Hotel Quality; Hospitality Industry; Municipal-Level Analysis; Online Rental Platforms

Artificial intelligence for the protection and promotion of Italian-made products

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(Informatica Srl)

Il presente lavoro presenta nuovi approcci per la tutela e valorizzazione del made in Italy. In particolare, viene presentato un metodo e relativo prototipo basato su intelligenza artificiale per la generazione automatica di nuove fantasie tessili, con l'obiettivo di valutarne le potenzialità nell'ambito dell'apprendimento e generazione di pattern stilistici. Il processo inizia con l'acquisizione di campioni di stile raccolti in un repository fotografico e la costruzione di una ontologia per l'addestramento supervisionato deep learning oriented. È stato realizzato un modello per apprendere lo stile dello stilista Angelo Inglese. Seguendo tale approccio il sistema, inoltre, a partire da dettagli architettonici locali, consente di generare fantasie coerenti con lo stile dello stilista. Tale approccio può guidare lo stilista nella valutazione e realizzazione di nuove collezioni. Inoltre, vengono altresì presentate le potenzialità del rendering PBR aptico-sonoro in chiave utente, con la presentazione del prototipo sviluppato nell'ambito del progetto di ricerca PBR Fashion.

Keywords: Made in Italy; Artificial Intelligence; Textile Pattern Generation; Deep Learning; PBR Fashion

The Economic Dimension of Sustainability according to SDGs: A Classification of STIs

Venera Tomaselli, Maria Daniela Gianmanco

(University of Catania)

The economic aspect of sustainability is crucial in current measurement systems to support polic evaluations related to sustainable tourism. This study contributes to the measurement effort of tourism sustainability by creating a systematic classification of Sustainable Tourism Indicators (STIs) aligned with the Sustainable Development Goals (SDGs) of Agenda 2030, mainly focused on the economic dimension. These specific Goals highlight economic resilience, decent employment, inclusive growth, and institutional capacity. Sustainability challenges, SDG targets, stakeholder perspectives, and data features are combined in a multidimensional analytical framework to offer a comprehensive set of STIs useful to measure the economic impacts of tourism and monitor policy-making. These selected STIs support evidence-based tourism strategies to promote local economic growth, reduce regional disparities, improve labour market inclusion, and strengthen governance. The study proposes an operative tool to integrate economic sustainability into tourism assessment, acknowledging tourism's role in driving fair and resilient economic development.

Keywords: Sustainable Tourism; Economic Sustainability; Sustainable Tourism Indicators; Sustainable Development Goals; Evidence-Based Policy

C8.

Telemedicine for environmental sustainability and the enhancement of tourism services

Conveners & Chairpersons

Fabio Manca (University of Bari "Aldo Moro")

Telemedicine for Maternal Health: A Scalable and Sustainable Educational Model

Marialuisa Sveva Marozzi

(University of Bari Aldo Moro)

The RALNES project, conducted with the support of CITEL, exemplifies how telemedicine and online education can enhance healthcare delivery, promote sustainability, and empower vulnerable populations. By offering a series of 23 thematic webinars tailored to the needs of Syrian women, the project addressed critical issues in maternal and neonatal health—ranging from nutrition and prenatal care to pediatric emergencies and reproductive health. This presentation outlines how the use of tele-education platforms enabled the delivery of high-quality, interactive health training across borders, minimizing environmental impact by eliminating travel and optimizing resource use. It highlights how the accessibility of digital health services fosters inclusion, overcomes geographic barriers, and offers a scalable model for delivering care and education even in fragile contexts. The RALNES experience also illustrates how telemedicine can indirectly support tourism-related services, ensuring access to health expertise for mobile or displaced populations. Through active participant engagement and real-time clinical interaction, the project demonstrated that tele-education is not only a sustainable tool but also a powerful means of global health empowerment.

Keywords: Telemedicine; Tele-education; Maternal and Neonatal Health; Global Health; Sustainability

Sustainable Tourism Through Telemedicine and Digital Health Services: Environmental Impact Assessment and CO_2 Reduction Strategies

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Background: The convergence of digital health technologies and sustainable tourism represents a critical opportunity for environmental impact reduction in the 21st century. This systematic literature review examines how telemedicine and digital health services can drive sustainable tourism development while significantly reducing CO_2 emissions.

Objective: To evaluate the environmental impact of telemedicine services on sustainable tourism, with particular focus on CO_2 reduction through analysis of international studies, European initiatives, and the Italian experience, highlighting the Puglia COReHealth model as a replicable excellence.

Methods: Systematic literature review following PRISMA guidelines across multiple databases covering 2015-2025. Search terms included telemedicine, sustainable tourism, environmental impact, and CO_2 reduction. Data extraction focused on quantitative environmental metrics and sustainability indicators.

Results: Analysis of 692 studies revealed significant CO_2 reduction potential across telemedicine modalities: video consultations (45-78% emission reduction), telemonitoring (62-85% reduction), telecardiology (38-67% reduction), telerehabilitation (52-74% reduction), and emergency teleconsults (41-69% reduction). The Puglia COReHealth model demonstrates measurable environmental benefits while supporting medical tourism sustainability. Conclusions: Digital health services represent a strategic driver for sustainable tourism development. Investment in telemedicine infrastructure, supported by innovative regional policies and structured financing, can effectively combine technological innovation, environmental sustainability, and economic development, contributing significantly to Sustainable Development Goals.

