Dottorato di Ricerca in
"Ingegneria per l'Innovazione e lo Sviluppo Sostenibile"

TITOLO DELLA TESI
"*Service Ecosystems and Social Innovation in the Inner Areas for a Regenerative Economy*"

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Abstract

The doctoral thesis “Service Ecosystems and Social Innovation in the Inner Areas for a Regenerative Economy” investigates how institutional dynamics and social innovation interact in shaping service ecosystems within peripheral and rural territories. Anchored in the New Institutional Economics (NIE) framework, it explores how formal and informal institutions jointly influence the capacity of inner areas to achieve economic, social, and environmental regeneration. Through the concept of service ecosystems—adaptive configurations of actors, technologies, and institutions—the research examines social innovation as a collective capability for addressing local challenges and fostering a regenerative economy.

Empirically, the study focuses on rural Italy, analysing data from the 2024 RIOM survey across 40 municipalities in Basilicata, Campania, and Molise. Using mixed methods (non-parametric and multivariate analysis), it identifies how perceptions of institutional adequacy, trust, and community cohesion shape innovation readiness and well-being. Results highlight the complementary role of formal and informal institutions: strong social trust and cohesion enhance resilience but require infrastructural and digital reinforcement to sustain innovation. The thesis contributes to institutional and service-ecosystem theories by introducing the concept of institutional synchronisation—the alignment of formal structures and informal networks—as a precondition for regenerative territorial development. It offers actionable insights for place-based policies such as the Italian National Strategy for Inner Areas (SNAI), advocating integrated interventions that strengthen institutional complementarities rather than addressing isolated deficits.

Sintesi

La tesi di dottorato “Service Ecosystems and Social Innovation in the Inner Areas for a Regenerative Economy” analizza come le dinamiche istituzionali e i processi di innovazione sociale interagiscano nel modellare gli ecosistemi di servizio nei territori periferici e rurali. Radicata nel quadro della New Institutional Economics (NIE), la ricerca indaga in che modo le istituzioni formali e informali co-determinano la capacità delle aree interne di rigenerarsi economicamente, socialmente e ambientalmente. Attraverso la lente degli ecosistemi di servizio—configurazioni adattive di attori, tecnologie e istituzioni—l’innovazione sociale è interpretata come capacità collettiva di affrontare le sfide locali e promuovere un’economia rigenerativa.

Sul piano empirico, lo studio si concentra sull’Italia rurale, utilizzando i dati dell’indagine

RIOM 2024 condotta in 40 comuni di Basilicata, Campania e Molise. Attraverso un approccio misto (analisi non parametriche e multivariate), vengono esplorate le relazioni tra percezioni di adeguatezza istituzionale, fiducia sociale e coesione comunitaria rispetto alla prontezza all'innovazione e al benessere. I risultati evidenziano la complementarità tra istituzioni formali e informali: la fiducia e la coesione sociale rafforzano la resilienza, ma necessitano di adeguati supporti infrastrutturali e digitali per tradursi in innovazione sostenuta. La tesi contribuisce alla teoria degli ecosistemi di servizio e dell'economia istituzionale introducendo il concetto di sincronizzazione istituzionale, intesa come allineamento tra strutture formali e reti relazionali, condizione essenziale per uno sviluppo territoriale rigenerativo. Infine, offre spunti operativi per politiche place-based come la Strategia Nazionale per le Aree Interne (SNAI), suggerendo interventi integrati capaci di valorizzare le complementarità istituzionali.

Introduction

The doctoral thesis "Service Ecosystems and Social Innovation in the Inner Areas for a Regenerative Economy" explores how institutional dynamics and social innovation processes interact to shape the evolution of service ecosystems in peripheral and rural territories. The work lies at the intersection of institutional economics, digitalisation studies, and territorial development, aiming to understand how formal and informal institutions co-determine the capacity of inner areas to regenerate economically, socially, and environmentally.

Rooted in the framework of the New Institutional Economics (NIE), the thesis builds on the principle that institutions—formal rules, informal norms, and their enforcement characteristics—define the "rules of the game" within which human interaction occurs (North, 1990; Ménard & Shirley, 2025). Institutions shape incentives, reduce uncertainty, and influence the emergence of entrepreneurial and innovation systems (Bruton et al., 2010; Audretsch & Belitski, 2017). Within this framework, the thesis assumes that innovation in rural and inner contexts is not merely a function of technological advancement but a complex outcome of the interplay between formal institutional infrastructures—such as transport, finance, and governance—and informal institutions, including trust, reciprocity, and social cohesion (Ledeneva & Efendic, 2021; Fernandes & Ferreira, 2022).

The research investigates these interactions through the lens of service ecosystems, defined as self-adjusting configurations of actors, technologies, and institutions that co-create value through resource integration and service exchange (Vargo & Lusch, 2016; Vargo et al., 2015). Within such systems, social innovation emerges as a collective capacity to generate new solutions to social challenges, often by leveraging local knowledge and relational capital (Moulaert et al., 2013; Basile & Cavallo, 2020). This approach connects innovation processes with well-being and sustainability, fostering what can be termed a regenerative economy—an economic paradigm oriented toward restoring ecological balance, social cohesion, and long-term resilience (Riva et al., 2020).

Context and research rationale

Inner areas represent institutional peripheries of national economies, characterised by demographic decline, infrastructural fragility, and economic marginality (Salvati & Carlucci, 2011; Vendemmia et al., 2021). Yet, they retain a rich endowment of social capital, environmental heritage, and collective intelligence—factors that may act as hidden drivers of innovation if adequately integrated with formal systems of support (Bosworth & Turner, 2018;

Ferrara et al., 2017). The Italian National Strategy for Inner Areas (SNAI) embodies this principle by pursuing place-based development policies that combine infrastructure investments, public service enhancement, and the mobilisation of community assets (Barca et al., 2014).

Against this background, the thesis aims to empirically test how the coexistence of strong informal institutions and weak formal infrastructures affects innovation readiness and the emergence of digitalisation-based service ecosystems in rural Italy. It specifically examines how social cohesion, trust, and relational quality influence perceptions of institutional adequacy, well-being, and entrepreneurial dynamism (Igwe et al., 2020; Webb et al., 2020).

The analysis relies on the RIOM ("Risks and Opportunities in Southern Inland Areas") survey, conducted in 2024 by the University of Basilicata, which collected data from over 2,000 respondents across 40 municipalities in Basilicata, Campania, and Molise. The survey integrates socio-demographic indicators with 23 Likert-type perception variables assessing individual well-being, community relations, and institutional quality. The resulting dataset allows for a three-pillar analysis—Psychological and Material Wellbeing (PMW), Informal Institutions (II), and Formal Institutions (FI)—each representing a distinct dimension of the service ecosystem.

Methodologically, the thesis employs a mixed descriptive–inferential approach combining non-parametric statistics (Mann–Whitney U, Kruskal–Wallis, and Dunn's post-hoc tests) with multivariate analysis (Principal Coordinates Analysis, hierarchical clustering using Gower distances). This strategy, consistent with the analytical workflow described in Chapters 1 and 2, enables the identification of significant differences among socio-demographic and municipal groups, correlations among institutional perceptions, and the exploration of high-dimensional relationships that shape territorial ecosystems.

This doctoral research contributes to both theory and practice by:

- Bridging institutional and service-ecosystem theories to explain how digitalisation processes interact with local institutional contexts in shaping innovation pathways.
- Providing empirical evidence from underexplored rural and inner areas, thereby enriching the literature on peripheral innovation systems (Aguilar, 2021; Asmit et al., 2024).

- Developing an interpretative framework for assessing how individual perceptions of institutions correlate with socio-demographic factors, well-being, and innovation readiness.
- Offering policy-relevant insights for place-based strategies such as SNAI, suggesting that interventions should address institutional complementarities rather than single deficits.

The results confirm that while strong informal institutions (e.g., social trust, mutual aid) enhance community resilience, they are insufficient to trigger sustained innovation without corresponding improvements in formal structures—such as broadband connectivity, transport, and digital skills. Conversely, even well-designed formal systems fail if they disregard community norms and social capital (Williams & Vorley, 2015; Reiners, 2022). This dual dependency underscores the need for institutional synchronisation, where the effectiveness of public investment aligns with local relational infrastructures and digital adoption behaviours.

By linking institutional performance to well-being and innovation capacity, the thesis contributes to defining the contours of a regenerative economy—an economy capable of restoring, rather than merely sustaining, the ecosystems on which it depends. The regenerative paradigm implies that digitalisation, far from being a purely technological process, can serve as a catalyst for social learning, inclusive governance, and community-driven resilience (Barile et al., 2025; Nambisan et al., 2019). In this sense, service ecosystems in inner areas can evolve into laboratories of collective intelligence where technological infrastructures, social networks, and institutional frameworks co-evolve toward sustainability (Elia et al., 2020; Content et al., 2020).

Ultimately, this doctoral work demonstrates that rural innovation resists simple categorisation: it is multidimensional, context-dependent, and deeply embedded in social relations. By integrating statistical, spatial, and institutional analysis, the thesis advances the understanding of how local ecosystems can transition from vulnerability to regeneration through balanced institutional architectures and the active participation of communities.

Structure of the thesis

The thesis is organised into three main chapters, each addressing a specific scale and perspective of analysis.

The first chapter, “Relational Density and Digital Scarcity in Rural Districts”, focuses on the Montagna Materana (MOMA) area in the Basilicata region. It maps institutional ecosystems for digital entrepreneurship and analyses how perceptions of institutional adequacy relate to digitalisation and innovation readiness. The findings reveal strong social cohesion and high relational quality but a persistent digital divide and infrastructural weaknesses—especially in transport and advanced technological services—limiting the area’s capacity for regenerative innovation (Quaranta et al., 2020; Elia et al., 2020).

The second chapter, “Wellbeing and Landscapes under Formal and Informal Institutions”, expands the analysis to include the Sele-Tanagro (SETA) area in Campania, allowing for comparative assessment between MOMA and SETA. The study identifies converging institutional dynamics: both areas show robust social capital but face significant infrastructural and digital skill gaps. However, SETA performs relatively better in transport connectivity and labour availability, while MOMA maintains stronger community cohesion. The findings suggest that synchronised improvements in both formal and informal institutional dimensions are crucial for enhancing innovation readiness (Fuentelsaz et al., 2019; Urbano et al., 2019).

The third chapter, “The Institutional Economy of Entrepreneurial Networks for Digitisation-Based Service Ecosystems”, integrates the results into a broader theoretical framework of the institutional economy of innovation. It discusses the conditions under which institutional complementarities—between trust networks and market or policy instruments—generate adaptive, resilient, and inclusive ecosystems in peripheral regions (Amendolagine & von Jacobi, 2023; Zhang & Wei, 2023). By connecting empirical evidence with the conceptual architecture of NIE and service-dominant logic, the thesis contributes to the theorisation of institutional synchronisation as a precondition for regenerative development.

Chapter 1

Relational density and digital scarcity in rural districts: mapping institutional ecosystems for digital entrepreneurship in Italian inner areas[1]

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Abstract

Purpose: The purpose of this chapter is to examine how individual perceptions of formal and informal institutions influence digitalisation-based service ecosystems and their entrepreneurial networks in the inner areas of Italy. It identifies locally relevant institutional drivers and barriers that affect digital entrepreneurial ecosystems.

Methodology: The analysis is based on a sample of 303 individuals from Montagna Materana (MOMA), an inner area of the Region of Basilicata in Southern Italy, interviewed in 2024. The survey encompasses sociodemographics and an assessment of various personal and institutional perceptions, using a Likert scale. The analysis combines descriptive and inferential methods, including Kruskal-Wallis, Mann-Whitney U, Dunn Post Hoc tests, Principal Coordinates Analysis (PCoA), and hierarchical clustering.

Findings: The MOMA area demonstrates strong social cohesion with high community bonds and relational quality. However, a significant digital divide exists, separating younger respondents—who show greater internet use and trust in remote work—from older groups. Formal institutional support has moderately positive scores, except for weak transport infrastructure. Well-being is modestly linked to perceptions of one's own environment. PCoA suggests high dimensionality, with minimal clustering. Municipal differences appear only around financial services and employment stress.

Limitations/implications: Missing data and weak municipal distinctions require further testing. The absence of innovative start-ups, SMEs or incubators calls for alternative innovation metrics. Yet, the study underscores the multifaceted role of institutional support in rural digitalisation. It proposes a framework integrating institutional perceptions with psychological and material well-being.

[1] This is chapter 5 of the book *Rethinking Rural* - submitted to Elsevier, 1st Edition - April 1, 2026.

Recommendations: Further research should test for missing data patterns, explore nonlinear relationships, compare across regions, and combine subjective and objective measures of innovation readiness.

Keywords: Institutional Economics; Inner Areas; Local Development; Entrepreneurial Ecosystems; Rural Digitalisation.

1. Introduction

How far can digital innovation travel when the road to the next town has potholes and internet is not part of daily life? This chapter probes the tension arising from the intricate web of formal institutions—roads, finance, public research—and informal ones—trust, mutual aid, shared norms—that shape digitalisation-based service ecosystems and entrepreneurial networks in Italy's inner areas.

Recognising that structural conditions and cultural assets intertwine in non-linear, geo-specific ways, this study zooms in on the Montagna Materana (MOMA) area to show blends of community norms and infrastructural gaps which can either catalyse or stifle local initiatives. Leveraging primary data from the RIOM survey, this analysis maps residents' institutional perceptions and provides evidence that grasping the formal-informal institutional balance is essential for crafting effective context-sensitive policies in peripheral regions.

The chapter stems from the University of Basilicata-funded research project 'Analysis of relationships between formal and informal institutions and the entrepreneurial network in digitalisation-based service ecosystems', which aims to investigate, through direct surveys and multi-level modelling, how formal and informal institutions influence the emergence of entrepreneurial networks in service ecosystems, with a focus on identifying related drivers and barriers.

The investigation draws on the 'Risks-opportunities in southern inland areas' (RIOM) dataset, analysing a sample of 303 individuals from MOMA, an inner area of the Region of Basilicata in Southern Italy. The study offers an exploratory assessment of the structural influence of formal and informal institutions on digitalisation-based service ecosystems and their entrepreneurial networks in inner areas.

This section is followed by a literature review examining recent studies, focusing on the role of formal and informal institutions in digitalisation-based entrepreneurial ecosystems. Then an

overview of the survey in use is presented, providing an account of the survey methodology, data collection, survey structure, geographical framework and resulting variables. Next, the methodology section outlines the sources of the input data, data cleaning operations, defines the variables of interest, and describes the analytical approach used.

The results section presents an overview of descriptive statistics calculated through univariate analysis for all variables in the analysis, a focus on socio-demographic and municipal differences through bivariate analyses, and highlighting significant differences, and multivariate exploratory analysis (e.g., (Francaviglia et al., 2019)). The latter is followed by the discussion, emphasizing the possible roles of formal and informal institutions as drivers of innovation and their variability across respondents' characteristics. Finally, it follows the conclusion remarks, suggesting the direction for future research. Supporting materials—including the questionnaire and detailed tables—are provided in the appendices.

2. From potholes to mutual aid: Drivers, barriers, and balances in rural innovation

Formal and informal institutions generate an intricate web of contrasting forces affecting entrepreneurial networks development (Ménard & Shirley, 2025). In high-income countries, such as Italy, digital entrepreneurship ecosystems arise through collective intelligence mechanisms over processes, resources, and products (Elia et al., 2020) in competitive systems where institutional effects are variably integrated within business models (Bouncken & Kraus, 2022).

Informal institutions, including community ties, grassroots mutual aid networks, trust in innovation and digital tools, substantially influence the incentives for entrepreneurs and the labour force to engage in entrepreneurship and digital innovation ecosystems (Ledeneva & Efendic, 2021). Meanwhile, formal institutions, such as rule of law, transport infrastructures, or technological research infrastructures, determine the level of contextual conduciveness for such ecosystems (Salimath & Cullen, 2010).

The role of informal institutions in entrepreneurship networks

Informal institutions, including shared social norms and trust, underpin the development and durability of entrepreneurial networks. Social cohesion and informal collaboration notably enhance vibrant entrepreneurial ecosystems (Fernandes & Ferreira, 2022). Community ties and trust are foundational to entrepreneurial processes determining the level of collaboration,

resource sharing and risk mitigation (Lee et al., 2022). Namely, trust-based networks can compensate for resource limitations, especially in peripheral areas, and evidence suggests that trust in the local context and family support help mitigate risks and spur innovation in low-resource contexts (Igwe et al., 2020).

Grassroots mutual aid and volunteering attitudes generate localised support systems and are associated with enhanced resilience of entrepreneurial networks (Sarkar et al., 2019), especially during crises and economic downturns (Castro & Zermeño, 2020). If these informal mechanisms contribute to lower entry barriers in rural areas for entrepreneurs, the latter, in turn, drive scientific research, promotes lifestyles, and fosters exchange relationships within expansive territorial networks (Basile & Cavallo, 2020; Wilson et al., 2017). Moreover, trust in digital solutions, social media, and remote work technologies not only support the dissemination of entrepreneurial knowledge and practices but also strengthen the cultural and social prerequisites for thriving digitalisation-based ecosystems (Huđek et al., 2021; Reiners, 2022). Namely, skills related to cloud and mobile computing, internet of things, big data analytics and social media constitute key factors influencing small and medium-sized enterprises' (SME) competition and innovation dynamics (European Commission-DG GROW et al., 2015).

The role of formal institutions in digitalisation-based service ecosystems

A key role of formal institutions in shaping digitalisation-driven service ecosystems concentrates in the quality of the structural (material and normative) support offered to entrepreneurs and workers and the reduction of uncertainties related to transactions, which is particularly relevant in times of economic downturn (Williams & Vorley, 2015). For instance, while complex bureaucratic constrains may disincentivize economic activity (McMullen et al., 2008), the availability of financial services, advisory support, advanced technological infrastructures, and efficient public institutions is considered conducive to increased entrepreneurial initiatives (Audretsch & Belitski, 2017). Additionally, corruption is negatively associated with an atmosphere conducive to collaboration and innovation (Bendickson et al., 2021).

Access to information, which is tightly related to access to internet, accelerates and enhances information flow, driving the conception, development, production, and accessibility of innovative products and services (Yoo et al., 2010). Particularly, formal institutions such as

public research bodies facilitate knowledge-sharing and can substantially boost innovation and entrepreneurial success (Fudickar & Hottenrott, 2019).

Interplay between formal and informal institutions

Balancing formal and informal non-linear effects is crucial for developing a theory of institutional ecosystems (Amendolagine & von Jacobi, 2023), within which digital services are crafted. The scenarios most conducive to entrepreneurial ventures are those where market systems, public incentives and infrastructure development operate in tandem with supportive community norms (Urbano et al., 2019). For instance, evidence shows that the coupling of digital financial resources with traditional support networks bolsters participation and strengthens entrepreneurial networks (Zhang & Wei, 2023). Effective formal institutions determine the foundational framework able to host digitalisation-based ecosystems, while their sustainability and continuous development depend on supportive informal institutions such as community trust, collaboration and dynamism (Fuentelsaz et al., 2019; Webb et al., 2020), yet both institution types' effect size on entrepreneurship varies according to contextual and spatial specificities (Biasi et al., 2019; Goletsis et al., 2025; Seifollahi-Aghmiuni et al., 2022). Nevertheless, the interdependencies between values, norms, concrete framework and entrepreneurship are often not suitable for generalisations and can still be challenging to identify or fully understand (Bruton et al., 2010). This research aims to explore data on these interdependencies linking culture, norms, behaviours, formal institutions, and entrepreneurship with digitalisation-based service ecosystems.

3. From conversations to data: The RIOM survey

The RIOM survey was carried out between 9 March and 25 April 2024 with a focus on inner areas of Southern Italy. Out of 37,544 phone calls conducted, a random sample of 2,024 respondents was achieved (5.39%). The response rate calculated by including both complete and partial interviews as respondents, in accordance with the *Response Rate 2* defined by the American Association for Public Opinion Research (AAPOR, 2023), resulted in a rate of 6.52%. The sample is considered representative of the reference population, with a maximum margin of error of 2.18% at the 95% confidence level.

The survey's geographical framework consists of 40 municipalities located in three inner areas of southern Italy, as outlined in Table 1 and represented in Figure 1. The chapter only focuses on the MOMA area.

Table 1: Geographical framework of the survey.

Geographic area	No. Respondents	No. Municipalities	Province	Region
Montagna Materana (MOMA)	303	8	Matera	Basilicata
Sele-Tanagro (SETA)	1399	19	Salerno	Campania
Mainarde (MAIN)	322	13	Isernia	Molise

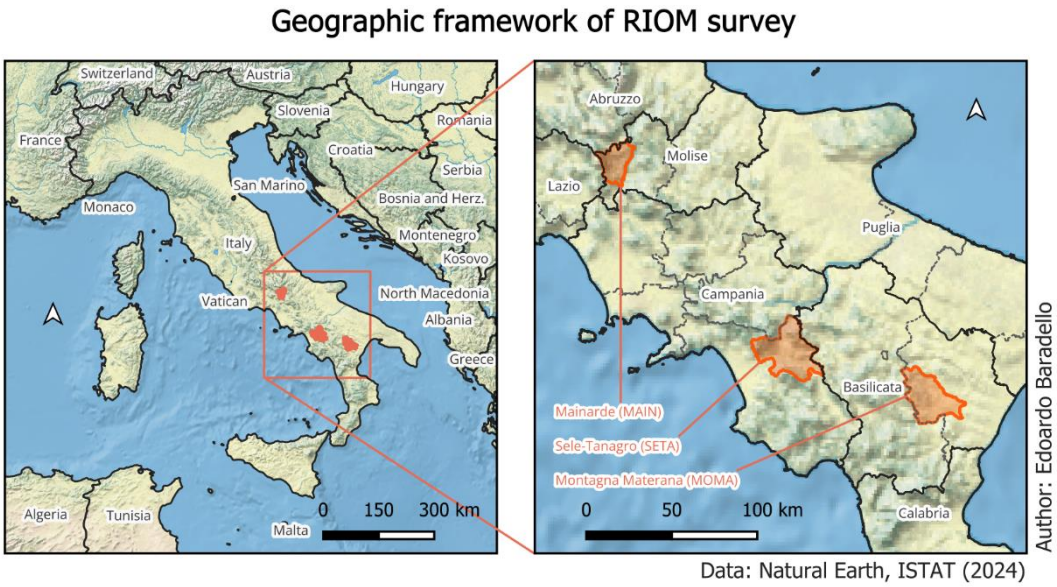


Figure 1: Geographical framework of interest. Map of grouped municipalities in the areas of interest.

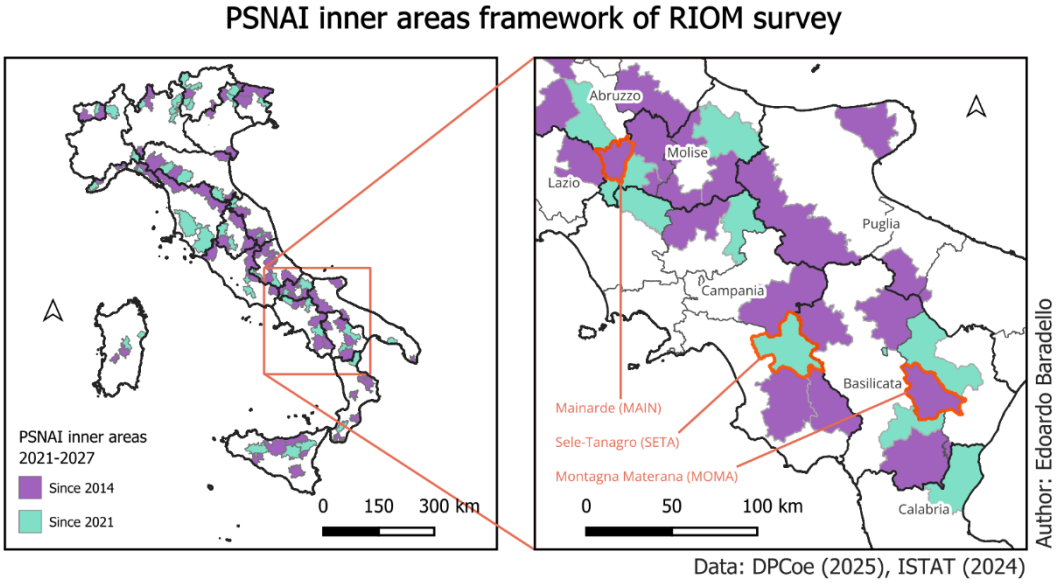


Figure 2: Italian National Strategy for Inner Areas (SNAI) framework of interest. Map showing grouped municipalities classified as official inner areas in the 2021-2027 framework colour-coded by their original classification since 2014 (purple) and since 2021 (green), with a focus on the selected survey regions.

The questionnaire is divided into three sections. The first section focuses on individual socio-demographic (SD) variables, covering: age, gender, household composition, education, employment, and lifestyle. The second section addresses personal assessments (PA), exploring life satisfaction, community integration, and challenges impacting individual well-being. The third section dives into innovation ecosystem assessments (IA), examining perceptions of local development, innovation readiness, and the adequacy of services and infrastructure. Sections two and three are measured using a Likert scale ranging from 1 to 10, where 1 represents "not at all," "never," or "very rarely," and 10 represents "always," "very often," or "very much".

For this study, 44 variables of the RIOM dataset were considered. Their names, descriptions and corresponding sections are detailed in Table 2. The variable *id* serves as the unique identifier for each survey record, while the variable *municip_code* acts as a foreign key linking each respondent to the municipality they live in. The complete list of questions of the survey is reported in Annex A: Questionnaire.

Table 2: List of variables used from the RIOM dataset.

Sec.	No.	Variable	Label
ID	1	id	Unique identifier
SD	2	birth_year	Birth year
	3	years_old	Age
	4	years_old_bin	Age (bins)
	5	gender_binary	Binary gender
	6	household_size	Household size
	7	household_size_bin	Household size (bins)
	8	civil_status	Civil status
	9	education_lvl	Education level
	10	sec_school_type	Secondary school type
	11	sec_school_name	Secondary school name
	12	university_type	University type
	13	sport_type	Sport type
	14	work_type_des	Work type description
	15	work_type_group	Work type group
	16	work_publ_priv	Public/private sector
	17	work_sector	Work sector
	18	work_sector_des	Work sector description
	19	workplace_expected	Workplace expected

Sec.	No.	Variable	Label
PA	20	pa_serenity	Personal serenity
	21	pa_community_bond	Community bond
	22	pa_small_env	Small environment influence
	23	pa_relational_qual	Relational quality
	24	pa_covid_support	Pandemic community support
	25	pa_assoc_involv	Involvement in associations
	26	pa_help_ease	Community help request ease
	27	pa_financ_stability	Financial stability
	28	pa_conjunctural_stress	Conjunctural stress
	29	pa_jobmarket_stress	Job market stress
	30	pa_soc_media_trust	Social media trust
	31	pa_remotework_dev	Remote work development benefit
	32	pa_innov_readiness	Innovation readiness
	33	pa_wellbeing	Subjective wellbeing
	34	pa_internet_use	Internet use
IA	35	ia_financial_serv	Financial services quality
	36	ia_consult_serv	Consulting services quality
	37	ia_adv_tech_serv	Advanced technological services quality
	38	ia_gov_support	Public institutions support quality
	39	ia_transport_link	Physical connection services quality
	40	ia_intangible_link	Intangible services quality
	41	ia_labor_avail	Suitable labour availability
	42	ia_local_benefit	Ethical consumer benefit
MU	43	geo_area	Geographic area (MOMA, SETA, MAIN)
	44	municip_code	Municipality code

4. Methodology

4.1. Input data

The primary input data for the analysis was derived from multiple datasets, including the RIOM survey dataset from the University of Basilicata, municipal statistical data, geographic boundary information, and other socio-economic datasets from the Italian National Statistical Institute (ISTAT), the Italian Business Register and the Ministry of Enterprises and Made in Italy (MIMIT). The RIOM survey dataset, which forms the core of this analysis, was loaded from an spreadsheet file, while municipal data was sourced from ISTAT public spreadsheet files, covering statistics such as population, elevation, and geographic classifications. The list of all datasets used in this chapter is found in Table 3, the municipal variables in Table 4. The resulting matrix of available input data has 2,024 rows and 88 columns.

Table 3: List of all input datasets.

Source	Dataset name	Description
UNIBAS	Survey dataset	Contains survey responses with socio-demographic and individual assessment variables.
ISTAT	Municipal statistical codes	Provides ISTAT statistical codes and municipal names (30/06/2024).
	Municipal boundaries	Contains geographic boundaries for municipalities.
	Municipal elevation	Includes elevation-related statistics (minimum, maximum, mean, etc.) for municipalities (2011).
	Municipal statistical classification	Contains classifications and dimensions of municipalities (01/01/2024).
	Municipal resident population	Provides population data by municipality, including total resident population (01/01/2024).
MIMIT	List of innovative start-ups	Provides the list of innovative start-up registered offices by municipality (03/03/2025)
	List of innovative SMEs	Provides the list of innovative SME registered offices by municipality (03/03/2025)
	List of incubators	Provides the list of business incubator registered offices by municipality (03/03/2025)

Table 4: List of municipal variables derived from ISTAT and MIMIT datasets. Numbering follows the one of variables from the RIOM dataset.

Sec.	No.	Variable	Label
MU	45	municip_name	Municipality name
	46	territorial_unit_code	Territorial unit code
	47	territorial_unit_name	Territorial unit name
	48	region_code	Region code
	49	region_name	Region name
	50	municipality_progressive_code	Municipality progressive code
	51	alphanumeric_municipality_code	Alphanumeric municipality code
	52	car_plate_code	Car plate code
	53	municip_numeric_code_110	Municipal numeric code 110
	54	municip_numeric_code_107	Municipal numeric code 107
	55	municip_numeric_code_103	Municipal numeric code 103
	56	cadastral_municipality_code	Cadastral municipality code
	57	NUTS1_code_2021	NUTS1 code 2021
	58	NUTS2_code_2021	NUTS2 code 2021
	59	NUTS3_code_2021	NUTS3 code 2021
	60	NUTS1_code_2024	NUTS1 code 2024
	61	NUTS2_code_2024	NUTS2 code 2024
	62	NUTS3_code_2024	NUTS3 code 2024
	63	shape_length_2024_m	Shape length 2024
	64	area_shp_2024_m2	Area (m^2) 2024

Sec.	No.	Variable	Label
	65	area_shp_2024_ha	Area (ha) 2024
	66	surface_2024_ha	Surface area (ha) 2024
	67	surface_2024_ha_bin	Surface area (ha) 2024 (bins)
	68	surface_2024_km2	Surface area (km²) 2024
	69	min_elev	Minimum elevation
	70	max_elev	Maximum elevation
	71	elev_range	Elevation range
	72	elev_range_bin	Elevation range (bins)
	73	elev_mean	Mean elevation
	74	elev_mean_bin	Mean elevation (bins)
	75	elev_median	Median elevation
	76	elev_std	Elevation standard deviation
	77	elev_zone	Elevation zone
	78	elev_center	Central elevation
	79	legal_pop_2021	Legal population 2021
	80	res_pop_2022	Resident population 2022
	81	res_pop_2024	Resident population 2024
	82	res_pop_2024_bin	Resident population 2024 (bins)
	83	pop_density_2024_km2	Population density (2024)
	84	pop_density_2024_km2_bin	Population density (2024) (bins)
	85	urbanisation_lvl_2018	Urbanization level 2018
	86	startup_count_2025	Innovative start-ups (2025)
	87	sme_count_2025	Innovative SMEs (2025)
	88	incubator_count_2025	Business incubators (2025)

A specific exploratory analysis was conducted on the Italian Business Register of Innovative Start-ups and SMEs, published by InfoCamere and MIMIT on its dedicated portal[2], with the aim of assigning a quantitative proxy information of innovation by municipality. This registry contains a specific subset of Italian companies selected based on MIMIT's innovation-related criteria and allows the identification of the municipality of the legal seat of each enterprise, which, despite not determining a direct linear link with the local labour force, entails a certain degree of institutional receptivity. Three lists are provided: one for innovative start-ups, one for innovative SMEs, and one for business incubators.

Nevertheless, when considering the Province of Matera, no enterprise was identified on the three lists in the eight municipalities of interest for the MOMA area at the 3rd March 2025. Overall, in 2025 the Province of Matera counted 17 innovative start-ups (across six municipalities), 12 innovative SMEs (all in Matera), and no incubator. Therefore, further

[2] Data are available at https://startup.registroimprese.it/, data in this study are updated to 03/03/2025.

research is suggested to identify alternative sources of information, either standalone or combined, to identify a relevant proxy of innovation readiness in the MOMA area.

4.2. Data cleaning

An R script was used to integrate input data into an extended version of the RIOM survey dataset, which included municipal data for each record. First, the RIOM dataset was pre-processed and translated into English. Subsequently, selected municipal variables were merged with the RIOM dataset using a left join. Across the workflow, the following actions were taken to resolve inconsistencies and standardise RIOM responses.

The data collector manually entered the secondary school name (***sec_school_name***), which specifies the 'Other' category of the secondary school type (*sec_school_type*), and the description of the work sector (***work_sector_des***), which specifies the 'Other' category of the work sector (*work_sector*). For the former, values were remapped to standardise the various entries for 'Teacher Training School' ('magistrale', 'Magistrale', 'MAGISTRALE', 'scuola magistrale', 'istituto magistrale', 'magistrali', 'vecchio diploma magistrale'). Concerning the latter, values were remapped to standardise the various entries for 'Construction' ('edilizia', 'Edilizia', 'Edile', 'edile', 'EDILIZIA'), and for 'Craftsmanship' ('artigianato', 'Artigianato', 'artigiano', 'ARTIGIANO').

The data collector entered 'Bachelor's Degree' and 'Master's Degree' as university degree type (***university_type***) for all records reporting the value 'University degree' as their education level (*education_lvl*). For simplicity, *university_type* was then redefined to include: the original values, the new value 'Doctorate, Master' for records where the education level was reported as such, and 'None' for the remaining records. Although the Italian term 'Master' generates a limited ambiguity in an ordinal classification of educational levels[3], the value 'Doctorate, Master' was interpreted as the European Qualifications Framework (EQF) level 8 (Conferenza Stato-Regioni, 2012) and encoded as the highest level in the ordinal variables: *university_type* and *education_lvl*.

Furthermore, the data collector recorded the daily internet usage (***pa_internet_use***) by asking for the average number of hours spent online per day, using a 0–24 hour scale to facilitate the

[3] In the Italian educational system, there are two types of advanced Masters which correspond to '1st degree' and '2nd degree' Master. Both degrees are postgraduate short specialisation degrees that correspond to the EQF levels 7 and 8, respectively (Conferenza Stato-Regioni, 2012). A 1st degree Master is accessible after a bachelor's degree and has the EQF level of master's degrees ('*Laurea Magistrale*'), while a 2nd degree Master is accessible after a Master's Degree and has the EQF level of doctoral degrees.

respondent. The numerical scale was then converted to a 1–10 Likert scale according to the equivalences provided in Table 5.

Table 5: Conversion from hours to Likert scale for internet use.

Time in hours	Likert scale	Time in hours	Likert scale
0	1	5	6
1	2	6–7	7
2	3	8–9	8
3	4	10–15	9
4	5	16–24	10

Finally, the three variables describing the benefits of remote work for local development (***pa_remotework_dev***), local innovation readiness (***pa_innov_readiness***), and the availability of advanced technological services (***ia_adv_tech_serv***) contained null values encoded with the text: '(DO NOT READ!) Does not know'[4]. These text entries were converted to null values, excluded through pairwise deletion from univariate and bivariate statistics when involved and through listwise deletion for multivariate statistics, based on missingness test results.

4.3. Variables of interest

The research question identified explores the relationship between the perceived adequacy or insufficiency of formal and informal support, and their role in shaping digitalisation-based service ecosystems and their entrepreneurial networks. In order to explore those relationships, a three-pillar approach is adopted classifying the 23 available assessment variables in relation to psychological and material wellbeing (PMW), informal institutions (II), and formal institutions (FI).

Table 6: 23 Likert-type perception variables classified by area.

[4] '(NON LEGGERE!) Non sa / non conosco' (translation by the authors).

Area	Measure	Variable	Wellbeing dimension
PMW	Perceived level of serenity of life	pa_serenity	Psychological wellbeing
	Perceived importance of living in a small or moderately sized environment for the quality of life	pa_small_env	Benefits of a small living environment on material wellbeing
	Perceived ease of the household's economic situation	pa_financ_stability	Material wellbeing
	Perceived burden of current global challenges on personal serenity (post-pandemic, eco-anxiety, wars)	pa_conjunctural_stress	Psychological burden of global stressors
	Perceived burden of the challenging employment situation	pa_jobmarket_stress	Psychological burden of employment stressors
	Perceived strength of personal well-being	pa_wellbeing	Subjective wellbeing (overall)
Area	Measure	Variable	Informal institution
II	Perceived depth of the bond with one's community	pa_community_bond	Community ties and trust
	Perceived quality of relationships with one's social environment (family, relatives, friends)	pa_relational_qual	Relationship networks
	Perceived support from one's community during the COVID-19 pandemic	pa_covid_support	Grassroots mutual aid networks
	Perceived level of involvement in local associations	pa_assoc_involv	Volunteering and civic engagement
	Perceived ease of seeking help from one's community	pa_help_ease	Help request ease culture
	Perceived reliability of information circulating on social media	pa_soc_media_trust	Trust in social media information
	Perceived contribution of smart working to community development	pa_remotework_dev	Trust in remote work benefits
	Perceived readiness of the local entrepreneurial and institutional fabric to meet innovation challenges	pa_innov_readiness	Trust in local innovation ecosystems
	Daily internet usage for study, work, and information needs	pa_internet_use	Trust and reliance on internet
	Perceived advantages of local and sustainable production in attracting conscientious consumers	ia_local_benefit	Consumers ethical awareness
Area	Measure	Variable	Formal institution
FI	Perceived quality of financial services (e.g. access to credit)	ia_financial_serv	Banking and financial institutions
	Perceived quality of consultancy and/or accompaniment services (e.g. business incubators)	ia_consult_serv	Business development support infrastructures
	Perceived quality of advanced technology services (e.g., contacts with research	ia_adv_tech_serv	Technological research infrastructures

centres, innovation ecosystems, technology parks)		
Perceived quality of support services from public institutions (e.g., municipality, chamber of commerce, etc.)	ia_gov_support	Public institutions
Perceived quality of physical connection services (e.g., roads, railways, airports)	ia_transport_link	Transport infrastructure systems
Perceived quality of intangible connection services (e.g. broadband)	ia_intangible_link	Intangible infrastructure systems
Perceived availability of suitable labour	ia_labor_avail	Labour markets

Firstly, six key variables concern the perceived psychological and material wellbeing of respondents and the main psychological stressors to which they are exposed. *pa_serenity* gauges overall life tranquillity, whereas *pa_small_env* reflects how much living in a small- or medium-sized settlement is seen as enhancing material quality of life. Economic stability is captured by *pa_financ_stability*, while two distinct measures—global shocks (*pa_conjunctural_stress*) and labour-market challenges (*pa_jobmarket_stress*)—probe the psychological burden of external stressors. Finally, *pa_wellbeing* offers a holistic self-assessment that integrates these material and emotional elements. Taken together, these provide a individual positioning against which the influence of institutional supports can be interpreted.

Secondly, input data capture perceptions regarding ten dimensions of the level of support provided by informal institutions. Namely, *pa_community_bond*, *pa_relational_qual*, focus on the informal institutions of sense of community and community networks, *pa_covid_support*, *pa_assoc_involv* and *pa_help_ease* address the informal institutions of trust and reciprocity. Moreover, *pa_internet_use* and *pa_soc_media_trust* offer a perspective on the trust and cultural relevance of digital technologies and social networks. Additionally, *pa_remotework_dev* holds evidence about the level of trust in the benefits of remote working on local development, while *ia_local_benefit* provides a glimpse into the popularity of community values related to ecological and healthy lifestyles. Moreover, input data portray one proxy (subjective) measure of the strength of entrepreneurial networks aimed at the emergence of digitalisation-based service ecosystems, *pa_innov_readiness*, which also represent to a certain extent the informal support of trust in local innovation ecosystems.

Lastly, the RIOM dataset captures the perceptions regarding seven dimensions of the quality of support provided by formal institutions. Financial intermediation (*ia_financial_serv*) and business-development assistance (*ia_consult_serv*) represent core market-oriented institutions,

while *ia_adv_tech_serv* signals access to higher-order research and technology transfer facilities. Public institutional commitment is gauged through *ia_gov_support*, and the territorial connectivity, essential for digital service ecosystems and entrepreneurship at large, is split into tangible (*ia_transport_link*) and intangible (*ia_intangible_link*) networks. Lastly, *ia_labor_avail* captures perceptions of whether local human capital matches the skill requirements of innovative ventures.

4.4. Analytical approach

The analytical approach combined descriptive and inferential methods to examine the nature of the literature-derived drivers of innovation and the possible relationship between institutional support factors and socio-demographic and municipal dynamics. Summary statistics, frequencies and visualizations are provided as an overview of aggregate data; the univariate analysis describes distributions and trends. The bivariate analysis identifies significant differences across relevant groups for the variables of interest and correlation between assessment variables. Lastly, multivariate analysis addresses patterns among variables and their clustering.

4.4.1. Missing data

Concerning univariate and bivariate analysis, missing data (5–10% in each of three variables of interest) are excluded by pairwise deletion, removing incomplete cases for each specific statistics calculation where necessary. All exploratory multivariate analysis was performed starting from a subset of data obtained through the removal of the SD variables *sec_school_type*, *sec_school_name*, *work_publ_priv*, *work_sector*, *work_sector_des*, and *workplace_expected*, and the subsequent removal by listwise deletion of all null values, present only in *pa_remotework_dev*, *pa_innov_readiness* and *ia_adv_tech_serv*, thus obtaining a matrix of data for the MOMA area with 259 rows and 82 columns. Following Jamshidian and Jalal (Jamshidian et al., 2014; Jamshidian & Jalal, 2010) methodology, a nonparametric distribution-free Missing Completely at Random (MCAR) test was run on a subset of variables including key socio-demographics (age, household size, gender, civil status, sport, work type, educational level) and the 23 Likert variables. As a result, we failed to reject the null hypothesis that data are MCAR for the MOMA area ($AD^* = 7.47, p = 0.086, g = 6, \alpha = 0.05$), and, thus, performed the analysis through pairwise and listwise deletion as described.

4.4.2. Univariate analysis

The relative frequency distribution is reported for categorical variables, while for numeric variables summary statistics are reported and a binned version of the latter is included in the categorical frequencies. The summary statistics included for numeric variables are count, number of missing values, mean, median, mode, variance, standard deviation, interquartile range (IQR), median absolute deviation (MAD), skewness, kurtosis, as well as the first (Q1) and third (Q3) quartiles. It is important to note that despite all assessment variables are encoded with a 1–10 numeric discrete scale, those variables are categorical ordinal, thus the meaning of the summary statistics, which are reported for them too in the Annex B: Univariate statistics, should be bounded to it.