Keywords: Telemedicine, sustainable tourism, CO_2 reduction, digital health, environmental impact, COReHealth Puglia

Artificial Intelligence Support in Lung Ultrasound to optimize medical resources

Sebastiano Cicco

(University of Bari Aldo Moro)

Lung ultrasound (LUS) is increasingly recognized as a valuable diagnostic tool for identifying and monitoring lung diseases, thanks to its non-invasive nature, absence of radiation, and ease of repeatability. While high-resolution computed tomography (HRCT) remains the gold standard for assessing severity, the use of LUS—especially when combined with artificial intelligence (AI) algorithms—opens new avenues for more sustainable and accessible follow-up strategies. AI-powered portable ultrasound device designed to automatically detect typical lung ultrasound change patterns may provide a grading of interstitial involvement. The comparison between the AI algorithm and expert interpretation showed good agreement, suggesting that even non-expert operators can achieve clinically useful results with minimal training. The adoption of such automated solutions can contribute to more efficient healthcare resource management by reducing the need for repeated radiological exams and limiting radiation exposure. Moreover, the ability to perform real-time assessments in decentralized settings supports a more ecological and inclusive approach to chronic lung disease care. In conclusion, integrating AI into LUS represents a concrete opportunity to enhance the accessibility, efficiency, and sustainability of lung disease diagnosis and monitoring, particularly in resource-limited environments.

Keywords: Lung Ultrasound; Artificial Intelligence; Chronic Lung Disease; Sustainable Healthcare; Diagnostic Imaging

Digital solutions for public Healthcare: A Mobile-AI architecture for continuous cognitive monitoring

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(University of Bari Aldo Moro)

Recent developments in the field of telemedicine represent a strategic lever to promote a more sustainable, equitable, and patient-centered healthcare model. In this context, this study presents the design and implementation of a smartphone-based application aimed at enabling continuous, unobtrusive monitoring of the daily lifestyle of older adults and/or individuals with chronic conditions. The app leverages sensors integrated into mobile devices to collect data related to motor parameters (e.g., steps, calories, GPS location, recognized activities), with the goal of identifying meaningful behavioral patterns. The primary aim of the study is to explore the correlation between movement data and cognitive functioning. Each user's movement data were anonymized using a unique identifier (UID) and categorized into two cognitive functioning class (1-2 vs 3-4) for comparative analysis. For predictive analysis, a Leave-One-User-Out (LOUO) approach was adopted using four models: Logistic Regression, Random Forest, Convolutional Neural Network (CNN), and Transformer architecture. Experimental results indicated that deep learning models, particularly CNNs and Transformers, outperformed traditional approaches (Accuracy = 0.849, F1 ≈ 0.83), highlighting the presence of informative patterns embedded in mobility data. This demonstrates that data collected from mobile devices serve as a valuable tool for monitoring cognitive decline, contributing to the development of intelligent solutions for preventive, personalized, and proactive medicine.

Keywords: Telemedicine; Mobile Health; Cognitive Decline Monitoring; Deep Learning; Preventive Medicine

Digital Narrative Medicine and sustainability

Stefania Massaro

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Sustainability in healthcare is increasingly recognized as a multidimensional challenge that encompasses environmental, economic, social and organizational dimensions. Reducing the ecological footprint of medical services requires innovative approaches that optimize resources, minimize unnecessary travel and hospitalizations, and foster patient-centered care. In this context, telemedicine emerges as a powerful enabler, offering opportunities to reimagine the organization of healthcare delivery while aligning with broader goals of environmental responsibility, equity, and system efficiency.

Within this framework, the digitalization of Narrative Medicine represents a crucial development. Narrative Medicine, initially developed as a complementary methodology to evidence-based medicine, emphasizes attentive listening and reflection, allowing patients' stories to become integral parts of clinical decision-making while enabling physicians to strengthen their own empathy and professional voice. By translating these principles into digital environments—through platforms, mobile applications, conversational agents, and even robotics—Digital Narrative Medicine (DNM) ensures that the patient's voice is not only preserved but amplified. This "story of care" strengthens the therapeutic alliance and simultaneously generates structured data of clinical and educational value, supporting diagnosis, monitoring, and research.

DNM thus responds effectively to the emerging challenges of contemporary healthcare systems, such as the management of chronic conditions, the personalization of treatments, and the need for more sustainable and resilient models of care. It contributes to environmental and temporal sustainability by reducing patient travel and maximizing the efficient use of both time and healthcare resources. On a social level, it promotes equity of access for patients living in remote or fragile contexts, supports the involvement of families and communities in the care process, and mitigates isolation in elderly or chronically ill patients through interactive digital tools. From a professional and organizational perspective, sustainability is strengthened by facilitating multidisciplinary teamwork and shared decision-making, which improve both resource allocation and patient outcomes. Furthermore, DNM supports educational sustainability by offering immersive and interactive digital learning environments that enhance professional training in a lasting and scalable way, preparing healthcare workers for human-centered digital care. Finally, it functions as a governance tool that establishes bidirectional communication flows between patients and healthcare systems, thereby improving responsiveness, appropriateness, and overall quality of care.

In conclusion, by embedding narrative practices into telemedicine, DNM contributes to building healthcare systems that are environmentally responsible, economically viable, socially equitable, and professionally resilient, while reaffirming the centrality of the patient's voice. This convergence highlights the transformative potential of innovative approaches for a future of medicine in which data, narratives, and sustainability are seamlessly intertwined.

Keywords: Sustainable Healthcare; Telemedicine; Digital Narrative Medicine; Patient-Centered Care; Healthcare Innovation

C9.

Indicators and methods for measuring tourism phenomena

Conveners & Chairpersons

Venera Tomaselli (University of Catania)

Antonella Massari (University of Bari Aldo Moro)

Journey to the sea. How seaside and nautical tourism in Apulia and Italy are changing

Marco Antonioli

(Studio Giaccardi & Associati)

The purpose of the study "Journey to the Sea" was to understand and analyze changes in seaside and nautical tourism, an iconic and massive business in Italian vacations, thus seeking to contribute to innovation in the offering and new support for economic operators and local administrators. The research was carried out on a sample of 16 major seaside and nautical tourism destinations, including four in Puglia: Costa dei Due Mari, Costa di Bari, Gargano, and Nardò, which will be the focus of the intervention. All destinations were analyzed based on four drivers of transformation, data and information from official sources, data and information from tourism portals, and data and information on the impact of climate change.

Keywords: Tourism, seaside tourism, nautical tourism, Apulia, Italy

What indicators to measure the social sustainability of tourism? An SDGs-based classification of STIs

Venera Tomaselli, Maria Daniela Gianmanco

(University of Catania)

The social dimension of sustainability has gained increasing relevance in the discourse on sustainable tourism, yet it remains insufficiently integrated into measurement frameworks and policy evaluation. This study addresses this critical gap by proposing a systematic classification of 81 out of 262 Sustainable Tourism Indicators (STIs) explicitly aligned with the 8 out of 17 Sustainable Development Goals (SDGs), focusing on the socially-oriented goals such as poverty reduction, gender equality, decent work, reduced inequalities, inclusive urban development, and strong institutions. Drawing on a multidimensional analytical framework - including sustainability issues, SDG targets, stakeholder perspectives, and data characteristics - the study offers a comprehensive toolkit for assessing the social impacts of tourism and monitoring progress toward social sustainability. The results provide researchers, policymakers, and practitioners with a robust evidence base for designing and implementing tourism policies that promote equity, social inclusion, cultural preservation, and participatory governance. By advancing an integrated approach to social sustainability in tourism, this research contributes to the operationalization of the 2030 Agenda and reinforces the role of tourism as a catalyst for socially just and inclusive development.

Keywords: Sustainable tourism indicators; Agenda 2030 SDGs; social sustainability; STIs classification.

*Territorial Clustering Techniques for the Analysis of Tourism Sustainability in Puglia**

Paola Perchinunno, Antonella Massari, Corrado Crocetta, Samuela L'Abbate*

(University of Bari Aldo Moro)

Tourism sustainability is a key factor for regional development, especially in areas rich in natural and cultural heritage such as Apulia. This study examines the use of clustering techniques to identify spatial and temporal patterns of tourism in the region, with the aim of detecting areas subject to sustainable tourism pressure. In particular, it compares two density-based clustering algorithms: DBSCAN (Density-Based Spatial Clustering of Applications with Noise) and HDBSCAN (Hierarchical DBSCAN). While DBSCAN is effective in identifying arbitrarily shaped clusters and handling noise, it requires empirical parameter choice and may struggle with varying data densities. HDBSCAN addresses these limitations by automatically determining the optimal cluster structure and adapting more effectively to density variations. The application of both methods to tourism data from Apulia highlights similarities and differences between the clusters, offering complementary perspectives in the analysis of sustainability.

Keywords: Territorial clustering, DBSCAN, HDBSCAN, Sustainable tourism

*This study was carried out within PRIN: RESEARCH PROJECTS OF SIGNIFICANT NATIONAL INTEREST – Call 2022 PNRR Prot. P2022B3NFH. This manuscript reflects only the authors 'view and opinions, neither the European Union nor the European Commission can be considered Responsible for them.

A new integrated methodological approach to determining the economic impact of tourism on the Italian economy

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([1]University of Sassari,[2]University of Teramo)

This study presents an integrated methodological approach to assess the economic impact of tourism on the Italian economy, overcoming the challenge of defining tourism as a distinct sector in standard economic classifications. By leveraging the Tourism Satellite Accounts (TSA) framework to weight tourism-related activities within Input-Output (IO) tables, tourism is constructed as an autonomous economic branch. Analyzing 2019 data, the research reveals that a €1 increase in tourism final demand generates a €1.886 rise in total economic output. While the sector exhibits a strong dispersion power (1.075), indicating its capacity to stimulate other industries, its sensitivity index (0.934) and below-average forward linkages (1.640) suggest insufficient integration into the national value chain. Technical coefficients further highlight a somewhat independent nature. Overall, Italian tourism is identified as a significant "leading" sector with substantial economic potential, underscoring the need for policies to enhance its inter-industry linkages and broader economic integration.

Keywords: Tourism Satellite Accounts; Input–Output Analysis; Economic Impact; Italian Economy

Indicators of social sustainability of tourism in big cities

Antonella Bianchino, Daniela Fusco, Salvatore Coppola

(ISTAT)

Over the last decades, urban areas have been rapidly transforming and their populations have grown remarkably. Alongside rapid urbanization, the growth of the tourism sector, made cities increasingly popular destinations for business and leisure tourists. Today, the income generated from tourism contributes significantly to the socio-economic and cultural development of many cities, but the growth of urban tourism also creates important challenges to ensure sustainable growth in term of, among other things, socio-cultural pressure. The new availability of data also at the sub-municipal level facilitates the development of measures to study the phenomenon from the host community perspective, also at the neighbourhood level. The study proposes a set of indicators calculated using official and online data to assess the social sustainability of tourism.