4.4.3. Bivariate analysis

The Mann–Whitney U nonparametric test (MWU), also known as Mann–Whitney–Wilcoxon, and the Kruskal–Wallis (KW) nonparametric test, focusing only on the ordinal information in the data, were used to identify significant changes between Likert-item assessment variables and groupings based on socio-demographic and municipal variables; missing data were removed by pairwise deletion. The MWU was applied for binary grouping variables, such as *gender_binary*, while the KW was used for grouping variables with three or more levels. Both tests were conducted with a significance level (α) of 0.05. Subsequently, the Dunn's Post Hoc nonparametric test (DPH) was run only for those grouping variables which reported a significant α for Kruskal–Wallis to determine which specific pairs of groups are significantly different. Dunn's test was conducted through pairwise comparisons of groups with Bonferroni correction.

Additionally, the correlation among assessment variables is reported as part of the multivariate analysis as the sample is obtained by listwise deletion. Spearman's rank correlation coefficient was used due to its robustness against non-normal data distributions and its suitability for ordinal variables, such as the Likert-item assessment variables. Furthermore, variables were ordered into the predefined thematic groups described in section 4.3 (wellbeing, informal, and formal support) to enhance interpretability.

4.4.4. Multivariate analysis

The analytical approach in use aimed to assess possible relationships among variables and uncover patterns within the sample. Two subsets of variables were defined to run the same high-dimensional analysis. A large subset, composed by 31 variables described in Table 7,

included key socio-demographic variables, all assessment variables and the *municip_name* nominal variable. A small subset, composed by 14 variables and described in Table 8, included a similar subset with a selection of assessment variables in order to study the possible effects of multicollinearity.

Table 7: Subset 1 of variables included in the multivariate analysis (31).

Demographics	Activities	Assessment	Municipal
years_old	sport_type	All	municip_name
household_size	work_type_des		
gender_binary			
civil_status			
education_lvl			

Table 8: Subset 2 of variables included in the multivariate analysis (14).

Demographics	Activities	Assessment	Municipal
years_old	sport_type	pa_wellbeing	None
household_size	work_type_des	pa_jobmarket_stress	
gender_binary		pa_community_bond	
civil_status		pa_assoc_involv	
education_lvl		pa_innov_readiness	
		ia_financial_serv	
		ia_transport_link	

The Gower distance matrix was computed for its capacity to handle mixed data type (quantitative, nominal and ordinal), and a Principal Coordinates Analysis (PCoA) was built considering the first two principal coordinates components and spatially represent their relationship. Then, a hierarchical clustering, based on Gower distances and built via the Ward method, was performed selecting the number of clusters based on the max Average Silhouette Width (ASW).

5. Results

5.1. Missing values

It should be noted that nine variables are not complete for the entire dataset and in the MOMA area too. A review of these variables is presented below referring to the 303 respondents for the latter region. Concerning socio-demographic characteristics, six variables report empty cells in the respective cases presented below.

The type of secondary education diploma (*sec_school_type*) is provided for the 162 respondents (53%) whose education level (*education_lvl*) is recorded as 'Secondary school diploma'. For the remaining 141 respondents (47%), where the secondary education type is blank, their education levels are classified as 'Compulsory education', 'University degree', and 'Doctorate, Master'. Notably, secondary education type is not reported for the 57 respondents (19%) with higher education qualifications—55 with a 'University degree' and 2 with a 'Doctorate, Master'— even though such individuals must have obtained a secondary education diploma.

Furthermore, the name of the secondary education diploma (*sec_school_name*) is reported only for the 18 respondents whose secondary education type is classified as 'Other'. Among the 303 respondents in the MOMA area, 18 (6%) have both a secondary school type and name recorded, 144 (48%) have only the type of secondary education diploma specified—categorised as either as 'High School' (11%), 'Technical School' (18%) or 'Vocational School' (18%)—and 141 (47%) have blank values both for type and name. It is worth noting that similar considerations apply to the latter subset as those described in the previous paragraph.

The public/private nature of actual employment (*work_publ_priv*) is reported only for the 131 respondents (43%) whose work type (*work_type_des*) is recorded as 'Fixed-term employee', 'Occasional worker', and 'Permanent employee'. The remaining 172 respondents (57%) fall into the following work type categories: 'Not working', 'Other non-professional status', 'Retired', 'Self-employed', 'Unemployed', and 'Unpaid domestic worker'. It is important to highlight that 'Self-employed' respondents are not classified as part of the private sector under *work_publ_priv*.

Besides, the work sector (*work_sector*) is reported for the 161 respondents (53%) whose work type is recorded as 'Fixed-term employee', 'Occasional worker', 'Permanent employee', or 'Self-employed'. The remaining 142 respondents (47%), who have a blank value for the work

sector, belong to the following work types: ‘Not working’, ‘Other non-professional status’, ‘Retired’, ‘Unemployed’, and ‘Unpaid domestic worker’.

Additionally, the specific description of the work sector (*work_sector_des*) is reported only for the 7 respondents whose work sector is classified as ‘Other’. Among the 303 respondents in the MOMA area, 7 (2%) have both the work sector and specific description recorded, 154 (51%) have only the work sector specified—categorised as either as ‘Agriculture’ (9%), ‘Commerce’ (5%), ‘Industry’ (8%) or ‘Services’ (29%)—and 142 (47%) have blank values for both fields.

Finally, the expected workplace for the next employment (*workplace_expected*) is reported for the 142 (47%) respondents whose work type is recorded as ‘Not working’, ‘Other non-professional status’, ‘Retired’, ‘Unemployed’, and ‘Unpaid domestic worker’. The remaining 161 respondents (53%), who have a blank value for the expected workplace, belong to the following work types: ‘Fixed-term employee’, ‘Occasional worker’, ‘Permanent employee’, or ‘Self-employed’.

Given the described nature of the six socio-demographic variables *sec_school_type*, *sec_school_name*, *work_publ_priv*, *work_sector*, *work_sector_des*, and *workplace_expected*, the variables are excluded from bivariate and multivariate analysis and maintained only for qualitative investigations.

Concerning the PA and IA sections, three variables contain null values. Specifically, null values are present for benefits of remote working on local development (*pa_remotework_dev*), where the count of null values sums to 15 respondents (5%), reducing the usable sample to 288 observations. Similarly, null values are found in perceived readiness for innovation (*pa_innov_readiness*), with a count of 18 respondents (6%), reducing the usable sample to 285 observations. Finally, they occur in advanced technological services (*ia_adv_tech_serv*), totalling 29 respondents (10%), reducing the usable sample to 274 observations.

Given that this study focuses on an exploratory descriptive analysis of the assessment variables and that of the latter only *pa_remotework_dev*, *pa_innov_readiness* and *ia_adv_tech_serv* have a moderate number of missing values, the statistics presented in this chapter are calculated by pairwise deletion for univariate and bivariate analysis and listwise for multivariate analysis, according to test results, assuming missing values are MCAR. Missing data for the three variables of interest are therefore excluded from calculation of specific univariate and bivariate

statistics where they would be employed, while the complete record is excluded if any of the three variables has a null value for multivariate analysis.

Therefore, the comparisons between any of the three mentioned variable percentage scores and the rest of the assessment variables cannot be operated without acknowledging the specific sample size of the statistics. Conversely, the listwise deletion of records based on the combined missing values of the three variables determines the reduction of the sample size from 303 to 259 with a loss of 14.52% of the information of the original matrix (Table 9). Given that the individual level of missing data for each of latter three variables is moderate (4.95%–9.57%), this research suggests carrying further analysis to determine whether the missing values are MCAR in all other areas of the RIOM survey before proceeding to more complex comparative analysis.

Table 9: Table of the impact of the removal of missing values by listwise deletion for variables of interest in the MOMA area.

No.	Variables for listwise deletion of NA	Retained rows	Removed rows
0	None	303 (100%)	0 (0%)
1	pa_remotework_dev	288 (95.05%)	15 (4.95%)
1	pa_innov_readiness	285 (94.06%)	18 (5.94%)
1	ia_adv_tech_serv	274 (90.43%)	29 (9.57%)
2	pa_remotework_dev, pa_innov_readiness	277 (91.42%)	26 (8.58%)
2	pa_remotework_dev, ia_adv_tech_serv	264 (87.13%)	39 (12.87%)
2	pa_innov_readiness, ia_adv_tech_serv	266 (87.79%)	37 (12.21%)
3	pa_remotework_dev, pa_innov_readiness, ia_adv_tech_serv	259 (85.48%)	44 (14.52%)

5.2. Univariate analysis

5.2.1. Socio-demographic characteristics

The socio-demographic profile of respondents from the MOMA area includes a subset of 303 individuals. The average age of respondents is approximately 52 years old (SD = 18.5); respondents are distributed across the 18–98 years age range. Gender, measured as a binary variable, is nearly evenly distributed (51.8% male, 48.2% female). Moreover, most respondents have between one and four household members: two (28.4%), three (23.4%), four (22.8%) and

one (15.8%); the median household size is 3, and the maximum size is 7. Most respondents (55.4%) are married or cohabitating, followed by those who are single (34%), and in smaller proportions are widowed (6.6%) and divorced/separated (4%).

The analysis of maximum educational attainment revealed that 27.7% of respondents had completed compulsory education, 53.5% held a secondary school diploma, 18.2% had a university degree, and only 0.7% held either a PhD or an advanced Master degree. Most respondents reported not practising any sport (71.3%), while 18.8% engaged in individual sports and 9.9% participated in team sports. Additionally, employment data showed that 47% of respondents were not formally employed, classified as 'Not working' (18.2%), 'Other non-professional status' (2.3%), 'Retired' (16.2%), 'Unemployed' (6.6%) and 'Unpaid domestic worker' (3.6%). Moreover, out of all respondents, 27.4% were permanent employees, 9.9% were self-employed, 12.2% were fixed-term employees, and 3.6% were occasional workers. Finally, out of the subset of not employed respondents defined above (n = 142), 49% expected to find their next job in Basilicata region, 1% in other regions in southern Italy or islands, 30% in Central-Northern Italy and 20% abroad.

5.2.2. Assessment characteristics

The summary statistics for the 23 Likert-based categorical ordinal variables assessing personal and innovation ecosystem are reported in Table 10, while their relative frequency distributions are reported in Table 11. Additionally, these distributions are visualised using diverging stacked bar charts: Figure 3 for PA variables and Figure 4 for IA variables. In the following results, "lower" or "negative" scores refer to Likert-item values 1–5 and "higher" or "positive" scores refer to Likert-item values 6–10.

Table 10: Summary statistics of personal assessment (pa) and innovation ecosystem assessment (ia) variables. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are excluded from calculations.

Variable	Count	Missing	Median	Mode	Min	Max	Range	IQR	Q1	Q3
pa_serenity	303	0	7	8	1	10	9	2	6	8
pa_community_bond	303	0	8	10	1	10	9	3	7	10
pa_small_env	303	0	8	8	1	10	9	2	7	9
pa_relational_qual	303	0	9	10	1	10	9	2	8	10
pa_covid_support	303	0	7	8	1	10	9	4	5	9
pa_assoc_involv	303	0	5	5	1	10	9	5	2.5	7.5
pa_help_ease	303	0	6	8	1	10	9	4	4	8
pa_financ_stability	303	0	7	8	1	10	9	2	6	8
pa_conjunctural_stress	303	0	7	7	1	10	9	3	5	8
pa_jobmarket_stress	303	0	7	10	1	10	9	4	5	9
pa_soc_media_trust	303	0	4	5	1	10	9	4	2	6
pa_remotework_dev	288	15	6	8	1	10	9	4	4	8
pa_innov_readiness	285	18	5	5	1	10	9	3	4	7
pa_wellbeing	303	0	7	8	1	10	9	2	6	8
pa_internet_use	303	0	3	2	1	9	8	4	2	6
ia_financial_serv	303	0	6	6	1	10	9	3	4	7
ia_consult_serv	303	0	6	5	1	10	9	3	4	7
ia_adv_tech_serv	274	29	5	5	1	10	9	4	3	7
ia_gov_support	303	0	5	5	1	10	9	3	4	7
ia_transport_link	303	0	3	1	1	10	9	4	1	5
ia_intangible_link	303	0	6	7	1	10	9	3	5	8
ia_labor_avail	303	0	5	5	1	10	9	3	3	6
ia_local_benefit	303	0	6	6	1	10	9	3	4	7

Table 11: Relative frequencies of personal assessment (pa) and innovation ecosystem assessment (ia) variables. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are excluded from calculations, thus they do not correspond to figures cited when indicating the total sample size instead of their reduced one.

Variable	1	2	3	4	5	6	7	8	9	10
pa_serenity (303)	4.3%	1.7%	2.3%	2%	9.9%	11.2%	20.5%	23.8%	11.2%	13.2%
pa_community_bond (303)	3.3%	2.3%	0.7%	2.3%	7.9%	5.9%	12.9%	23.4%	13.9%	27.4%
pa_small_env (303)	1.3%	1%	1.7%	2.6%	4.6%	9.2%	14.5%	28.7%	11.9%	24.4%
pa_relational_qual (303)	1%	0%	0%	1%	1.3%	2%	3.6%	23.1%	21.5%	46.5%
pa_covid_support (303)	9.2%	1.7%	3.3%	1.7%	12.9%	8.6%	12.9%	22.4%	10.6%	16.8%
pa_assoc_involv (303)	18.2%	6.9%	3%	6.3%	18.5%	8.6%	13.5%	9.2%	5%	10.9%
pa_help_ease (303)	12.5%	5%	5.6%	3.3%	13.5%	11.2%	14.2%	14.5%	8.9%	11.2%
pa_financ_stability (303)	5%	2.3%	4%	4.3%	8.3%	11.9%	17.2%	23.8%	10.2%	13.2%
pa_conjunctural_stress (303)	6.3%	2.6%	3%	5.6%	12.5%	12.9%	22.1%	14.9%	6.9%	13.2%
pa_jobmarket_stress (303)	10.6%	5.3%	6.6%	2%	11.9%	8.6%	11.2%	14.9%	11.2%	17.8%
pa_soc_media_trust (303)	17.5%	12.2%	9.2%	12.2%	20.8%	10.9%	9.9%	3.6%	2%	1.7%
pa_remotework_dev (288)	9.4%	5.9%	4.9%	6.9%	14.9%	13.2%	12.8%	15.6%	7.6%	8.7%
pa_innov_readiness (285)	8.8%	5.6%	7.4%	8.8%	20.4%	18.2%	17.2%	7.4%	2.1%	4.2%
pa_wellbeing (303)	2.3%	2%	1.3%	2.6%	9.2%	11.6%	21.1%	27.7%	9.6%	12.5%
pa_internet_use (303)	12.9%	24.1%	19.5%	10.2%	4.6%	7.6%	8.9%	4%	8.3%	0%
ia_financial_serv (303)	9.9%	8.6%	5%	6.3%	16.5%	17.5%	12.5%	11.2%	4.3%	8.3%
ia_consult_serv (303)	7.9%	6.9%	6.3%	5.6%	21.5%	18.8%	17.5%	7.9%	4%	3.6%
ia_adv_tech_serv (274)	12.8%	9.1%	8.4%	7.7%	18.6%	15.3%	13.1%	8.4%	1.8%	4.7%
ia_gov_support (303)	14.2%	5.9%	4.6%	10.9%	17.8%	14.5%	14.9%	8.9%	4.3%	4%
ia_transport_link (303)	34.7%	13.9%	8.9%	13.5%	13.5%	3.3%	6.3%	4.6%	0.3%	1%
ia_intangible_link (303)	5.9%	5%	4.3%	7.3%	15.5%	16.2%	16.8%	13.9%	5%	10.2%
ia_labor_avail (303)	9.9%	6.9%	8.6%	9.6%	22.4%	19.1%	12.9%	7.3%	2%	1.3%
ia_local_benefit (303)	8.3%	4.6%	6.3%	7.9%	17.2%	21.8%	13.9%	12.2%	3.3%	4.6%

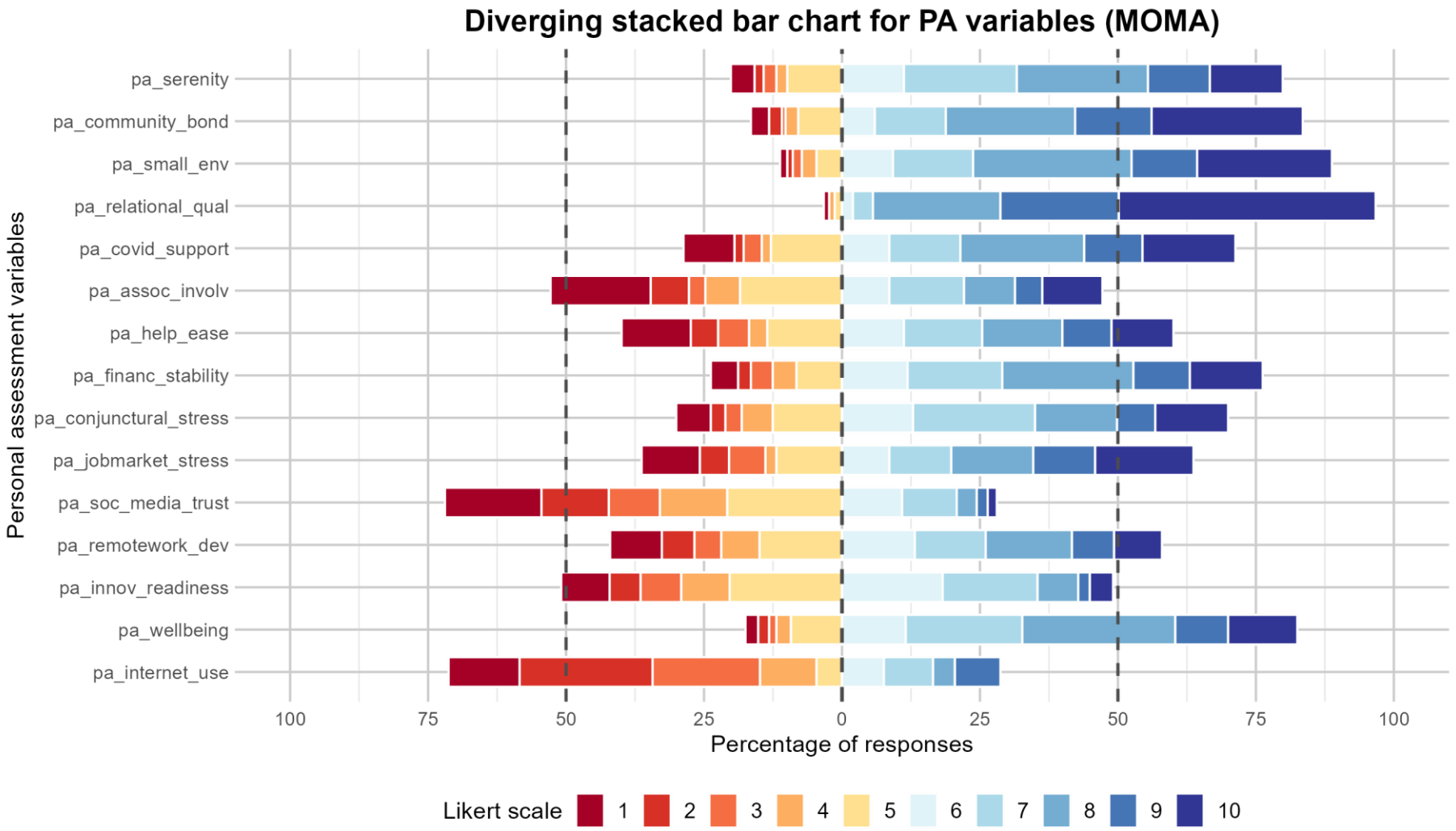


Figure 3: Diverging stacked bar chart of the 15 Likert-based personal assessment variables. Missing values for pa_remotework_dev and pa_innov_readiness are excluded from calculations of score percentages.

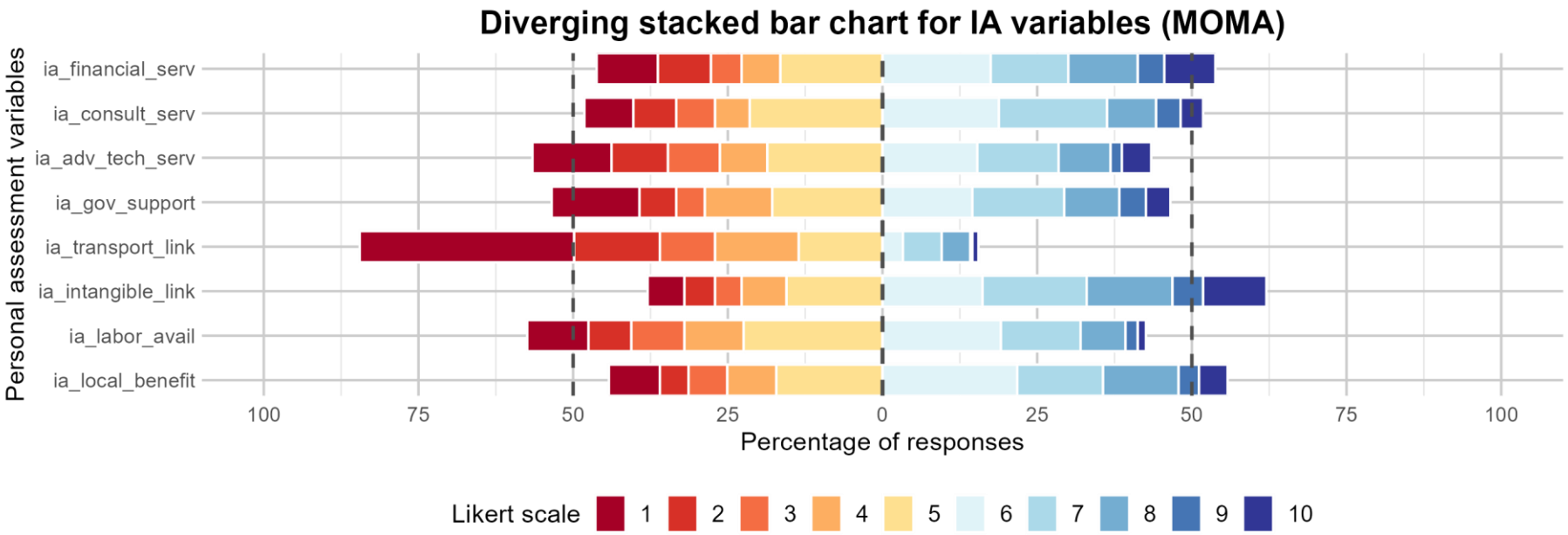


Figure 4: Diverging stacked bar chart of the 8 Likert-based innovation ecosystem assessment variables. Missing values for ia_adv_tech_serv are excluded from calculations of score percentages.

Concerning the six measures of **personal and material well-being**, respondents reported a higher proportion of aggregated positive scores compared to aggregated negative scores for all variables. Perceived level of serenity of life (*pa_serenity*) and perceived strength of personal well-being (*pa_wellbeing*) reported a similar distribution of scores, with a median of 7 and a mode of 8 (respectively 23.8% and 27.7%), with aggregated negative scores below 25%. Perceived importance of living in a small or moderately sized environment for the quality of life (*pa_small_env*) and perceived ease of the household's economic situation (*pa_financ_stability*) had a median of 8 and 7, respectively, and both a mode of 8 (respectively 28.7% and 23.8%), with aggregated negative scores below 25%. Perceived burden of current global challenges on personal serenity (*pa_conjunctural_stress*) had a median and mode of 7 (22.1%). Perceived burden of the challenging employment situation (*pa_jobmarket_stress*) had a median of 7 and a mode of 10 (17.8%).

Concerning the ten variables portraying **measures of informal support**, on the one hand respondents reported a higher proportion of aggregated positive scores compared to aggregated negative scores for six variables: *pa_community_bond*, *pa_relational_qual*, *pa_covid_support*, *pa_help_ease*, *pa_remotework_dev, and ia_local_benefit*. The distribution of responses for perceived depth of the bond with one's community (*pa_community_bond*) and perceived quality of relationships with one's social environment (*pa_relational_qual*) was heavily concentrated toward higher scores, with more than 75% of respondents reporting values between 6 and 10. The variables showed a median of 8 and 9, respectively, and both a mode of 10, reported by 27.4% and 46.5% of respondents, respectively. Additionally, *pa_relational_qual* did not report any score for the values 2 and 3.

The remaining 4 variables with an overall positive trend had a more even distribution of scores. Perceived support from one's community during the COVID-19 pandemic (*pa_covid_support*) had a median of 7 and a mode of 8 (22.4%). Perceived ease of seeking help from the community (*pa_help_ease*) had a median of 6 and a mode of 8 (14.5%). Perceived contribution of smart working to community development (*pa_remotework_dev*) had a median of 6 and mode of 8 (14.9%, considering null values in relative frequencies). Perceived advantages of local and sustainable production in attracting conscientious consumers (*ia_local_benefit*) had a median and mode of 6 (21.8%).

On the other hand, respondents reported a higher proportion of aggregated negative scores compared to aggregated positive scores for three variables: *pa_assoc_involv*,

pa_soc_media_trust, *pa_internet_use*, and *pa_innov_readiness*. The distribution of responses for daily internet usage for study, work, and information needs (*pa_internet_use*) and perceived reliability of information circulating on social media (*pa_soc_media_trust*) had a marked distributional asymmetry in favour of lower scores, with a median of 3 and 4 and a mode of 2 (24.1%) and 5 (20.8%), respectively. Besides, *pa_internet_use* maximum value was 9. Perceived level of involvement in local associations (*pa_assoc_involv*) had a more even distribution of scores with a median and mode of 5 (18.5%).

Concerning the perceived readiness of the local entrepreneurial and institutional fabric to meet innovation challenges (*pa_innov_readiness*), a possible proxy of the perceived **strength of local entrepreneurial innovation ecosystems**, respondents reported a balanced distribution of scores with a slightly higher value of aggregate negative scores. *pa_innov_readiness* had a median and mode of 5 (19.1%) and presented an aggregated 52.5% of scores for categories 5,6, and 7 (considering null values in relative frequencies).

Lastly, concerning the seven variables capturing **measures of formal support**, respondents reported a higher proportion of aggregated higher scores compared to aggregated lower scores. This trend is valid for all variables except for perceived quality of physical connection service (*ia_transport_link*). The latter had a median of 3 and mode of 1 reported by 34.7% of respondents, with a concentration towards lower scores and aggregated positive scores below 25%. Besides, out of the 303 valid responses for *ia_transport_link*, only 1 respondent reported the value 9 and 3 respondents the value 10.

The remaining six variables presented an overall concentration of scores in the Likert-item values 5, 6, and 7. Perceived quality of financial services (*ia_financial_serv*) had a median and mode of 6, reported by 17.5% of respondents. Perceived quality of consultancy and/or accompaniment services (*ia_consult_serv*) had a median of 6 and a mode of 5, reported by 21.5% of respondents. Perceived quality of advanced technology services (*ia_adv_tech_serv*) had a median and mode of 5, reported by 16.8% of respondents (considering null values in relative frequencies). Perceived quality of support services from public institutions (*ia_gov_support*) had a median and mode of 5, reported by 17.8% of respondents. Perceived quality of intangible services (*ia_intangible_link*) had a median of 6 and mode of 7, reported by 16.8% of respondents. Perceived availability of suitable labour (*ia_labor_avail*) had a median and mode of 5, reported by 22.4% of respondents.

5.2.3. Municipal characteristics

The 303 respondents from the MOMA area were located in the eight municipalities listed in Table 12, all located in the Province of Matera in the Region of Basilicata.

Table 12: Frequencies of respondents' municipalities for the MOMA area.

Municipality	Count	Percentage
Accettura	41	13.5%
Aliano	22	7.3%
Cirigliano	18	5.9%
Craco	25	8.3%
Gorgoglione	44	14.5%
Oliveto Lucano	16	5.3%
San Mauro Forte	46	15.2%
Stigliano	91	30%

Considering the geographic features of the municipalities in the MOMA area, the average surface of the eight municipalities (2024) is 10,990.2 ha, ranging from a minimum of 1,501.5 ha to a maximum of 21,096 ha. The surface of the municipality is in the interval [1,501–5,000] ha for the 25.7% of respondents, in (5,000–10,000] ha for 44.2%, and in (10,000–21,097] ha for 30%. Moreover, the average of the respondents' mean elevation of municipalities (2011) is 500.7 metres above sea level (masl), with a minimum of 174.9 masl and a maximum of 782.8 masl. Namely, the 60.7% of respondents was in a municipality with a mean elevation within the interval [174–500] masl, while the remaining 39.3% within (500–1,000] masl. The average municipal elevation range of respondents is 821.5 m, ranging from a minimum of 356 m to a maximum of 1,043 m.

Looking at the demography of municipalities, the respondent's municipal resident population (2024) ranged from a minimum of 275 to a maximum of 3,513 inhabitants. 11.2% of respondents lived in a municipality with [275–500] inhabitants, 30% in a municipality with (500–1,000] inhabitants, and 58.7% in a municipality with (1,000–3,513] inhabitants. The average respondent's municipality demographic density is 16 persons/km² ranging from a minimum of 7.7 to a maximum of 24.4 persons/km². 84.5% of the respondents lived in a municipality with (10–50] persons/km², while only 15.5% with [7–10] persons/km². All respondents were in a municipality classified with the Italian urbanisation level 3, i.e. 'Rural area' or 'Sparsely populated area'.

5.3. Bivariate analysis

The bivariate exploratory analysis was conducted using Mann–Whitney U (MWU), Kruskal–Wallis (KW), and Dunn's Post Hoc (DPH) nonparametric tests and identified significant associations among variables. Below only significant differences are reported for MWU and KW with their p values. For KW, when pairwise comparison using DPH were significant, these are also reported. Specific considerations regarding group differences are drawn only for significant MWU and DPH pairs, with additional reference to medians, modes and contingency tables.

In many cases, a significant KW did not result in any specific significant DPH pair after Bonferroni correction. This may occur, for instance, because the observed differences are spread across multiple groups, the adjustment for multiple comparisons reduces the statistical power, or the data exhibit complex non-monotonic relationships.

5.3.1. Socio-demographic analysis

The bivariate analysis reveals several significant differences in socio-demographic groups across the assessment variables.

5.3.1.1. Wellbeing

- **Age groups** have significant differences for material wellbeing (KW $p < 0.001$) and conjunctural stress (KW $p = 0.017$, one significant DPH pair). Respondents aged 55–64 showed a significantly lower burden of conjunctural stress compared to the age group 65–74 with a median of 5 and 7, respectively.
- **Household size groups** have significant differences for subjective wellbeing (KW $p = 0.032$, one significant DPH pair). Single-person households reported lower subjective wellbeing compared to five-persons households with a median of 7 and 8 and a mode of 5 and 8, respectively.
- **Educational level groups** have significant differences for material wellbeing (KW $p < 0.001$, three significant DPH pairs) and job-market stress (KW $p = 0.004$, one significant DPH pair). Respondents with compulsory education only reported a lower material wellbeing (median of 6) compared to both secondary school diploma and university degree owners (median of 7 and 8 respectively). Similarly, university degree owners showed a significantly higher material wellbeing (median of 8) compared to secondary school diploma owners (median of 7). Moreover, respondents having completed compulsory education reported a sizably lower burden of job-market-related

stress compared to graduated respondents, with a median of 5 and 8, respectively, and both with a mode of 10.

- **Work type groups** have significant differences for material wellbeing (KW p = 0.003).

5.3.1.2. Informal institutions

- **Age groups** have significant differences for trust in social media (KW p = 0.027), trust in remote work benefits (KW p = 0.001, two significant DPH pairs), internet use (KW p < 0.001, ten significant DPH pairs), and consumers ethical awareness (p = 0.006, one significant DPH pair). Namely, younger respondents aged 25–34 reported higher trust in the benefits of remote working compared to the older age group 55–64, with a median of 7 and 5 and a mode of 7 and 1, respectively, and compared to the age group 75–84, with a median of 5 and a mode of 6. The ten significant pairwise comparison shed light on a significant and progressive digital divide across age groups with younger respondents reporting higher internet use compared to older age groups. Respondents age groups 18–24 and 25–34 reported a significantly higher median (respectively 6 and 5) when pairwise compared to the age groups 55–64 (3), 65–74 (2), and 75–84 (2). Likewise, respondents aged 35–44 reported a significantly higher median (4) when compared to age groups 65–74 (2) and 75–84 (2). Similarly, both age groups 45–54 (3) and 55–64 (3) showed the trend when compared to the age group 75–84 (2). Concerning the consumer ethical awareness, respondents age group 25–34 showed higher scores compared to the age group 35–44, with a median of 6 and 4.5 respectively.
- **Gender groups** have significant differences for community bond (MWU p < 0.001), help request ease (MWU p = 0.022) and internet use (MWU p = 0.035). Specifically, men reported a moderately higher community bond compared to women, with a median of 9 and 8 and a mode of 10 and 8, respectively. Men also reported a higher ease in requesting help, with a median of 7 and 6 and a mode of 8 and 5, respectively. Lastly, while presenting the same low median (3) and mode (2), men showed a slightly higher internet use than women, with higher percentage scores for 7,8,9 and a less than half of the percentage scores of women for the score 1, indicating almost no use. It is useful to recall that none of the respondents in the MOMA area reported a value of 10 for internet use irrespective of any socio-demographic characteristics.
- **Household size groups** have significant differences for trust in social media (KW p = 0.008, one significant DPH pair), internet use (KW p < 0.001, four significant DPH pairs), and consumer ethical awareness (KW p = 0.019, one significant DPH pair).

Concerning social media, respondents in two-persons households had a lower trust in social media compared to three-persons households, with a median of 3 and 5 and a mode of 1 and 5, respectively. Furthermore, a trend was identified associating increasing household size (between 1 and 3 members) with increasing use of internet. Specifically, pairwise comparisons show that single-person and two-persons households had significantly lower internet use (both with median 2) than households of three and four people (median of 5 and 4 respectively). Lastly, single-person households revealed a moderately lower perceived consumer ethical awareness than households of three members with a median of 5 and 6, respectively.

- **Educational level groups** have significant differences for trust in remote work (KW $p = 0.018$) and internet use (KW $p < 0.001$, two significant DPH pairs). Respondents having completed compulsory education only reported a lower use of internet (median of 2) compared to both secondary school diploma and university degree owners (both with a median of 4). The former concentrated 68% of scores between 1 and 2, while the latter two groups 24% and 26%, respectively.
- **Sport type groups** have significant differences for community bond (KW $p < 0.001$, two significant DPH pairs), emergency support (KW $p = 0.034$, one significant DPH pair), association involvement (KW $p = 0.002$, two significant DPH pairs), help request ease (KW $p = 0.009$, two significant DPH pairs), trust in social media (KW $p = 0.012$, two significant DPH pairs), and internet use (KW $p < 0.001$, one significant DPH pair). Team sport players scored higher for community bond (median of 10) if compared to both non-players and individual sport players (both with a median of 8). Team sport practitioners are also associated to higher perceived emergency support compared to individual sport ones with a median of 8 and 7, respectively. Following a similar trend, team sport players reported a higher involvement in local associations (median of 7.5) compared to non-players and individual sport players (both with a median of 5). In line with those results, team sports are associated with higher ease of requesting help (median of 8) compared to both other groups (both with a median of 6), and a higher trust in social media (median of 5.5) compared to both other groups (both with a median of 4). Lastly, team sport practitioners displayed a higher use of internet (median of 5.5) compared to non-practitioners.
- **Work type groups** (*work_type_des*) have significant differences for association involvement (KW $p = 0.032$, one significant DPH pair), trust in social media (KW $p =$

0.050), trust in remote work (KW p = 0.04), and internet use (KW p < 0.001, nine significant DPH pairs). Namely, occasional workers had significantly higher scores in association involvement compared to unpaid domestic workers with a median of 7 and 3, respectively. Moreover, respondents classified as not working reported a lower use of internet (median of 2, 35% of scores for 1) compared to retired (median of 2, 27% of scores for 1), self-employed (median of 3.5), fixed-term employees (median of 4), permanent employees (median of 4), other non-professional status (median of 7). Likewise, those classified as retired reported a lower use of internet (median of 2) compared to self-employed (median of 3.5), fixed-term employees (median of 4), permanent employees (median of 4), other non-professional status (median of 7). Lastly, unpaid domestic workers showed a lower internet use (median of 2) when compared to respondents with other non-professional status (median of 7).

5.3.1.3. Formal institutions

- **Age groups** (*years_old_bin*) have significant differences for financial services (KW p = 0.005), physical connection services (KW p = 0.041), and labour availability (KW p = 0.011, two significant DPH pairs). Concerning the latter, younger respondents aged 18–24 reported higher scores for perceived availability of suitable labour, with a median of 7, compared to middle-aged individuals (45–54 and 55–64), both with a median of 5.
- **Gender groups** have significant differences for labour availability (MWU p = 0.003). Women perceived a moderately higher availability of suitable labour compared to men with a median of 5.5 and 5, respectively.
- **Household size groups** (*household_size_bin*) have significant differences for intangible connection services (KW p = 0.043, one significant DPH pair). Respondents living in a single-person household reported a lower perceived quality of intangible services compared to those living in a three-person household, with a median of 5 and 7, respectively.
- **Sport type groups** have significant differences for financial services (KW p = 0.005, one significant DPH pair), consultancy services (KW p = 0.018, one significant DPH pair), public institutional support (KW p = 0.001, two significant DPH pairs), and physical connection services (p = 0.003, two significant DPH pairs). Respondents practising individual sports reported a lower perceived quality of financial services compared to those practising a team sport, with a median of 5 and 7, respectively.

Likewise, they also reported comparatively a lower quality of consultancy services, with a median of 5 and 6, respectively. Concerning the quality of public support, individual sport practitioners displayed a marginally lower positive share compared to non-practitioners (both with a median of 5), and a markedly lower median compared to team sport practitioners, with a median of 5 and 7, respectively. Lastly, individual sport practitioners reported lower perceived quality of physical infrastructure compared to non-practitioners, with a median of 2 and 3 respectively, as well as compared to team sport practitioners, with a median of 4.

5.3.2. Regional differences

Few significant differences across municipalities were identified within the MOMA area. Hence, before presenting them, information is briefly provided on the significant differences that are found between municipalities at the level of the entire RIOM dataset to contextualise the subsequent information on the MOMA area. For RIOM regions, several assessment variables exhibited significant differences across areas (MOMA, SETA, and MAIN) and across municipalities. All significant differences, only for area and municipal groups, are reported without specific pairwise comparisons descriptions.

5.3.2.1. Wellbeing

- **Area groups** have significant differences for benefits or living in a small environment (KW $p < 0.001$, one significant DPH pair) and subjective wellbeing (KW $p = 0.01$, two significant DPH pairs).

5.3.2.2. Informal institutions

- **Area groups** have significant differences for community bond (KW $p = 0.001$, one significant DPH pair), relational quality (KW $p < 0.001$, one significant DPH pair), ease of help request (KW $p = 0.023$), and use of internet (KW $p = 0.001$, one significant DPH pair).
- **Municipal groups** have significant differences for community bond (KW $p = 0.012$), association involvement (KW $p = 0.009$, one significant DPH pair), help ease (KW $p = 0.048$), and innovation readiness (KW $p = 0.011$, two significant DPH pairs).
- **Start-up count groups** (*startup_count_2025*) have significant differences for relational quality (KW $p = 0.016$, one significant DPH pair), association involvement (KW $p = 0.046$, one significant DPH pair), and innovation readiness (KW $p = 0.033$, one significant DPH pair).

5.3.2.3. Formal institutions

- **Area groups** have significant differences for physical connection services (KW p < 0.001, three significant DPH pairs) and availability of suitable labour (KW p = 0.001, two significant DPH pairs).
- **Municipal groups** have significant differences for consultancy services (KW p = 0.02), public institutional support (KW p = 0.019, one significant DPH pair), physical connection services (KW p < 0.001, 39 significant DPH pairs), intangible connection services (KW p = 0.032), and availability of suitable labour (KW p = 0.01).
- **Start-up count groups** (*startup_count_2025*) have significant differences for public institutional support (KW p = 0.014, one significant DPH pair).

Table 13: Results of the Kruskal Wallis test with each assessment variable as response variable and municipalities as the explanatory variable, calculated for the entire RIOM area.

Variable	Chi_Squared	DF	P_Value	Significance
pa_serenity	49.12	39	0.128	No significant differences (p ≥ 0.10)
pa_community_bond	61.696	39	0.012	Significant differences (p < 0.05)
pa_small_env	44.72	39	0.244	No significant differences (p ≥ 0.10)
pa_relational_qual	53.952	39	0.056	Marginal significance (0.05 ≤ p < 0.10)
pa_covid_support	39.348	39	0.454	No significant differences (p ≥ 0.10)
pa_assoc_involv	63.015	39	0.009	Significant differences (p < 0.05)
pa_help_ease	54.779	39	0.048	Significant differences (p < 0.05)
pa_financ_stability	53.644	39	0.059	Marginal significance (0.05 ≤ p < 0.10)
pa_conjunctural_stress	47.177	39	0.173	No significant differences (p ≥ 0.10)
pa_jobmarket_stress	47.383	39	0.168	No significant differences (p ≥ 0.10)
pa_soc_media_trust	44.69	39	0.245	No significant differences (p ≥ 0.10)
pa_remotework_dev	52.89	39	0.068	Marginal significance (0.05 ≤ p < 0.10)
pa_innov_readiness	62.135	39	0.011	Significant differences (p < 0.05)
pa_wellbeing	53.852	39	0.057	Marginal significance (0.05 ≤ p < 0.10)
pa_internet_use	45.474	39	0.22	No significant differences (p ≥ 0.10)
ia_financial_serv	53.802	39	0.058	Marginal significance (0.05 ≤ p < 0.10)
ia_consult_serv	59.255	39	0.02	Significant differences (p < 0.05)
ia_adv_tech_serv	51.891	39	0.081	Marginal significance (0.05 ≤ p < 0.10)
ia_gov_support	59.464	39	0.019	Significant differences (p < 0.05)
ia_transport_link	157.871	39	0	Significant differences (p < 0.05)
ia_intangible_link	56.893	39	0.032	Significant differences (p < 0.05)
ia_labor_avail	62.295	39	0.01	Significant differences (p < 0.05)
ia_local_benefit	54.457	39	0.051	Marginal significance (0.05 ≤ p < 0.10)

5.3.3. Municipal analysis

At the level of the MOMA area, tests were conducted both by municipal groups and by four municipal-derived variable groups (*surface_2024_ha_bin*, *elev_mean_bin*, *res_pop_2024_bin*, and *pop_density_2024_km2_bin*). In contrast to the entire RIOM dataset, the analysis within the MOMA area displayed only two cases of variables with significant differences across municipal groups.