Keywords: Overtourism, Sustainability, Indicators, Multisource approach, small areas

Composite indicators for tourism-related spatial data. A Machine Learning approach

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This paper preliminary reviews the main composite indicators used in the literature to assess the sustainability of tourism destinations, along with their competitiveness and resilience. Then, it uses a wide range of data sources at the municipal level in Italy, including web scraping, to derive a wide set of core and complementary indicators, and construct composite indicators for tourism destinations. The methodology leverages on Principal Component Analysis and Factor Analysis as key statistical methodologies enhanced with machine learning methods to improve accuracy, robustness, and interpretability. In particular, it uses sparse PCA (also known as "penalized PCA") to improve interpretability by highlighting the most relevant and representative variables, thereby facilitating clearer understanding and communication of the resulting indicators.

Keywords: Composite indicators; Tourism sector; Spatial data; Principal Component Analysis, Machine learning techniques.

C10.
Sustainable Scenarios in Healthcare

Conveners & Chairpersons

Mariangela Zenga (University of Milano-Bicocca)

Federica Codignola (University of Milano-Bicocca)

FutureS Study: statistical insights into generational change and healthcare system evolution

Erika Grammatica,Carlotta Galeone, Paolo Mariani,Mariangela Zenga

(University of Milano-Bicocca)

The FutureS Study is a longitudinal, multinational research initiative designed to anticipate transformative trends in healthcare systems over the next 5–7 years, with a particular focus on the generational transition introduced by Generation Z healthcare professionals (HCPs). Developed in collaboration between DoxaPharma and the Bicocca Applied Statistical Center (B-ASC), the project investigates how this new generation of professionals, characterized by distinct backgrounds, expectations, and professional needs, is reshaping clinical, relational, organizational, and sustainability paradigms within both pharmaceutical companies and the national healthcare system.

In a first phase, a desk analysis of the main demographic, economic, and social phenomena was conducted, aimed at consolidating a framework of robust evidence and mapping potential transformational trajectories destined to impact the Italian healthcare system in the coming years.

Subsequently, text mining techniques were applied to a corpus of open-ended responses collected through a structured survey of pharmaceutical and healthcare companies. This computational approach enabled the extraction of recurring semantic patterns, the identification of latent topics, and the mapping of expectations, perceived critical issues, and anticipated opportunities.

Building on these insights, the next phase will implement the Delphi methodology with general practitioners, medical specialists, and healthcare professionals.

Keywords: Healthcare systems, generational transition, desk analysis, text mining.

Data-Driven Insights into AIFA's Drug Innovativeness Evaluations Using Text Mining

Carlotta Galeone, Andrea Marcellusi, Andrea Marletta,Daniele Pirotta

(University of Milano-Bicocca)

Since 2017, the Italian Medicines Agency (AIFA) has published innovation assessment reports for newly authorised drugs, limited to those for which companies formally request recognition of innovativeness. These assessments provide evaluation on three items: therapeutic need, added clinical value, and quality of evidence. Beyond their regulatory role, they constitute a valuable source of information on how pharmaceutical innovation is conceptualised and communicated. However, to date, these documents have not been analysed using text mining approaches. The complete corpus of AIFA innovation assessment reports released between 2017 and 2024 has been compiled and a pre-processing phase has been applied to clean the reports. The proposed approach provides two principal tools to analyse the corpus. Firstly, a dictionary containing the most frequent words has been obtained and represented by wordclouds and networks in order to detect which are terms and topics of interest in compiling these reports. Secondly, splitting the corpus in two sub-corpora on the basis of the outcome of the assessment (approved or not approved innovativeness), some statistical models have been applied to verify the association between the final outcome and the presence (or absence) of specified terms. Finally, since the reports are available for multiple years, the evolution of the most influential terms and topics has been explored. The project is being carried out in collaboration with ISPOR Chapter Rome, providing methodological and scientific support.

Keywords: Pharmaceutical Innovation; AIFA; Innovation Assessment Reports; Text Mining; Regulatory Science

Cultivating sustainability: a data-driven exploration of organic farming across Europe

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([1]Bio Organica Italia, [2]IULM)

The gradual move towards sustainable farming is a key goal under the European Green Deal. From an agronomic point of view, organic agriculture relies on technically demanding techniques (e.g., nutrient management without synthetics, control of pests using organism interactions, diversified crop rotations) that are extremely heterogeneous across European regions, with significant repercussions on both agronomic performance and environmental externalities. At the same time, organic products fill an increasing niche in world trade, affecting trade volumes, market access, and competitive structure all important to management decisions in agri-food export sectors. Despite this dual relevance, few studies have analysed empirically agronomic practices together with market related variables in a single statistical framework and applied this model to the analysis of interrelations of sustainability across countries. This paper fills this research gap by creating a harmonized panel dataset for 27 European countries using data from Eurostat, FAOSTAT, and Eurobarometer. The data set include more than 30 variables measuring the organic agriculture surface, the use of input (for instance pesticide or fertilizers), the contribution to greenhouse gasses emissions, the added value of organic sector, the flow of organic product exporting, the occupation rate in the agriculture sector or sense of well-being of citizens. Methodologically, we apply Sparse Principal Component Analysis (Sparse PCA) to obtain estimates and select variables that contributed most in explaining the variance between countries. Finally, Gaussian Graphical Models are used to perform inference on partial correlation structures and to assess conditional dependencies among agronomic, economic, environmental, and social components. Cluster structures are found with model-based clustering combined with GMMs and robustness checks via DPMs. Random Forest algorithms, in conjunction with SHAP value analyses, ensure additional understanding of the relative role of individual predictors on cluster assignment and sustainability profile. Estimation of Spatial Econometric Models (Spatial Autoregressive and Spatial Error form) is conducted to capture the spatial spillover effects and regional interdependence of both organic adoption and sustainability results. The results identify four clusters of European countries in terms of agronomic orientation, export performance and aggregated sustainability evaluation. Our results provide valuable new evidence about the multivariate network of dependencies between organic agriculture, market dynamics and sustainability, with methodological and policy implications for agronomists, export managers, and stakeholders involved in sustainable development in agriculture.