5.3.3.1. Wellbeing

- **Municipal groups** have significant differences for job market stress (KW p = 0.013, three significant DPH pairs). Namely, statistically significant differences are found for the municipality of Oliveto Lucano associated in pairs with the municipalities of Aliano, Gorgoglione and Stigliano. Respondents from Oliveto Lucano reported largely lower job-market stress scores, with a median of 3.5 and a mode of 3, compared to Aliano which had a median of 8 and mode of 10, and to Gorgoglione and Stigliano, both with a median of 7 and mode of 10.

5.3.3.2. Informal institutions

- **Municipal population density groups** (*pop_density_2024_km2_bin*) have significant differences for trust in social media (MW p = 0.024). Namely, respondents located in municipalities with 7–10 persons /km² showed a higher trust in social media compared to those with 10–50 persons /km², with a median of 5 and 4, respectively.

5.3.3.3. Formal institutions

- **Municipal groups** have significant differences for financial services (KW p = 0.044).
- **Municipal surface groups** (*surface_2024_ha_bin*) have significant differences for financial services (KW p = 0.029, one significant DPH pair) and consultancy services (KW p = 0.04). Concerning the former, respondents living in municipalities with a surface of between 1,000 and 5,000 ha reported a lower quality of financial services (median 5) compared to those living in municipalities with a surface above 10,000 ha (median 6).

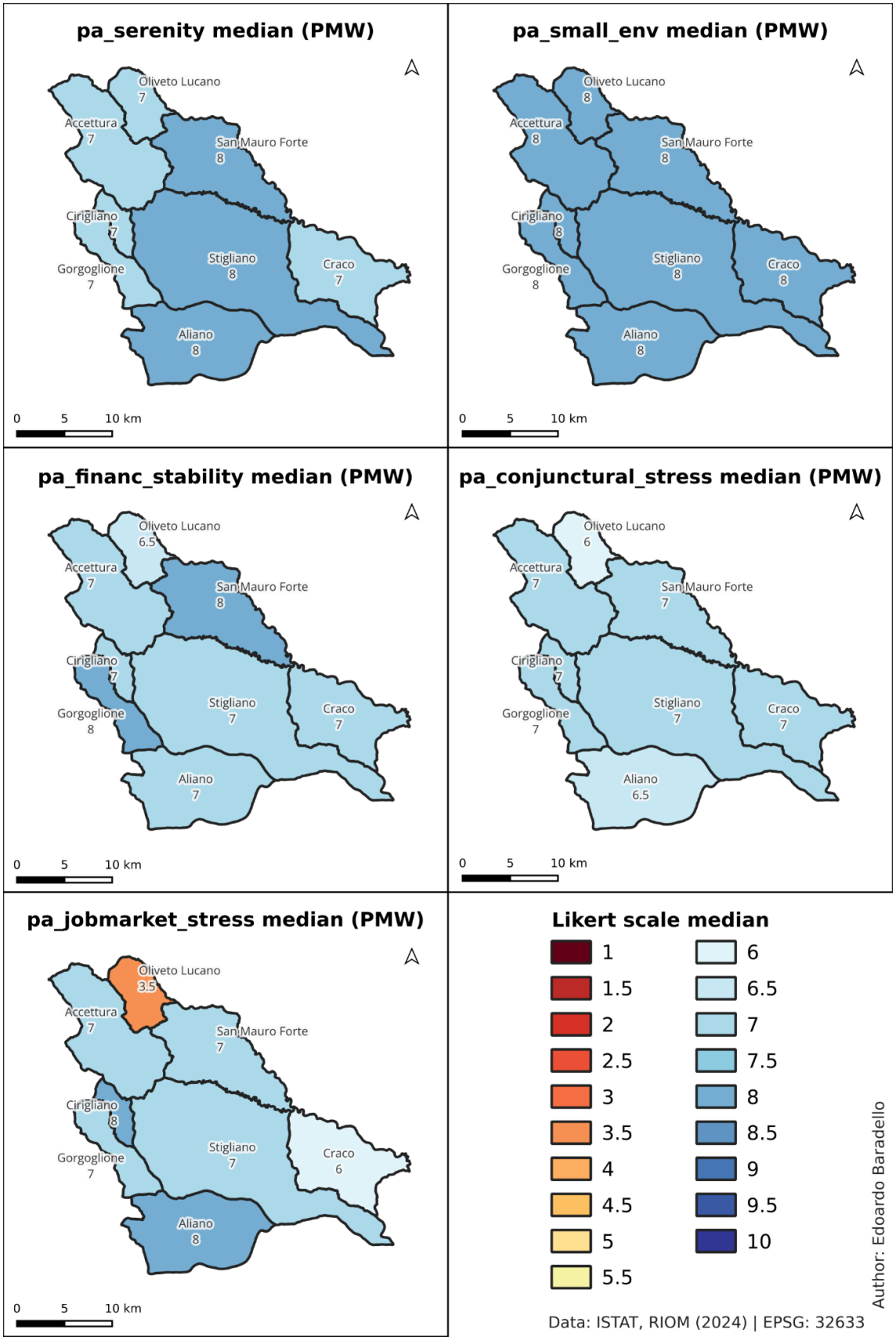
Overall, the analysis highlights that while the entire RIOM dataset experiences more pronounced variability in several key assessment variables across municipalities, the MOMA area remains relatively more consistent.

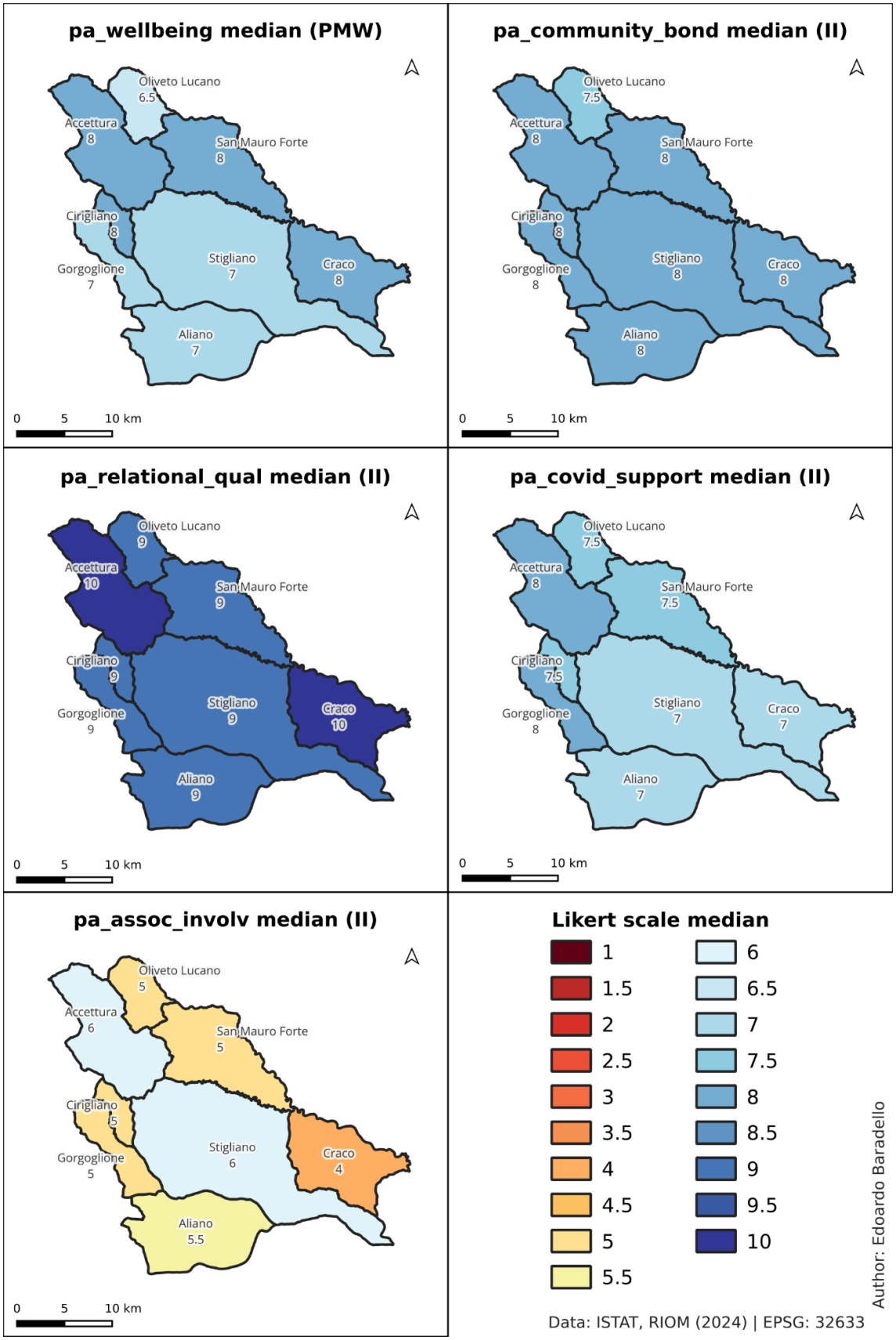
Table 14: Results of the Kruskal Wallis test with each assessment variable as response variable and municipalities as the explanatory variable, calculated for the MOMA area.

Variable	Chi_Squared	DF	P_Value	Significance
pa_serenity	2.669	7	0.914	No significant differences (p ≥ 0.10)
pa_community_bond	6.78	7	0.452	No significant differences (p ≥ 0.10)
pa_small_env	1.029	7	0.994	No significant differences (p ≥ 0.10)
pa_relational_qual	5.254	7	0.629	No significant differences (p ≥ 0.10)
pa_covid_support	1.63	7	0.977	No significant differences (p ≥ 0.10)
pa_assoc_involv	12.054	7	0.099	Marginal significance (0.05 ≤ p < 0.10)
pa_help_ease	7.249	7	0.403	No significant differences (p ≥ 0.10)
pa_financ_stability	7.126	7	0.416	No significant differences (p ≥ 0.10)
pa_conjunctural_stress	7.391	7	0.389	No significant differences (p ≥ 0.10)
pa_jobmarket_stress	17.856	7	0.013	Significant differences (p < 0.05)
pa_soc_media_trust	9.415	7	0.224	No significant differences (p ≥ 0.10)
pa_remotework_dev	2.916	7	0.893	No significant differences (p ≥ 0.10)
pa_innov_readiness	4.752	7	0.69	No significant differences (p ≥ 0.10)
pa_wellbeing	12.109	7	0.097	Marginal significance (0.05 ≤ p < 0.10)
pa_internet_use	5.243	7	0.63	No significant differences (p ≥ 0.10)
ia_financial_serv	14.463	7	0.044	Significant differences (p < 0.05)
ia_consult_serv	11.366	7	0.123	No significant differences (p ≥ 0.10)
ia_adv_tech_serv	7.598	7	0.369	No significant differences (p ≥ 0.10)
ia_gov_support	7.594	7	0.37	No significant differences (p ≥ 0.10)
ia_transport_link	13.099	7	0.07	Marginal significance (0.05 ≤ p < 0.10)
ia_intangible_link	4.836	7	0.68	No significant differences (p ≥ 0.10)
ia_labor_avail	11.062	7	0.136	No significant differences (p ≥ 0.10)
ia_local_benefit	2.063	7	0.956	No significant differences (p ≥ 0.10)

5.3.3.4. Municipal mapping

This section presents choropleth maps of the MOMA area, divided by municipality. Each map shades municipalities according to their median value—a measure of central tendency that curbs the influence of outliers—for each assessment variable, calculated using pairwise deletion. As outlined in the adopted statistical approach, only colour differences corresponding to a significant DPH pairwise comparison should be interpreted as statistically significant. Other variations are purely descriptive and might be attributable to random fluctuations.


pa_serenity median (PMW)
Oliveto Lucano 7
Accettura 7
San Mauro Forte 8
Cirigliano 7
Gorgoglione 7
Stigliano 8
Craco 7
Aliano 8
0 5 10 km
pa_small_env median (PMW)
Oliveto Lucano 8
Accettura 8
San Mauro Forte 8
Cirigliano 8
Gorgoglione 8
Stigliano 8
Craco 8
Aliano 8
0 5 10 km
pa_financ_stability median (PMW)
Oliveto Lucano 6.5
Accettura 7
San Mauro Forte 8
Cirigliano 7
Gorgoglione 8
Stigliano 7
Craco 7
Aliano 7
0 5 10 km
pa_conjunctural_stress median (PMW)
Oliveto Lucano 6
Accettura 7
San Mauro Forte 7
Cirigliano 7
Gorgoglione 7
Stigliano 7
Craco 7
Aliano 6.5
0 5 10 km
pa_jobmarket_stress median (PMW)
Oliveto Lucano 3.5
Accettura 7
San Mauro Forte 7
Cirigliano 8
Gorgoglione 7
Stigliano 7
Craco 6
Aliano 8
0 5 10 km
Likert scale median
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Data: ISTAT, RIOM (2024) | EPSG: 32633
Author: Edoardo Baradello


pa_wellbeing median (PMW)
Oliveto Lucano 6.5
Accettura 8
San Mauro Forte 8
Cirigliano 8
Gorgoglione 7
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pa_community_bond median (II)
Oliveto Lucano 7.5
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pa_relational_qual median (II)
Oliveto Lucano 9
Accettura 10
San Mauro Forte 9
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pa_covid_support median (II)
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pa_assoc_involv median (II)
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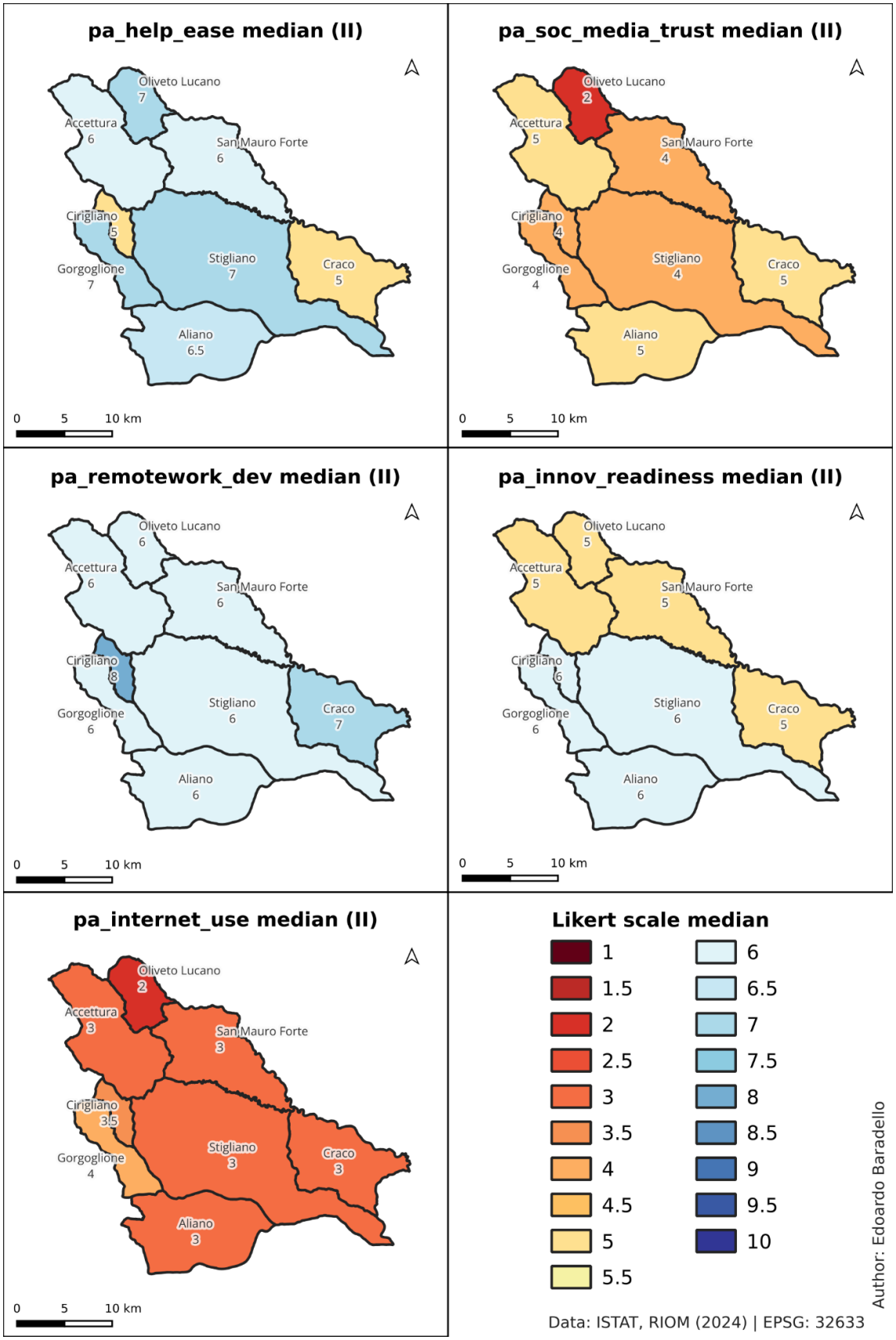
Author: Edoardo Baradello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pa_innov_readiness median (II)
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pa_internet_use median (II)
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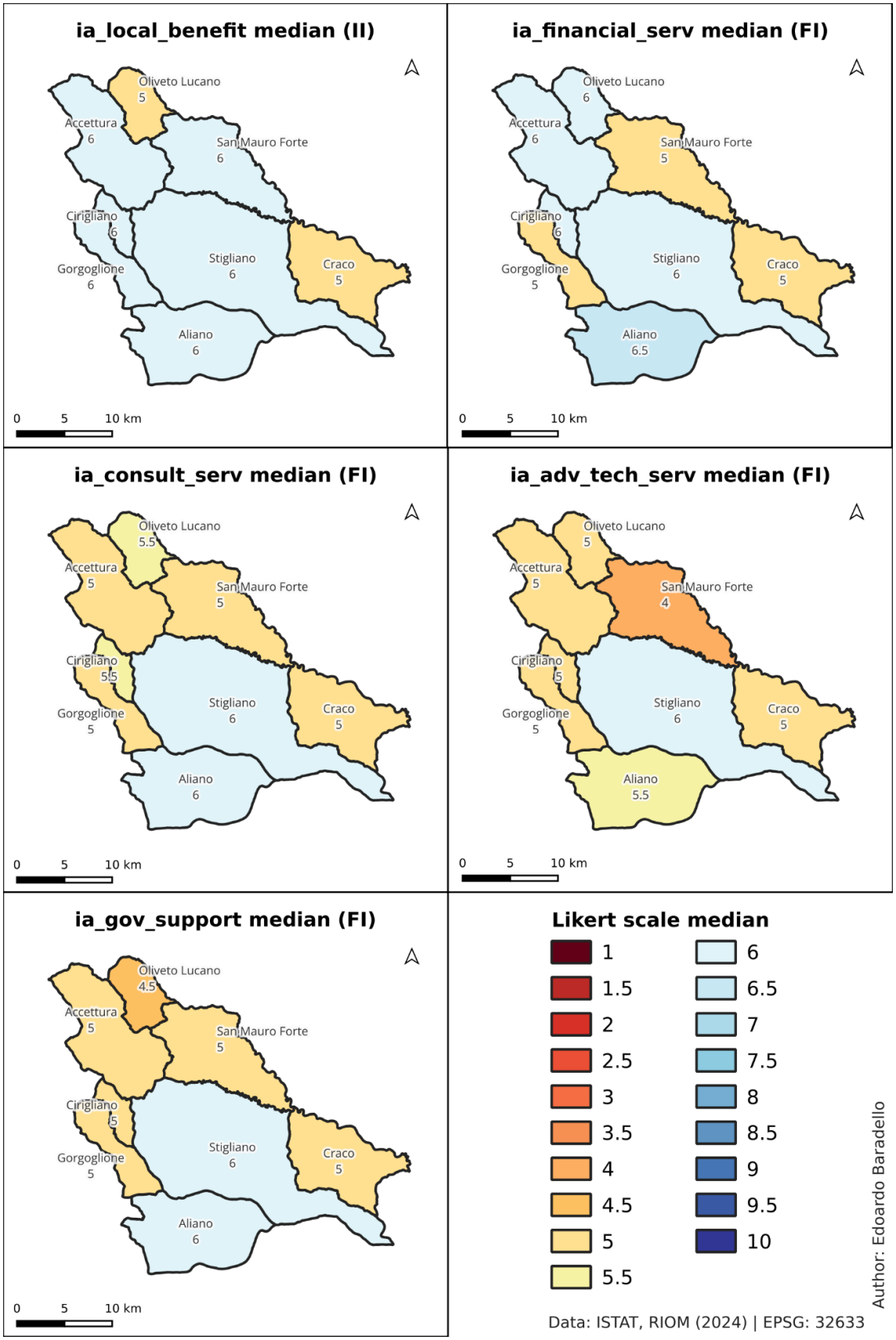
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ia_financial_serv median (FI)
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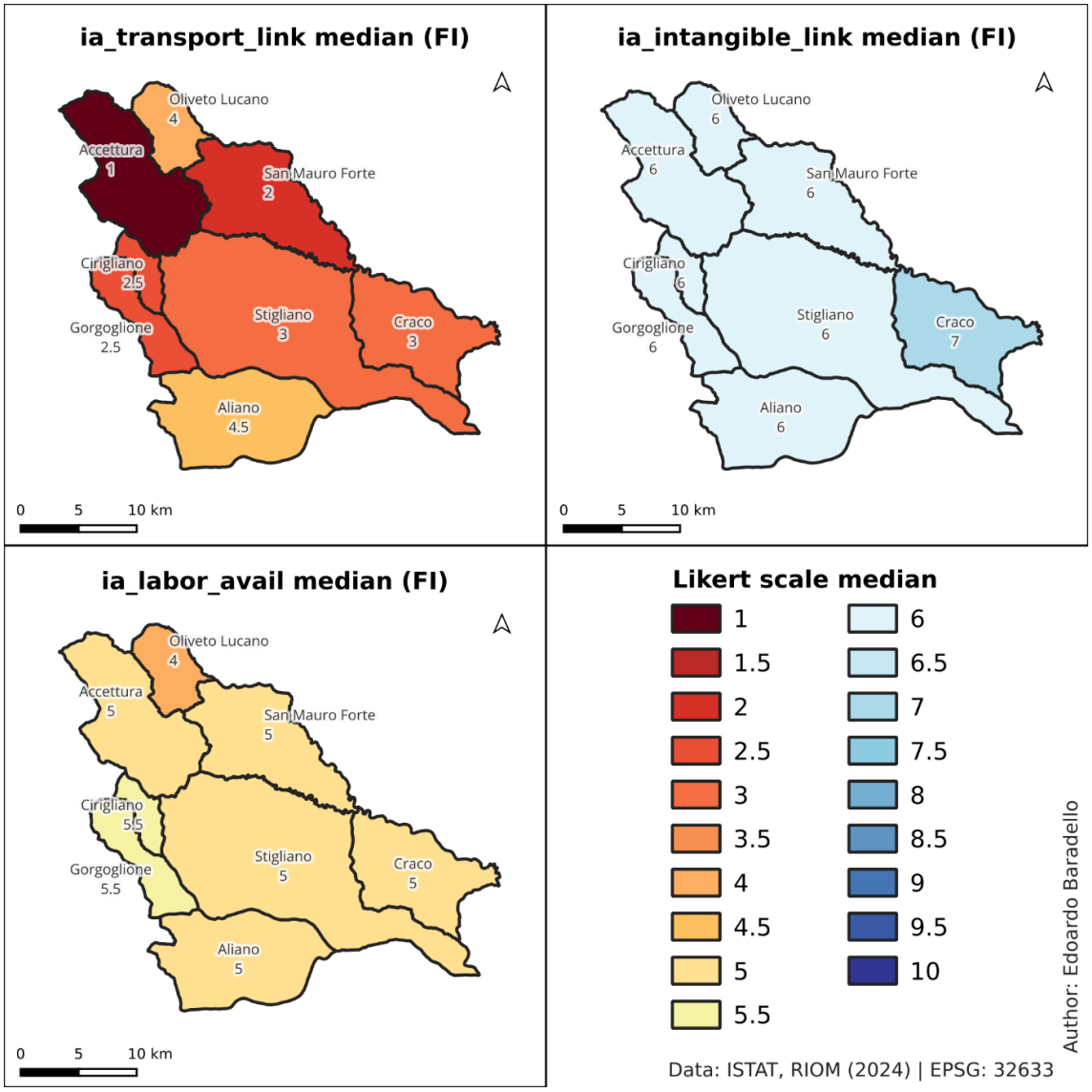

Figure 5: Choropleth maps of the MOMA area by municipality, showing median Likert scale values for each assessment variable.

5.4. Multivariate analysis

Before moving to multivariate statistics, correlation among assessment variables was studied taking the assessment variables with listwise deletion of null values. The analysis of the matrix of Spearman's rank correlation coefficients (nonparametric) revealed key relationships among variables related to personal and innovation ecosystem assessments.

Across the matrix (Figure 6), negative correlations were almost absent (within $|r| < 0.1$), while negligible ($|r| < 0.1$), weak ($0.1 \leq |r| < 0.3$), and moderate ($0.3 \leq |r| < 0.5$) positive correlations were dominant. Overall, a consistently moderate positive correlation was observed

among all variables related to formal institutions (FI). Furthermore, moderate positive correlations were observed within thematic "clusters", such as variables representing informal support (II) (e.g., community bond, help request ease and perceived innovation readiness) and certain variables representing wellbeing (PMW) (e.g., serenity and overall wellbeing). These thematic correlations suggest the possible presence of consistent underlying patterns at least for FI and II. Furthermore, weak and moderate positive correlations are observed between FI and II, indicating their limited positive linear association, whereas overall weaker correlations between FI and II with PMW reflect a lower association with PMW.

Besides, it should be noted that internet use (within II) and conjunctural and job market stress (within PMW) present an overall negligible correlation with all assessment variables, suggesting the absence of a linear relationship.

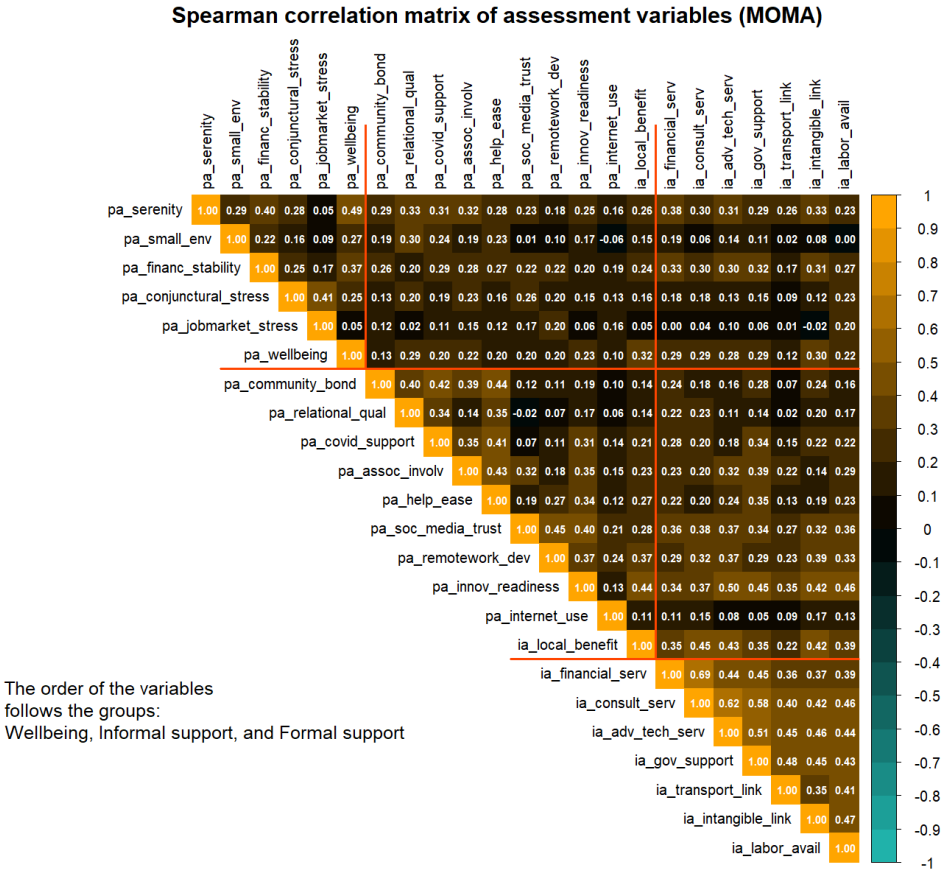

Figure 6: Spearman correlation matrix of assessment variables for the MOMA area.

Given the analysed correlation matrix and the high dimensionality of the data matrix available (259 x 82 for the MOMA area), the PCoA and clustering analysis were conducted with a large subset (31 variables, Table 7) and a small subset (14 variables, Table 8). In the latter, only a core group of assessment variables were maintained attempting to obtain lower absolute

correlation among them in order to partially exclude the noise produced by similar measurements.

5.4.1. Large subset (31 variables)

The PCoA analysis of the large subset reveals that there is no single dominant axis that explains a large portion of the variance in the MOMA area, which is spread across many dimensions (Figure 7). Given the use of Gower distances on a mixture of demographic, Likert-item, and categorical data, the variation in the data is quite multidimensional, with the first two principal axis explaining only 13% of the total variance. Furthermore, the curve of cumulative variance explained, in Figure 7, ascends gradually suggesting that adding a moderate number of dimensions may still miss relevant nuances in the data.

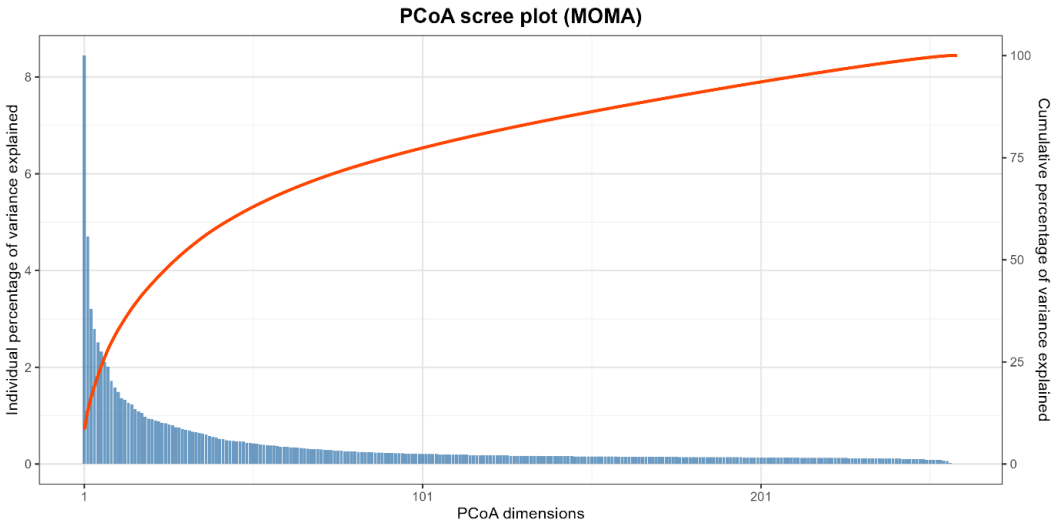

Figure 7: PCoA scree plot of the large subset for the MOMA area.

Given that the first two coordinates alone explain a small fraction of total Gower variation, their 2D plotting may not reveal specific structure, which might be absent or hidden in higher dimensions. When colour-coding innovation readiness in the PCoA space of the first two axes according to their Likert score (Figure 8), this perception is not found to be a dominant driver, with a slight grouping of higher (left-side) vs lower (right-side) readiness individuals. Repeating this exercise for gender (Figure 9), PCoA does not show a strong separation purely by gender but a slight concentration of men in the upper-side and women in the lower-side.

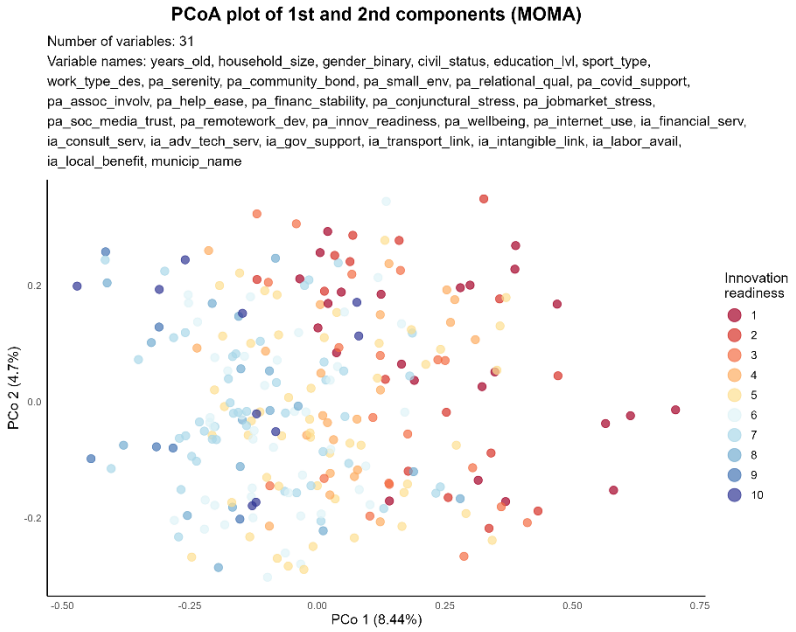

Figure 8: PCoA plot of 1st and 2nd axes of the large subset for the MOMA area colour-coded by innovation readiness.

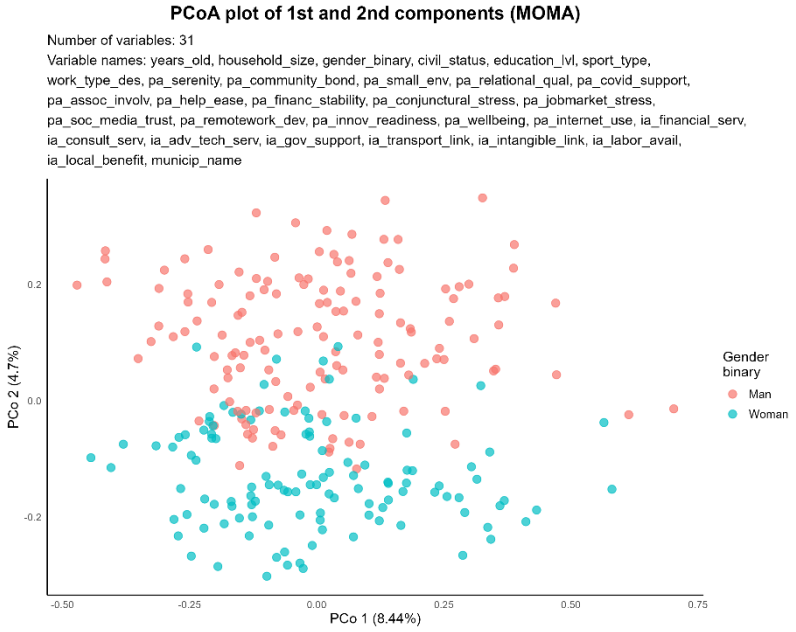

Figure 9: PCoA plot of 1st and 2nd axes of the large subset for the MOMA area colour-coded by gender.

Additionally, when computing the silhouette scores for the Gower matrix between 2 and 20 clusters (Figure 10), a peak is found at $k = 2$ with a ASW of only 0.1. Hence, data are not forming tight or well-defined clusters. The two-cluster solution derived from hierarchical clustering with Gower distances is weak and reveals two clusters that are not sharply defined

(Figure 11). Overall, the analysis indicates a rather spread distribution of responses across multiple dimensions, highlighting that, for the MOMA area, meaningful segmentations will likely remain subtle.

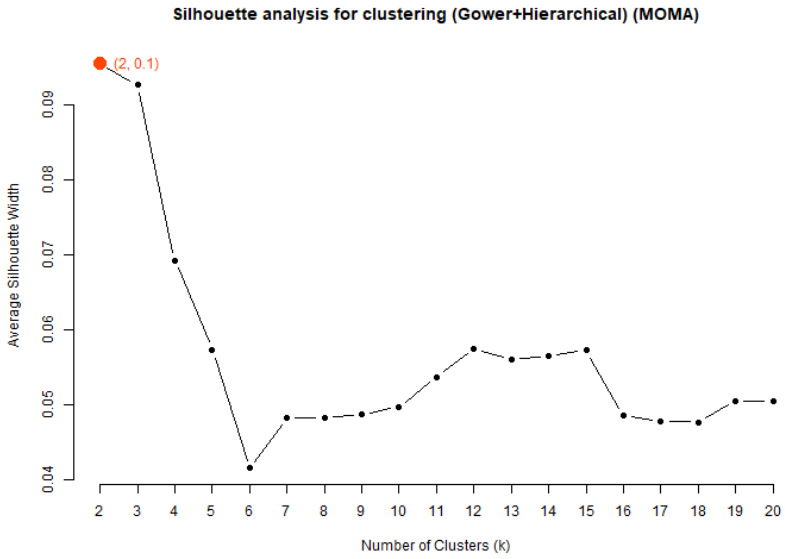

Figure 10: Silhouette analysis for clustering of the large subset for the MOMA area.

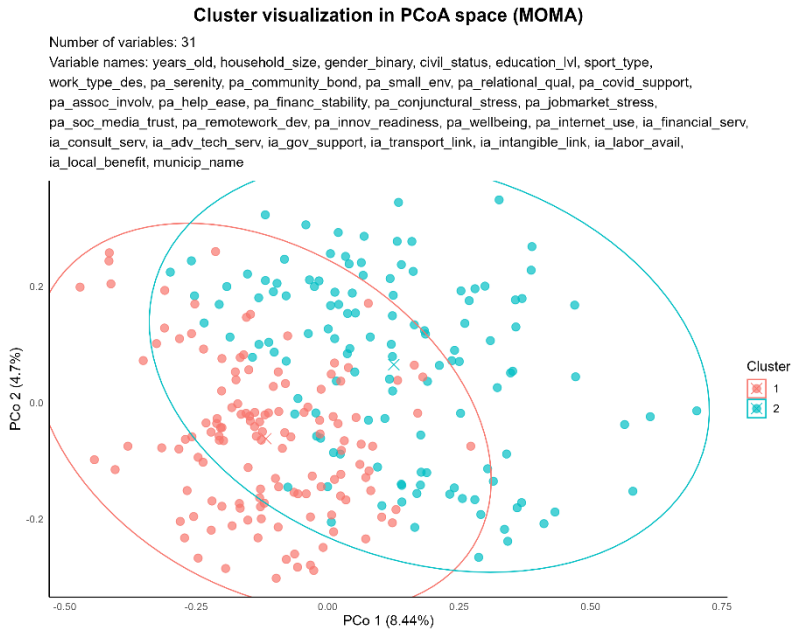

Figure 11: Cluster visualisation in PCoA space of the large subset for the MOMA area.

5.4.2. Small subset (14 variables)

When carrying the same analysis with the reduced subset of variables, the first two components still explain a small slice of overall variability, approximately 13%, confirming that a

substantial part of variation lies in higher dimensions (Figure 12). Silhouette values are somewhat higher but still very low to define strong clusters (Figure 15). The two clusters that maximise ASW at 0.15 are partially aligned with gender (Figure 14, Figure 16), yet the weak clustering suggest that data do not naturally segment.

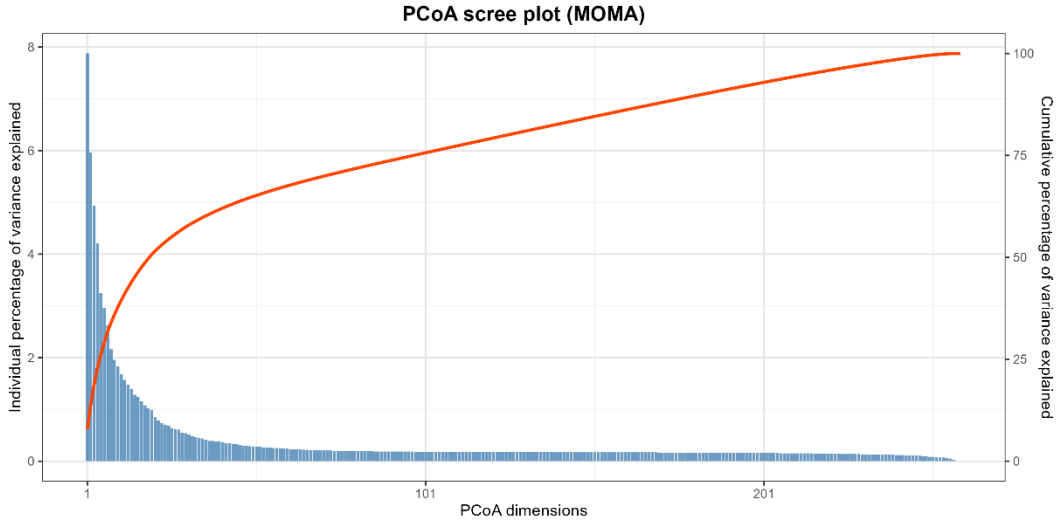

Figure 12: PCoA scree plot of the small subset for the MOMA area.

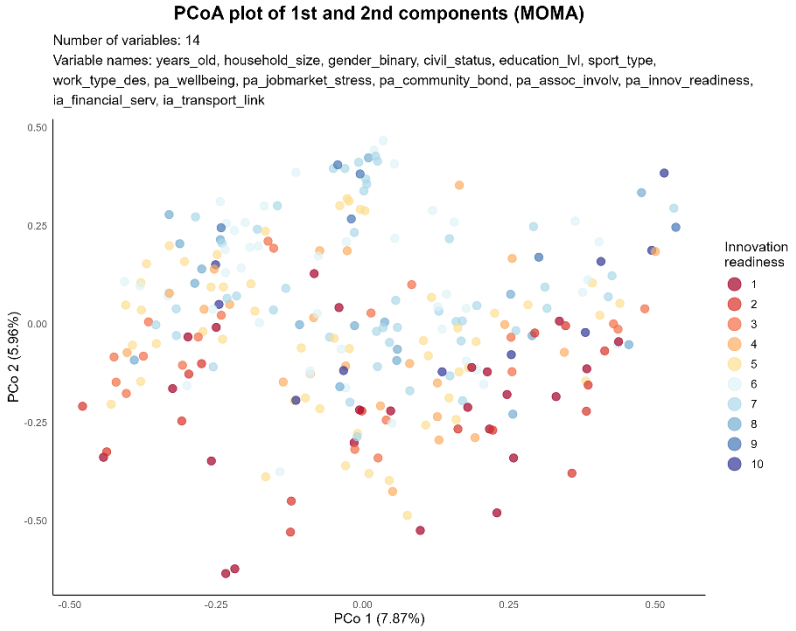

Figure 13: PCoA plot of 1st and 2nd axes of the small subset for the MOMA area colour-coded by innovation readiness.