Keywords: Organic farming; Agronomy; Export management; Sustainability; Sparse PCA; Gaussian Graphical Models; Model-Based Clustering; Random Forest; SHAP values; Spatial Econometrics; European agriculture.

Inelmovix: postural prevention through data analysis using an exoskeleton

Vincenzo Dottorini, Roberto Paolicelli, Angelo Romano, Alessandro D'Alcantara, Davide Scintu, Giuseppe Oddo, Giulio Setzu, Vito Santarcangelo

(Informatica Srl)

Il presente lavoro esplora un'innovativa applicazione di esoscheletri a tecnologia passiva, integrati con sensoristica avanzata e moduli di intelligenza artificiale, per la valutazione del carico posturale e la prevenzione proattiva degli infortuni negli operatori impegnati in attività di manutenzione industriale, con particolare attenzione al settore elettrico. L'esoscheletro in esame è progettato per coadiuvare gli operatori in posizioni scomode o durante la gestione di carichi fisici, tramite la sua integrazione nel capo di abbigliamento da lavoro di un operatore di impianti elettrici. A differenza delle soluzioni tradizionali, questo sistema integra una rete di sensori inerziali e laser (accelerometri e giroscopi) che mappano in tempo reale i movimenti e le posture assunte dagli operatori. I dati raccolti vengono elaborati mediante moduli di intelligenza artificiale che monitorano la correttezza posturale, identificano comportamenti potenzialmente pericolosi e generano alert in caso di movimenti scorretti o cadute. L'analisi statistica dei flussi sensoriali consente di quantificare con precisione il carico posturale associato a specifiche movimentazioni, offrendo così una base oggettiva per la valutazione del rischio di infortunio. Inoltre, il sistema include un modulo di intelligenza spiegabile (XAI), in grado di generare attività di training personalizzate, adattate alle esigenze dell'operatore, con l'obiettivo di migliorare e personalizzare l'ergonomia operativa. Attraverso il metodo statistico, abbiamo evidenziato come i segnali sensoriali raccolti siano fortemente correlati a specifici schemi di sovraccarico posturale, validando l'efficacia del sistema nel contesto industriale. Questo approccio rappresenta un avanzamento significativo nella prevenzione attiva degli infortuni e nell'ottimizzazione delle pratiche lavorative.

Keywords: Passive Exoskeleton; Occupational Safety; Postural Load Assessment; Artificial Intelligence; Industrial Ergonomics

C11.

Mathematical and Statistical Tools for Measuring Sustainability

Conveners & Chairpersons

Leonardo Salvatore Alaimo (University of Rome La Sapienza)

Measuring to Share, Sharing to Transform: Knowledge in Action for Circular Business Practices

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(University of Modena and Reggio Emilia)

Corporate attempts to operationalise the circular economy (CE) have proliferated since the seminal vision put forward European Commission (2015). Yet empirical studies consistently show large implementation gaps between rhetorical commitment and material progress (Kirchherr et al., 2017). A key explanation is epistemic: circularity requires firms to convert fragmented, tacit, and often locally embedded insights into coordinated, cross-boundary actions (Korhonen et al., 2018). Building on the practice-based theory of organisational knowing, which positions "knowing...as an ongoing social accomplishment" (Orlikowski, 2002, p. 253), this paper develops a Measure–Share–Transform (M-S-T) framework.

We utilize the unsupervised Random Forest (RF) algorithm to identify the most influential variables underlying the data structure. Furthermore, once the important variables are selected, we construct composite indicators based on the minimal depth criterion which shows the average minimal depth across the forest, and the 'count' measure reflects the normalized average number of maximal subtrees by the size of the tree (Greco at al., 2019). These data-driven composite indicators then serve as inputs for clustering, allowing us to group units that exhibit similar aggregate characteristics.

We apply such framework on data collected via a regional survey (spring 2024) on 1,189 firms in Emilia-Romagna, Italy, an archetypal European SME region transitioning toward CE, that captured both circular-action variables and knowledge-process variables, together with contextual controls.

The results show how circular indicators may act as generative boundary objects rather than static data repositories. By identifying measurement and sharing practices as co-evolving, we enrich the capability-based view of CE (Bocken, et al., 2014). The study therefore advances three theoretical contributions. First, it extends practice theory to CE by demonstrating that sustainability indicators can operate as generative boundary objects for CE practices. Second, it explains micro-mechanisms of circular capability: measurement alone is insufficient; its power lies in its knowledge "circulation". Third, it offers a parsimonious diagnostic dashboard: firms ranking in the top quartile on both knowledge and circular variables align with the knowledge-enabled archetype and can plausibly adopt more advanced CE practices.

Managerially, the findings counsel embedding indicator development in cross-functional routines such as progress evaluations, supplier audits, innovation lab, so that latent operational knowledge can become discussable and actionable. For policymakers, linking grants to evidence of both investment and knowledge-sharing infrastructures could amplify public returns.

Keywords: Circular Economy; Organizational Knowing; Composite Indicators; Random Forest; SMEs

Trends and Disparities in ESG Performance: A Country-level Comparative Analysis

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This study investigates the relationship between Environmental, Social, and Governance (ESG) performance among firms from multiple countries, with a specific emphasis on determining and measuring the significant impact of country-specific factors. Employing company-level ESG data from a large international sample, the study identifies trends, patterns, and differences in ESG ratings, evaluating whether and to what extent country-specific parameters influence companies' ESG performance. Applying unsupervised machine learning techniques, the analysis identifies significant national effects that shape the distribution of ESG metrics, revealing key trends, structural differences, and groups of companies exhibiting similar ESG profiles. By incorporating country-level indicators and comparing results across multiple countries, the study aims to clarify the influence of national contexts on firms' ESG performance. The findings offer valuable insights for investors, policymakers, and corporate managers, emphasizing the critical role of country-specific indicators in ESG integration, assessment, and strategic decision-making.

Keywords: ESG Performance; Country-Specific Factors; Multinational Firms; Machine Learning; Corporate Sustainability.

*Unsupervised Density-Based Methods for Interpreting Sustainability Data**

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(University of Bari Aldo Moro)

The measurement of sustainability across different domains: environmental, economic and social represents a crucial challenge for understanding complex phenomena and supporting responsible development strategies. In this context, density-based clustering algorithms such as DBSCAN (Density- Based Spatial Clustering of Applications with Noise) and HDBSCAN (Hierarchical DBSCAN) offer effective tools for identifying data structures without requiring prior knowledge of the number of clusters. DBSCAN enables the detection of clusters with arbitrary shapes. HDBSCAN, its hierarchical extension, is particularly useful when data exhibit regions of varying density, as is often the case in sustainability analyses. The adoption of these methods allows for the identification of coherent groups of behaviors, territories or entities with shared characteristics, thereby improving the interpretation of indicators and facilitating comparison across different contexts. These approaches have proven valuable, for example, in the analysis of urban policies, corporate practices or environmental scenarios, contributing to a more integrated and comparative understanding of sustainability.

*This study was carried out within GRINS - Growing Resilient, Inclusive and Sustainable and received funding from the European Union Next-Generation EU (NATIONAL RECOVERY AND RESILIENCE PLAN NRRP). MISSION 4, COMPONENT 2, INVESTMENT 1.3 - D.D. 1558 11/10/2022, PE00000018 Spoke 8 social sustainability). This manuscript reflects only the authors' view and opinions, neither the European Union nor the European Commission can be considered Responsible for them.

Keywords: Density-based clustering, DBSCAN, HDBSCAN, Pattern detection

New Mathematical Models for Mobile Cartographic Tracking

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(Informatica Srl)

Il paper mira a presentare un approccio l'innovativo riguardante il mapping e tracciamento cartografico dell'integrità stradale tramite dispositivi itineranti Gretavision, implementazione della nuova tecnica di un brevetto di invenzione industriale della società Ecosud. Il dispositivo installato su mezzi di trasporto su strada dotato di sensori inerziali, GPS e telecamera rileva dati relativi alle oscillazioni e saggi fotografici georeferenziandoli lungo l'acquisizione. Il modello M(x,s) va quindi a mappare in ogni secondo di rilevamento (t) a cui corrispondono le coordinate GPS (s) la presenza di problematiche stradali (es. cantiere, assenza di segnaletica) acquisite da telecamere e la presenza di tratti eterogenei del manto stradale (es. buche, asfalto consumato) tramite il modello addestrato su vibrazioni. Ne esce quindi una funzione cartografica M(x,s) che consente un monitoraggio a costo zero dello stato delle strade x in modo collaborativo sfruttando l'acquisizione real-time percorrendo tratti stradali canonici (es. bus) o montandoli a bordo di flotte (es. auto aziendali, taxi, ncc).

Keywords: Road Infrastructure Monitoring; Gretavision; Sensor-Based Mapping; GPS Data; Pavement Condition

C12.
Academic Session in Tribute to Franco D'Ovidio

Conveners & Chairpersons

Corrado Crocetta (University of Bari Aldo Moro)

Ernesto Toma (University of Bari Aldo Moro)

Soft Skills in the Labour Market: Time Trajectories and Evolving Requirements in Tourism Professional Profiles

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(University of Milano-Bicocca)

The recruitment process in the Labour Market has been always ruled essentially by two factors: the previous working experience and the analysis of the competences owned by the candidates. One of the most important innovations about this issue is represented by the focus on the skills moved from the hard to the field of the soft skills. This new point of view has generated an innovative way of choosing the hired candidates and produced a lot of scientific contributes on the theme. This study tries to analyze this topic starting from a large database provided by the Adecco Group and containing more than a million and half of job offers. For each job advertisement, information about the hired candidate are available in terms of personal details, previous experiences and owned soft skills. The job offers covered nine macro-economic sectors and the focus is here about the figures of the tourism sector. From a methodological point of view, since the Adecco Group dataset contains job offers from 2016 to 2024, a Weighted Factor Analysis has been implemented to reduce the number of the dimensions extracting the factors that characterize the most influential soft skills. This technique has allowed to detect cluster of soft skills and to underline differences among the tourism professional figures. Furthermore, the application of this approach led to the creation of the time trajectories drawn to follow the evolution of the requirements over the considered period.