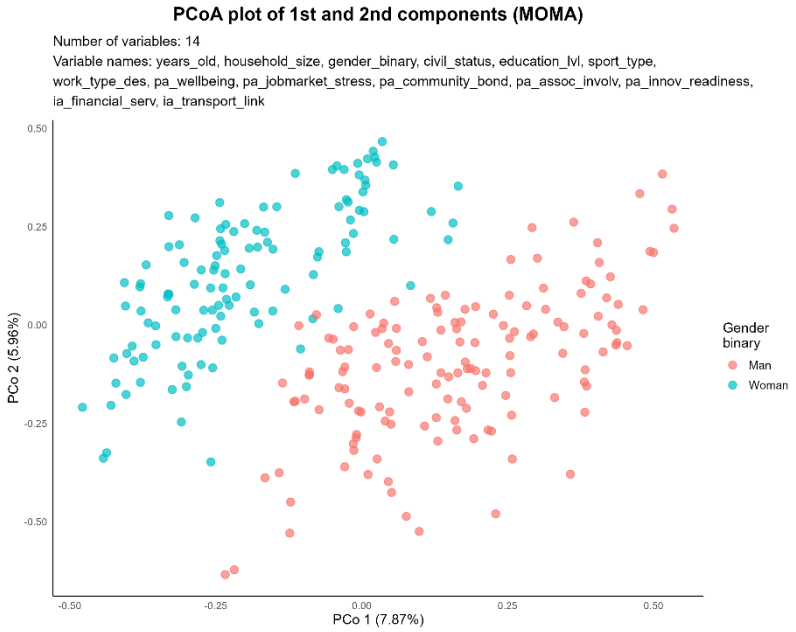

Figure 14: PCoA plot of 1st and 2nd axes of the small subset for the MOMA area colour-coded by gender.

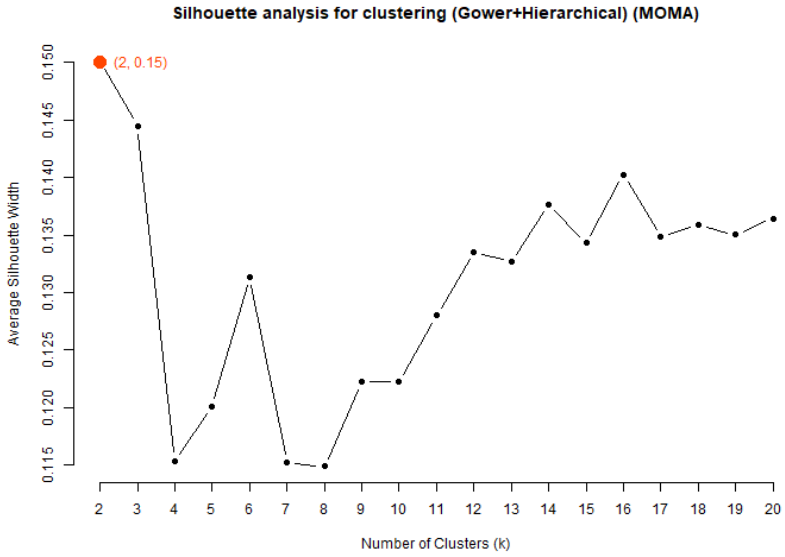

Figure 15: Silhouette analysis for clustering of the small subset for the MOMA area.

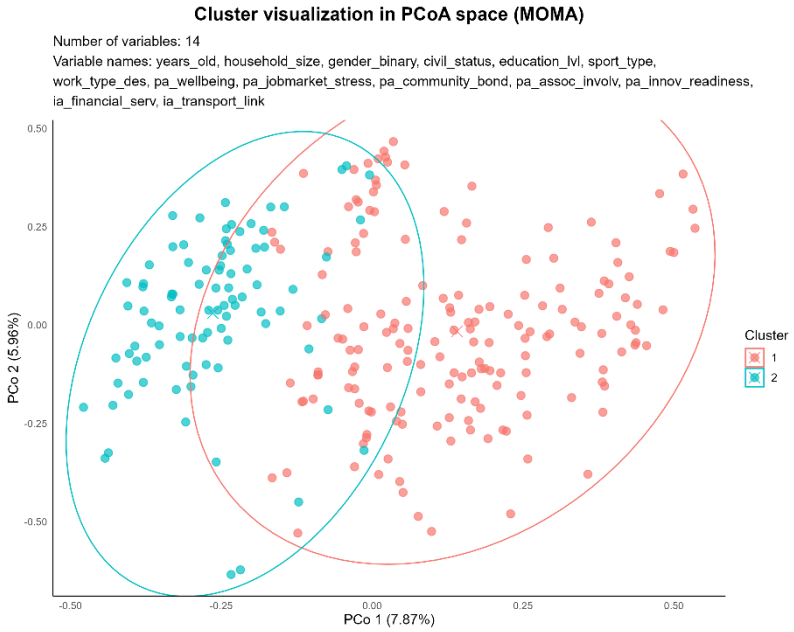

Figure 16: Cluster visualisation in PCoA space of the small subset for the MOMA area.

6. Discussion

This section interprets the findings for the MOMA area through the three pillar lens—psychological and material well being (PMW), informal institutions (II), and formal institutions (FI)—and reflects on multivariate evidence, limitations, and future directions.

Inner areas of Montagna Materana (MOMA) exhibit a notable combination of strong social cohesion and relational capital alongside a pronounced digital divide and patchy formal institutional support. High community bonds, relational quality, and positive subjective well-being coexist with significant gaps in internet use, trust in social media, and transport infrastructure, affecting perceived readiness for innovation. The dataset maintains considerable dimensionality, limiting straightforward segmentation.

Regarding personal and material well-being, responses predominantly skew toward the positive end of the Likert scale, with median values consistently at 7 or above. PMW correlates positively, albeit weakly, with all other assessment variables, showing significant differences across various socio-demographic groupings. This indicates a modest association between respondents' social positioning and how they perceive their own resources and environment.

For example, respondents aged 55-64 shoulder a lighter burden of global-crisis stress than those 65-74. Generally, most respondents report positive levels of life satisfaction and subjective well-being; however, respondents living alone report lower scores compared to large households. Moreover, higher qualifications are associated with better material well-being but also balanced with more intense job-market stress. Concerning the latter, Oliveto Lucano stands out with markedly lower job-market stress, detected by significant differences with Aliano, Gorgoglione and Stigliano.

Regarding informal institutions, the analysis depicts robust community ties and relational quality but relatively weak involvement in civic associations, low perceived innovation readiness, and low average internet use. Strong community bonds, high relational quality, and trust in community support signal robust social cohesion that the literature commonly associates with a positive reinforcement of entrepreneurial ecosystems (Fernandes & Ferreira, 2022). Counterbalancing this asset, low reliance on digital technologies and skepticism towards social media may constitute barriers to the effective development of innovative services that rely on digital integration (Nambisan et al., 2019).

A generational digital divide suggests a markedly higher reliance on internet and trust in remote working for younger respondents. A second digital divide concerns household size, with elements suggesting larger households are significantly more digitally engaged than smaller, both in terms of internet use and trust in social media. Besides, men reported slightly higher scores for community bonds and ease in help-seeking behaviours, while women reported greater labour availability.

Furthermore, higher educational attainments are associated with a strong increase in trust and usage of digital tools. If education matters, team sport practice seems to be at the heart of a better informal institutional support environment, including stronger community bond, emergency support, association involvement, help request ease, trust in social media, and internet use. Occasional workers participate in associations more than unpaid domestic workers. Lastly, an association suggests that trust in social media seems to decrease slightly with an increased population density.

Regarding formal institutional support, respondents reported a more even distribution of scores with a concentration of values in the 5–7 range on the Likert scale, except for transport infrastructure, which was perceived as highly inadequate. The specific formal institutions investigated seem to constitute a solid theoretical concept as they present a moderate to good

positive correlation among themselves and in relation to perceived innovation readiness too. Financial services, consultancy, and intangible connection services were perceived as overall moderately supportive, identifying some foundational elements potentially conducive to entrepreneurial activities. However, perceived inadequacies in transport and advanced technological infrastructure are likely to represent considerable barriers to ecosystem development, aligning with the expectation found in the literature of the adverse impact of insufficient infrastructure on economic activity (Runiewicz-Wardyn, 2014).

Age and gender influenced perceptions of formal institutions significantly. Younger respondents perceived better financial services and labour availability, reflecting either greater familiarity or higher expectations among youth. Women reported higher labour availability too. In line with informal institutions, team sport practice is also associated with higher formal institutional quality, particularly financial and public institutional support, while individual-sport practice is associated with a lower perception of physical connection services. Lastly, as expectations on the rarefaction of proximity services would suggest, a decreasing municipality size is associated with worse financial and consultancy services, which in turn are identifies by the literature as supportive elements (Liedtke et al., 2021).

Few significant municipal differences were observed within the MOMA area, predominantly regarding financial services and employment stress. Municipalities lacked innovative start-ups, SMEs, and incubators (as of 3 March 2025), pointing towards broader structural challenges and the necessity for alternative metrics to assess local innovation readiness. Furthermore, Principal Coordinates Analysis (PCoA) confirms a highly dimensional perception space, with the first two components explaining only approximately 13% of the total variance, revealing no strong clustering patterns.

Compared to other studies, this chapter uniquely focuses on detailed local-scale institutional analysis of Montagna Materana, allowing a situated understanding of the interplay of institutional factors identified by the literature, which proves to be complex and needs more nuanced analytical approaches (A. Ferrara et al., 2016; Mancino et al., 2016; Sallustio et al., 2018). Whereas most rural-innovation research still relies on case-study, city-focused, regional or national averages (e.g., (Audretsch & Belitski, 2017; Bosworth & Turner, 2018; Salimath & Cullen, 2010)), the present work drills down to the eight MOMA municipalities and shows through a spatial approach how strong community bonds coexist with a pronounced digital divide and physical infrastructural limits—an institutional mix that broader studies tend to

smooth out. The chapter's finding that social cohesion does not automatically translate into high entrepreneurial dynamism echoes arguments that dense relational capital is only one ingredient of a vibrant ecosystem mediated by other mechanisms, such as knowledge absorption capacity (Dias & Silva, 2021). Hence, it also supports calls for simultaneous strengthening of formal and informal support mechanisms (Igwe et al., 2020; Lee et al., 2022). Moreover, the high dimensionality of perceptions extends reported evidence (Aguilar, 2021; Asmit et al., 2024) that rural innovation pathways resist simple clustering, underscoring the value of fine-grained, locally grounded diagnostics such as those developed here for policy design in Southern Europe's Mediterranean inner areas.

However, limitations include a modest sample size, reduced to 259 individuals due to missing data on three variables of interest, potentially affecting generalisability. Further testing is required to determine whether missing data are random (MCAR) across other RIOM areas too. Moreover, unlike expectations, the study did not find significant differences between municipalities except for financial services and job market stress, suggesting a level of 'homogeneity' in the MOMA area requiring further investigation.

This study aimed to elucidate how formal and informal institutions are associated with key dimensions of digitalisation-based service ecosystems and their entrepreneurial networks in the inner areas of the Province of Matera. It highlights institutional interdependencies and their significant roles in shaping drivers or barriers for innovation, emphasizing the importance of considering the psychological and material well-being of individuals when assessing their potential for entrepreneurial activity. The analysis demonstrates the need to consider multiple socio-demographic and spatial factors (Salvati & Zitti, 2008; Salvati & Carlucci, 2011; Kosmas et al., 2015), and their complex interactions in order to effectively address innovation ecosystems, and, thus, shape their related policies (Colantoni et al., 2015; C. Ferrara et al., 2017; Tomao et al., 2017).

Further analysis is needed to test the assumption of MCAR beyond the MOMA area, as well as to study possible nonlinear relationships linking variables with lower correlations to other assessment variables, such as internet use, conjunctural stress and job-market stress (Quaranta et al., 2020; Vardopoulos et al., 2021; Coluzzi et al., 2022). Additionally, more detailed investigations into the homogeneity of MOMA, with comparative analyses between the three RIOM areas, are required to confirm the findings, to explore regional and local effects, and identify more meaningful segmentations and clustering (e.g., (Incerti et al., 2007)). Lastly,

further research is suggested to couple the available subjective data with objective proxy measures of innovation readiness, entrepreneurial capacities, and digital ecosystems in the area, as no innovative start-ups and SMEs or incubators were identified in MOMA municipalities.

7. Concluding remarks

This chapter examined the Montagna Materana (MOMA) area, focusing on the institutional economy affecting the local innovation ecosystem. This research identifies strong social cohesion with a high quality of community bonds and relationships, supportive of entrepreneurial activity. However, a digital divide exists between age groups, with younger individuals showing greater internet use and trust in remote work, contrasting with lower engagement from older respondents. Moreover, while formal institutional support was rated moderately positive in all dimensions, physical connection services were perceived as notably weak, constituting a specific fundamental barrier.

The chapter suggests that the highly dimensional integration of formal and informal institutions creates contrasting drivers, shaping supportive and inhibitive environments for innovation, while also noting the role of wellbeing in differentiating the perceptions of the respondents. Further research is needed to investigate missing data, potential nonlinear relationships, and regional differences. Additionally, it is suggested to identify alternative objective measures of innovation readiness, given the apparent lack of innovative start-ups or SMEs in the area. Lastly, the analysis revealed a certain level of municipal homogeneity within the MOMA area, in contrast with the variability found throughout the RIOM dataset, which calls for further exploration and more elaborate analytical approaches.

8. Acknowledgements

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Chapter 2

Wellbeing and landscapes under formal and informal institutions: Envisioning barriers and drivers of digital service ecosystems in rural Italy[5]

Authors: Edoardo Baradello, Rosanna Salvia, Roberta Pecoraro, Luca Salvati, Giovanni Quaranta

Abstract

A survey collecting Likert-type perception data on institutions and innovation from two rural areas of Southern Italy was carried out to address a basic question in the New Institutional Economics, namely how formal and informal institutions can positively affect digitisation-based service ecosystems and their entrepreneurship networks in inner areas? Contributing to fill this knowledge gap, we inform evidence-based policy design and contribute to the theorization of integrated institutional dynamics. Results of a direct survey across more than 1700 respondents indicate that both areas investigated are often consistent across the evidence base, yet they reveal significant differences between municipalities and socio-demographic groups, and carry clear implications for policy design and local implementation of effective programmes in the domain of digitalisation-based service ecosystems. Context-specific, sometimes non-linear dynamics, shape entrepreneurship and service ecosystems in institutional peripheries in ways that require specific program calibration. Rural areas in Southern Italy seem to rest on robust social capital while facing clear and variegated gaps in hard-infrastructures and digital skills. The efficient achievement of policies oriented to digitalisation-based service ecosystem development may then hinge on formal-informal synchronised upgrades to physical and intangible infrastructures, skills, and on translating community strengths into digital adoption and digitally integrated proximity services—delivered through finely targeted, place- and group-sensitive interventions.

Keywords: service ecosystems, inner areas, digital transition, institutional economics, local development, entrepreneurial ecosystems, nonparametric statistical methods.

[5] This is chapter 6 of the book *Rethinking Rural* - submitted to Elsevier, 1st Edition - April 1, 2026.

1. Introduction

What do community bonds or relational quality have to do with consultancy or financial services? How do informal institutions relate to formal ones and influence the innovation readiness of a region? Answering these and similar questions requires defining the geographical and institutional landscape where contrasting institutional forces influence entrepreneurial networks development (Ménard & Shirley, 2025a). The empirical journey connecting real places to multifaceted theoretical concepts such as institutions (Nguyet & Tinh, 2025), entrepreneurial ecosystems (Malecki, 2018; Stam & van de Ven, 2021), digital entrepreneurship and innovation systems (Satalkina & Steiner, 2020), is paved with analytical decisions and contextual interpretations. In the case of an advanced economic system with persistent regional disparities such as Italy, where inner rural areas mostly locate at the 'periphery' of the national economy (Vendemmia et al., 2021), this process is key to provide local and national administrators with solid evidence to design effective public policies for geographically isolated and service-poor areas (Monturano et al., 2025).

Since innovation ecosystems are rooted in knowledge sharing mechanisms connecting individuals, businesses, and organisations with variable knowledge and resource levels (Bouncken & Kraus, 2022), capturing perception asymmetries on institutional landscapes addresses the foundational drivers that ignite such ecosystems (Fernandes & Ferreira, 2022), as well as their potential focus on sustainability (Neumeyer & Santos, 2018). Namely, the digital transformation of infrastructures, businesses, skills, and public services, such as the one at the core of contemporary European Union policies (European Commission, 2025), depends on the enablement of the entrepreneurial and institutional ecosystem to produce unprompted change (Nambisan et al., 2019).

In the theoretical framework of the New Institutional Economics (NIE), change is tightly bound to the (assumed) uncertainty faced by individuals and organisations which, by nature, have incomplete information or limited capacity to elaborate information about unforeseen events (Ménard & Shirley, 2025b). To address such uncertainty, and therefore reduce the resulting transaction costs, institutions emerge as locally variable sets of rules and norms which compose a framework "within which human interaction takes place" (North, 1990, p. 4). Specifically, a constellation of informal institutions—e.g. the culture of volunteering or the trust in social media—and formal institutions—e.g. transport infrastructures or financial services—generate an intricate web of contrasting forces affecting entrepreneurial networks (Ledeneva & Efendic,

2021) and innovation ecosystem development (Salimath & Cullen, 2010). This local institutional network is in turn embedded in a wider entrepreneurial ecosystem which affect generalized economic performance (Content et al., 2020), and where digital entrepreneurship is built through collective intelligence mechanisms (Elia et al., 2020). Thus, taking the perspective of a service ecosystem, the creation of new value rests on an institutionalisation process where existing institutions are integrated with existing technologies (Vargo et al., 2015).

Informal institutions—shared norms, reciprocity, and especially trust—shape incentives (Ledeneva & Efendic, 2021), social cohesion (Fernandes & Ferreira, 2022), trust-based collaboration and resource sharing (Lee et al., 2022). They, thus, form the social infrastructure from which entrepreneurial networks originate, and then promote new lifestyles, drive scientific innovation, and build cooperation with other territories (Basile & Cavallo, 2020). Territorial trust- and family-based informal networks (Igwe et al., 2020), grassroots mutual aid (Wilson et al., 2017), volunteering (Sarkar et al., 2019), and professional peer-group support (Manimala et al., 2015) contribute to offset resource gaps, mitigate risks and catalyse innovation, especially during crisis or adverse economic conjunctures (Castro & Zermeño, 2020).

On top of these functions, a complementary subset of digital-related institutions influences the adoption capacity of new technologies and is, thus, pivotal to the growth of digitalisation-based service ecosystems (Barile et al., 2025). Confidence in digital tools, social media, and remote-work technologies, and the familiarity with internet-based technologies enable and accelerate the spread of entrepreneurial know-how while reinforcing labour, cultural and social conditions for digitalisation-led ecosystems (Huđek et al., 2021). Namely, advanced digital capabilities—such as the internet of things, cloud and mobile computing, big-data analytics, and social-media marketing—now figure prominently in SMEs' competitiveness and innovation dynamics (European Commission-DG GROW et al., 2015).

Formal institutions—established entities, codified rules and procedures—regulate the conduciveness to entrepreneurship of the ecosystem (Salimath & Cullen, 2010), offering structural normative and material support to entrepreneurs, workers, and citizens (Reiners, 2022). Relevant barriers to entrepreneurship and economic activity are associated, for instance, to heavy bureaucratic constraints (McMullen et al., 2008), corruption—intersectional to formal and informal institutions—(Bendickson et al., 2021), and frequently changing rules (Williams

& Vorley, 2015). Whereas access to finance and consultancy services, strong infrastructures, and efficient public bodies are associated with venture growth (Audretsch & Belitski, 2017).

The information flow of digital knowledge is mediated by formal institutions such as digital skills educational programmes, infrastructures for the access to the internet, advanced public research facilities, which enable and accelerates the brokering of knowledge-sharing (Fudickar & Hottenrott, 2019), and the flows from ideation to production and reach for innovative products (Yoo et al., 2010). Hence, because digital policies can enable or constrain innovation, their design and governance remain a central institution to such ecosystem performance (Nambisan et al., 2019).

This institutional ecosystem for digital services is affected by contrasting, non-linear forces dependent on spatial and socio-economic specificities—especially in peripheral economies—which resist generalization (Ghura, 2019; Goletsis et al., 2025; Seifollahi-Aghmiuni et al., 2022), and tend to follow integrative and disintegrative ecosystem dynamics (Pocek, 2022). The integration of formal rules and informal ties is paramount to generate sustainable and resilient platforms for economic activity (Amendolagine & von Jacobi, 2023; Fuentelsaz et al., 2019; Ménard & Shirley, 2025a; Webb et al., 2020); for instance, coupling digital financial services and traditional support networks strengthens entrepreneurial activity (Zhang & Wei, 2023). Furthermore, institutional assets tend to vary across socio-demographic groups (Manimala et al., 2015). For instance, within firms, digital transformation is filtered through SME constraints, individual capabilities, social capital, and generational gaps (Pelletier & Cloutier, 2019). Hence, to obtain the conditions for thriving ecosystems, appropriate public programmes and rules, market mechanisms and infrastructures should be paired with supportive community norms and habits (Urbano et al., 2019).

This pairing is context-dependent and, in the case of inner area of Italy, it is framed within the place-based policy objectives of the Italy's National Strategy for Inner Areas, hereafter SNAI (PCM-DPCoes, 2025). The inner areas defined under SNAI have experienced a marginalization process including prolonged demographic decline and depopulation, human and social capital depletion, employment contraction, land abandonment, and lack of infrastructures (Salvati and Carlucci, 2011). Policy responses have led only to partial gains so far. Conceptually, these areas can be considered institutional peripheries (Vendemmia et al., 2021)—encompassing a substantial share of national territory, population, forests, and protected areas (Sallustio et al., 2018)—where resource scarcities, structural gaps and

institutional voids echo certain conditions studied in emerging economies (Cao & Shi, 2021). In this setting, the study of perceptions about institutions provides relevant subjective measures of innovation readiness, and its drivers and barriers, which can inform research beyond (and, possibly, outside) Europe (Martins et al., 2021).

How formal and informal institutions interact to co-produce these drivers and barriers still remains under-specified (Bruton et al., 2010). In this study, we employ a non-parametric workflow to assess Likert-type perception data on institutions and innovation from inner (rural) areas in Southern Italy. We address the question: how formal and informal institutions can positively affect digitisation-based service ecosystems and their entrepreneurship networks in inner areas? Contributing to fill this knowledge gap, we inform evidence-based SNAI policy design and contribute to the theorization of integrated institutional dynamics. Taken together, both areas investigated are often consistent across the evidence base, yet they reveal significant differences between municipalities and socio-demographic groups, and carry clear implications for policy design and local implementation of effective programs in the domain of digitisation-based service ecosystems.

2. Methodology

In order to provide contextual evidence on Italian inner areas' institutional dynamics, an empirical analysis was built based on a cross-sectional survey conducted in three regions in Southern Italy (Figure 1).

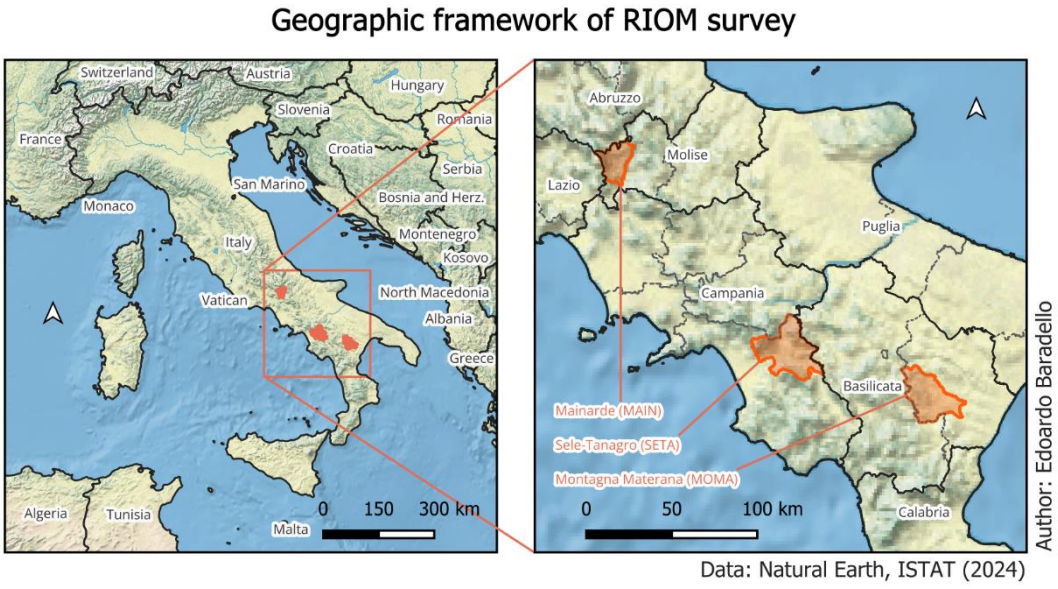


Figure 17: RIOM survey geographic framework.

The ‘Risks-opportunities in southern inland areas’ (RIOM) survey collected individuals’ Likert-type perceptions on formal and informal institutions and innovation, together with a basic set of socio-demographics (age, gender, household composition, education, employment, and lifestyle). Conducted between 9th March and 25th April 2024, the survey collected a total random sample of 2,024 respondents (out of 37,544 phone calls), with a response rate of 6.5%—including both complete and partial interviews as defined by the American Association for Public Opinion Research (AAPOR, 2023). The spatial granularity of data was bound to the municipal level, assigned to each respondent based on their main residence (Table 1). The sample obtained is taken as representative of the reference population with a maximum margin of error of 2.2% at the 95% confidence level.

Table 15: RIOM survey geographic structure.

Geographic area	No. Respondents	No. Municipalities	Province	Region
Montagna Materana (MOMA)	303	8	Matera	Basilicata
Sele-Tanagro (SETA)	1399	19	Salerno	Campania
Mainarde (MAIN)	322	13	Isernia	Molise

In this study, a comparative analysis of Montagna Materana (MOMA) and Sele-Tanagro (SETA) areas is carried out, leading to a total sample of 1,702 individuals distributed in 27 municipalities. Both areas are currently official SNAI targeted areas, MOMA since 2014 while SETA since 2021 (Figure 2).

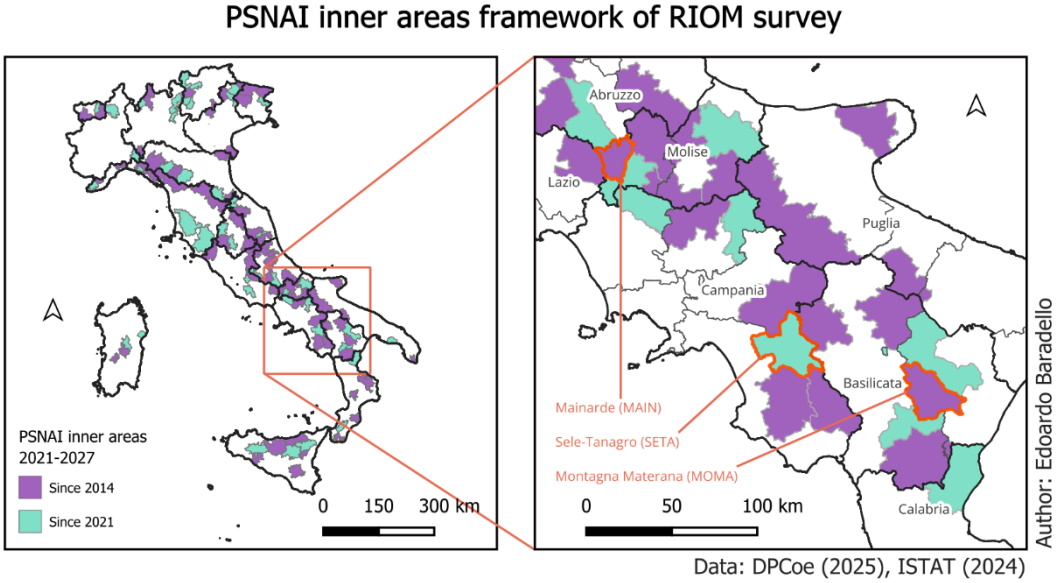


Figure 18: Current Italian official inner areas under SNAI by year of definition.

Additional municipal-level geographical and demographical data were sourced from the Italian National Statistical Institute (ISTAT), the Italian Business Register and the Ministry of Enterprises and Made in Italy (MIMIT). Published by the latter two, the Italian Business Register of Innovative Start-ups and SMEs was analysed to assess the presence of innovative start-ups, innovative SMEs, and business incubators.

Furthermore, in order to structure the investigation, three thematic areas were defined to theorise the institutional landscape described by the 23 Likert-type variables collected within the individual responses to the survey's questionnaire (see Table 2): Psychological and Material Wellbeing (PMW), Informal Institutions (II), and Formal Institutions (FI). The six variables reported in PMW reported perceptions concerning subjective wellbeing, economic stability, material quality of life, and the burden of job-related and conjuncture stressors. The ten dimension of II captured the sense of community and network, trust, reciprocity, the cultural relevance of digital skills, social media, remote working, ethical consumer behaviour and an overall the trust in local innovation readiness. Lastly, the seven dimensions portraying FI describe the quality of financial and consultancy services, advanced research facilities and support, public support programmes, physical and 'intangible' infrastructural networks and job availability.

Table 16: Likert-type perception variables classified by topic.

Likert-type perceptions data			
Area	**Measure**	**Variable name**	**Wellbeing dimension**
PMW	Perceived level of serenity of life	pa_serenity	Psychological wellbeing
	Perceived strength of personal well-being	pa_wellbeing	Subjective wellbeing (overall)
	Perceived ease of the household's economic situation	pa_financ_stability	Material wellbeing
	Perceived importance of living in a small or moderately sized environment for the quality of life	pa_small_env	Benefits of a small living environment on material wellbeing
	Perceived burden of current global challenges on personal serenity (post-pandemic, eco-anxiety, wars)	pa_conjunctural_stress	Psychological burden of global stressors
	Perceived burden of the challenging employment situation	pa_jobmarket_stress	Psychological burden of employment stressors
Area	**Measure**	**Variable name**	**Informal institution**
II	Perceived depth of the bond with one's community	pa_community_bond	Community ties and trust
	Perceived quality of relationships with one's social environment (family, relatives, friends)	pa_relational_qual	Relationship networks
	Perceived support from one's community during the COVID-19 pandemic	pa_covid_support	Grassroots mutual aid networks
	Perceived ease of seeking help from one's community	pa_help_ease	Help request ease culture
	Perceived level of involvement in local associations	pa_assoc_involv	Volunteering and civic engagement
	Perceived contribution of remote working to community development	pa_remotework_dev	Trust in remote work benefits
	Perceived advantages of local and sustainable production in attracting conscientious consumers	ia_local_benefit	Consumers ethical awareness
	Daily internet usage for study, work, and information needs	pa_internet_use	Trust and reliance on internet
	Perceived reliability of information circulating on social media	pa_soc_media_trust	Trust in social media information
	Perceived readiness of the local entrepreneurial and institutional fabric to meet innovation challenges	pa_innov_readiness	Trust in local innovation ecosystems
Area	**Measure**	**Variable name**	**Formal institution**
FI	Perceived quality of financial services (e.g. access to credit)	ia_financial_serv	Banking and financial institutions
	Perceived quality of consultancy and/or accompaniment services (e.g. business incubators)	ia_consult_serv	Business development support infrastructures

Perceived quality of advanced technology services (e.g., contacts with research centres, innovation ecosystems, technology parks)	ia_adv_tech_serv	Technological research infrastructures
Perceived quality of support services from public institutions (e.g., municipality, chamber of commerce, etc.)	ia_gov_support	Public institutions
Perceived availability of suitable labour	ia_labor_avail	Labour markets
Perceived quality of physical connection services (e.g., roads, railways, airports)	ia_transport_link	Transport infrastructure systems
Perceived quality of intangible connection services (e.g. broadband)	ia_intangible_link	Intangible infrastructure systems

As illustrated in Table 2, the 23 Likert-type variables in the RIOM survey were recorded on an even 1–10 integer range, where 1 stands for 'not at all', 'never', or 'very rarely', and 10 for 'always', 'very often', or 'very much', minimising social desirability and neutral-response biases (Abulela & Khalaf, 2024). A complete technical report describing the operational steps adopted during the survey was proposed as a Supplementary Materials' (SM) file, together with a detailed description of additional variables and quantitative information collected within the survey. Data cleaning operations included the standardisation of nominal categories for secondary socio-demographic variables (secondary school name and type, and work sector), the structuring of ordinal variables which were reported as nominal (e.g. educational level), the conversion of the internet usage from a hours scale to a Likert scale, and the imputation of missing values.

3. Results

3.1. Descriptive statistics

3.1.1. Informal institutions

While delineating similar trends, MOMA showed less differences concerning informal institutions compared with SETA (Table 3).

Table 3: Significant differences for informal institutions across socio-demographic groups. 'sDPHp' refers to 'significant Dunn's Post Hoc test pair/s'. pa_remotework_dev is excluded from the analysis.

Significant differences in informal institutions		
Grouping	**MOMA**	**SETA**

Age	*ia_local_benefit* (KW p = 0.006, 1 sDPHp); *pa_internet_use* (KW p < 0.001, 10 sDPHp); *pa_soc_media_trust* (KW p = 0.027, no sDPHp)	*ia_local_benefit* (KW p < 0.001, 2 sDPHp); *pa_internet_use* (KW p < 0.001, 22 sDPHp); *pa_soc_media_trust* (KW p < 0.001, 5 sDPHp)
Gender	*pa_community_bond* (MWU p < 0.001); *pa_help_ease* (MWU p = 0.022); *pa_internet_use* (MWU p = 0.035)	*pa_community_bond* (MWU p = 0.009); *pa_assoc_involv* (MWU p = 0.016); *ia_local_benefit* (MWU p = 0.004); *pa_internet_use* (MWU p = 0.005); *pa_soc_media_trust* (MWU p = 0.024); *pa_innov_readiness* (MWU p = 0.003)
Education level	*pa_internet_use* (KW p < 0.001, 2 sDPHp)	*pa_relational_qual* (KW p = 0.013, no sDPHp); *pa_help_ease* (KW p = 0.029, 1 sDPHp); *pa_assoc_involv* (KW p < 0.001, 2 sDPHp); *ia_local_benefit* (KW p < 0.001, 2 sDPHp); *pa_internet_use* (KW p < 0.001, 4 sDPHp); *pa_soc_media_trust* (KW p < 0.001, 2 sDPHp)
Work type	*pa_assoc_involv* (KW p = 0.032, 1 sDPHp); *pa_internet_use* (KW p < 0.001, 9 sDPHp); *pa_soc_media_trust* (KW p = 0.050, no sDPHp)	*pa_community_bond* (KW p < 0.001, 4 sDPHp); *pa_covid_support* (KW p = 0.005, 2 sDPHp); *pa_help_ease* (KW p = 0.008, no sDPHp); *pa_assoc_involv* (KW p < 0.001, 9 sDPHp); *pa_internet_use* (KW p < 0.001, 18 sDPHp); *pa_soc_media_trust* (KW p < 0.001, 8 sDPHp); *pa_innov_readiness* (KW p = 0.029, 1 sDPHp)
Household size	*ia_local_benefit* (KW p = 0.019, 1 sDPHp); *pa_internet_use* (KW p < 0.001, 4 sDPHp); *pa_soc_media_trust* (KW p = 0.008, 1 sDPHp)	*pa_internet_use* (KW p < 0.001, 6 sDPHp); *pa_soc_media_trust* (KW p = 0.013, 1 sDPHp)

Sport type	*pa_community_bond* (KW p < 0.001, 2 sDPHp); *pa_covid_support* (KW p = 0.034, 1 sDPHp); *pa_help_ease* (KW p = 0.009, 2 sDPHp); *pa_assoc_involv* (KW p = 0.002, 2 sDPHp); *pa_internet_use* (KW p < 0.001, 1 sDPHp); *pa_soc_media_trust* (KW p = 0.012, 2 sDPHp)	*pa_community_bond* (KW p = 0.031, 1 sDPHp); *pa_relational_qual* (KW p = 0.005, 2 sDPHp); *pa_help_ease* (KW p = 0.003, 1 sDPHp); *pa_assoc_involv* (KW p = 0.003, 1 sDPHp); *ia_local_benefit* (KW p = 0.021, 1 sDPHp); *pa_internet_use* (KW p < 0.001, 2 sDPHp); *pa_soc_media_trust* (KW p = 0.005, 1 sDPHp)

Age groups provided a consistent set of differences across areas for benefit of sustainable production (1 sDPHp for MOMA and 2 sDPHp for SETA), internet use (10 sDPHp for MOMA and 22 sDPHp for SETA), and trust in social media (no sDPHp for MOMA and 5 sDPHp for SETA). Younger respondents reported higher benefits of sustainable production compared to older ones, both in MOMA (median = 6 and 4.5 respectively for 25–34 and 35–44 group) and in SETA (median = 6 for 18–24, 25–34 and 45–54 group). Use of internet reveals a generational trend with a strong negative correlation between age and internet use, ranging from a median of 6 in MOMA and 7 in SETA for the 18–24 group, to a median of 1 in both areas for the groups 85–103. Similarly, only in SETA, a higher trust in social media is recorded for the 18–24 and 25–34 groups (both with a median of 5) compared to, respectively, 45–64 groups (medians = 3-4) and 65–74 (3).

Gender (binary) reported differences in social cohesion for community bond in both areas, for help ease in MOMA and association involvement in SETA, for benefits of sustainable production in SETA, for internet use in both areas and for trust in social media and innovation readiness in SETA. Men reported marginally higher community bond compared to women, with respectively a median of 9 and 8 for MOMA, and a slightly higher share of positive scores versus negative ones for SETA. In MOMA, women reported a marginally lower propensity to request help compared to men. In SETA, women also reported a marginally lower involvement in associations compared to men. Concerning the benefits of sustainable production, men reported a slightly lower scoring compared to women in SETA. For internet use in both areas, instead, men reported marginally higher scores in the upper tier and lower in the bottom tier, compared to women. Lastly, only in SETA, women reported higher trust in social media and a

higher perception of innovation readiness compared to men, with marginally higher scores in the first case and a median of 6 versus 5 in the second case.

In SETA, the educational levels are associated to differences in the social cohesion measures of relational quality (no sDPHp), help request ease (1 sDPHp), and involvement in associations (2 sDPHp), as well as in benefits of sustainable production (2 sDPHp), internet use (4 sDPHp) and trust in social media (2 sDPHp). In MOMA, only internet use reported differences (2 sDPHp). In SETA, respondents with compulsory education only presented lower involvement in associations and help request ease (median = 5) compared to secondary school diploma holders (5) and university degree holders (6), for the first variable, and to secondary school diploma holders (6), for the second variable. Besides, in SETA, the benefits of sustainable production (5) and trust in social media (3) were also less valued by respondents with compulsory education compared to those with the subsequent two educational levels (median = 6 for sustainability and 4 for social media). As expected, across both areas, various differences provided evidence that internet use increases with higher educational levels from compulsory education (median = 2 in both areas) to secondary school diploma (median = 4 in both MOMA and SETA), university degree (median = 4 and 5 in MOMA and SETA, respectively), and master/doctoral degrees (median = 5.5 in SETA).

In the case of work-type groups, three differences were identified in both areas, involvement in association (1 sDPHp in MOMA and 9 sDPHp), use of internet (9 sDPHp in MOMA and 18 sDPHp in SETA) and trust in social media (no sDPHp in MOMA and 8 sDPHp in SETA). Only in SETA, differences were present for community bond (4 sDPHp), emergency mutual aid (2 sDPHp), help request ease (no sDPHp), and innovation readiness (1 sDPHp). Concerning measures of social cohesion, in SETA, community bond was higher in terms of concentration of positive extremes or median among self-employed compared to fixed term employees, occasional workers, respondents not working and retired. Besides, permanent employees reported a higher cumulative share of positive scores for emergency mutual aid, compared to fixed term employees and occasional workers. In MOMA, unpaid domestic workers displayed a markedly lower involvement in association compared to occasional workers, with a median of 3 and 7 respectively. Partially in line with the latter finding, unpaid domestic workers, occasional workers, respondents not working, unemployed, and retired in SETA, reported lower association involvement compared to permanent employees and self-employed. In both areas, a pattern of associations suggests a low internet use for retirees (median = 2 in both areas), unpaid domestic workers and respondents not working (in both cases, median = 2 and

3, respectively in MOMA and SETA) compared to other groups (with median ranges 2–6 and 2–7). Only in SETA, unpaid domestic workers reported the lowest group trust for social media, followed by retirees, respondents not working, permanent employees, self-employed, fixed term employees, unemployed, and other non-professional status. Lastly, respondents not working reported lower perceived innovation readiness compared to respondents with other non-professional status.

Concerning household size grouping, while benefits of sustainable production recorded differences in MOMA only (1 sDPHp), internet use (4 sDPHp in MOMA and 6 sDPHp in SETA) and trust in social media (1 sDPHp in both areas) signalled them in both areas. Namely, only in MOMA, three-person households declared higher benefits of sustainable production (median = 6) compared to single-person households (median = 5). Internet use signalled higher reliance of most common larger households (3–5) compared to smaller ones. Similarly, smaller households reported lower trust in social media compared to larger ones, in MOMA two-person households reported lower trust (median = 3) compared to those of three persons (median = 5), while in SETA single-person households reported lower trust (median = 3) compared to four-person households (median = 4).

When looking at sport practice, common differences across areas included community bond (2 sDPHp in MOMA and 1 sDPHp in SETA), help request ease (2 sDPHp in MOMA and 1 sDPHp in SETA), involvement in associations (2 sDPHp in MOMA and 1 sDPHp in SETA), internet use (1 sDPHp in MOMA and 2 sDPHp in SETA) and trust in social media (2 sDPHp in MOMA and 1 sDPHp in SETA. Emergency mutual help presented differences only in MOMA (1 sDPHp), while SETA recorded them for relational quality (2 sDPHp) and benefits of sustainable production (1 sDPHp). Across both areas practicing a team sport was associated to higher social cohesion or digital skills. Community bond was found higher among team sport practitioners (median = 10 in MOMA and 8 in SETA) in terms of median or positive shares compared to non-practitioners—and, for MOMA only, compared to individual sport practitioners too (with a median = 8 in both areas). Only in MOMA, a similar result saw team sport associated to higher emergency mutual aid (median = 8) compared to individual sport (7). Meanwhile, only in SETA, better relational quality was observed for team sport practice (median = 10) compared to both individual sport and no practice (both with a median = 9). Team sport is related to higher ease of requesting help (median = 8 in MOMA and 7 in SETA) compared to both other groups for MOMA and to non-practitioners only for SETA (all with a median = 6 in both areas). Team players reported higher involvement in associations (median

= 7.5 in MOMA and 6 in SETA) compared to non-practitioners—and, for MOMA only, compared to individual sport practitioners too (both with a median = 5 in both areas). Only in SETA, individual sports practitioners also reported slightly higher shared of positive values for benefits of sustainable production compared to non practitioners. Respondents not practicing any sport also reported lower internet use (median = 3 in both areas) compared to team sport practitioners (median = 5.5 in MOMA and 4.5 in SETA) and, only for SETA, to individual sport practitioners (median = 6). In MOMA, team sport is associated with higher trust in social media (median = 5.5) compared to both other groups (both with a median of 4), while, in SETA, individual sport players reported it higher (5) compared to non-practitioners (4).

3.1.2. Formal institutions

In line with previous sections, SETA records a wider range of differences in formal institutions across most groups compared to MOMA (Table 4).

Table 4: Significant differences for formal institutions across socio-demographic groups. 'sDPHp' refers to 'significant Dunn's Post Hoc test pair/s'.

Significant differences in formal institutions		
Grouping	**MOMA**	**SETA**
Age	*ia_financial_serv* (KW p = 0.005, no sDPHp); *ia_labor_avail* (KW p = 0.011, 2 sDPHp); *ia_transport_link* (KW p = 0.041, no sDPHp)	*ia_financial_serv* (KW p < 0.001, 7 sDPHp); *ia_consult_serv* (KW p = 0.001, 4 sDPHp); *ia_adv_tech_serv* (KW p = 0.049, no sDPHp); *ia_gov_support* (KW p = 0.019, 1 sDPHp); *ia_labor_avail* (KW p < 0.001, 6 sDPHp); *ia_intangible_link* (KW p = 0.020, 1 sDPHp)
Gender	*ia_labor_avail* (MWU p = 0.003)	*ia_financial_serv* (MWU p = 0.002); *ia_adv_tech_serv* (MWU p = 0.016); *ia_gov_support* (MWU p = 0.009); *ia_transport_link* (MWU p < 0.001); *ia_intangible_link* (MWU p = 0.003)
Education level	None	*ia_financial_serv* (KW p < 0.001, 2 sDPHp); *ia_consult_serv* (KW p < 0.001, 2 sDPHp); *ia_gov_support*

		(KW p = 0.006, 2 sDPHp); *ia_labor_avail* (KW p < 0.001, 4 sDPHp); *ia_transport_link* (KW p < 0.001, 3 sDPHp); *ia_intangible_link* (KW p = 0.049, no sDPHp)
Work type	None	*ia_financial_serv* (KW p < 0.001, 2 sDPHp); *ia_consult_serv* (KW p < 0.001, 4 sDPHp); *ia_adv_tech_serv* (KW p = 0.020, 1 sDPHp); *ia_labor_avail* (KW p < 0.001, 8 sDPHp); *ia_intangible_link* (KW p = 0.014, no sDPHp)
Household size	*ia_intangible_link* (KW p = 0.043, 1 sDPHp)	None
Sport type	*ia_financial_serv* (KW p = 0.005, 1 sDPHp); *ia_consult_serv* (KW p = 0.018, 1 sDPHp); *ia_gov_support* (KW p = 0.001, 2 sDPHp); *ia_transport_link* (KW p = 0.003, 2 sDPHp)	*ia_financial_serv* (KW p < 0.001, 1 sDPHp); *ia_consult_serv* (KW p = 0.005, 1 sDPHp); *ia_gov_support* (KW p = 0.006, 1 sDPHp); *ia_labor_avail* (KW p < 0.001, 2 sDPHp); *ia_transport_link* (KW p < 0.001, 1 sDPHp); *ia_intangible_link* (KW p < 0.001, 1 sDPHp)

Age is a grouping factor generating relevant differences in both areas for financial services (no sDPHp in MOMA and 7 sDPHp in SETA), suitable labour availability (2 sDPHp in MOMA and 6 sDPHp IN SETA). Meanwhile, differences in physical infrastructures were reported only in MOMA (no sDPHp); SETA recorded differences for consultancy services (4 sDPHp), advanced technological services (no sDPHp), public support (1 sDPHp), and intangible infrastructures (1 sDPHp). Namely, only in SETA, younger respondents reported higher quality of financial services compared to older generations with a progressive sequence of group 18-25 (median = 7), group 25-34 (6), and groups 35-84 (5). A similar age difference is observed in SETA for consultancy services, with a higher median (6) for group 18-25 compared to 5 for groups 45-84. In line with other formal institutions in SETA, the youngest respondent group showed higher public institutional support (median = 6) compared to the group 45-54 (5) and higher quality of intangible infrastructures (7) compared to the group 65-74 (6). Lastly, the

availability of a suitable labour force was rated higher among young groups across both areas, i.e. group 18–24 (median = 7 in MOMA and 6 in SETA), and, for SETA only, group 25-34 (6), compared to various older groups all reporting a median of 5 in both areas.

Across all differences identified in both areas, women perceived marginally higher quality of formal infrastructures compared to men. On the one hand, in MOMA, women perceived a higher labour availability than men. On the other hand, in SETA, women reported marginally higher shares of positive values, compared to men, for financial and advanced technological services, public support, physical infrastructures and intangible infrastructures, with, only for the latter, a one point difference in the median (7 versus 6). Education level did not capture significant differences for MOMA, while did so for SETA for financial services (2 sDPHp), consultancy services (2 sDPHp), public support (2 sDPHp), job availability (4 sDPHp), and physical and intangible infrastructures (respectively 3 sDPHp and no sDPHp). In SETA, compulsory education was associated to lower perceived quality of formal institutions compared to secondary education and university for financial services, consulting services and public institutional support, and physical infrastructures. This trend was also observed for available labour, with the addition of a marginally higher scoring of university education versus secondary education.

Similarly to educational attainments, employment groups recorded differences in SETA only, for financial (2 sDPHp), consultancy (4 sDPHp), and advanced technological services (1 sDPHp), labour availability (8 sDPHp) and intangible infrastructures (no sDPHp). Respondents classified as ‘not working’ displayed lower quality of financial services (median = 5) compared to permanent employees (6) and ‘other non-professional status’ (6.5). The latter group reported higher scores for consultancy services (median = 6) compared to occasional workers, retirees, unpaid domestic workers, and respondents not working (all with a median = 5), for advanced technological services (median = 6) compared to unpaid domestic workers (5), and for availability of suitable labour (7) compared to retirees, unpaid domestic workers, and respondents not working (all with a median of 5). Besides, self-employed and unpaid domestic workers signalled lower availability of suitable labour force (both with a median = 5) compared to fixed term employees, permanent employees (both with a median = 6), and ‘other non professional status’ (7).

If household size only mattered for intangible infrastructure in MOMA alone (median = 5 for single-person household against 7 for three-person household), evident differences were

identified in relation to sport practice in both areas including financial (1 sDPHp in both areas) and consultancy services (1 sDPHp in both areas), public support (2 sDPHp in MOMA and 1 sDPHp in SETA), labour availability (2 sDPHp only in SETA), physical (2 sDPHp in MOMA and 1 sDPHp in SETA) and intangible infrastructures (1 sDPHp only in SETA). In MOMA, higher scores were associated to team sport players compared to individual sport players for financial services (median of 7 versus 5), consultancy services (median of 6 versus 5), and public support (median of 7 versus 5). The latter also saw a higher positive share for public support in non-practitioners compared to individual sport practitioners (both with a median = 5). Always in MOMA, quality of physical infrastructure is segmented from individual sport practitioners (median = 2) to non-practitioners (3) and team sport practitioners (4). Meanwhile in SETA, individual sport was associated to moderately higher scoring compared to non-practitioners for financial (in terms of positive shares), consultancy (6 versus 5), and advanced technological services (in terms of positive shares), public support (in terms of positive shares), labour availability (6 versus 5) and intangible infrastructures (7 versus 6). Labour availability recoded lower scoring of non-practitioners (5) compared to both individual sport and team sport (6).

4. Spatial trends

4.1. Inter-area

The comparison of Likert perceptions between the two areas under investigation reveals few (but meaningful) significant differences by pillar (Table 5).

Table 5: Significant differences for all Likert variables between MOMA and SETA areas.

Significant differences by geographic area	
Pillar	MOMA-SETA
PMW	pa_wellbeing (MWU p = 0.004); pa_small_env (MWU p = 0.041)
II	pa_community_bond (MWU p = <0.001); pa_relational_qual (MWU p = <0.001); pa_internet_use (MWU p = <0.001)
FI	ia_labor_avail (MWU p = 0.004) ia_transport_link (MWU p = <0.001);

Among psychological and material wellbeing measures, subjective wellbeing and benefits of a small living environment register a marginally higher positive share in MOMA compared to SETA (both areas with a median of 7 for the first variable and 8 for the second one). Among informal institutions' measures, social cohesion measures of community bond and relational quality showed a marginally higher positive distribution in MOMA compared to SETA. The former variable reported a median of 8 in both areas, but a mode of, respectively, 10 and 8 and higher positive shares for MOMA (78% vs 69%), while the latter variable reported equal medians (9) and modes (10) but a higher positive share in MOMA (95% vs 89%). Internet use saw a better performance of SETA with a median of 4 against a median of 3 for MOMA. Lastly, formal institutions recorded differences for labour availability and physical infrastructures. A higher availability of suitable labour was perceived in SETA compared to MOMA, with respectively a median of 6 and 5, while perceptions of transport/physical infrastructures are markedly better in SETA (median of 5 and negative share of 41%) compared to MOMA (median of 3 and negative share of 71%).

4.2. Intra-area

When moving the analysis to the spatial level of municipalities, fewer significant differences were found across the three pillars (Table 6).

Table 6: Significant differences for psychological and material wellbeing across municipal groups. 'sDPHp' refers to 'significant Dunn's Post Hoc test pair/s'.

Significant differences in psychological and material wellbeing		
Grouping	MOMA	SETA
Municipality	pa_jobmarket_stress (KW p = 0.013, 3 sDPHp)	pa_conjunctural_stress (KW p = 0.027, no sDPHp)
Start-up count	None	pa_serenity (KW p = 0.034, 1 sDPHp)

Looking at wellbeing measures, significant differences were observed across municipalities for job market stress in MOMA (3 sDPHp) and for global stressors in SETA (no sDPHp). In the former case, Oliveto Lucano displayed markedly lower job-market stress, with a median of 3.5, compared to Gorgoglione, Stigliano (7) and Aliano (8). Besides, only in SETA, differences were observed for life serenity (1 sDPHp) across start up count groups (0/1/2), associating municipalities with one registered innovative start-up (only Oliveto Citra) to higher serenity (median = 8) compared to municipalities without any (7).

Concerning informal institutions, differences are almost only located in SETA, with only one case in MOMA. Municipal groups present differences only in SETA for association involvement (2 sDPHp), innovation readiness (1 sDPHp) and benefits of sustainable production (no sDPHp). Castelnuovo di Conza stood out for markedly lower association involvement (median of 3) compared to Oliveto Citra (6) and Auletta (7). Besides, Caggiano reported higher innovation readiness (median of 6 and mode of 7) compared to Campagna (median and mode of 5). Municipal surface and resident population groups also detected differences in SETA only, the former for community bond (1 sDPHp) and help request ease (no sDPHp), while the latter for community bond (2 sDPHp). Namely, municipalities with a surface in the range (1,000–5,000] ha were associated to higher community bond (median = 8) compared to those within the interval (10,000–21,097] ha (7). Besides, municipalities with lower resident population showed higher community bond compared to larger ones, with a decreasing sequence of (500–1,000] inhabitants group (median = 8 and higher positive share), (1,000–5,000] inhabitants group (median = 8) and (10,000–16,759] inhabitants group (7).

Municipal average population density captured differences in both areas (Table 7), for trust in social media in MOMA and for involvement in association in SETA (1 sDPHp).

Table 7: Significant differences for informal institutions across municipal groups. 'sDPHp' refers to 'significant Dunn's Post Hoc test pair/s'.

Significant differences in informal institutions		
Grouping	**MOMA**	**SETA**
Municipality	None	pa_assoc_involv (KW p = 0.017, 2 sDPHp); pa_innov_readiness (KW p = 0.003, 1 sDPHp); ia_local_benefit (KW p = 0.017, no sDPHp)
Surface bins	None	pa_community_bond (KW p = 0.014, 1 sDPHp); pa_help_ease (KW p = 0.023, no sDPHp)
Resident population bins	None	pa_community_bond (KW p = 0.005, 2 sDPHp)
Population density bins	pa_soc_media_trust (MWU p = 0.024)	pa_assoc_involv (KW p = 0.026, 1 sDPHp)

Start-up count	None	pa_relational_qual (KW p = 0.029, 1 sDPHp); pa_innov_readiness (KW p = 0.003, 2 sDPHp); ia_local_benefit (KW p = 0.014, 1 sDPHp)

In the first case, in MOMA, municipalities with 7–10 inhabitants/km² are associated with higher trust in social media (median = 5) compared to those with 10–50 inhabitants/km² (4). In SETA, municipalities with (10–50] inhabitants/km² displayed a lower involvement in associations (median = 5) compared to those with (100–132] inhabitants/km² (6). Lastly, start-up count groups revealed differences in SETA (as the latter area is the only one presenting any) for relational quality (1 sDPHp), innovation readiness (2 sDPHp) and benefit of sustainable production (1 sDPHp). The only municipality with one registered innovative start-up (Oliveto Citra) was associated to moderately higher scoring compared to the those with two registered (Campagna and Palomonte) for relational quality (slightly higher positive share) and benefit of sustainable production (both groups with a median of 6 and mode of 8 versus 5). Oliveto Citra also reported higher innovation readiness (median = 6) compared to both other groups (both with a median of 5).

When analysing formal institutions (Table 8), a limited number of differences was found across both areas.

Table 8: Significant differences for formal institutions across municipal groups. 'sDPHp' refers to 'significant Dunn's Post Hoc test pair/s'.

Significant differences in formal institutions		
Grouping	**MOMA**	**SETA**
Municipality	ia_financial_serv (KW p = 0.044, no sDPHp)	ia_consult_serv (KW p = 0.031, 2 sDPHp); ia_adv_tech_serv (KW p = 0.040, no sDPHp); ia_gov_support (KW p = 0.005, 1 sDPHp); ia_intangible_link (KW p = 0.015, no sDPHp)
Surface bins	ia_financial_serv (KW p = 0.029, 1 sDPHp); ia_consult_serv (KW p = 0.040, no sDPHp)	None

Start-up count	None	ia_gov_support (KW p = <0.001, 2 sDPHp)

In MOMA, municipalities are associated to differences in financial services (no sDPHp), while in SETA in consultancy (2 sDPHp) and advanced technology services (no sDPHp), public support (1 sDPHp) and intangible infrastructures (no sDPHp). In SETA, Contursi Terme was associated to higher quality of consultancy services (median = 6) compared to Postiglione and Sicignano degli Alburni (both with a median of 5). Besides, Oliveto Citra displayed higher public support (median = 6) compared to Palomonte (5).

Furthermore, while surface groups revealed differences only for MOMA, in relation to financial (1 sDPHp) and consultancy services (no sDPHp), start-up count did so for SETA, in relation to public support (2 sDPHp). Specifically, in MOMA, larger municipalities with a surface above 10,000 ha reported higher quality of financial services (median = 6) compared to those with a surface of between 1,000 and 5,000 ha (median = 5). Meanwhile, in SETA, Oliveto Citra (one registered start-up group) displayed higher public support (median = 6) compared to municipalities with two start-ups or none (both with a median of 5).

5. Discussion

Explicit results and broader analysis' outcomes reported as Supplementary Materials (SM) explain how common institutional patterns are accompanied by a large number of weakly significant differences across the two study areas and within them. We selected two inner areas in Southern Italy from the current SNAI policy framework for the period 2021-2027: Montagna Materana and Sele-Tanagro, defined as inner areas from, respectively, 2014 and 2021. We analysed perceptions of 1,702 residents employing a non-parametric workflow tailored to ordinal Likert data and a nested data structure (individuals, municipalities, geographical districts).

We observed the dominance of positive scores in life evaluation and material wellbeing, yet an evident concern for the impact of the living environment on life quality, and for the psychological burden of the challenging global and employment situation remains central. Strong community bonds and grassroots support characterise both areas. SETA reports higher internet use and labour availability as well as better quality of physical infrastructures; MOMA shows a slightly stronger cohesion but a severe transport deficit. Intangible infrastructures

(such as broadband) are moderate in both areas, while perceived innovation readiness hovers around neutral–slightly negative.

Digital divides largely characterise age and education gradients: internet use declines sharply with age and rises with schooling; in SETA, younger cohorts also trust social media more. Gender differences are modest but present (e.g. women in SETA report slightly higher innovation-readiness than men), and work status maps to cohesion and digital use (e.g. retirees and unpaid domestic workers use internet least; self-employed show stronger community bond). Sport participation aligns with higher wellbeing levels and financial stability as well as higher scoring across almost all variables with significant differences. Larger households report higher subjective wellbeing.

Between areas, SETA's advantage lies in transport and labour availability; MOMA retains an edge on small-place benefits and elements of cohesion. Within areas, municipal heterogeneity is selective: in MOMA, job-market stress varies widely; in SETA, association involvement is lower in Castelnuovo di Conza, and municipalities with one start-up (Oliveto Citra) show higher serenity and innovation readiness—suggesting local demonstration effects. In MOMA, larger-surface municipalities perceive better financial services. Smaller and less-dense SETA municipalities tend to report stronger community bond.

We identified weak-to-moderate positive correlations within pillars (especially among FI items), with internet use and stressors behaving as near-independent outliers. Ordination on Gower distances (see Supplementary Materials) explains little of the total variance and the clustering via silhouettes analysis reports low figures, indicating the absence of crisp segments; a reduced set reveals gender-aligned banding in SETA but still resists natural clusters (Aguilar, 2021). This evidence contribute to characterise rural innovation as resisting simple clustering (Asmit et al., 2024). These results provide evidence of how one-size-fits-all strategy on the institutional ecosystems of inner areas of southern Italy would be unsuitable to produce effective change (Salvati & Zitti, 2008). Furthermore, they align to the literature effort to integrate spatial, socio-demographic and perception factors, for policy crafting (Colantoni et al., 2015; Ferrara et al., 2017; Tomao et al., 2017).

Combining formal rules/infrastructures with informal norms is necessary but insufficient if not matched with digital confidence and absorptive capacity (Dias & Silva, 2021). Namely, nuanced approaches are necessary to address complexity (Kosmas et al., 2015; Ferrara et al., 2016; Sallustio et al., 2018), especially in institutionally dense settings (Salvati & Carlucci,

2011). Our perception-based approach adds granular, inner-area evidence to the literature going beyond the focus on case-study, city-focused, regional or national averages (Audretsch & Belitski, 2017; Bosworth & Turner, 2018; Salimath & Cullen, 2010). Among the limits identified, a major is constituted by the restricted size of the dataset in use and by the fact that cross-sectional perceptions limit causal inference (Igwe et al., 2020). Besides, the low number of municipalities by area prevents multilevel modelling. Future studies should consider longitudinal or repeat cross-sections with 50+ municipalities by area, analyse them through mixed methods to unpack non-linear mechanisms, identify meaningful segmentations, and integrate objective measures of innovation (Lee et al., 2022).

6. Conclusions

Our study of Montagna Materana and Sele–Tanagro provides evidence of the coexistence of strong social capital, broadly positive life evaluation and material wellbeing with marked and area-specific constraints in transport, internet use and trust, skills, and access to proximity services. While the differences across municipalities and socio-demographic groups are real but mostly marginal, a continuum of institutional configurations stands out rather than crisp 'types'. Internet use—and confidence in digitally mediated services—lags among older, less-educated and non-active residents, while SETA's better transport and labour availability contrasts with MOMA's tighter cohesion but transport deficit. Correlations are weak (or moderate) and positive, and clustering results in poor segmentation, indicating that the rural innovation pathways explored do not collapse into simple buckets and that perceived innovation readiness can remain fragile despite a dense net of positively-graded informal support measures.

Policy should avoid one-size-fits-all blueprints and be declined to locally defined skills and infrastructural targets. The evidence points to synchronized action on formal and informal levers. Delivery mechanisms should address age, education and work status and be sensitive to municipal micro-contexts. Methodologically, this perception-based non-parametric analysis adds decision-relevant nuance but does not contribute to establish causality links; scaling to a higher number of municipalities investigated by area and repeating measurements over time—while integrating objective infrastructural and outcome measures—will be essential to capture causality, non-linear dynamics and to track whether tailored formal-informal-aware

interventions manage to transfer community strengths into digitally enabled development and shared prosperity.

Chapter 3

The institutional economy of entrepreneurial networks for digitisation-based service ecosystems. A perspective-based analysis of inland areas in southern Italy[6]

Authors: Edoardo Baradello, Rosanna Salvia, Roberta Pecoraro, Luca Salvati, Giovanni Quaranta

Executive summary

This report examines the perception-based institutional economy of entrepreneurial networks for digitisation-based service ecosystems in Sele-Tanagro (SETA) inner area of the Region of Campania in Southern Italy.

Objectives: The main objective is to understand how formal and informal institutions can positively influence digitisation-based service ecosystems and their entrepreneurial networks in inner areas. While doing so, the study attempts to identify locally relevant institutional drivers and barriers that affect digital entrepreneurial ecosystems.

Methodology: The study is based on the RIOM survey dataset (2024), which covers three regions in southern Italy and includes a sample of 1399 individuals in the SETA area. The survey encompasses the socio-demographics of the respondents and an assessment of various personal and institutional perceptions, using a Likert scale. The analysis combines descriptive and inferential methods, including Kruskal-Wallis, Mann-Whitney U, Dunn Post Hoc nonparametric tests, a Principal Coordinates Analysis (PCoA), and a hierarchical clustering.

Key Findings: In Sele-Tanagro, a solid web of community bonds, mutual aid and overall life-satisfaction co-exists with patchy formal supports—especially poor transport links, limited advanced technological, consultancy and public backing—and a marked age-driven digital divide, leaving overall local innovation readiness only modest despite high social cohesion.

Implications: Unlocking the area's entrepreneurial potential for digital innovation seems to rely on coupling its strong relational capital with targeted investment in digital skills, broadband

[6] Articolo sottoposto per la pubblicazione alla rivista Land Use Policy (Elsevier)

and transport infrastructure, as well as more widespread public and private support services for start-ups and innovative enterprises.

Limitations: The sample size for multivariate analysis was reduced to 1237 due to missing data whose assumption that are missing completely at random (MCAR) requires further testing. Additionally, the limited significant differences between municipalities within SETA may contrast with the broader analysis of the RIOM data set. Furthermore, only five innovative start-ups, no innovative SMEs and no incubator were identified in SETA, determining the need for alternative objective measures of digital innovation.

Recommendations: Further research should test the MCAR assumption, explore possible nonlinear relationships between variables, such as internet use and stressors. A detailed investigation into SETA's internal municipal differences would benefit from a comparative analysis with the other RIOM areas. Lastly, this report also recommends combining subjective assessment data with objective measures of innovation readiness and digital ecosystems to investigate alternative explanations for the identified associations.

1. Introduction

1.1.Context

This report is part of the project *Analysis of relationships between formal and informal institutions and the entrepreneurial network in digitisation-based service ecosystems* funded by the University of Basilicata (UNIBAS). The objectives of the project related to this report are as follows:

> ***Objectives**: Analysis of potential relationships between formal and informal institutions and entrepreneurial networks in digitization-based service ecosystems.*
>
> ***A3.1** - Direct surveys concerning formal institutions for multi-level logistic statistical modelling strategy, also considering territorial-level and individual-level effects upon the emergence of entrepreneurial networks in service ecosystems.*
>
> ***A3.2** - Direct surveys concerning informal institutions for multi-level logistic statistical modelling strategy, also considering territorial-level and individual-level effects upon the emergence of entrepreneurial networks in service ecosystems.*
>
> *(UNIBAS, 2024, p. 4)*

The expected results of the project related to this report are as follows:

> ***Expected results***
>
> ***R3.1*** *- Understanding drivers and barriers for efficient relationships between formal institutions and entrepreneurial network aimed at the emergence of digitization-based service ecosystems M 1–14*
>
> ***R3.2*** *- Understanding drivers and barriers for efficient relationships between informal institutions and entrepreneurial network aimed at the emergence of digitization-based service ecosystems M 11–24*
>
> *(UNIBAS, 2024, p. 4)*

This report is the second one of a series of three analytical reports on the *Rischi-opportunità nelle aree interne meridionali (RIOM)*[7] dataset that address the aforementioned objectives and expected results across selected internal areas of southern Italy. This report is focused on the geographical area of *Sele-Tanagro* (SETA) located in the Campania region. The first report of the series addresses the geographical area of *Montagna Materana* (MOMA) located in the Basilicata region. Lastly, the third report of the series presents the draft of a research article addressing a comparative analysis of the geographic areas of MOMA and SETA.

1.2.Research questions

This report specifically focusses on the RIOM dataset subset comprising respondents from the SETA area and addresses the following research question:

> *How formal and informal institutions can positively affect digitisation-based service ecosystems and their entrepreneurial networks in inner areas?*

1.3.Report structure

This report begins with this introduction, establishing the project-related context, defining the research questions, and explaining the structure of contents. This is followed by an overview of the RIOM survey providing an account of the survey methodology, data collection, survey

[7] Risks-opportunities in southern inland areas (RIOM) (translation by the author).

structure, geographical framework and resulting variables. The literature review examines recent studies, focusing on the role of formal and informal institutions in digitisation-based entrepreneurial ecosystems. Next, the methodology section outlines the sources of the input data, data cleaning operations, defines the variables of interest, and describes the analytical approach used.

The results section presents an overview of descriptive statistics calculated through univariate analysis for all variables in the analysis, a focus on socio-demographic and municipal differences through bivariate analyses, and highlighting significant differences, and multivariate exploratory analysis. The latter is followed by the discussion, which interprets the results, emphasizing the possible roles of formal and informal institutions as drivers of innovation and their variability across respondents' characteristics. Finally, the conclusion summarizes and suggests the direction for future research.

Furthermore, the reader can find in the appendices supporting information, including the survey questionnaire and comprehensive tables with univariate statistics. Throughout this document, references are made to operations and data reported in three supplementary files:

- the R script file *R00_RIOM_master_file.R*,
- the Excel file *G00_RIOM_Analysis_Report_SETA.xlsx*, and
- the Excel file *G00_RIOM_Analysis_Report_MOMA_SETA_MAIN.xlsx*.

2. RIOM survey overview

The RIOM survey was carried out between 9 March 2024 and 25 April 2024. Out of 37,544 phone calls conducted, a random sample of 2,024 respondents was achieved (5.39%). The response rate calculated by including both complete and partial interviews as respondents, in accordance with the *Response Rate 2* defined by the American Association for Public Opinion Research (AAPOR, 2023), resulted in a rate of 6.52%. The sample is considered representative of the reference population, with a maximum margin of error of 2.18% at the 95% confidence level.

The survey's geographical framework consists of 40 municipalities located in three internal areas of southern Italy, as outlined in Table 1 and represented in Figure 1. This report will only focus on the SETA area.

Table 17: Geographical framework of the survey.

Geographic area	No. Respondents	No. Municipalities	Province	Region
Montagna Materana (MOMA)	303	8	Matera	Basilicata
Sele-Tanagro (SETA)	1399	19	Salerno	Campania
Mainarde (MAIN)	322	13	Isernia	Molise

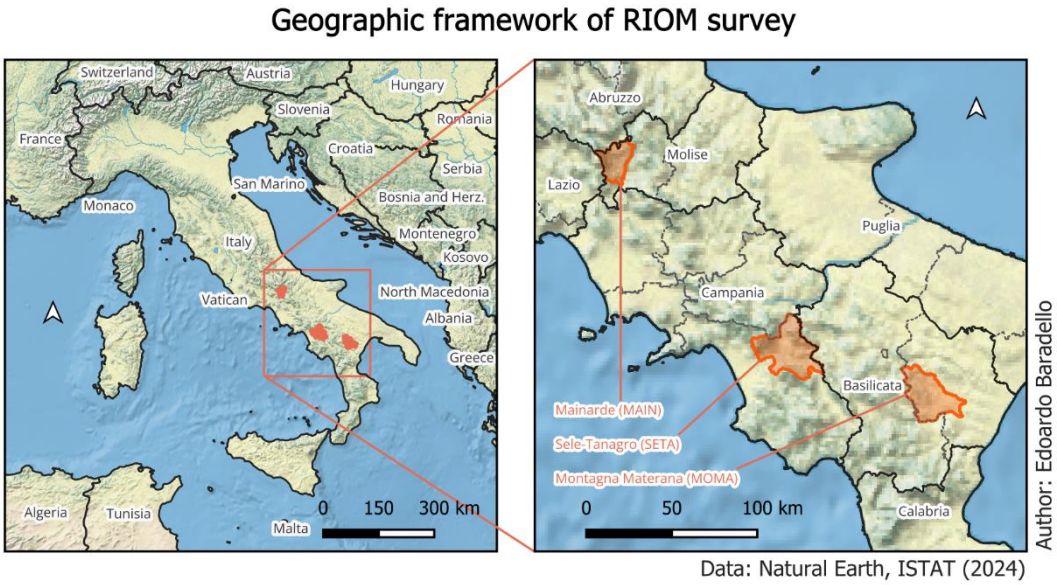


Figure 19: Geographical framework of interest. Map of municipalities in the areas of interest.

The questionnaire is divided into three sections. The first section focuses on individual Socio-Demographic (SD) variables, covering: age, gender, household composition, education, employment, and lifestyle. The second section addresses Personal Assessments (PA), exploring life satisfaction, community integration, and challenges impacting individual well-being. The third section dives into Innovation ecosystem Assessments (IA), examining perceptions of local development, innovation readiness, and the adequacy of services and infrastructure. Sections two and three are measured using a Likert scale ranging from 1 to 10, where 1 represents "not at all," "never," or "very rarely," and 10 represents "always," "very often," or "very much".

For this report, 44 variables of the RIOM dataset were considered. Their names, descriptions and corresponding sections are detailed in Table 2. It is important to note that the variable *id* serves as the unique identifier for each survey record, while the variable *municip_code* acts as a foreign key linking each respondent to the municipality they live in. The complete list of questions of the survey is reported in Annex A: Questionnaire.

Table 18: List of variables used from the RIOM dataset.

Sec.	No.	Variable	Label
ID	1	id	Unique identifier
SD	2	birth_year	Birth year
	3	years_old	Age
	4	years_old_bin	Age (bins)
	5	gender_binary	Binary gender
	6	household_size	Household size
	7	household_size_bin	Household size (bins)
	8	civil_status	Civil status
	9	education_lvl	Education level
	10	sec_school_type	Secondary school type
	11	sec_school_name	Secondary school name
	12	university_type	University type
	13	sport_type	Sport type
	14	work_type_des	Work type description
	15	work_type_group	Work type group
	16	work_publ_priv	Public/private sector
	17	work_sector	Work sector
	18	work_sector_des	Work sector description
	19	workplace_expected	Workplace expected
PA	20	pa_serenity	Personal serenity
	21	pa_community_bond	Community bond
	22	pa_small_env	Small environment influence
	23	pa_relational_qual	Relational quality
	24	pa_covid_support	Pandemic community support
	25	pa_assoc_involv	Involvement in associations
	26	pa_help_ease	Community help request ease
	27	pa_financ_stability	Financial stability
	28	pa_conjunctural_stress	Conjunctural stress
	29	pa_jobmarket_stress	Job market stress
	30	pa_soc_media_trust	Social media trust
	31	pa_remotework_dev	Remote work development benefit
	32	pa_innov_readiness	Innovation readiness
	33	pa_wellbeing	Subjective wellbeing
	34	pa_internet_use	Internet use
IA	35	ia_financial_serv	Financial services quality

Sec.	No.	Variable	Label
	36	ia_consult_serv	Consulting services quality
	37	ia_adv_tech_serv	Advanced technological services quality
	38	ia_gov_support	Public institutions support quality
	39	ia_transport_link	Physical connection services quality
	40	ia_intangible_link	Intangible services quality
	41	ia_labor_avail	Suitable labour availability
	42	ia_local_benefit	Ethical consumer benefit
MU	43	geo_area	Geographic area (MOMA, SETA, MAIN)
	44	municip_code	Municipality code

3. Literature review

Formal and informal institutions play a crucial role in causing the expansion and contraction of entrepreneurial networks in digitisation-based service ecosystems. The former, such as rule of law, transport infrastructures, or technological research infrastructures, determine the level of contextual conduciveness for entrepreneurship and digital innovation, while informal institutions, including community ties, grassroots mutual aid networks, trust in innovation and digital tools, substantially influence the incentives of entrepreneurs and the labour force to engage in such ecosystems.

3.1.The role of informal institutions in entrepreneurship networks

Informal institutions, including shared social norms and trust, underpin the development and durability of entrepreneurial networks. Social cohesion and informal collaboration notably enhance vibrant entrepreneurial ecosystems (Beinhocker, 2007). Community ties and trust are foundational to entrepreneurial processes determining the level of collaboration, resource sharing and risk mitigation. Namely, trust-based networks can compensate for resource limitations, especially in peripheral areas, and evidence suggests that trust in the local context and family support help mitigate risks and spur innovation in low-resource contexts (Igwe et al., 2020).

Grassroots mutual aid and volunteering attitudes generate localised support systems and are associated with enhanced resilience of entrepreneurial networks, especially during crises and economic downturns. If these informal mechanisms contribute to lower entry barriers in rural areas for entrepreneurs, the latter, in turn, drives scientific research, promotes lifestyles, and fosters exchange relationships within expansive territorial networks (Basile & Cavallo, 2020).

Moreover, trust in digital solutions, social media, and remote work technologies not only support the dissemination of entrepreneurial knowledge and practices but also strengthen the cultural and social prerequisites for thriving digitisation-based ecosystems. Namely, skills related to cloud and mobile computing, internet of things, big data analytics and social media constitute key factors influencing small and medium-sized enterprises' (SME) firms competition and innovation dynamics (DG GROW et al., 2015).

3.2.The role of formal institutions in digitisation-based service ecosystems

A key role of formal institutions in shaping digitisation-driven service ecosystems concentrates in the quality of the structural (material and normative) support offered to entrepreneurs and workers and the reduction of uncertainties related to transactions. For instance, while complex bureaucratic constrains may disincentivize economic activity (McMullen et al., 2008), the availability of financial services, advisory support, advanced technological infrastructures, and efficient public institutions is considered conductive to increased entrepreneurial initiatives (Audretsch & Belitski, 2017). Additionally, corruption is negatively associated with an atmosphere conductive to collaboration and innovation (Bendickson et al., 2021).

Access to information, which is tightly related to access to internet, accelerates and enhances information flow, driving the conception, development, production, and accessibility of innovative products and services (Yoo et al., 2010). Particularly, formal institutions such as public research bodies facilitate knowledge-sharing and can substantially boost innovation and entrepreneurial success (Fudickar & Hottenrott, 2019).

3.3.Interplay between formal and informal institutions

Balancing formal and informal institutional effects is crucial for developing the theory of digitisation-based service ecosystems. The scenarios most conducive to entrepreneurial ventures are those where market systems, public incentives and infrastructure development operate in tandem with supportive community norms. For instance, evidence shows that the coupling of digital financial resources with traditional support networks bolsters participation and strengthens entrepreneurial networks (Zhang & Wei, 2023). Effective formal institutions determine the foundational framework able to host digitisation-based ecosystems, while their sustainability and continuous development depend on supportive informal institutions such as community trust, collaboration and dynamism. Nevertheless, the interdependencies between values, norms, concrete framework and entrepreneurship are often not suitable for generalisations and can still be challenging to identify or fully understand (Bruton et al., 2010).

This series of reports aims to explore data on these interdependencies linking culture, norms, behaviours, formal institutions, and entrepreneurship with digitisation-based service ecosystems.

4. Methodology

4.1.Input data

The primary input data for this analysis was derived from multiple datasets, including the RIOM survey dataset from the University of Basilicata, municipal statistical data, geographic boundary information, and other socio-economic datasets from the Italian National Statistical Institute (ISTAT), the Italian Business Register and the Ministry of Enterprises and Made in Italy (MIMIT). The RIOM survey dataset, which forms the core of this analysis, was loaded from an Excel file, while municipal data was sourced from ISTAT and MIMIT public Excel files, covering statistics such as population, elevation, and geographic classifications. The list of all datasets used in this report is found in Table 3. The resulting matrix of available input data has 2,024 rows and 88 columns.

Table 19: List of all input datasets.

Source	Dataset name	Description
UNIBAS	Survey dataset	Contains survey responses with socio-demographic and individual assessment variables.
ISTAT	Municipal statistical codes	Provides ISTAT statistical codes and municipal names (30/06/2024).
	Municipal boundaries	Contains geographic boundaries for municipalities.
	Municipal elevation	Includes elevation-related statistics (minimum, maximum, mean, etc.) for municipalities (2011).
	Municipal statistical classification	Contains classifications and dimensions of municipalities (01/01/2024).
	Municipal resident population	Provides population data by municipality, including total resident population (01/01/2024).
MIMIT	List of innovative start-ups	Provides the list of innovative start-up registered offices by municipality (03/03/2025)
	List of innovative SMEs	Provides the list of innovative SME registered offices by municipality (03/03/2025)
	List of incubators	Provides the list of business incubator registered offices by municipality (03/03/2025)

Table 20: List of municipal variables derived from ISTAT datasets. Numbering follows the one of Table 2.

Sec.	No.	Variable	Label
MU	45	municip_name	Municipality name
	46	territorial_unit_code	Territorial unit code

Sec.	No.	Variable	Label
	47	territorial_unit_name	Territorial unit name
	48	region_code	Region code
	49	region_name	Region name
	50	municipality_progressive_code	Municipality progressive code
	51	alphanumeric_municipality_code	Alphanumeric municipality code
	52	car_plate_code	Car plate code
	53	municip_numeric_code_110	Municipal numeric code 110
	54	municip_numeric_code_107	Municipal numeric code 107
	55	municip_numeric_code_103	Municipal numeric code 103
	56	cadastral_municipality_code	Cadastral municipality code
	57	NUTS1_code_2021	NUTS1 code 2021
	58	NUTS2_code_2021	NUTS2 code 2021
	59	NUTS3_code_2021	NUTS3 code 2021
	60	NUTS1_code_2024	NUTS1 code 2024
	61	NUTS2_code_2024	NUTS2 code 2024
	62	NUTS3_code_2024	NUTS3 code 2024
	63	shape_length_2024_m	Shape length 2024
	64	area_shp_2024_m2	Area (m^2) 2024
	65	area_shp_2024_ha	Area (ha) 2024
	66	surface_2024_ha	Surface area (ha) 2024
	67	surface_2024_ha_bin	Surface area (ha) 2024 (bins)
	68	surface_2024_km2	Surface area (km^2) 2024
	69	min_elev	Minimum elevation
	70	max_elev	Maximum elevation
	71	elev_range	Elevation range
	72	elev_range_bin	Elevation range (bins)
	73	elev_mean	Mean elevation
	74	elev_mean_bin	Mean elevation (bins)
	75	elev_median	Median elevation
	76	elev_std	Elevation standard deviation
	77	elev_zone	Elevation zone
	78	elev_center	Central elevation
	79	legal_pop_2021	Legal population 2021
	80	res_pop_2022	Resident population 2022
	81	res_pop_2024	Resident population 2024
	82	res_pop_2024_bin	Resident population 2024 (bins)
	83	pop_density_2024_km2	Population density (2024)
	84	pop_density_2024_km2_bin	Population density (2024) (bins)
	85	urbanisation_lvl_2018	Urbanization level 2018
	86	startup_count_2025	Innovative start-ups (2025)
	87	sme_count_2025	Innovative SMEs (2025)
	88	incubator_count_2025	Business incubators (2025)

A specific exploratory analysis was conducted on the Italian Business Register of Innovative Start-ups and SMEs, published by InfoCamere and the Ministry of Enterprises and Made in Italy (MIMIT) on its dedicated portal[8], with the aim of assigning a quantitative proxy information of innovation by municipality. This registry contains a specific subset of Italian companies selected based on MIMIT's innovation-related criteria and allows the identification of the municipality of the legal seat of each enterprise, which, despite not determining a direct linear link with the local labour force, entails a certain degree of institutional receptivity. Three lists are provided: one for innovative start-ups, one for innovative SMEs, and one for business incubators.

When considering the province of Salerno, five innovative start-ups were identified for the SETA area (two in Campagna, one in Oliveto Citra, and two in Palomonte), while no innovative SMEs or incubators were found. Overall, the Province of Salerno counted 241 innovative start-ups (across 51 municipalities), 56 innovative SMEs (across 20 municipalities), and one incubator (in Pontecagnano Faiano). Despite this analysis provides evidence of possible specific institutional receptivity for Campagna, Oliveto Citra, Palomonte, further research is suggested to identify alternative sources of information, either standalone or combined, to identify a relevant proxy of innovation readiness in SETA area.

4.2.Data cleaning

An R script (*R00_RIOM_master_file.R*) was used to integrate input data into an extended version of the RIOM survey dataset, which included municipal data for each record (*F99_RIOM_analysis_input_dataset.xlsx*). First, the RIOM dataset was pre-processed and translated into English. Subsequently, selected municipal variables were merged with the RIOM dataset using a left join. Across the workflow, the following actions were taken to resolve inconsistencies and standardise RIOM responses.

The data collector manually entered the secondary school name (***sec_school_name***), which specifies the 'Other' category of the secondary school type (*sec_school_type*), and the description of the work sector (***work_sector_des***), which specifies the 'Other' category of the work sector (*work_sector*). For the former, values were remapped to standardise the various entries for 'Teacher Training School' ('magistrale', 'Magistrale', 'MAGISTRALE', 'scuola magistrale', 'istituto magistrale', 'magistrali', 'vecchio diploma magistrale'). Concerning the latter, values were remapped to standardise the various entries for 'Construction' ('edilizia',

[8] Data are available at https://startup.registroimprese.it/, data in this report are updated to 16/12/2024.

'Edilizia', 'Edile', 'edile', 'EDILIZIA'), and for 'Craftsmanship' ('artigianato', 'Artigianato', 'artigiano', 'ARTIGIANO').

The data collector entered 'Bachelor's Degree' and 'Master's Degree' as university degree type (***university_type***) for all records reporting the value 'University degree' as their education level (*education_lvl*). For simplicity, *university_type* was then redefined to include: the original values, the new value 'Doctorate, Master' for records where the education level was reported as such, and 'None' for the remaining records. Although the Italian term 'Master' generates a limited ambiguity in an ordinal classification of educational levels[9], the value 'Doctorate, Master' was encoded as the higher level in the ordinal variables: *university_type* and *education_lvl*.

Furthermore, the data collector recorded the daily internet usage (***pa_internet_use***) by asking for the average number of hours spent online per day, using a 0–24 hour scale to facilitate the respondent. The numerical scale was then converted to a 1–10 Likert scale according to the equivalences provided in Table 5, which are justified by a normalisation of exponential reporting.

Table 21: Conversion from hours to Likert scale for the pa_internet_use variable.

Time in hours	Likert scale	Time in hours	Likert scale
0	1	5	6
1	2	6–7	7
2	3	8–9	8
3	4	10–15	9
4	5	16–24	10

Finally, the three variables describing the benefits of remote work for local development (***pa_remotework_dev***), local innovation readiness (***pa_innov_readiness***), and the availability of advanced technological services (***ia_adv_tech_serv***) contained null values encoded with the text: '(DO NOT READ!) Does not know'[10]. These text entries were converted to null values, excluded through pairwise deletion from univariate and bivariate statistics when involved and through listwise deletion for multivariate statistics.