Keywords: Labour Market; Soft Skills; Recruitment; Tourism Sector; Weighted Factor Analysis

What dimensions shape student satisfaction with Teaching? Insights from the University of Bari

Ernesto Toma, Angela Maria D'Uggento, Ilaria Pepe

(University of Bari Aldo Moro)

Assessing student satisfaction with teaching is a key issue in evaluating the quality of higher education, with the role of contextual and individual factors becoming increasingly important. This study examines the determinants of student satisfaction at the University of Bari, drawing on data from the Institutional Student Opinion Survey, which collects ratings disaggregated by department, degree programme and academic area. The analytical framework is based on the SERVPERF model, which operationalises service quality based on five dimensions: Tangibles, Reliability, Responsiveness, Assurance and Empathy (Parasuraman, Zeithaml, & Berry, 1988). These dimensions are used to construct a mediation model designed to examine not only their direct impact on overall satisfaction with teaching, but also their indirect impact through students expressed interest in the course and their educational background. The study uses a multilevel statistical approach to account for the hierarchical structure of the data, where students are classified into degree programmes, departments, and academic areas. Mediation effects are estimated to capture the extent to which individual motivation and educational background determine the impact of perceived Teaching quality on satisfaction scores. Particular attention is paid to the heterogeneity of effects across academic disciplines by analysing whether the weight of each SERVPERF dimension varies by disciplinary context. The findings show both direct and mediated relationships between perceived Teaching quality and student satisfaction. These results highlight the importance of considering both organisational determinants (such as academic department and programme) and individual characteristics when modelling satisfaction. The study illustrates the usefulness of integrating measures of service quality with mediation analyses in higher education research. From a university management perspective, it provides insights for university managers seeking to develop measures to strengthen Teaching effectiveness, and improve the overall student learning experience, while also benefiting from the positive image of the university reported by satisfied students.

Keywords: Student Satisfaction, Teaching Quality, Higher Education, SERVPERF Model, Mediation Analysis

C13.

Perspectives and Challenges of Contemporary Tourism

Conveners & Chairpersons

Tonio Di Battista (University of Chieti-Pescara G. d'Annunzio)

Eugenia Nissi (University of Chieti-Pescara G. d'Annunzio)

Modelling the Geographies of Care: A Multivariate Approach to the Sustainability of Medical Tourism

Margaret Antonicelli

(IULM)

Medical tourism constitutes an increasingly relevant phenomenon within the broader transformations of contemporary mobility, healthcare accessibility, and territorial development. This research aims to explore the sustainability of medical tourism through a complex, data-driven statistical framework, with particular attention to spatial heterogeneity and structural disparities among regions.

The study develops a composite indicator to measure medical tourism sustainability, based on a selection of variables reflecting healthcare quality, infrastructural capacity, patient mobility, cost-efficiency, and institutional support. The indicator is constructed using a Multi-Criteria Decision Analysis (MCDA) approach, allowing for the integration of both quantitative and qualitative dimensions.

The empirical analysis covers the 20 Italian regions and selected Mediterranean EU countries (Spain, Greece, Croatia, Portugal), over the period 2015–2023, drawing from official datasets (ISTAT, Eurostat, OECD, Ministry of Health). To explore the underlying structure of the phenomenon, a Structural Equation Model (SEM) is applied, enabling the identification of latent factors influencing regional performance in the field of medical tourism. Spatial econometric models (Spatial Lag and Spatial Error) assess territorial interdependencies, while a supervised learning algorithm (Random Forest) classifies regions based on their development potential. The findings highlight persistent regional disparities and emphasize the need for integrated policy actions that transcend sectoral boundaries. Medical tourism, if properly governed, may contribute not only to economic diversification, but also to more equitable and sustainable healthcare systems.

Keywords: Medical Tourism; Structural Equation Modelling; Spatial Econometrics; Regional Disparities; Multi-Criteria Decision Analysis; Health Mobility, Machine Learning in Tourism Studies; Tourism and Healthcare Integration

Visitor Experience and Profile-Based Segmentation in Natural Protected Areas: A Case Study in the Majella National Park

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(University of Chieti-Pescara G. d'Annunzio)

Protected areas play a dual role in environmental conservation and nature-based tourism. Effective visitor management is essential to balance these objectives, requiring a solid understanding of visitor perceptions, motivations, and satisfaction. This study investigates visitor experiences in Italy's Majella National Park (MNP), aiming to identify distinct visitor profiles and inform tailored, sustainable tourism strategies. Data were collected during the summer of 2020 from 151 visitors through a self-administered questionnaire, covering demographics, travel behavior, satisfaction, and previous park experience. A two-step analytical approach was employed: first, the Graded Response Model (GRM) assessed the relative importance and discrimination power of satisfaction items. Second, Bayesian Profile Regression (BPR) enabled the segmentation of visitors into homogeneous clusters based on their demographic and behavioral profiles. Findings reveal the significance of services like public transport, catering, and multilingual staff in shaping satisfaction. The BPR identified clear visitor segments, including a highly satisfied group mostly from the Abruzzo region, aged 25–45, with prior park experience and medium-length stays. Other clusters differed in education, spending, and origin, underlining the diversity of expectations and experiences. This study demonstrates the value of advanced statistical tools for understanding visitor heterogeneity in protected areas. The results offer practical insights for park managers to refine marketing, improve services, and promote sustainability by aligning management strategies with the specific needs of distinct visitor groups.