[9] In the Italian educational system, there are two types of advanced Masters which correspond to '1st degree' and '2nd degreed' Master. Both degrees are postgraduate short specialisation degrees that correspond to the European Qualifications Framework (EQF) levels 7 and 8, respectively (Conferenza Stato-Regioni, 2012). A 1st degree Master is accessible after a bachelor's degree and has the EQF level of master's degrees ('*Laurea Magistrale*'), while a 2nd degree Master is accessible after a Master's Degree and has the EQF level of doctoral degrees.

[10] '(NON LEGGERE!) Non sa / non conosco' (translation by the author).

4.3.Variables of interest

The research question identified explores the relationship between the perceived adequacy or insufficiency of formal and informal support, and their role in shaping digitalisation-based service ecosystems and their entrepreneurial networks. In order to explore those relationships, a three-pillar approach is adopted classifying the 23 available assessment variables in relation to psychological and material wellbeing (PMW), informal institutions (II), and formal institutions (FI).

Firstly, six key variables concern the perceived psychological and material wellbeing (PMW) of respondents and the main psychological stressors to which they are exposed (Table 22).

Table 22: Measures of the psychological and material wellbeing contained in the input dataset.

Sec.	Measures of psychological and material wellbeing	Variable name	Wellbeing dimension
PA	Perceived level of serenity of life	pa_serenity	Psychological wellbeing
	Perceived importance of living in a small or moderately sized environment for the quality of life	pa_small_env	Benefits of a small living environment on material wellbeing
	Perceived ease of the household's economic situation	pa_financ_stability	Material wellbeing
	Perceived burden of current global challenges on personal serenity (post-pandemic, eco-anxiety, wars)	pa_conjunctural_stress	Psychological burden of global stressors
	Perceived burden of the challenging employment situation	pa_jobmarket_stress	Psychological burden of employment stressors
	Perceived strength of personal well-being	pa_wellbeing	Subjective wellbeing (overall)

Secondly, input data capture perceptions regarding ten dimensions of the level of support provided by informal institutions (II) (Table 23). Namely, *pa_community_bond*, *pa_relational_qual*, focus on the informal institutions of sense of community and community networks, *pa_covid_support*, *pa_assoc_involv* and *pa_help_ease* address the informal institutions of trust and reciprocity. Moreover, *pa_internet_use* and *pa_soc_media_trust* offer a perspective on the trust and cultural relevance of digital technologies and social networks. Additionally, *pa_remotework_dev* holds evidence about the level of trust in the benefits of remote working on local development, while *ia_local_benefit* provides a glimpse into the popularity of community values related to ecological and healthy lifestyles. Moreover, input data portray one proxy (subjective) measure of the strength of entrepreneurial networks aimed

at the emergence of digitisation-based service ecosystems, *pa_innov_readiness*, which also represent to a certain extent the informal support of trust in local innovation ecosystems.

Table 23: Measures of informal support to entrepreneurial networks contained in the input dataset.

Sec.	Measures of informal support	Variable name	Informal institution
PA	Perceived depth of the bond with one's community	pa_community_bond	Community ties and trust
	Perceived quality of relationships with one's social environment (family, relatives, friends)	pa_relational_qual	Relationship networks
	Perceived support from one's community during the COVID-19 pandemic	pa_covid_support	Grassroots mutual aid networks
	Perceived level of involvement in local associations	pa_assoc_involv	Volunteering and civic engagement
	Perceived ease of seeking help from one's community	pa_help_ease	Help request ease culture
	Perceived reliability of information circulating on social media	pa_soc_media_trust	Trust in social media information
	Perceived contribution of smart working to community development	pa_remotework_dev	Trust in remote work benefits
	Perceived readiness of the local entrepreneurial and institutional fabric to meet innovation challenges	pa_innov_readiness	Trust in local innovation ecosystems
	Daily internet usage for study, work, and information needs	pa_internet_use	Trust and reliance on internet
IA	Perceived advantages of local and sustainable production in attracting conscientious consumers	ia_local_benefit	Consumers ethical awareness

Lastly, the RIOM dataset captures the perceptions regarding seven dimensions of the quality of support provided by formal institutions (FI) (Table 24).

Table 24: Measures of formal support to entrepreneurial networks contained in the input dataset.

Sec.	Measures of formal support	Variable name	Formal institution
IA	Perceived quality of financial services (e.g. access to credit)	ia_financial_serv	Banking and financial institutions
	Perceived quality of consultancy and/or accompaniment services (e.g. business incubators)	ia_consult_serv	Business development support infrastructures
	Perceived quality of advanced technology services (e.g., contacts with research centres, innovation ecosystems, technology parks)	ia_adv_tech_serv	Technological research infrastructures
	Perceived quality of support services from public institutions (e.g., municipality, chamber of commerce, etc.)	ia_gov_support	Public institutions
	Perceived quality of physical connection services (e.g., roads, railways, airports)	ia_transport_link	Transport infrastructure systems
	Perceived quality of intangible connection services (e.g. broadband)	ia_intangible_link	Intangible infrastructure systems
	Perceived availability of suitable labour	ia_labor_avail	Labour markets

4.4.Analytical approach

The analytical approach combined descriptive and inferential methods to examine the nature of the literature-derived drivers of innovation and the possible relationship between institutional support factors and socio-demographic and municipal dynamics. Summary statistics, frequencies and visualizations are provided as an overview of aggregate data; the univariate analysis describes distributions and trends. The bivariate analysis identifies significant differences across relevant groups for the variables of interest and correlation between assessment variables. Lastly, multivariate analysis addresses patterns among variables and their clustering.

4.4.1. Missing data

Concerning univariate and bivariate analysis, missing data (4–8% in three variables of interest) are excluded by pairwise deletion, removing incomplete cases for each specific statistics calculation where necessary. All exploratory multivariate analysis was performed starting from a subset of data obtained through the removal of the SD variables *sec_school_type*, *sec_school_name*, *work_publ_priv*, *work_sector*, *work_sector_des*, and *workplace_expected*, and the subsequent removal by listwise deletion of all null values, present only in *pa_remotework_dev*, *pa_innov_readiness* and *ia_adv_tech_serv*, thus obtaining a matrix of data for the SETA area with 1237 rows and 82 columns. Further research is suggested in testing for the Missing Completely at Random (MCAR) assumptions for the latter three variables.

4.4.2. Univariate analysis

The relative frequency distribution is reported for categorical variables, while for numeric variables summary statistics are reported and a binned version of the latter is included in the categorical frequencies. The summary statistics included for numeric variables are count, number of missing values, mean, median, mode, variance, standard deviation, interquartile range (IQR), median absolute deviation (MAD), skewness, kurtosis, as well as the first (Q1) and third (Q3) quartiles. It is important to note that despite all assessment variables are encoded with a 1–10 numeric discrete scale, those variables are categorical ordinal, thus the meaning of the summary statistics, which are reported for them too in the Annex B: Univariate statistics, should be bounded to it.

4.4.3. Bivariate analysis

The Mann–Whitney U nonparametric test (MWU), also known as Mann–Whitney–Wilcoxon, and the Kruskal–Wallis (KW) nonparametric test, focusing only on the ordinal information in the data, were used to identify significant changes between Likert-item assessment variables and groupings based on socio-demographic and municipal variables; missing data were removed by pairwise deletion. The MWU was applied for binary grouping variables, such as *gender_binary*, while the KW was used for grouping variables with three or more levels. Both tests were conducted with a significance level (α) of 0.05. Subsequently, the Dunn's Post Hoc nonparametric test (DPH) was run only for those grouping variables which reported a significant α for Kruskal–Wallis to determine which specific pairs of groups are significantly different. Dunn's test was conducted through pairwise comparisons of groups with Bonferroni correction.

Moreover, summary statistics of assessment variables were calculated by municipal groups, and choropleth maps were produced to provide descriptive support for the significant differences identified through inferential analysis.

Additionally, the correlation among assessment variables is reported as part of the multivariate analysis as the sample is obtained by listwise deletion. Spearman's rank correlation coefficient was used due to its robustness against non-normal data distributions and its suitability for ordinal variables, such as the Likert-item assessment variables. Furthermore, variables were ordered into the predefined thematic groups described in section 4.3 (wellbeing, informal, and formal support) to enhance interpretability.

4.4.4. Multivariate analysis

The analytical approach in use aimed to assess possible relationships among variables and uncover patterns within the sample. Two subsets of variables were defined to run the same high-dimensional analysis. A large subset, composed by 31 variables described in Table 7, included key socio-demographic variables, all assessment variables and the *municip_name* nominal variable. A small subset, composed by 14 variables and described in Table 8, included a similar subset with a selection of assessment variables in order to study the possible effects of multicollinearity.

Table 25: Subset 1 of variables included in the multivariate analysis (31).

Demographics	Activities	Assessment	Municipal
years_old	sport_type	All	municip_name
household_size	work_type_des		
gender_binary			
civil_status			
education_lvl			

Table 26: Subset 2 of variables included in the multivariate analysis (14).

Demographics	Activities	Assessment	Municipal
years_old	sport_type	pa_wellbeing	None
household_size	work_type_des	pa_jobmarket_stress	
gender_binary		pa_community_bond	
civil_status		pa_assoc_involv	
education_lvl		pa_innov_readiness	
		ia_financial_serv	
		ia_transport_link	

The Gower distance matrix was computed for its capacity to handle mixed data type (quantitative, nominal and ordinal), and a Principal Coordinates Analysis (PCoA) was built considering the first two principal coordinates components and spatially represent their relationship. Then, a hierarchical clustering, based on Gower distances and built via the Ward method, was performed selecting the number of clusters based on the max Average Silhouette Width (ASW).

5. Results

5.1.Missing values

It should be noted that nine variables are not complete for the entire dataset and in SETA area too. A review of these variables is presented below referring to the 1399 respondents for the latter region. Concerning socio-demographic characteristics, six variables report empty cells in the respective cases presented below.

The type of secondary education diploma (***sec_school_type***) is provided for the 738 respondents (53%) whose education level (*education_lvl*) is recorded as 'Secondary school diploma'. For the remaining 661 respondents (47%), where the secondary education type is blank, their education levels are classified as 'Compulsory education', 'University degree', and 'Doctorate, Master'. Notably, secondary education type is not reported for the 345 respondents (25%) with higher education qualifications—325 with a 'University degree' and 20 with a 'Doctorate, Master'— even though such individuals must have obtained a secondary education diploma.

Furthermore, the name of the secondary education diploma (***sec_school_name***) is reported only for the 35 respondents whose secondary education type is classified as 'Other'. Among the 1399 respondents in SETA area, 35 (3%) have both a secondary school type and name recorded, 703 (50%) have only the type of secondary education diploma specified—categorised as either as 'High School' (14%), 'Technical School' (23%) or 'Vocational School' (13%)—and 661 (47%) have blank values both for type and name. It is worth noting that similar considerations apply to the latter subset as those described in the previous paragraph.

The public/private nature of actual employment (***work_publ_priv***) is reported only for the 657 respondents (47%) whose work type (*work_type_des*) is recorded as 'Fixed-term employee', 'Occasional worker', and 'Permanent employee'. The remaining 742 respondents (53%) fall into the following work type categories: 'Not working', 'Other non-professional status', 'Retired', 'Self-employed', 'Unemployed', and 'Unpaid domestic worker'. It is important to highlight that 'Self-employed' respondents are not classified as part of the private sector under *work_publ_priv*.

Besides, the work sector (***work_sector***) is reported for the 840 respondents (60%) whose work type is recorded as 'Fixed-term employee', 'Occasional worker', 'Permanent employee', or 'Self-employed'. The remaining 559 respondents (40%), who have a blank value for the work

sector, belong to the following work types: ‘Not working’, ‘Other non-professional status’, ‘Retired’, ‘Unemployed’, and ‘Unpaid domestic worker’.

Additionally, the specific description of the work sector (***work_sector_des***) is reported only for the 41 respondents whose work sector is classified as ‘Other’. Among the 1399 respondents in SETA area, 41 (3%) have both the work sector and specific description recorded, 799 (59%) have only the work sector specified—categorised as either as ‘Agriculture’ (7%), ‘Commerce’ (7%), ‘Industry’ (9%) or ‘Services’ (35%)—and 559 (40%) have blank values for both fields.

Finally, the expected workplace for the next employment (***workplace_expected***) is reported for the 559 (40%) respondents whose work type is recorded as ‘Not working’, ‘Other non-professional status’, ‘Retired’, ‘Unemployed’, and ‘Unpaid domestic worker’. The remaining 840 respondents (60%), who have a blank value for the expected workplace, belong to the following work types: ‘Fixed-term employee’, ‘Occasional worker’, ‘Permanent employee’, or ‘Self-employed’.

Given the described nature of the six socio-demographic variables *sec_school_type*, *sec_school_name*, *work_publ_priv*, *work_sector*, *work_sector_des*, and *workplace_expected*, the variables are excluded from bivariate and multivariate analysis and maintained only for qualitative investigations.

Concerning the PA and IA sections, three variables contain null values. Specifically, null values are present for benefits of remote working on local development (***pa_remotework_dev***), where the count of null values sums to 53 respondents (4%), reducing the usable sample to 1346 observations. Similarly, null values are found in perceived readiness for innovation (***pa_innov_readiness***), with a count of 56 respondents (4%), reducing the usable sample to 1343 observations. Finally, they occur in advanced technological services (***ia_adv_tech_serv***), totalling 115 respondents (8%), reducing the usable sample to 1284 observations.

Given that this report focuses on an exploratory descriptive analysis of the assessment variables and that of the latter only *pa_remotework_dev*, *pa_innov_readiness* and *ia_adv_tech_serv* have a moderate number of missing values, the statistics presented in this report are calculated by pairwise deletion for univariate and bivariate analysis and listwise for multivariate analysis, thus assuming missing values are MCAR. Missing data for the three variables of interest are therefore excluded from calculation of specific univariate and bivariate statistics where they would be employed, while the complete record is excluded if any of the three variables has a null value for multivariate analysis.

Therefore, the comparisons between any of the three mentioned variable percentage scores and the rest of the assessment variables cannot be operated without acknowledging the specific sample size of the statistics. Conversely, the listwise deletion of records based on the combined missing values of the three variables determines the reduction of the sample size from 1399 to 1237 with a loss of 11.58% of the information of the original matrix (Table 9). Given that the individual level of missing data for each of latter three variables is moderate (3.79%-8.22%), this report suggests carrying further analysis to determine whether the missing values are MCAR before proceeding to more complex analysis.

Table 27: Table of the impact of the removal of missing values by listwise deletion for variables of interest in the SETA area.

No.	Variables for listwise deletion of NA	Retained rows	Removed rows
0	None	1399 (100%)	0 (0%)
1	pa_remotework_dev	1346 (96.21%)	53 (3.79%)
1	pa_innov_readiness	1343 (96%)	56 (4%)
1	ia_adv_tech_serv	1284 (91.78%)	115 (8.22%)
2	pa_remotework_dev, pa_innov_readiness	1311 (93.71%)	88 (6.29%)
2	pa_remotework_dev, ia_adv_tech_serv	1257 (89.85%)	142 (10.15%)
2	pa_innov_readiness, ia_adv_tech_serv	1253 (89.56%)	146 (10.44%)
3	pa_remotework_dev, pa_innov_readiness, ia_adv_tech_serv	1237 (88.42%)	162 (11.58%)

5.2.Univariate analysis

A complete dashboard of descriptive statistics for all variables is reported in the Excel document *G00_RIOM_Analysis_Report_SETA.xlsx*.

5.2.1. Socio-demographic characteristics

The socio-demographic profile of respondents from the SETA area includes a subset of 1399 individuals. The average age of respondents is approximately 48 years old (SD = 17.1); respondents are evenly distributed across the 18-103 years age range. Gender, measured as a binary variable, is nearly evenly distributed (50.7% male, 49.3% female). Moreover, most respondents have between one and five household members: four (29.3%), three (22.5%), two (21.4%), one (12.2%), and five (10.5%); the median household size is 3, and the maximum

size is 20. Most respondents (54.4%) are married or cohabitating, followed by those who are single (32.7%), and in smaller proportions are widowed (6.5%) and divorced/separated (6.4%).

The analysis of maximum educational attainment revealed that 22.6% of respondents had completed compulsory education, 52.8% held a secondary school diploma, 23.2% had a university degree, and only 1.4% held either a PhD or an advanced Master degree. Most respondents reported not practising any sport (59.6%), while 31.5% engaged in individual sports and 8.9% participated in team sports. Additionally, employment data showed that 40% of respondents were not formally employed, classified as 'Not working' (10.5%), 'Other non-professional status' (4.3%), 'Retired' (13.2%), 'Unemployed' (5.9%) and 'Unpaid domestic worker' (6.1%). Moreover, out of all respondents, 30.1% were permanent employees, 13.1% were self-employed, 11.7% were fixed-term employees, and 5.2% were occasional workers. Finally, out of the subset of not employed respondents defined above (n = 559), 44.5% expected to find their next job in Campania region, 4.3% in other regions in southern Italy or islands, 33.5% in Central-Northern Italy and 17.7% abroad.

5.2.2. Assessment characteristics

The summary statistics for the 23 Likert-based categorical ordinal variables assessing personal and innovation ecosystem are reported in Table 10, while their relative frequency distributions are reported in Table 11. Additionally, these distributions are visualised using diverging stacked bar charts: Figure 3 for PA variables and Figure 4 for IA variables. In the following results, lower scores or negative scores refer to Likert-item values 1–5 and higher or positive scores refer to Likert-item values 6–10.

Table 28: Summary statistics of personal assessment (pa) and innovation ecosystem assessment (ia) variables. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are excluded from calculations.

Variable	Count	Missing	Median	Mode	Min	Max	Range	IQR	Q1	Q3
pa_serenity	1399	0	7	8	1	10	9	2	6	8
pa_community_bond	1399	0	8	8	1	10	9	3	6	9
pa_small_env	1399	0	8	8	1	10	9	3	6	9
pa_relational_qual	1399	0	9	10	1	10	9	2	8	10
pa_covid_support	1399	0	7	8	1	10	9	4	5	9
pa_assoc_involv	1399	0	5	1	1	10	9	4.5	3	7.5
pa_help_ease	1399	0	6	8	1	10	9	5	3	8
pa_financ_stability	1399	0	7	8	1	10	9	2	6	8
pa_conjunctural_stress	1399	0	7	7	1	10	9	3	5	8
pa_jobmarket_stress	1399	0	7	8	1	10	9	3	5	8
pa_soc_media_trust	1399	0	4	1	1	10	9	3	2	5
pa_remotework_dev	1346	53	6	5	1	10	9	4	4	8
pa_innov_readiness	1343	56	5	5	1	10	9	3	4	7
pa_wellbeing	1399	0	7	8	1	10	9	2	6	8
pa_internet_use	1399	0	4	2	1	10	9	5	2	7
ia_financial_serv	1399	0	6	5	1	10	9	3	4	7
ia_consult_serv	1399	0	5	5	1	10	9	3	4	7
ia_adv_tech_serv	1284	115	5	5	1	10	9	3	4	7
ia_gov_support	1399	0	5	6	1	10	9	3	4	7
ia_transport_link	1399	0	5	5	1	10	9	3	3	6
ia_intangible_link	1399	0	6	7	1	10	9	3	5	8
ia_labor_avail	1399	0	6	6	1	10	9	3	4	7
ia_local_benefit	1399	0	6	6	1	10	9	2	5	7

Table 29: Relative frequencies of personal assessment (pa) and innovation ecosystem assessment (ia) variables. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are excluded from calculations, thus they do not correspond to figures cited when indicating the total sample size instead of their reduced one.

Variable	1	2	3	4	5	6	7	8	9	10
pa_serenity (1399)	5.6%	1.5%	2.9%	2.6%	10.2%	12.6%	18.3%	24.9%	7.6%	13.9%
pa_community_bond (1399)	3%	2.3%	3.1%	3.3%	8.8%	10.1%	15.8%	21.7%	11.1%	20.8%
pa_small_env (1399)	2.1%	1.1%	1.4%	2.9%	8.9%	10%	15.5%	24.9%	10.9%	22.3%
pa_relational_qual (1399)	1.1%	0.4%	0.4%	1.1%	3.1%	4.9%	11.2%	20.9%	17.5%	39.2%
pa_covid_support (1399)	9.6%	3.6%	3.1%	3.2%	10.2%	10.8%	14.4%	18.6%	9.6%	16.9%
pa_assoc_involv (1399)	17.8%	5.9%	6.6%	6.4%	15%	10.5%	12.7%	11.2%	5.6%	8.3%
pa_help_ease (1399)	14.3%	6.1%	5.6%	5%	13.8%	12.5%	11.9%	14.5%	5.4%	10.9%
pa_financ_stability (1399)	3.9%	2.4%	3.6%	4.1%	10.7%	14.4%	18.2%	20.1%	10.2%	12.2%
pa_conjunctural_stress (1399)	4.9%	3.9%	3.4%	5.6%	12.9%	13.4%	17.4%	16.2%	8.8%	13.5%
pa_jobmarket_stress (1399)	8.8%	3.6%	3.7%	4%	12.3%	14.4%	13.9%	15.2%	8.9%	15.2%
pa_soc_media_trust (1399)	22.4%	9.4%	10.9%	12.2%	20.9%	10.5%	6.8%	3.6%	1.6%	1.7%
pa_remotework_dev (1346)	8.6%	4.6%	6.4%	5.9%	17.2%	14.3%	15.6%	16.2%	4.5%	6.7%
pa_innov_readiness (1343)	6.1%	4.5%	6.9%	10.5%	23.5%	19.9%	16.3%	7.8%	1.9%	2.7%
pa_wellbeing (1399)	2.4%	1.9%	1.7%	2.9%	10.4%	19.2%	21.2%	22.4%	7.6%	10.2%
pa_internet_use (1399)	7.6%	20.3%	17.7%	11.6%	7.2%	8.6%	9.6%	6.9%	9.2%	1.3%
ia_financial_serv (1399)	8.8%	4.3%	5.6%	7.2%	18.7%	18.5%	17.6%	11.7%	2.6%	5%
ia_consult_serv (1399)	8.3%	5.2%	7.6%	8.2%	22.9%	20.2%	16.5%	7.6%	1%	2.4%
ia_adv_tech_serv (1284)	9.7%	5.7%	7%	10.9%	20.4%	17.8%	13.7%	9.3%	2.6%	2.7%
ia_gov_support (1399)	10.9%	5.9%	7.1%	10.4%	20.2%	20.3%	12%	8.6%	1.9%	2.6%
ia_transport_link (1399)	14.4%	6.8%	8.5%	11.7%	19.4%	15.5%	11.7%	8.2%	1.7%	2.1%
ia_intangible_link (1399)	6.1%	4.1%	5.4%	6.2%	14.2%	15.7%	19.7%	16.1%	5.8%	6.7%
ia_labor_avail (1399)	7.5%	5.2%	7.9%	9.4%	18.9%	20.3%	16.6%	9.6%	1.6%	3%
ia_local_benefit (1399)	7.6%	3.8%	4.4%	9.1%	18.6%	19.4%	16.5%	11.9%	3.8%	4.9%

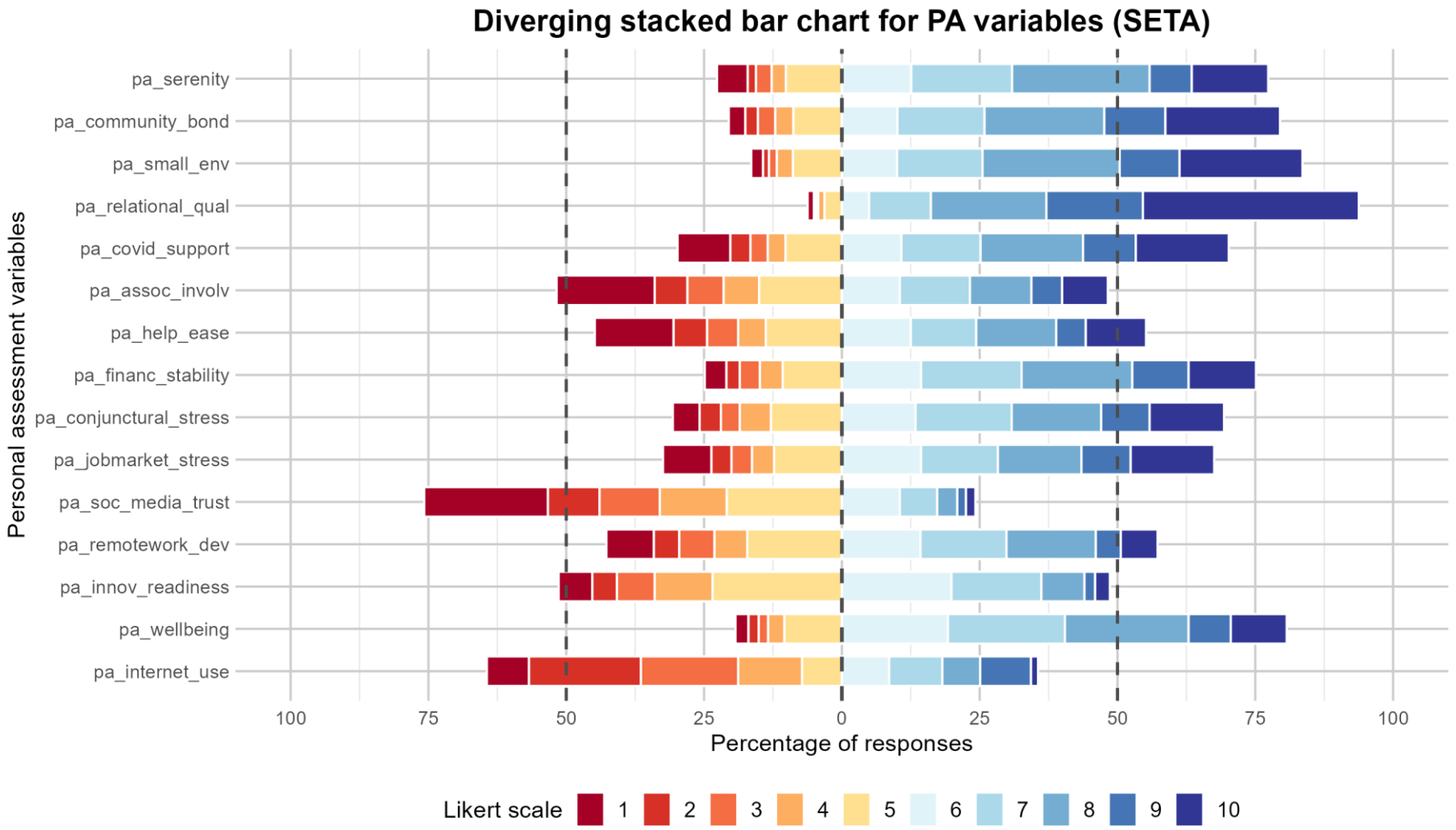


Figure 20: Diverging stacked bar chart of the 15 Likert-based personal assessment variables. Missing values for pa_remotework_dev and pa_innov_readiness are excluded from calculations of score percentages.

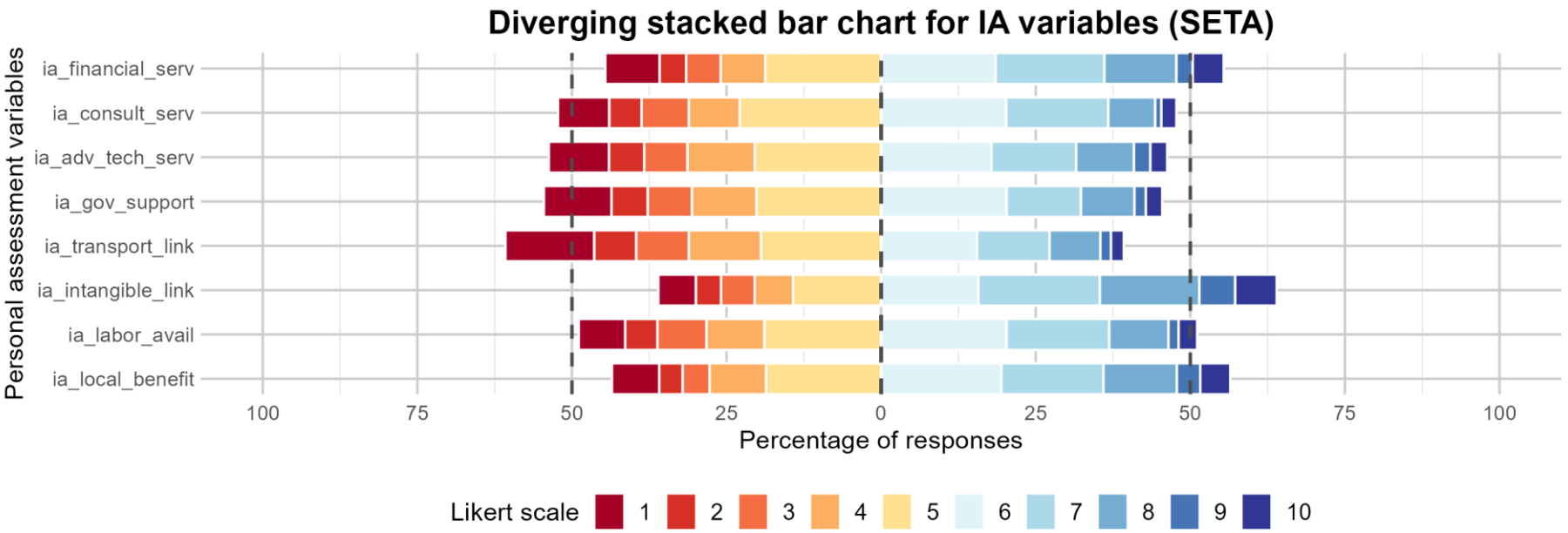


Figure 21: Diverging stacked bar chart of the 15 Likert-based innovation assessment variables. Missing values for ia_adv_tech_serv are excluded from calculations of score percentages.

Concerning the six measures of **personal and material well-being**, respondents reported a higher proportion of aggregated positive scores compared to aggregated negative scores for all variables. Perceived level of serenity of life (*pa_serenity*) and perceived strength of personal well-being (*pa_wellbeing*) reported a similar distribution of scores, with a median of 7 and a mode of 8 (respectively 24.9% and 22.4%), with aggregated negative scores below 25%. Perceived importance of living in a small or moderately sized environment for the quality of life (*pa_small_env*) and perceived ease of the household's economic situation (*pa_financ_stability*) had a median of 8 and 7, respectively, and both a mode of 8 (respectively 24.9% and 20.1%), with aggregated negative scores below 25%. Perceived burden of current global challenges on personal serenity (*pa_conjunctural_stress*) had a median and mode of 7 (17.4%). Perceived burden of the challenging employment situation (*pa_jobmarket_stress*) had a median of 7 and a mode of 8 (15.2%).

Concerning the ten variables portraying **measures of informal support**, on the one hand respondents reported a higher proportion of aggregated positive scores compared to aggregated negative scores for six variables: *pa_community_bond*, *pa_relational_qual*, *pa_covid_support*, *pa_help_ease*, *pa_remotework_dev, and ia_local_benefit*. The distribution of responses for perceived depth of the bond with one's community (*pa_community_bond*) and perceived quality of relationships with one's social environment (pa_relational_qual) was heavily concentrated toward higher scores, with more than 75% of respondents reporting values between 6 and 10. The variables showed a median of 8 and 9 and a mode of 8 (21.7%) and 10 (39.2%), respectively. Additionally, *pa_relational_qual* reported only approximately 0.4% for both the values 2 and 3, and an aggregated 6.2% for all negative values.

The remaining 4 variables with an overall positive trend had a more even distribution of scores. Perceived support from one's community during the COVID-19 pandemic (*pa_covid_support*) had a median of 7 and a mode of 8 (18.6%). Perceived ease of seeking help from the community (*pa_help_ease*) had a median of 6 and a mode of 8 (14.5%). Perceived contribution of smart working to community development (*pa_remotework_dev*) had a median of 6 and mode of 5 (17.2%) (considering null values in the count). Perceived advantages of local and sustainable production in attracting conscientious consumers (*ia_local_benefit*) had a median and mode of 6 (19.4%).

On the other hand, respondents reported a higher proportion of aggregated negative scores compared to aggregated positive scores for four variables: *pa_assoc_involv*,

pa_soc_media_trust, *pa_internet_use*, and *pa_innov_readiness*. The distribution of responses for daily internet usage for study, work, and information needs (*pa_internet_use*) and perceived reliability of information circulating on social media (*pa_soc_media_trust*) had a marked distributional asymmetry in favour of lower scores, with a median of 4 for both and a mode of 1 (22.4%) and 2 (20.3%), respectively. Besides, *pa_internet_use* value 10 was reported by only 1.3% of respondents. Perceived level of involvement in local associations (*pa_assoc_involv*) had a more even distribution of scores with a median of 5 and mode of 1 (17.8%).

Concerning the perceived readiness of the local entrepreneurial and institutional fabric to meet innovation challenges (*pa_innov_readiness*), a possible proxy of the perceived **strength of local entrepreneurial innovation ecosystems**, respondents reported a balanced distribution of scores with a slightly higher value of aggregate negative scores. *pa_innov_readiness* had a median and mode of 5 (23.5%) and presented an aggregated 57.3% of scores for categories 5,6, and 7 (considering null values in the count).

Lastly, concerning the seven variables capturing **measures of formal support**, respondents reported a higher proportion of aggregated higher scores compared to aggregated lower scores for three variables: *ia_financial_serv*, *ia_intangible_link*, and *ia_labor_avail*. Conversely, a higher aggregate proportion of negative scores is observed for four variables: *ia_consult_serv*, *ia_adv_tech_serv*, *ia_gov_support*, and *ia_transport_link*. Overall all seven variables displayed a concentration of scores in the Likert-item values 5, 6, and 7.

Concerning the former group, perceived quality of financial services (*ia_financial_serv*) had a median of 6 and mode of 5, reported by 18.7% of respondents. Perceived quality of intangible services (*ia_intangible_link*) had a median of 6 and mode of 7, reported by 19.7% of respondents. Perceived availability of suitable labour (*ia_labor_avail*) had a median and mode of 6, reported by 20.3% of respondents.

Concerning the latter group, perceived quality of consultancy and/or accompaniment services (*ia_consult_serv*) had a median and mode of 5, reported by 22.9% of respondents. Perceived quality of advanced technology services (*ia_adv_tech_serv*) had a median and mode of 5, reported by 20.4% of respondents (considering null values in the count). Perceived quality of support services from public institutions (*ia_gov_support*) had a median of 5 and mode of 6, reported by 20.3% of respondents. Perceived quality of physical connection service (*ia_transport_link*) had a median and mode of 5 reported by 19.4% of respondents.

5.2.3. Municipal characteristics

The 1399 respondents from SETA area were located in the nineteen municipalities listed in Table 12, all located in the Province of Salerno in the Region of Campania.

Table 30: Frequencies of respondents' municipalities for SETA area.

Municipality	Count	Percent.	Municipality	Count	Percent.
Auletta	60	4.3%	Petina	55	3.9%
Buccino	115	8.2%	Postiglione	77	5.5%
Caggiano	94	6.7%	Ricigliano	58	4.1%
Campagna	133	9.5%	Romagnano al Monte	28	2%
Castelnuovo di Conza	36	2.6%	Salvitelle	26	1.9%
Colliano	96	6.9%	San Gregorio Magno	79	5.6%
Contursi Terme	70	5%	Santomenna	26	1.9%
Laviano	63	4.5%	Sicignano degli Alburni	96	6.9%
Oliveto Citra	98	7%	Valva	80	5.7%
Palomonte	109	7.8%			

Considering the geographic features of the municipalities in SETA area, the average surface of the 19 municipalities (2024) is 5,044.4 ha, ranging from a minimum of 868.2 ha to a maximum of 13,597 ha. The surface of the municipality is in the intervals [868–1,000] ha for 5.7% of respondents, (1,000–5,000] ha for the 52.7%, in (5,000–10,000] ha for 32.1%, and in (10,000–21,097] ha for 9.5%. Moreover, the average of the respondents' mean elevation of municipalities (2011) is 545 metres above sea level (masl), with a minimum of 209.1 masl and a maximum of 938.1 masl. Namely, the 48.5% of respondents was in a municipality with a mean elevation within the interval [209–500] masl, while the remaining 51.5% within (500–1,000] masl. The average municipal elevation range of respondents is 1,168.2 m, ranging from a minimum of 475 m to a maximum of 1,748 m.

Looking at the demography of municipalities, the respondent's municipal resident population (2024) ranged from a minimum of 370 to a maximum of 16,759 inhabitants. 5.7% of respondents lived in a municipality with [370–500] inhabitants, 6.5% in a municipality with (500–1,000] inhabitants, 78.3% in a municipality with (1,000–5,000] inhabitants, and 9.5% in a municipality with 16,759 inhabitants (Municipality of Campagna). The average respondent's municipality demographic density is approximately 72 persons/km² ranging from a minimum of 23.5 to a maximum of 131.5 persons/km². 33.2% of the respondents lived in a municipality with [23–50] persons/km², 37.5% with (50–100] persons/km², and 29.3% with (100–132]

persons/km². The 90.5% of respondents were in a municipality classified with the Italian urbanisation level 3, i.e. 'Rural area' or 'Sparsely populated area', while only 9.5% were classified at level 2, i.e. "Small towns and suburbs" or "Areas of intermediate population density". Lastly, the respondents living in a municipality with one (Oliveto Citra) and two (Campagna and Palomonte) registered innovative start-ups were 7% and 17.3%, respectively, while 75.7% of respondents was based in a municipality with none.

5.3.Bivariate analysis

The bivariate exploratory analysis was conducted using Mann–Whitney U (MWU), Kruskal–Wallis (KW), and Dunn's Post Hoc (DPH) nonparametric tests and identified significant associations among variables. Below only significant differences are reported for MWU and KW with their p values. For KW, when pairwise comparison using DPH were significant, these are also reported. Specific considerations regarding group differences are drawn only for significant MWU and DPH pairs, with additional reference to medians, modes and contingency tables.

In many cases, a significant KW did not result in any specific significant DPH pair after Bonferroni correction. This may occur, for instance, because the observed differences are spread across multiple groups, the adjustment for multiple comparisons reduces the statistical power, or the data exhibit complex non-monotonic relationships.

A complete dashboard with tests and contingency tables for each Likert-item assessment variable, taken as response variables, contingent to several grouping variables, taken as explanatory variables, is reported in the document *G00_RIOM_Analysis_Report_SETA.xlsx*.

5.3.1. Socio-demographic analysis

The bivariate analysis reveals several significant differences in socio-demographic groups across the assessment variables.

5.3.1.1.Wellbeing

- **Age groups** have significant differences for personal serenity (KW p = 0.001, two significant DPH pairs), small environment influence (KW p < 0.001, five significant DPH pairs), financial stability (KW p < 0.001, three significant DPH pairs), and subjective wellbeing (KW p = 0.001, one significant DPH pair). Respondents aged 55–64 (median of 7) showed a significant slightly lower serenity of life compared to age groups 18–24 and 25–34 (median of 8). Besides, youngest respondents (median of 7),

aged 18–24, reported lower benefits of living in a small environment compared to age groups from 35 to 74, as well as the age group 25-34 showed a similar behaviour compared to age group 55–64. Additionally, the youngest respondent group (median of 8) reported slightly higher financial stability compared to age groups between 35 and 64 (all median of 7). Lastly, respondents aged 18-24 reported also a higher subjective wellbeing compared to the age group 55-64, with a median of 8 and 7 respectively.

- **Gender groups** have significant differences for personal serenity (MWU $p = 0.049$), small environment influence (MWU $p = 0.035$), conjunctural stress (MWU $p < 0.001$), and job-market stress (MWU $p < 0.001$). Specifically, despite summary statistics for serenity of life are equal, women reported an higher proportion of extremely low (score 1) and a lower proportion of extremely high scores (score 10) compared to men. Men reported a slightly higher proportion of extremely high scores compared to women concerning the benefits of living in a small environment. Moreover, women reported consistently higher perceived burden of conjunctural stress and of job-market stress compared to men across all the scale. For the latter case, respondent groups reported a median of 7 and 6 and a mode of 10 and 6, respectively.
- **Household size groups** have significant differences for subjective wellbeing (KW $p < 0.001$, three significant DPH pairs). Namely, five-persons households (median of 8) reported higher subjective wellbeing compared to households of 1,2 or 3 (all median of 7).
- **Educational level groups** have significant differences for personal serenity (KW $p = 0.014$, one significant DPH pair), financial stability (KW $p < 0.001$, three significant DPH pairs) and subjective wellbeing (KW = 0.007, one significant DPH pair). Respondents with only compulsory education reported a lower personal serenity (median of 7) compared to university degree holders (median of 8). Similarly, respondents with compulsory education only reported higher concentration of negative scores for subjective wellbeing compared to those with a university degree. Moreover, respondents with only compulsory education (median of 6) also showed a lower level of financial stability compared to respondents with secondary school diploma or a university degree(median of 7 and 8, respectively). Consistently, a coherent significant relation was observed between the latter two categories too.
- **Sport type groups** have significant differences for personal serenity (KW $p < 0.001$, two significant DPH pairs), financial stability (KW $p < 0.001$, two significant DPH

pairs), and subjective wellbeing (KW $p < 0.001$, two significant DPH pairs). Non-practitioners showed lower personal serenity (median of 7) compared to both individual-sport practitioners and team-sport practitioners (both with a median of 8). A similar trend emerged with a higher concentration of negative scores for non-practitioners compared to both other groups, for financial stability (in a moderate way) and subjective wellbeing (in a more marked way). Concerning subjective wellbeing, contingency tables also revealed that team sport practitioners reported higher overall scores with a median of 7.5, compared to 7 for the other groups.

- **Work type groups** have significant differences for personal serenity (KW $p < 0.001$, three significant DPH pairs), small environment influence (KW $p < 0.001$, five significant DPH pairs), financial stability (KW $p < 0.001$, 14 significant DPH pairs), and subjective wellbeing (KW $p < 0.001$, six significant DPH pairs). Respondents with 'Other non-professional status' (median of 8) reported higher life serenity compared to unemployed (median of 6), 'Not working' and fixed-term employees (both with a median of 7). Concerning the benefits of living in a small environment, self-employed respondents, who are more likely to work form home, reported higher scores (median of 8) compared to occasional workers, unemployed, and unpaid domestic workers (all with a median of 7). Permanent employees reported higher benefits (median of 8) compared to unpaid domestic workers and occasional workers (both with a median of 7). Furthermore, occasional workers reported a consistently lower financial stability (median of 6), compared to permanent employees, self-employed workers, retirees (all with a median of 7), and respondents with other non-professional status (median of 8). Besides, the latter group also reported higher financial stability compared to fixed-term employees. Following expectations, unemployed respondents reported lower financial stability (median of 6) compared to permanent employees, self-employed workers, retirees (all with a median of 7), and respondents with other non-professional status (median of 8). Lastly, unpaid domestic workers reported lower financial stability (median of 6) compared to permanent employees, self-employed workers, retirees, respondents not working (all with a median of 7) and respondents with other non-professional status (median of 8). Concerning wellbeing, respondents with other non-professional status showed higher scores (median of 8) compared to occasional worker, unpaid domestic worker (both with a median of 6), respondents not working, unemployed one, and retirees (all with a median of 7).

5.3.1.2.Informal institutions

- **Age groups** have significant differences for trust in social media (KW $p < 0.001$, five significant DPH pairs), remote work development benefit (KW $p < 0.001$, eight significant DPH pairs), internet use (KW $p < 0.001$, 22 significant DPH pairs), and consumer ethical awareness (KW $p < 0.001$, two significant DPH pairs). Across different pairs, it is possible to observe that the youngest age groups (18–24 and 25–34) have significantly higher trust in social media (both a median of 5) compared to respondents in the age groups from 45 to 84 (medians between 4 and 3) and 65–74 (median of 3), respectively. Similarly, youngest respondents (18-34) reported higher benefits of remote working (median of 7) compared to age groups between 35 and 74 (all with a median of 6). When analysing internet use, a clear digital divide is portrayed by 22 pairs of significant differences across all age groups suggesting a strong negative correlation between age and internet use, with the median decreasing from 7 for youngest respondents to 1 older ones. Lastly, younger adults (18–24 and 25–34) reported higher perceived consumer ethical awareness (both with a median of 6) compared to the age group 45–54 (with a median of 5).
- **Gender groups** have significant differences for community bond (MWU $p = 0.009$), association involvement (MWU $p = 0.016$), social media trust (MWU $p = 0.024$), remote work development benefit (MWU $p < 0.001$), innovation readiness (MWU $p = 0.005$), internet use (MWU $p = 0.005$), and local benefit (MWU $p = 0.004$). Despite the distribution is quite even, women reported a slightly higher amount of negative scores for community bond and men reported a higher share of the score 10 for the same variable. Men reported a higher involvement in local association compared to women, with a median of 6 and 5, respectively. Concerning trust in social media, women showed overall slightly higher scores. Moreover, men reported overall a slightly lower perception of the benefits of remote work compared to women. Women reported higher trust in the local innovation readiness compared to men, with a median of 6 and 5, respectively. Concerning the use of internet a slightly higher share of women reported the extreme score 1 compared to men, while other scores have a more balanced distribution. Lastly, men reported overall a slightly lower perception of consumer ethical awareness compared to women.
- **Household size groups** have significant differences for social media trust (KW $p = 0.013$, one significant DPH pair) and internet use (KW $p < 0.001$, six significant DPH

pairs). Respondents in single-person households presented lower social media trust (median of 3) compared to four-person households (median of 4). Both single-person households and two-persons households reported lower internet use (both with a median of 3) compared to households composed of three, four and five individuals, with a median of 4, 5, and 5, respectively.

- **Educational level groups** have significant differences for relational quality (KW = 0.013, no significant DPH pair), association involvement (KW $p < 0.001$, two significant DPH pairs), help request ease (KW $p = 0.029$, one significant DPH pairs), social media trust (KW $p < 0.001$, two significant DPH pairs), remote work development benefit (KW $p < 0.001$, four significant DPH pairs), internet use (KW $p < 0.001$, four significant DPH pairs), and local benefit (KW $p < 0.001$, two significant DPH pairs). Respondents with compulsory education only showed a higher share of negative values for association involvement (median of 5) compared to secondary school diploma (median of 5) and university degree holders (median of 6), as well as for help request ease (median of 5) compared to secondary school diploma holders (median of 6). Likewise, respondents with compulsory education only also showed lower trust in social media (median of 3) and ethical consumer behaviour (median of 5) compared to the subsequent two educational levels, both with a median of 4 for the first variable and 6 for the second one. Lastly, a trend was observable with higher education levels (secondary, university, and doctoral/master) showing higher perceived benefits of remote work (median of 6, 7, and 7.5) and reliance on internet (median of 4, 5, and 5.5), compared to respondents with compulsory education (median of 5 for the first variable and 2 for the second one), as well as between secondary and university levels.
- **Sport type groups** have significant differences for community bond (KW $p = 0.031$, one significant DPH pair), relational quality (KW $p = 0.005$, two significant DPH pairs), association involvement (KW $p = 0.003$, one significant DPH pair), help request ease (KW $p = 0.003$, one significant DPH pair), social media trust (KW $p = 0.005$, one significant DPH pair), remote work development benefit (KW $p < 0.001$, two significant DPH pairs), internet use (KW $p < 0.001$, two significant DPH pairs), and consumer ethical awareness (KW $p < 0.021$, one significant DPH pair). All significant tests show consistently that either team or individual sport practitioners reported higher scores for the 8 variables considered above compared to non practitioners. Better

relational quality is associated with team sport practice (median of 10) compared both to individual sport and no sport (both with a median of 9). Moreover, not practicing any sport is linked to lower reliance on internet (median of 3) and perceived benefits of remote work (median of 6), compared to practicing individual sports (median of 6 and of 7, respectively) or team sports (median of 4.5 and 6, respectively). Respondents playing in a team reported higher levels of community bond (overall lower negative and higher positive scores), association involvement (median of 6), and help request ease (median of 7) compared to non practitioners (median of 5 and 6, respectively for the latter two). Meanwhile, respondents playing individually reported higher levels of trust in social media (median of 5), and consumer ethical awareness (lower negative extreme and higher positive extreme scores) compared to non-practitioners (median of 4 for the former variable).

- **Work type groups** (*work_type_des*) have significant differences for community bond (KW $p = 0.001$, four significant DPH pairs), pandemic community support (KW $p = 0.005$, two significant DPH pairs), association involvement (KW $p < 0.001$, nine significant DPH pairs), help request ease (KW $p = 0.008$, no significant DPH pairs), social media trust (KW $p < 0.001$, eight significant DPH pairs), remote work development benefit (KW $p = 0.001$, six significant DPH pairs), and internet use (KW $p < 0.001$, 18 significant DPH pairs). Self employed respondents reported overall higher scores and a markedly higher share of the extreme positive value 10 for community bond (median of 8) compared to fixed-term employees (median of 8), occasional workers, respondents not working and retired (all with a median of 7).Permanent employees showed a higher cumulative share of positive scores for pandemic community support (median of 7), compared to fixed term employees (median of 7) and occasional workers (median of 5). Additionally, permanent employees as well as self-employed respondents reported higher involvement in association (both with a median of 6) compared to respondents not working, unemployed, retired (all with a median of 5), unpaid domestic workers and occasional workers (both with a median of 4). Concerning trust in social media, respondents with other non-professional status reported higher scores (median of 5) compared to respondents not working, permanent employees (both with a median of 4), retirees (median of 3) and unpaid domestic workers (median of 2). The latter group reported lower scores compared to fixed term employees, unemployed, other non-professional status (all with a median of 5), self-employed and retired (both with a median of 4). Moreover, respondents with other non

professional status reported the highest scores for benefits of remote working (median of 8) compared to almost all other categories (medians between 6 and7). A pattern of association concerning internet use suggests that unpaid domestic workers, respondents not working (both with a median of 3), and retirees (median of 2) had much lower scores compared to other groups (with medians between 4 and 6).

5.3.1.3.Formal institutions

- **Age groups** (*years_old_bin*) have significant differences for financial services quality (KW $p < 0.001$, seven significant DPH pairs), consulting services quality (KW $p = 0.001$, four significant DPH pairs), public institutional support (KW $p = 0.019$, one significant DPH pair), intangible connection services (KW $p = 0.02$, one significant DPH pair), and suitable labour availability (KW $p < 0.001$, six significant DPH pairs). A clear age gap is observable with higher perceived quality of financial services by the youngest respondent group (18-25, median of 7) compared to the age groups within 35-84 (decreasing median 6/5), and for the age group 25-34 (median of 6) compared to the age groups within 55-74 (median of 5). Similarly, the gap is also observable for quality of consultancy services with a median of 6 for respondents aged 18-25 versus a median of 5 for respondents in the age groups within 45-84. Moreover, youngest respondents also reported a higher quality of public institutional support (median of 6) compared to the age group 45-54 (median of 5) and higher aggregate scores for intangible links (median of 7) compared to the age group 65-74 (median of 6). Lastly, Youngest respondents also reported higher aggregate positive scores for available labour force (median of 6) compared to respondents in the age group 45-84 (median of 5), and respondents aged 25-34 (median of 6) compared to those in the age groups 45-54 and 75-84.
- **Gender groups** have significant differences financial services quality (MWU $p = 0.002$), advanced technological services quality (MWU $p = 0.041$), public institutions support (MWU $p = 0.009$), physical connection services (MWU $p < 0.001$), and intangible connection services (MWU $p = 0.003$). Women reported a slightly higher aggregate share of positive scores for all variables aforementioned compared to men.
- **Educational level groups** have significant differences for financial services quality (KW $p < 0.001$, two significant DPH pairs), consulting services quality (KW $p < 0.001$, two significant DPH pairs), public institutional support (KW $p = 0.006$, two significant DPH pairs), physical connection services (KW $p < 0.001$, three significant DPH pairs),

intangible connection services (KW p = 0.049, no significant DPH pair), and suitable labour availability (KW p < 0.001, four significant DPH pairs). Respondents with compulsory education reported lower scores for financial services, consulting services, and public institutional support (all with a median of 5) compared to those owning a secondary diploma or university degree (either through a 1 point difference in the median or a higher aggregate share of negative values). Similarly, they also reported lower quality of physical connection services (median of 4) compared to secondary diploma or university degree holder (median of 5 and 6 respectively), including a significant difference between the latter two groups. Lastly, respondents with compulsory education reported lower quality of available labour (median of 5) compared to all other groups (median of 6), and university degree holders showed a higher aggregate share of positive values compared to secondary diploma holders.

- **Sport type groups** have significant differences for financial services quality (KW p < 0.001, one significant DPH pair), consulting services quality (KW p = 0.005, one significant DPH pair), public institutions support (KW p = 0.006, one significant DPH pair), physical connection services (KW p = 0.001, one significant DPH pair), intangible connection services (KW p = 0.001, one significant DPH pair), and suitable labour availability (KW p < 0.001, two significant DPH pairs). With regard to all aforementioned variables, individual sport practitioners reported higher aggregate positive scores or a one point difference in the median compared to non practitioners. In the case of labour availability, a similar association was found between team sport practitioners (median of 6) and non practitioners (median of 5).
- **Work type groups** (*work_type_des*) have significant differences for financial services quality (KW p < 0.001, two significant DPH pairs), consulting services quality (KW p < 0.001, four significant DPH pairs), advanced technological services (KW p = 0.025, one significant DPH pair), intangible connection services (KW p = 0.015,), and suitable labour availability (KW p < 0.001, eight significant DPH pairs). Respondents not working showed lower perceived quality of financial services (median of 5) compared to respondents with other non-professional status (median of 6.5) and permanent employees (median of 6). Moreover, respondents with other non-professional status showed higher perceived quality of consultancy services (median of 6) compared to respondents not working, retirees, occasional workers, and unpaid domestic workers (all with a median of 5), as well as of advanced technological services (median of 6)

compared to unpaid domestic workers (5). Lastly, respondents with other non professional status reported higher availability of suitable labour (median of 7) compared to respondents not working, retired and unpaid domestic workers (all with a median of 5). Meanwhile, self-employed and unpaid domestic workers reported lower scores for the same variable (both with a median of 5) compared to respondents with other non professional status (median of 7), fixed term employees, and permanent employees (both with a median of 6).

5.3.2. Regional differences

Several significant differences across municipalities were identified within SETA area. Hence, before presenting them, information is briefly provided on the significant differences that are found between municipalities at the level of the entire RIOM dataset to contextualise the subsequent information on SETA area. For RIOM regions, several assessment variables exhibited significant differences across areas (MOMA, SETA, and MAIN) and across municipalities. All significant differences, only for area, municipal, and start-up count groups, are reported without specific pairwise comparisons descriptions.

5.3.2.1. Wellbeing

- **Area groups** have significant differences for benefits or living in a small environment (KW $p < 0.001$, one significant DPH pair) and subjective wellbeing (KW $p = 0.01$, two significant DPH pairs).

5.3.2.2. Informal institutions

- **Area groups** have significant differences for community bond (KW $p = 0.001$, one significant DPH pair), relational quality (KW $p < 0.001$, one significant DPH pair), ease of help request (KW $p = 0.023$, no significant DPH pair), and use of internet (KW $p = 0.001$, one significant DPH pair).
- **Municipal groups** have significant differences for community bond (KW $p = 0.012$, no significant DPH pair), association involvement (KW $p = 0.009$, one significant DPH pair), help ease (KW $p = 0.048$, no significant DPH pair), and innovation readiness (KW $p = 0.011$, two significant DPH pairs).
- **Start-up count groups** (*startup_count_2025*) have significant differences for relational quality (KW $p = 0.016$, one significant DPH pair), association involvement

(KW p = 0.046, one significant DPH pair), and innovation readiness (KW p = 0.033, one significant DPH pair).

5.3.2.3. Formal institutions

- **Area groups** have significant differences for physical connection services (KW p < 0.001, three significant DPH pairs) and availability of suitable labour (KW p = 0.001, two significant DPH pairs).
- **Municipal groups** have significant differences for consultancy services (KW p = 0.02, no significant DPH pair), public institutional support (KW p = 0.019, one significant DPH pair), physical connection services (KW p < 0.001, 39 significant DPH pairs), intangible connection services (KW p = 0.032, no significant DPH pair), and availability of suitable labour (KW p = 0.01, no significant DPH pair).
- **Start-up count groups** (*startup_count_2025*) have significant differences for public institutional support (KW p = 0.014, one significant DPH pair).

Table 31: Results of the Kruskal Wallis test with each assessment variable as response variable and municipalities as the explanatory variable, calculated for the entire RIOM area.

Variable	Chi_Squared	DF	P_Value	Significance
pa_serenity	49.12	39	0.128	No significant differences (p ≥ 0.10)
pa_community_bond	61.696	39	0.012	Significant differences (p < 0.05)
pa_small_env	44.72	39	0.244	No significant differences (p ≥ 0.10)
pa_relational_qual	53.952	39	0.056	Marginal significance (0.05 ≤ p < 0.10)
pa_covid_support	39.348	39	0.454	No significant differences (p ≥ 0.10)
pa_assoc_involv	63.015	39	0.009	Significant differences (p < 0.05)
pa_help_ease	54.779	39	0.048	Significant differences (p < 0.05)
pa_financ_stability	53.644	39	0.059	Marginal significance (0.05 ≤ p < 0.10)
pa_conjunctural_stress	47.177	39	0.173	No significant differences (p ≥ 0.10)
pa_jobmarket_stress	47.383	39	0.168	No significant differences (p ≥ 0.10)
pa_soc_media_trust	44.69	39	0.245	No significant differences (p ≥ 0.10)
pa_remotework_dev	52.89	39	0.068	Marginal significance (0.05 ≤ p < 0.10)
pa_innov_readiness	62.135	39	0.011	Significant differences (p < 0.05)
pa_wellbeing	53.852	39	0.057	Marginal significance (0.05 ≤ p < 0.10)
pa_internet_use	45.474	39	0.22	No significant differences (p ≥ 0.10)
ia_financial_serv	53.802	39	0.058	Marginal significance (0.05 ≤ p < 0.10)
ia_consult_serv	59.255	39	0.02	Significant differences (p < 0.05)
ia_adv_tech_serv	51.891	39	0.081	Marginal significance (0.05 ≤ p < 0.10)
ia_gov_support	59.464	39	0.019	Significant differences (p < 0.05)
ia_transport_link	157.871	39	0	Significant differences (p < 0.05)

Variable	Chi_Squared	DF	P_Value	Significance
ia_intangible_link	56.893	39	0.032	Significant differences (p < 0.05)
ia_labor_avail	62.295	39	0.01	Significant differences (p < 0.05)
ia_local_benefit	54.457	39	0.051	Marginal significance (0.05 ≤ p < 0.10)

5.3.3. Municipal analysis

At the level of SETA area, tests were conducted both by municipal groups and by five municipal-derived variable groups (*surface_2024_ha_bin*, *elev_mean_bin*, *res_pop_2024_bin*, and *pop_density_2024_km2_bin*, *startup_count_2025*). Partially in line with the entire RIOM dataset, the analysis within SETA area displayed only nine cases of variables with significant differences across municipal groups, and several across municipality-based characteristics groups.

5.3.3.1. Wellbeing

- **Municipal groups** have significant differences for conjunctural stress (KW p = 0.027, no significant DPH pairs).
- **Start-up count groups** (*startup_count_2025*) have significant differences for personal serenity (KW p = 0.034, one significant DPH pair). Namely, respondents residing in a municipality with one registered innovative start-up reported a higher personal serenity (median of 8) compared to those residing in a municipality with none.

5.3.3.2. Informal institutions

- **Municipal groups** have significant differences for association involvement (KW p = 0.017, two significant DPH pairs), benefits of remote working (KW p = 0.0164, no significant DPH pair), innovation readiness (KW p = 0.01, no significant DPH pair), and consumer ethical (KW p = 0.017, no significant DPH pair). Concerning association involvement, Castelnuovo di Conza reported markedly lower scores (median of 3) compared to Auletta (median of 7) and Oliveto Citra (median of 6).
- **Municipal surface groups** (*surface_2024_ha_bin*) have significant differences for community bond (KW p = 0.014, one significant DPH pair) and help request ease (KW p = 0.023, no significant DPH pair). Respondents in municipalities with a surface in the interval (1,000–5,000] ha reported higher community bond (median of 8) compared to those within the interval (10,000–21,097] ha (median of 7).

- **Municipal resident population groups** (*res_pop_2024_bin*) have significant differences for community bond (KW p = 0.005, two significant DPH pairs). Respondents living in a municipality with a population between (500–1,000] inhabitants reported higher community bond (median of 8 and higher aggregate positive scores) compared to those living in municipalities with (1,000–5,000] or (10,000–16,759] inhabitants (with a median of 8 and 7 respectively).
- **Municipal population density groups** (*pop_density_2024_km2_bin*) have significant differences for association involvement (KW p = 0.026, one significant DPH pair). Specifically, respondents in municipalities with an average (10–50] persons/km² population density showed a lower involvement in associations (median of 5) compared to those living in municipalities with (100–132] persons/km² (median of 6).
- **Start-up count groups** (*startup_count_2025*) have significant differences for relational quality (KW p = 0.029, one significant DPH pair), innovation readiness (KW p = 0.007, two significant DPH pairs), and ethical consumer awareness (KW p = 0.014, one significant DPH pair). Respondents from municipalities with one registered innovative start-up recorded a slightly higher aggregate share of positive scores for relational quality compared to those with two registered start-ups. Moreover, the former group also reported higher perceived innovation readiness (median of 6) compared to respondents from municipalities with two start-ups or none (both with a median of 5). Lastly, the same group also reported higher aggregate positive scores for suitable labour availability compared to the group in municipalities with two start-ups (both groups with a median of 6).

5.3.3.3. Formal institutions

- **Municipal groups** have significant differences for consultancy services (KW p = 0.031, two significant DPH pairs), advanced technological services (KW p = 0.031, no significant DPH pair), public institutional support (KW p = 0.005, one significant DPH pair), and intangible connection services (KW p = 0.015, no significant DPH pair). Concerning consultancy services, the municipality of Contursi Terme displayed higher scores (median of 6) compared to Postiglione and Sicignano degli Alburni (both with a median of 5). Additionally, respondents from Oliveto Citra reported higher public institutional support (median of 6) compared to those from Palomonte (median of 5).
- **Start-up count groups** (*startup_count_2025*) have significant differences for public institutional support (KW p = 0.001, two significant DPH pairs). Respondents from

municipalities with one registered start-up reported higher quality of public support (median of 6) compared to respondents from municipalities with two start-ups or none (both with a median of 5).

Overall, the analysis highlights that some of the variability present in the entire RIOM area is also reproduced at the level of municipality groups within SETA area for both informal institutions (association involvement and innovation readiness) and formal institutions (consultancy services, public institutional support, and intangible connection services). Furthermore, the SETA area presents internal variability of municipality groups for psychological wellbeing (conjunctural stress), informal institutions (ethical consumer behaviour and remote working benefits) as well as for formal institutions (advanced technological services).

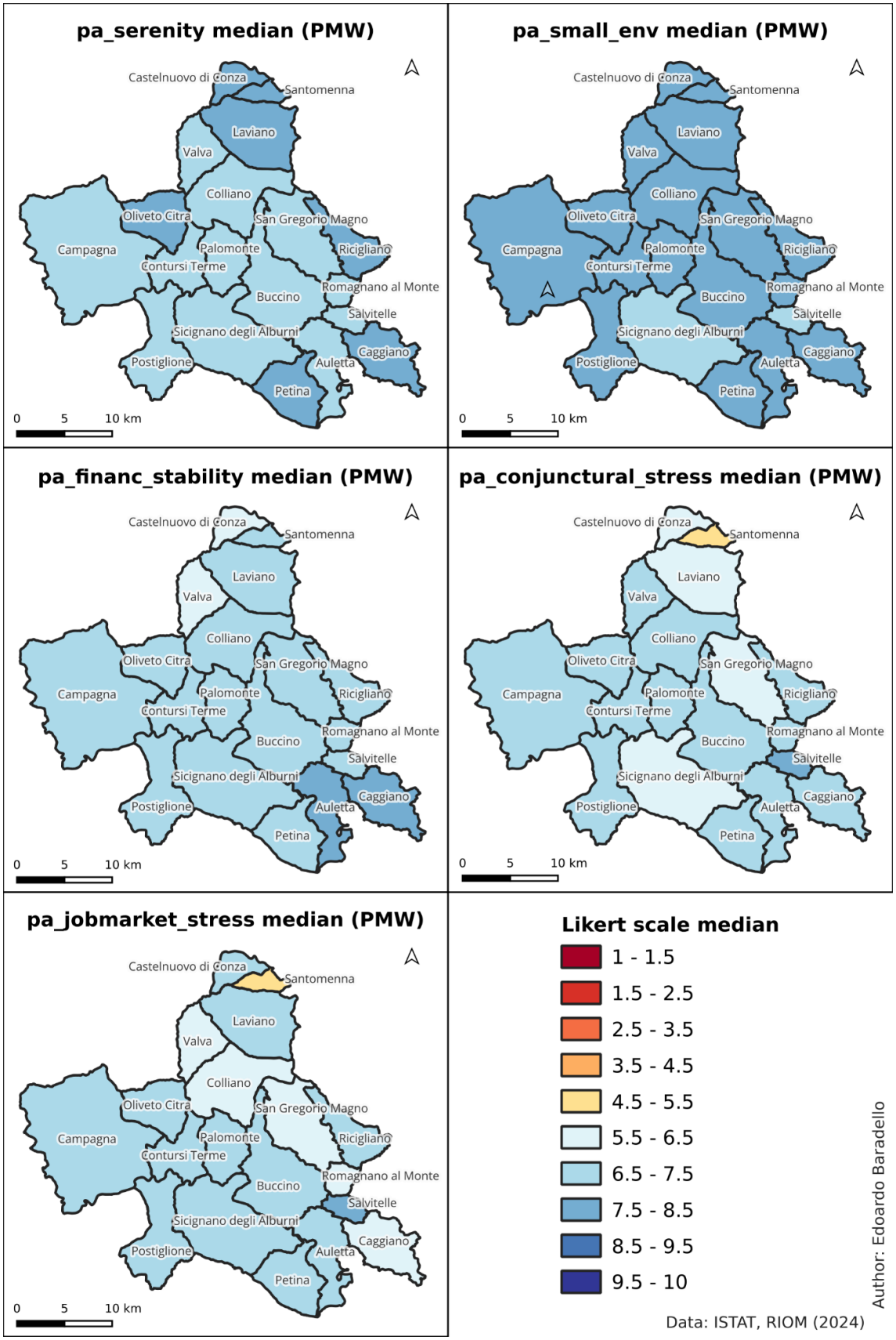
Table 32: Results of the Kruskal Wallis test with each assessment variable as response variable and municipalities as the explanatory variable, calculated for SETA area.

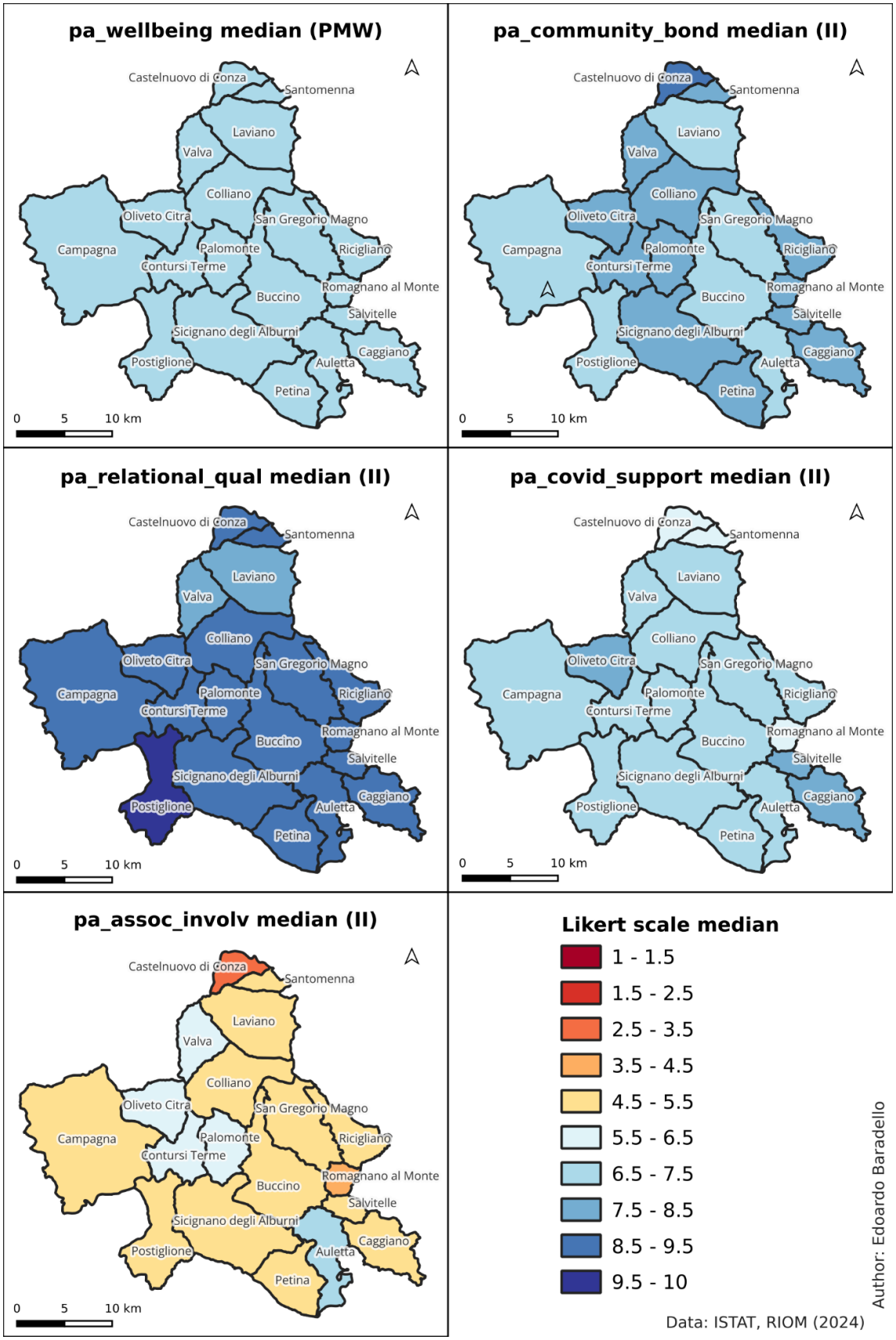
Variable	Chi_Squared	DF	P_Value	Significance
pa_serenity	24.751	18	0.132	No significant differences (p ≥ 0.10)
pa_community_bond	28.690	18	0.052	Marginal significance (0.05 ≤ p < 0.10)
pa_small_env	14.122	18	0.721	No significant differences (p ≥ 0.10)
pa_relational_qual	23.974	18	0.156	No significant differences (p ≥ 0.10)
pa_covid_support	21.675	18	0.247	No significant differences (p ≥ 0.10)
pa_assoc_involv	32.922	18	0.017	Significant differences (p < 0.05)
pa_help_ease	24.096	18	0.152	No significant differences (p ≥ 0.10)
pa_financ_stability	22.520	18	0.210	No significant differences (p ≥ 0.10)
pa_conjunctural_stress	31.221	18	0.027	Significant differences (p < 0.05)
pa_jobmarket_stress	21.536	18	0.253	No significant differences (p ≥ 0.10)
pa_soc_media_trust	20.515	18	0.305	No significant differences (p ≥ 0.10)
pa_remotework_dev	33.074	18	0.016	Significant differences (p < 0.05)
pa_innov_readiness	34.923	18	0.010	Significant differences (p < 0.05)
pa_wellbeing	13.496	18	0.761	No significant differences (p ≥ 0.10)
pa_internet_use	12.128	18	0.841	No significant differences (p ≥ 0.10)
ia_financial_serv	23.161	18	0.184	No significant differences (p ≥ 0.10)
ia_consult_serv	30.780	18	0.031	Significant differences (p < 0.05)
ia_adv_tech_serv	30.676	18	0.031	Significant differences (p < 0.05)
ia_gov_support	36.975	18	0.005	Significant differences (p < 0.05)
ia_transport_link	26.276	18	0.094	Marginal significance (0.05 ≤ p < 0.10)
ia_intangible_link	33.484	18	0.015	Significant differences (p < 0.05)
ia_labor_avail	18.590	18	0.417	No significant differences (p ≥ 0.10)

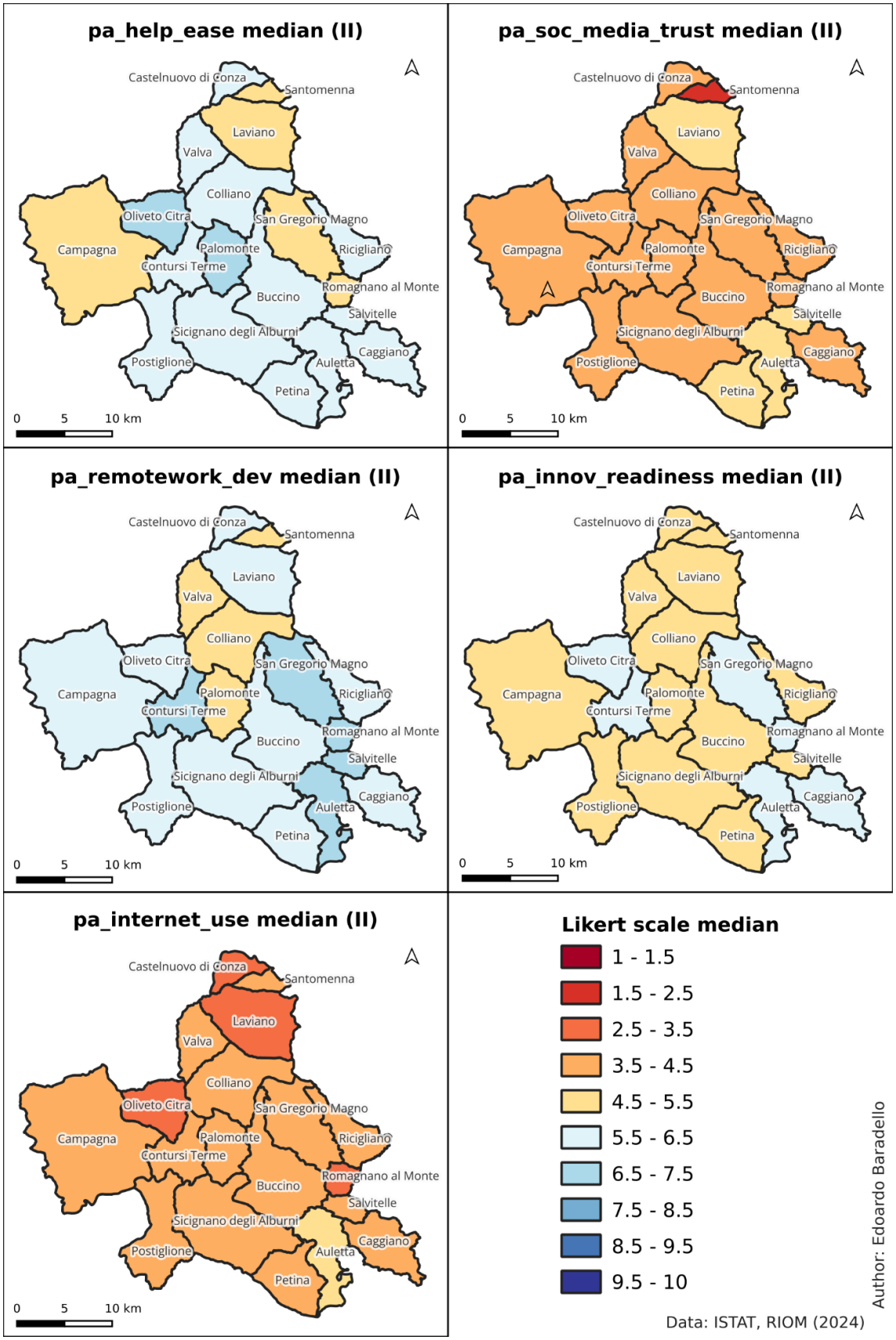
Variable	Chi_Squared	DF	P_Value	Significance
ia_local_benefit	32.931	18	0.017	Significant differences (p < 0.05)

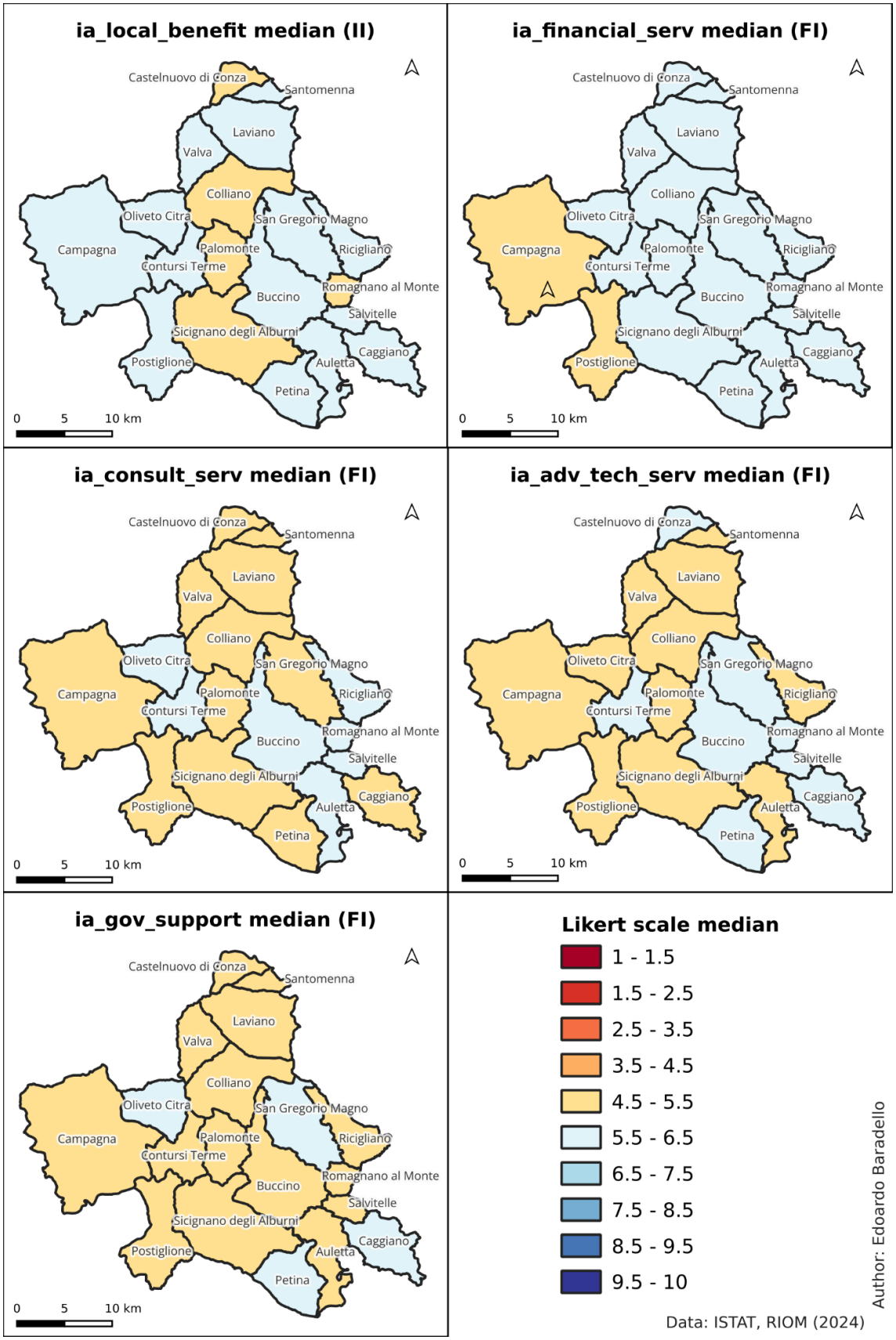
5.3.3.4. Municipal mapping

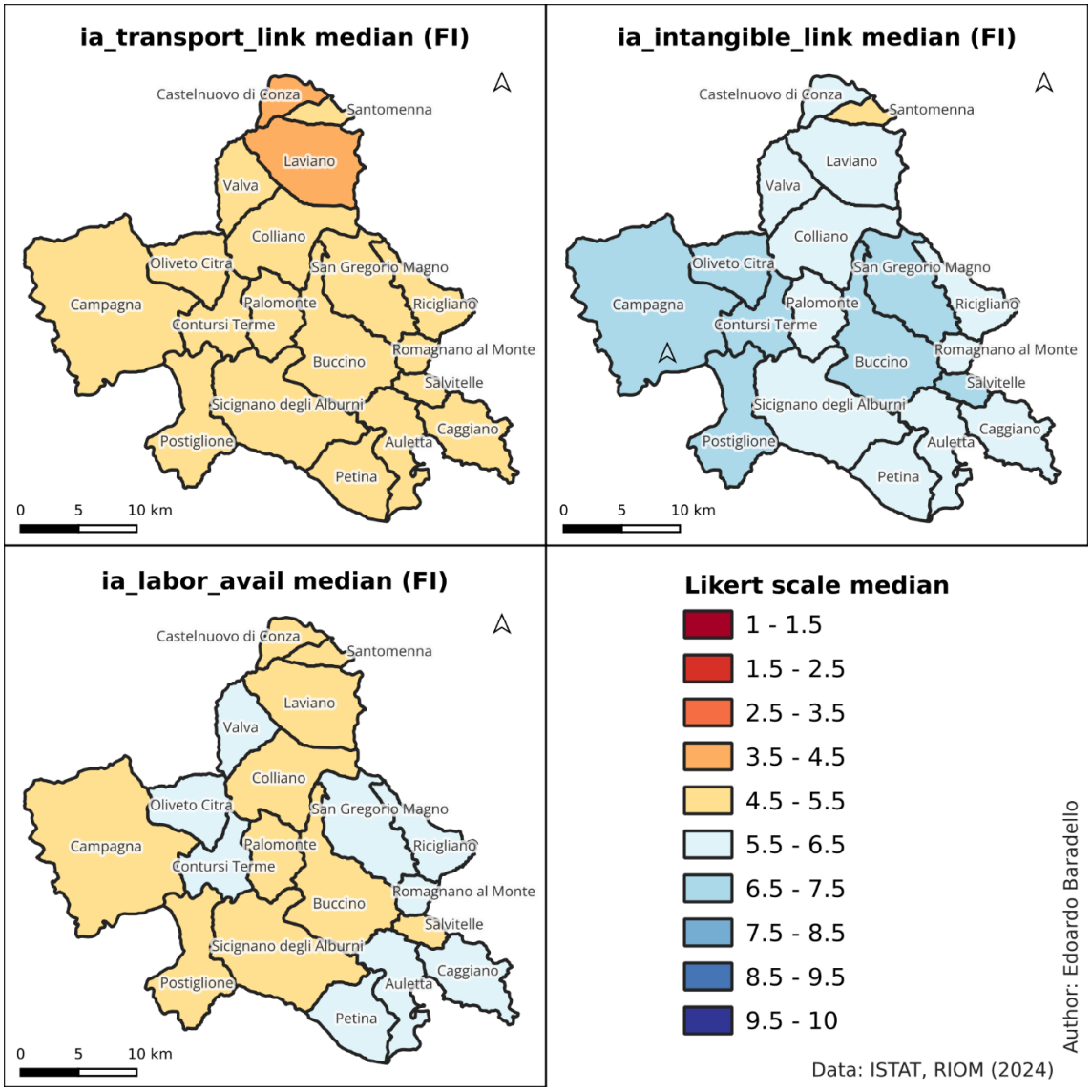
In this section choropleth maps for every municipality in the SETA area are displayed with regard to assessment variables. Each map shades municipalities by their median value—a measure of central tendency that curbs the influence of outliers. As described in the statistical approach adopted, only colour differences that correspond to at least one significant Dunn's Post Hoc (DPH) pairwise comparison should be treated as statistically significant. Other variations are purely descriptive and might be determined by random variations.


pa_serenity median (PMW)
pa_small_env median (PMW)
pa_financ_stability median (PMW)
pa_conjunctural_stress median (PMW)
pa_jobmarket_stress median (PMW)
Castelnuovo di Conza
Santomenna
Laviano
Valva
Colliano
Oliveto Citra
San Gregorio Magno
Campagna
Palomonte
Ricigliano
Contursi Terme
Romagnano al Monte
Buccino
Salvitelle
Sicignano degli Alburni
Caggiano
Postiglione
Auletta
Petina
0 5 10 km
Likert scale median
1 - 1.5
1.5 - 2.5
2.5 - 3.5
3.5 - 4.5
4.5 - 5.5
5.5 - 6.5
6.5 - 7.5
7.5 - 8.5
8.5 - 9.5
9.5 - 10
Author: Edoardo Baradello
Data: ISTAT, RIOM (2024)


pa_wellbeing median (PMW)
pa_community_bond median (II)
pa_relational_qual median (II)
pa_covid_support median (II)
pa_assoc_involv median (II)
Likert scale median
1 - 1.5
1.5 - 2.5
2.5 - 3.5
3.5 - 4.5
4.5 - 5.5
5.5 - 6.5
6.5 - 7.5
7.5 - 8.5
8.5 - 9.5
9.5 - 10
Castelnuovo di Conza
Santomenna
Laviano
Valva
Colliano
Oliveto Citra
San Gregorio Magno
Campagna
Palomonte
Ricigliano
Contursi Terme
Romagnano al Monte
Buccino
Salvitelle
Sicignano degli Alburni
Caggiano
Postiglione
Auletta
Petina
0 5 10 km
Author: Edoardo Baradello
Data: ISTAT, RIOM (2024)


pa_help_ease median (II)
pa_soc_media_trust median (II)
pa_remotework_dev median (II)
pa_innov_readiness median (II)
pa_internet_use median (II)
Castelnuovo di Conza
Santomenna
Laviano
Valva
Colliano
Oliveto Citra
San Gregorio Magno
Campagna
Palomonte
Ricigliano
Contursi Terme
Romagnano al Monte
Buccino
Salvitelle
Sicignano degli Alburni
Caggiano
Postiglione
Auletta
Petina
0 5 10 km
Likert scale median
1 - 1.5
1.5 - 2.5
2.5 - 3.5
3.5 - 4.5
4.5 - 5.5
5.5 - 6.5
6.5 - 7.5
7.5 - 8.5
8.5 - 9.5
9.5 - 10
Data: ISTAT, RIOM (2024)
Author: Edoardo Baradello


ia_local_benefit median (II)
ia_financial_serv median (FI)
ia_consult_serv median (FI)
ia_adv_tech_serv median (FI)
ia_gov_support median (FI)
Castelnuovo di Conza
Santomenna
Laviano
Valva
Colliano
Oliveto Citra
San Gregorio Magno
Campagna
Palomonte
Ricigliano
Contursi Terme
Romagnano al Monte
Buccino
Salvitelle
Sicignano degli Alburni
Caggiano
Postiglione
Auletta
Petina
0 5 10 km
Likert scale median
1 - 1.5
1.5 - 2.5
2.5 - 3.5
3.5 - 4.5
4.5 - 5.5
5.5 - 6.5
6.5 - 7.5
7.5 - 8.5
8.5 - 9.5
9.5 - 10
Author: Edoardo Baradello
Data: ISTAT, RIOM (2024)



5.4.Multivariate analysis

Before moving to multivariate statistics, correlation among assessment variables was studied taking the assessment variables with listwise deletion of null values. The analysis of the matrix of Spearman's rank correlation coefficients (nonparametric) revealed key relationships among variables related to personal and innovation ecosystem assessments.