Keywords: Protected Areas; Nature-Based Tourism; Visitor Satisfaction; Bayesian Profile Regression; Majella National Park

Coralvision: A New Bottom-Up Approach for Tourism Enhancement

Alessandro D'Alcantara, Angelo Romano, Michele Di Lecce, Vincenzo Ribaudo, Davide Scintu, Giulio Setzu, Sergio Vitullo, Marco Vito Calciano, Vito Santarcangelo

(Informatica Srl)

Il presente lavoro introduce un'iniziativa di ricerca industriale co-finanziata dall'Unione Europea e dal MUR, nata dall'esigenza di superare i limiti degli attuali strumenti digitali per la valorizzazione turistica, in particolare la tendenza dei motori di intelligenza artificiale generativa a produrre contenuti testuali e visivi imprecisi, generici o fuorvianti per i Punti di Interesse (POI) locali. Uno studio interno, basato su un campione di contenuti lucani valutati tramite crowd-computing, ha infatti rivelato che meno del 50% delle informazioni generate dall'IA soddisfaceva i criteri di affidabilità. Per affrontare questa criticità, iInformatica Srl ha sviluppato Coralvision, un innovativo sistema di fruizione turistica che implementa un approccio Human-in-the-Loop (HITL). Questo paradigma ibrido prevede che "ambasciatori turistici" locali (esperti e volontari) censiscano, validino e gestiscano una base di conoscenza semantica dei POI, mentre l'intelligenza artificiale interviene per affinare stilisticamente i testi, tradurre e adattare i contenuti alle necessità dell'utente, mantenendone l'autenticità e la qualità. La ricerca industriale si è altresì concentrata sullo studio e l'applicazione di SMART-TAG (BEACON) basati su tecnologia Bluetooth Low Energy (BLE), integrati in arredi urbani come le panchine. Questi dispositivi facilitano l'orientamento e consentono l'accesso immediato a contenuti digitali e multisensoriali direttamente dal browser dello smartphone, senza necessità di app native. Un elemento distintivo è lo sviluppo di un approccio multisensoriale automatico che combina storytelling con interazioni aptico-sonore, migliorando significativamente l'accessibilità e l'immersività dell'esperienza. Il progetto prevede un caso di studio applicativo nel mezzogiorno e annovera al momento già l'attivazione di 20 beacon associati ad ambasciatori turistici del territorio con l'intento di promuovere il coinvolgimento attivo dei residenti e rafforzare il tessuto sociale.

Keywords: Tourism Technology; Human-in-the-Loop; Coralvision; BLE Beacons; Multisensory Experience

Analysis of the Key Types of Loyalty for the Local Economy and Sustainability in World Heritage Cities: Passive and Active Attitudinal Loyalty and Behavioral Loyalty

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(University of Castilla-La Mancha)

The relevance of ensuring tourist loyalty to a destination is considered an essential factor for the sustainability and long-term viability of the site. To achieve this, economic activity that combines cultural approaches with the local economy constitutes a strategy for sustainable development. Thus, for this reason, many destinations have shifted their marketing strategies so that the goal is not only to attract new visitors, but also to foster loyalty among those who have already visited. This study explores the variables influencing destination loyalty, particularly in Spain, where tourism is a key economic driver. Spain's strong tourism identity is enhanced by its many UNESCO World Heritage Cities, which attract cultural tourists interested in history and art. The research aims to build a structural model analyzing tourist behavior in heritage cities, contributing to the literature by clarifying how different factors affect loyalty, with the aim of contributing to the local development of these cities. It distinguishes between behavioral and attitudinal loyalty, introducing a novel division between active and passive attitudinal components. The study was conducted in Cuenca, Spain, using survey data from 668 tourists. To test the hypotheses, the partial least squares structural equation modeling (PLS-SEM) method was applied. The findings offer valuable insights for the strategic management of heritage tourism destinations.

Keywords: local economy, sustainability, heritage, behavioral loyalty, passive attitudinal loyalty, active attitudinal loyalty

Investment in archaeological heritage and sustainable territorial development: analysis of four sites in Castilla-La Mancha (Spain)

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(University of Castilla-La Mancha)

Within the framework of European, national, and especially regional policies promoting cultural heritage as a driver of territorial development, the case of Castilla-La Mancha offers a particularly eloquent laboratory. The analysis of four key archaeological sites —the Archaeological Park of Libisosa (Lezuza, Albacete), Tolmo de Minateda (Hellín, Albacete), the Roman city of Segóbriga (Saelices, Cuenca), and the Roman Villa of Noheda (Villar de Domingo García, Cuenca)— allows for an assessment of how investment in conservation, restoration, and dissemination of heritage can generate tourism and socioeconomic growth dynamics in areas traditionally characterized by depopulation and structural weakness in their productive fabric. Over the past twenty-five years, each of these sites has received varying levels of intergenerational public funding aimed at both the material recovery of structures and archaeological research programs, as well as the creation of visitor infrastructure, interpretation centers, museum proposals, and cultural activation activities. The valorization strategy has led to a progressive increase in visitor numbers, with particularly notable growth in Segóbriga and Noheda, where monumental appeal has directly impacted the local economy by stimulating sectors related to hospitality, accommodation, and cultural services. This impact goes beyond mere tourist influx, deeply influencing community revitalization. In certain municipalities, it has helped curb population exodus by generating employment linked to heritage management. Overall, the study demonstrates that investment in archaeological heritage, when managed under sustainability parameters, not only ensures cultural transmission to future generations but also serves as an effective tool for territorial development in regions at risk of depopulation.

Keywords: investment, archaeology, sustainability, depopulation.

C14.

Innovations and Insights from Tourism Entrepreneurs

Conveners & Chairpersons

Ettore Ruggiero (University of Bari - Ceo NEXTWORK - Tourism experience in Puglia)

Corrado Crocetta (University of Bari Aldo Moro)

The session will feature experts from the tourism sector involved in the PRIN project *The Future of Sustainability* (CUP Code: H53D23009470001, Project Code: P2022B3NFH). The concluding remarks will be delivered by Federico Amedeo Lasco, Directorate-General for Promotion, Investment and Innovation, Ministry of Tourism, who will provide a synthesis of the presentations in light of the Ministry's strategic objectives.

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