Across the matrix (Figure 22), negative correlations were almost absent (within $|r| < 0.1$), while negligible ($|r| < 0.1$), weak ($0.1 \leq |r| < 0.3$), and moderate ($0.3 \leq |r| < 0.5$) positive correlations were dominant. Overall, a consistently moderate positive correlation was observed among all variables related to formal institutions (FI). Furthermore, moderate positive correlations were observed within thematic “clusters”, such as variables representing informal support (II) (e.g., community bond, help request ease and perceived innovation readiness) and

certain variables representing wellbeing (PMW) (e.g. serenity and overall wellbeing). These thematic correlations suggest the possible presence of consistent underlying patterns at least for FI and II. Furthermore, weak and moderate positive correlations are observed between FI and II, indicating their limited positive linear association, whereas overall weaker correlations between FI and II with PMW reflect a lower association with PMW.

Besides, it should be noted that internet use (II) and conjunctural and job market stress (PMW) present an overall negligible correlation with all assessment variables, suggesting the absence of a linear relationship.

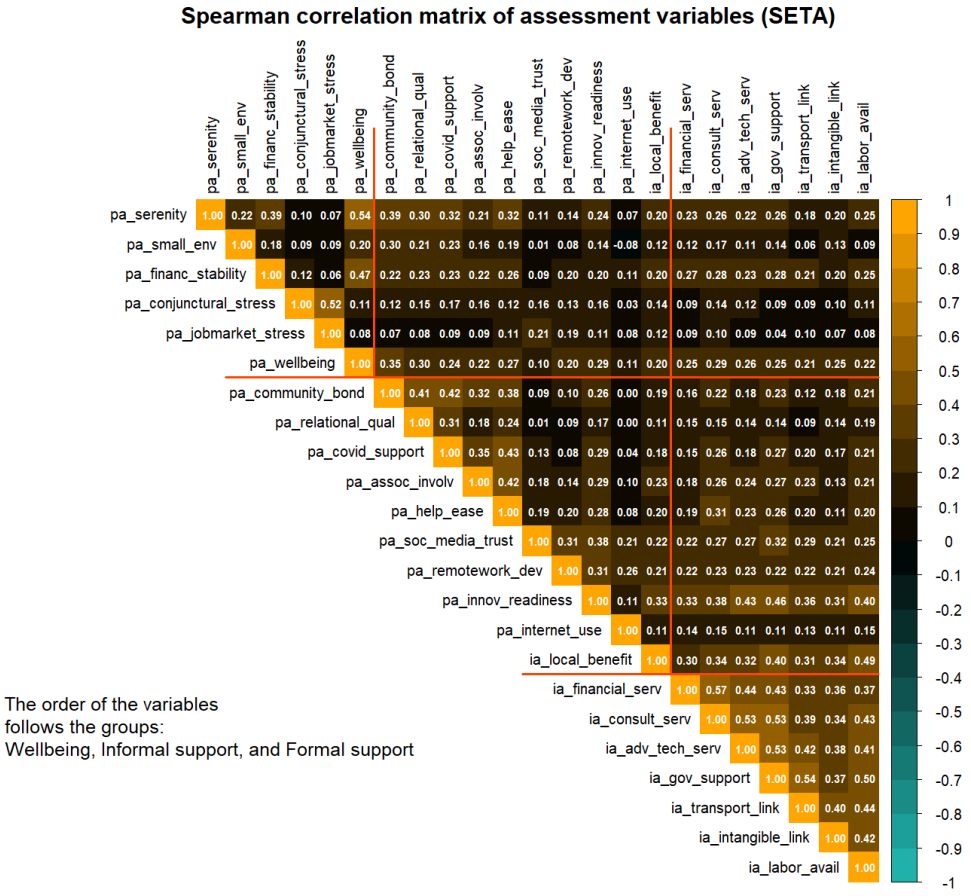


Figure 22: Spearman correlation matrix of assessment variables for SETA area.

Given the analysed correlation matrix and the high dimensionality of the data matrix available (1237 x 82 for SETA area), the PCoA and clustering analysis were conducted with a large subset (31 variables, Table 7) and a small subset (14 variables, Table 8). In the latter, only a core group of assessment variables were maintained attempting to obtain lower absolute

correlation among them in order to partially exclude the noise produced by similar measurements.

5.4.1. Large subset (31 variables)

The PCoA analysis of the large subset reveals that there is no single dominant axis that explains a large portion of the variance in the SETA area, which is spread across many dimensions (Figure 7). Given the use of Gower distances on a mixture of demographic, Likert-item, and categorical data, the variation in the data is quite multidimensional, with the first two principal axis explaining only 7% of the total variance. Furthermore, the curve of cumulative variance explained, in Figure 7, ascends gradually suggesting that adding a moderate number of dimensions may still miss relevant nuances in the data.

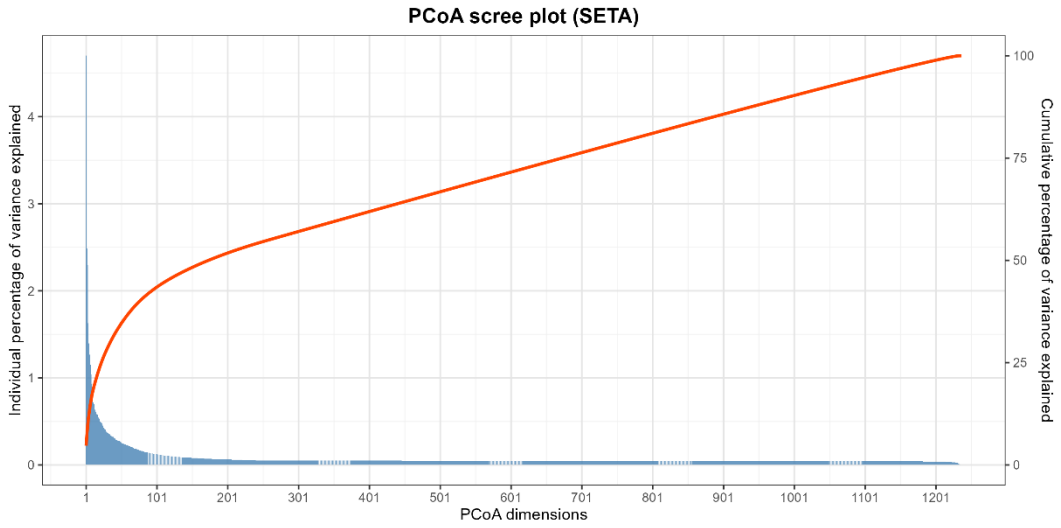


Figure 23: PCoA scree plot of the large subset for SETA area.

Given that the first two coordinates alone explain a small fraction of total Gower variation, their 2D plotting may not reveal specific structure, which might be absent or hidden in higher dimensions. When colour-coding innovation readiness in the PCoA space of the first two axes according to their Likert score (Figure 8), this perception is not found to be a dominant driver, with a slight grouping of higher (right-side) vs lower (left-side) readiness individuals. Repeating this exercise for gender (Figure 9), PCoA does not show a strong separation purely by gender but a slight concentration of men in the upper-side and women in the lower-side.

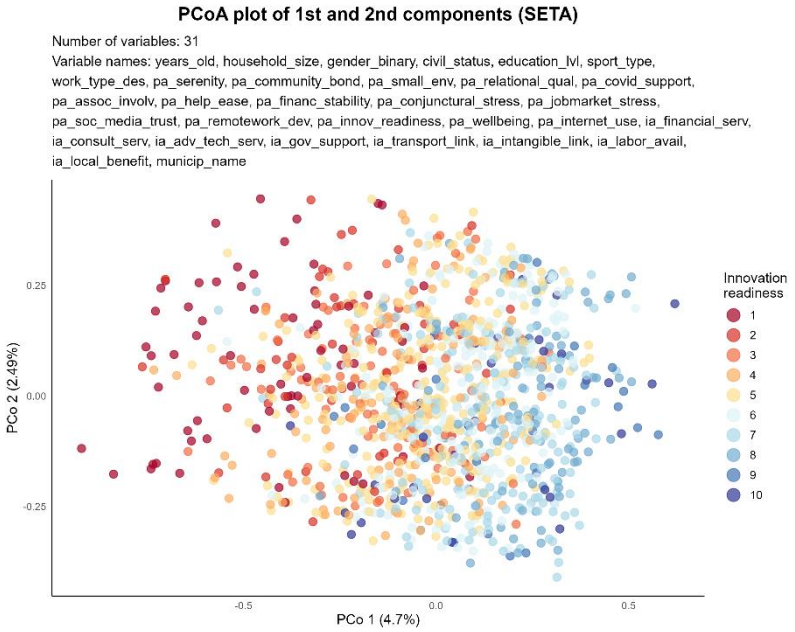


Figure 24: PCoA plot of 1st and 2nd axes of the large subset for SETA area colour-coded by innovation readiness.

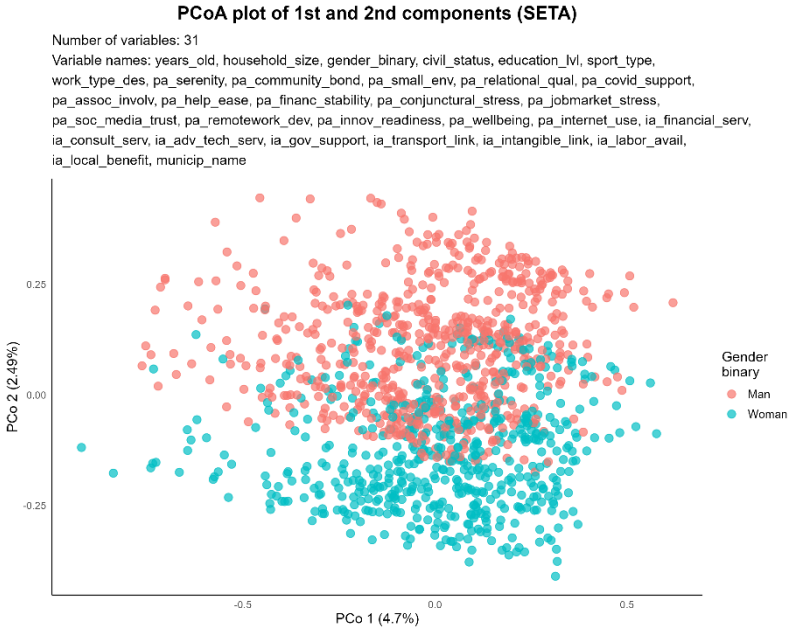


Figure 25: PCoA plot of 1st and 2nd axes of the large subset for SETA area colour-coded by gender.

Additionally, when computing the silhouette scores for the Gower matrix between 2 and 20 clusters (Figure 10), a peak is found at $k = 2$ with a ASW of only 0.09. Hence, data are not forming tight or well-defined clusters. The two-cluster solution derived from hierarchical clustering with Gower distances is weak and reveals two clusters that are not sharply defined

(Figure 11). Overall, the analysis indicates a rather spread distribution of responses across multiple dimensions, highlighting that, for SETA area, meaningful segmentations will likely remain subtle.

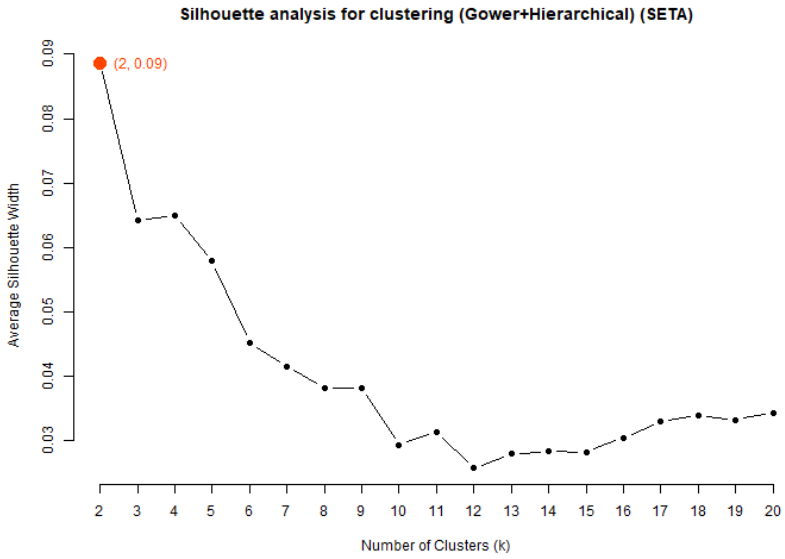


Figure 26: Silhouette analysis for clustering of the large subset for SETA area.

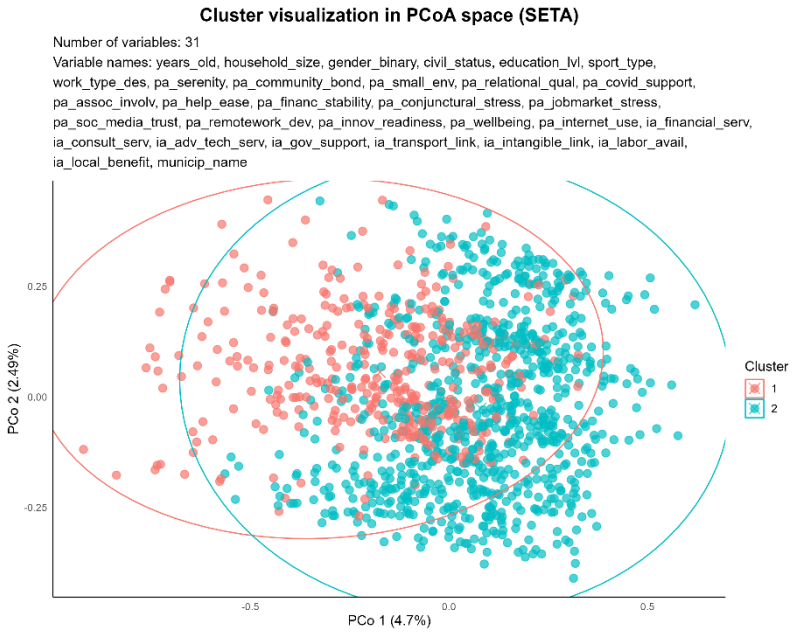


Figure 27: Cluster visualisation in PCoA space of the large subset for SETA area.

5.4.2. Small subset (14 variables)

When carrying the same analysis with the reduced subset of variables, the first two components still explain a small slice of overall variability, approximately 7%, confirming that a substantial part of variation lies in higher dimensions (Figure 12). Silhouette values are somewhat higher

but still very low to define strong clusters (Figure 15). The 11 clusters that maximise ASW at 0.15 overlap and do not clearly divide the plot in separated areas (Figure 16). The low explained variance and the weak clustering suggest that data do not naturally segment.

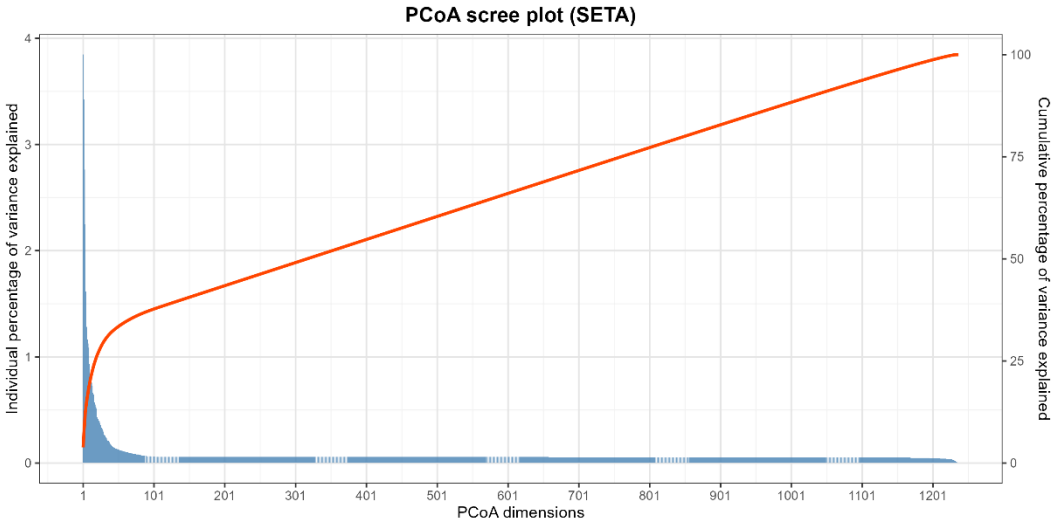


Figure 28: PCoA scree plot of the small subset for SETA area.

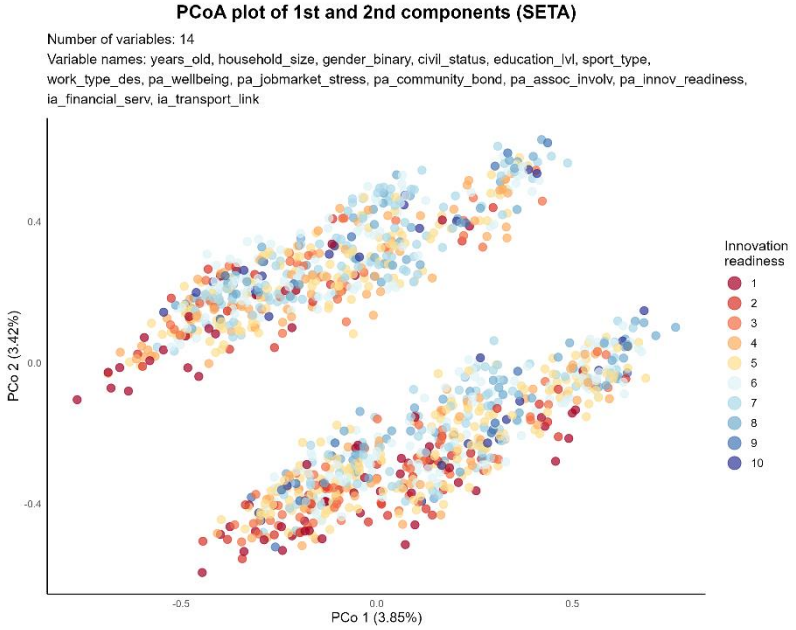


Figure 29: PCoA plot of 1st and 2nd axes of the small subset for SETA area colour-coded by innovation readiness.

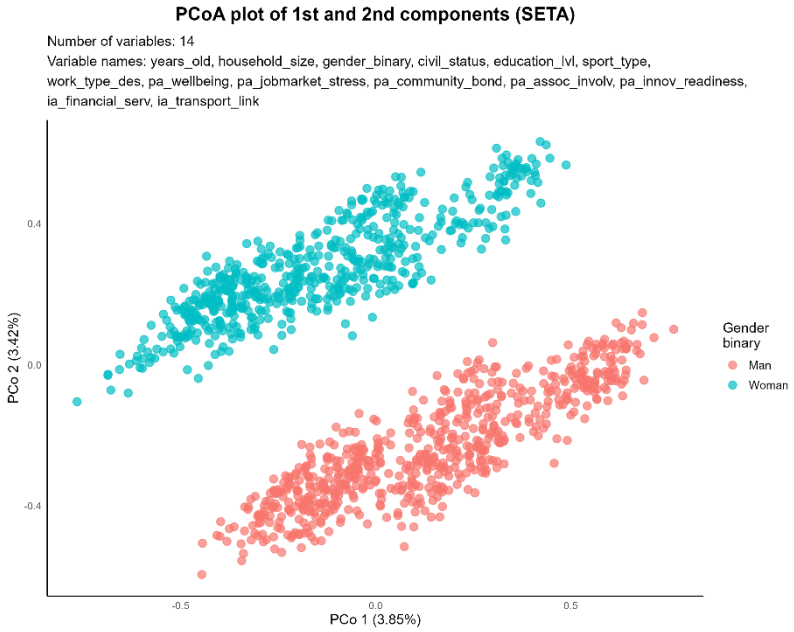


Figure 30: PCoA plot of 1st and 2nd axes of the small subset for SETA area colour-coded by gender.

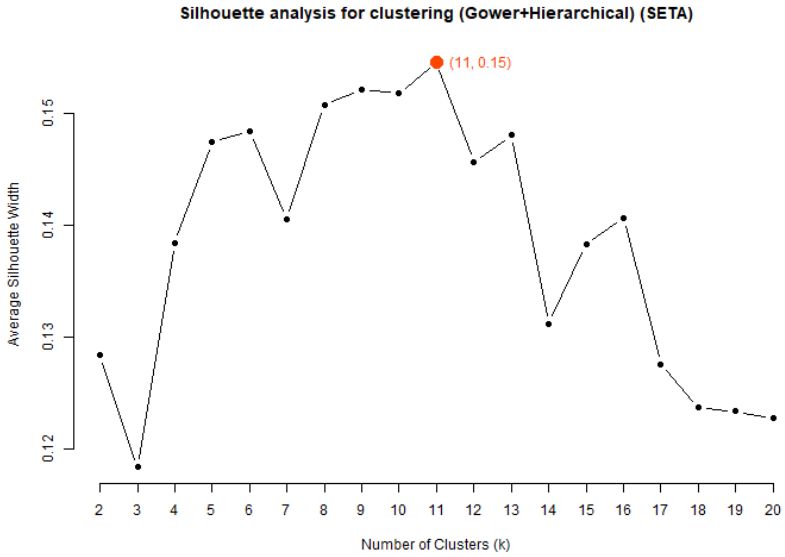


Figure 31: Silhouette analysis for clustering of the small subset for SETA area.

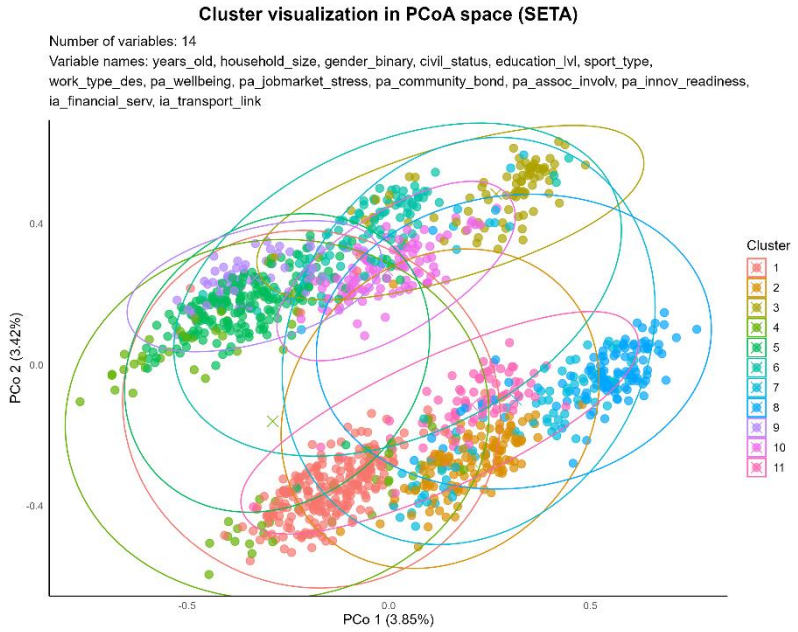


Figure 32: Cluster visualisation in PCoA space of the small subset for SETA area.

6. Discussion

This section interprets the findings for the SETA area through the three-pillar lens adopted—psychological and material well-being (PMW), informal institutions (II) and formal institutions (FI)—and then reflects on multivariate evidence, limitations and future work.

Inner areas of Sele-Tanagro are marked by the coexistence of positive reported wellbeing, strong relational capital, low digital culture, and patchy formal infrastructures. High community bonds, relational quality and subjective wellbeing accompany weaknesses in physical connection infrastructures, internet use, and, more lightly, in government support and advanced technological services. The whole dataset remains highly dimensional, resisting simple segmentation.

Concerning personal and material well-being (PMW), data mostly concentrates towards the positive end of the Likert scale with a median of 7 or above for all variables. PMW has overall a weak positive correlation with almost all other assessment variables and a large number of significant differences by socio-demographic groups and, few, by municipality groups, indicating a strong association between respondents social positioning and how they perceive their own resources and environment.

For instance, elements of an age divide suggest that younger respondents have better subjective wellbeing, financial stability, and value less small living environments compared to older generations. Additionally, women perceive more intensely the burden of exogenous psychological stressors and report slightly lower life serenity. The household size too provides evidence that larger ones (five-persons) report better subjective wellbeing. Higher educational attainments and sport practice were independently associated to better material and overall wellbeing. In accordance to expectations, more stable work statuses were associated with better financial stability. A particular case was the one of respondents classified with 'Other non-professional status' which reported higher scores across PMW variables. Lastly, despite its limited meaning, an association linking municipalities with one registered start-up with better life serenity suggests that a certain degree of psychological wellbeing could be part of a conductive environment for innovation.

The analysis of the support provided by informal institutions (II) depicts strong relational assets contextualised in a more contained civic participation and innovation culture, and a weak penetration of digital technologies. Very strong community bonds and relational links, as well as sound grassroots mutual aid culture, trust in remote working, and consumer ethical awareness in the SETA area determine a high level of social cohesion, laying the foundations of what can be considered a web supportive informal institutions for entrepreneurial and innovation ecosystems (Beinhocker, 2007; Igwe et al., 2020). Conversely, the overall slightly negative involvement in associations and low perceived innovation readiness can be seen as supporting mechanisms that are inactive, if not partially contrasting mechanisms. The consistently low reliance on internet technologies and lacking trust in social media of SETA area suggest an heavy barrier to the development of a vast majority of contemporary innovative goods and services, whose design, production, marketing or distribution are likely to be strongly associated with digital technologies (DG GROW et al., 2015). Overall, informal institutions have a weak or moderate positive correlation within the group and towards the rest of the assessment variables, with the exception of digital skills related variables which have negligible or very weak positive correlations with all variables.

In particular, findings depicts a strong age divide with increasing age corresponding to lowering reliance on internet, trust in social media, trust in the benefits of remote working, and perceived consumer ethical awareness. Notably, internet use significantly changes from a median of 7 for younger generations to one of 1 for older ones, testifying the extremely low reliance on digital technologies of a large segment of the population. Men showed marginally

higher community bond, involvement in associations, and use of internet, while women reported marginally higher trust in social media, remote working benefits, innovation readiness, and consumer ethical awareness. Additionally, smaller households reported lower trust in social media and internet, in line with the findings on the age divide and common family structures in SETA areas.

Moreover, A clear educational trend was identifiable linking growing educational attainments with better relational and digital informal institutions: association involvement, help request ease, trust in social media, ethical consumer behaviour, benefits of remote work, and reliance on internet. A clear association of practicing an individual or team sport and higher reported informal institutional support or involvement in informal institutions is evident from findings across almost all variables. Lastly, evidence suggests that better employment conditions (permanent employees and self-employed) are associated to stronger community bonds, community support culture, and association involvement compared to more unstable or unpaid conditions. Besides, respondents that are not working or belonging to an unpaid labour force or population segment reported low internet usage.

Several significant differences related to informal institutions are found among the 19 municipalities of SETA area or among municipality-based statistical groups, even though the Bonferroni correction leads to few significant DPH pairs. A relevant pattern of significant differences involving Castelnuovo di Conza (lower scores), Auletta and Oliveto Citra (higher scores) allows to observe that in line with expectations, Oliveto Citra has both overall significantly higher levels of involvement in associations and one registered innovative start-up. Even if not statistical significant, also Palomonte (2 registered innovative start-ups) reports levels of association involvement comparable to Oliveto Citra, while Campagna (2 registered innovative start-ups) does not, but as mentioned above, it could be considered an outlier in terms of its size.

Moving to formal institutions (FI) support, median scores cluster in the 5–6 range, signalling average but uninspiring formal support. Slightly positive financial services, intangible connection links and available labour force provide some structural minimal needs conductive to increased entrepreneurial (digital) initiatives: monetary capital management, digital telecommunication infrastructure and labour capital (Audretsch & Belitski, 2017). Nevertheless, the moderately positive perception of the suitability of local labour force for digital innovation jobs is likely to be partially limited by the negative findings on respondents

low reliance on digital technologies. Moreover, moderately negative consultancy services, advanced technological service, public institutional support and more markedly negative transport infrastructures define a set of formal institutions whose present state is unsupportive of flourishing entrepreneurial innovation ecosystems and thus constitute a barrier. Thus, a significant space for—traditionally public—investment opens in relation to transport, public support programmes and advanced research.

An age gap pattern highlights that younger respondents perceive a higher quality of several formal institutions, including financial and consultancy services, public support, intangible connection services, and labour force. This can be interpreted as either a major involvement or awareness of younger generations in such domains or an overall more positive attitude of the same. A similar positive asymmetry is also registered for women perceptions on all the aforementioned variables and on transport infrastructures. Additionally, increasing education attainments are associated with better quality of all aforementioned variables, with the exclusion of intangible link for which no significant change is registered. Overall, practicing a sport was associated with marginally higher quality of all formal institutions in the study. Concerning employment statuses, more stable conditions (e.g. permanent, fixed-term) are associated with a marginally higher perception of various formal institutions, and respondents classified with other non-professional status have higher scores across variables.

Few significant differences are identified by municipality concerning consultancy and public support. A limitedly useful information is the association of municipalities with one registered start-up (only Oliveto Citra) with higher quality of public support. Yet, it should be noted that municipalities with two start-ups (only Campagna and Palomonte) have overall lower scores compared to the former. A possible explanation of such counterintuitive finding could be partially related to the fact that Campagna and Palomonte have highest population density of the group of municipalities and Campagna represents an outlier in terms of geographic and demographic size, aspects that transform public support needs which may become more difficult to meet.

Compared to other studies, this report focuses on a local-scale detailed analysis of the specific geographic area of Sele-Tanagro, a peripheric inner area of a high income country. This geographical framework cut allows to contextually understand the interplay of institutional and wellbeing factors identified by the literature, provides evidence for transnational comparative analysis, and proves that an integrative institutional theory of innovation ecosystems is

complex and needs nuanced analytical approaches which anyhow tend to resist generalisation. Namely, the Principal Coordinates Analysis (PCoA) connotes the dataset as highly dimensional, with the first two components explaining only approximately 7% of the total variance, revealing no strong clustering patterns or natural segmentation.

However, a number of limitations are identified, starting with the reduced sample size of 1237 individuals due to missing data on three variables of interest. The lacking information could affect the generalisability of the results and may require further testing to determine if the missing data are missing completely at random (MCAR). Moreover, unlike expectations derived from pilot analysis, the study did not find a large number of significant differences (DPH) between municipalities except for association involvement, consultancy services and government support, suggesting a level of geographical 'homogeneity' in SETA area that requires further exploration.

This report aimed to understand how formal and informal institutions can positively affect digitisation-based service ecosystems and their entrepreneurial networks in the inner areas of the Province of Salerno. The study highlighted the significant role of varying levels of both formal and informal institutional support in constituting unsupportive, uninspiring, enabling, or supportive forces, as well as their interdependencies, as drivers of entrepreneurship and innovation. It also emphasises the importance of considering the psychological and material well-being of individuals when assessing their potential for contribution to digital innovation ecosystems. This analysis demonstrates the need to consider multiple factors and their complex interactions in order to address innovation ecosystems, opening several avenues for future exploration. Further analysis is needed to test the assumption of missing data, as well as to study possible nonlinear relationships linking variables with lower correlations to other assessment variables, such as internet use, conjunctural stress and job-market stress. Additionally, more detailed investigations into the geographical homogeneity of SETA, with comparative analyses between the three RIOM areas, are required to confirm the findings, to explore regional and local effects, and identify more meaningful segmentations and clustering. Lastly, further research is suggested to couple the available subjective data with more objective proxy measures of innovation readiness, entrepreneurial capacities, and digital ecosystems in the area, as only five innovative start-ups and no SMEs or incubators were identified in the municipalities of interest for SETA.

7. Conclusion

This report has examined the institutional economy affecting the development of digitisation-based service ecosystems and entrepreneurial networks in the Sele-Tanagro (SETA) area. By leveraging the RIOM survey data and conducting a comprehensive descriptive and inferential analysis, the study revealed the area's strong social cohesion, moderate levels of formal institutional support, and a marked digital divide. While informal support systems, such as community bonds and relational quality, showed strong positive trends, formal support systems like transport infrastructure and, moderately, consultancy services, advanced technological services, and public support demonstrated weaknesses. The multivariate analysis further confirmed the multidimensionality of institutional dynamics, highlighting the limited explanatory power of linear dimensions and suggesting a multifaceted ecosystem where psychological and material well-being factors intertwine with perceptions of institutional adequacy.

This study highlights that the highly dimensional integration of formal and informal institutions creates contrasting drivers that promote and contract innovation, while also developing the role of wellbeing in differentiating the perceptions of the respondents. Future research should build on these findings to investigate missing data, explore potential non-linear and interaction effects among variables, and regional differences. Additionally, it is suggested to identify alternative objective measures of innovation readiness, given the very poor presence of innovative start-ups and apparent lack of innovative SMEs and incubators in the area. A comparative analysis between SETA and other RIOM areas could shed light on local specificities and reveal broader patterns of institutional influence on entrepreneurial ecosystems. Strengthening transport and digital infrastructures, fostering trust in technological innovation, developing digital skills across generations, and amplifying the positive effects of community engagement appears to be central to build comprehensive strategies for nurturing sustainable, inclusive digitisation-based ecosystems in the inner areas of Southern Italy.

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Annexes

Annex A: Questionnaire

Individual socio-demographic characteristics

This section includes questions about demographic data, household composition, education, employment status, and lifestyle.

- Identifier
- Municipality code
- Could you please indicate the year of birth, just the year?
- Age
- Gender
- Could you please indicate the number of household members (including yourself)?
- Marital status
- Could you please indicate your educational qualification?
- Could you please indicate the type of secondary school where you obtained your diploma?
- Please specify
- Do you have a university degree?
- Could you please indicate if you practice any sport?
- Could you please indicate if you work? (categories)
- Could you please indicate if you work? (macro-categories)
- Do you work in the public or private sector?
- Could you please indicate the sector?
- Please specify
- Could you please indicate where you expect to find work?

Personal assessment

This section evaluates personal life satisfaction, community integration, and challenges affecting individual well-being. Values are encoded using a Likert scale ranging from 1 to 10, where 1 indicates ‘not at all’, ‘never’, or ‘very rarely’, and 10 represents ‘always’, ‘very often’, or ‘very much’.

- Overall, how serene would you define your life?
- How deep do you feel the bond with the community where you live?
- How important do you consider living in a not-too-large environment for the quality of life?
- How would you define the quality of your relationships with people in your environments (family, relatives, friends)?
- During the COVID-19 pandemic, to what extent did the community you live in help you cope with the emergency?
- How involved do you consider yourself in associations operating in the area?
- If you need help, do you easily ask others in the community where you live?

- How easily does your family make ends meet financially?
- How much does the particular moment we are living in (post-pandemic, eco-anxiety, wars) weigh on your serenity?
- How much does the difficult job market situation weigh on you?
- How reliable do you consider the information circulating on social media?
- After reflecting carefully, how strong do you now consider your personal level of well-being?

Innovation ecosystem assessment

This section addresses perceptions of local development, innovation readiness, and adequacy of services and infrastructure. Values are encoded using a Likert scale ranging from 1 to 10, where 1 indicates ‘not at all’, ‘never’, or ‘very rarely’, and 10 represents ‘always’, ‘very often’, or ‘very much’.

- How much do you think the spread of remote working can support the development of your community?
- In your opinion, how ready is the local entrepreneurial and institutional fabric to meet the challenges of innovation (digital, technological, organizational, etc.)?
- How much time do you use the Internet daily (websites, social media, etc.) for study, work, information, or other needs?
- How good and adequate do you consider financial services to be (e.g., access to credit)?
- How good and adequate do you consider consulting and/or support services to be (e.g., business incubators)?
- How good and adequate do you consider advanced technological services to be (e.g., contacts with research centres, innovation ecosystems, technology parks, etc.)?
- How good and adequate do you consider support services from public institutions to be (e.g., Municipality, Chamber of Commerce, etc.)?
- How good and adequate do you consider material connection services to be (e.g., roads, railways, airports, etc.)?
- How good and adequate do you consider intangible services to be (e.g., broadband)?
- How good and adequate do you consider availability of suitable labour to be?
- How good and adequate do you consider possible advantages of local/healthy production for reaching sensitive consumers to be?

Annex B: Univariate statistics

Summary statistics

Table 33: Table of the summary statistics for all quantitative variables. Likert variables are included, yet they should be interpreted as ordinal variables. Their presence in this table is motivated by their use in pilot analysis before the computation of the actual relevant statistics (Allen & Seaman, 2007). Mean, Variance, SD, Skewness, and Kurtosis are reported but should be interpreted cautiously for ordinal data due to the absence of interval-level assumptions for such data. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are excluded from calculations.

S.	Variable	Count	Missing	Mean	Median	Mode	Variance	Std_Dev	Min	Max	Range	IQR	MAD	Skewness	Kurtosis	Q1	Q3
SD	birth_year	303	0	1970.7	1969	1964	341	18.5	1925	2005	80	30.5	20.8	0.1	2	1956	1986.5
	years_old	303	0	52.3	54	59	341	18.5	18	98	80	30.5	20.8	-0.1	2	36.5	67
	household_size	303	0	2.8	3	2	1.7	1.3	1	7	6	2	1.5	0.4	2.8	2	4
PA	pa_serenity	303	0	7.1	7	8	4.9	2.2	1	10	9	2	1.5	-1	3.8	6	8
	pa_community_bond	303	0	7.7	8	10	5.2	2.3	1	10	9	3	1.5	-1.2	4.1	7	10
	pa_small_env	303	0	7.8	8	8	3.8	2	1	10	9	2	1.5	-1.1	4.3	7	9
	pa_relational_qual	303	0	8.9	9	10	2.1	1.5	1	10	9	2	1.5	-2.4	11.4	8	10
	pa_covid_support	303	0	6.8	7	8	7.2	2.7	1	10	9	4	3	-0.8	2.8	5	9
	pa_assoc_involv	303	0	5.3	5	5	8.6	2.9	1	10	9	5	4.4	-0.1	1.9	2.5	7.5
	pa_help_ease	303	0	6	6	8	8	2.8	1	10	9	4	3	-0.4	2.1	4	8
	pa_financ_stability	303	0	6.9	7	8	5.7	2.4	1	10	9	2	1.5	-0.8	3.1	6	8
	pa_conjunctural_stress	303	0	6.5	7	7	5.9	2.4	1	10	9	3	3	-0.6	2.8	5	8
	pa_jobmarket_stress	303	0	6.4	7	10	8.7	3	1	10	9	4	3	-0.5	2	5	9
	pa_soc_media_trust	303	0	4.2	4	5	5.3	2.3	1	10	9	4	3	0.2	2.3	2	6
	pa_remotework_dev	288	15	5.9	6	8	7	2.6	1	10	9	4	3	-0.3	2.2	4	8
	pa_innov_readiness	285	18	5.3	5	5	5.1	2.3	1	10	9	3	3	-0.2	2.6	4	7
	pa_wellbeing	303	0	7.2	7	8	4	2	1	10	9	2	1.5	-0.9	4.1	6	8
	pa_internet_use	303	0	4	3	2	6.2	2.5	1	9	8	4	1.5	0.7	2.3	2	6

S.	Variable	Count	Missing	Mean	Median	Mode	Variance	Std_Dev	Min	Max	Range	IQR	MAD	Skewness	Kurtosis	Q1	Q3
IA	ia_financial_serv	303	0	5.5	6	6	6.8	2.6	1	10	9	3	3	-0.2	2.2	4	7
	ia_consult_serv	303	0	5.4	6	5	5.2	2.3	1	10	9	3	1.5	-0.3	2.6	4	7
	ia_adv_tech_serv	274	29	4.9	5	5	6.2	2.5	1	10	9	4	3	0	2.2	3	7
	ia_gov_support	303	0	5.1	5	5	6.3	2.5	1	10	9	3	3	-0.1	2.2	4	7
	ia_transport_link	303	0	3.2	3	1	5.2	2.3	1	10	9	4	3	0.8	2.7	1	5
	ia_intangible_link	303	0	6.1	6	7	5.9	2.4	1	10	9	3	3	-0.3	2.5	5	8
	ia_labor_avail	303	0	4.9	5	5	4.7	2.2	1	10	9	3	1.5	-0.2	2.5	3	6
	ia_local_benefit	303	0	5.6	6	6	5.3	2.3	1	10	9	3	1.5	-0.3	2.6	4	7
MU	municip_code	303	0	77015.7	77019	77027	116	10.8	77001	77027	26	22	11.9	-0.1	1.3	77005	77027
	shape_length_2024_m	303	0	56331.8	48980.4	87906.9	5209306 18.8	22823.9	21190.5	87906.9	66716.4	54643.5	23302	0.3	1.8	33263.4	87906.9
	area_shp_2024_m2	303	0	1099626 16.4	903667 00.3	2111428 49.7	5.00399E +15	707389 01.5	149042 30.8	2111428 49.7	1962386 18.9	1762172 70.7	821970 06.6	0.5	1.7	349255 78.9	2111428 49.7
	area_shp_2024_ha	303	0	10996.3	9036.7	21114.3	5003992 1.9	7073.9	1490.4	21114.3	19623.9	17621.7	8219.7	0.5	1.7	3492.6	21114.3
	surface_2024_ha	303	0	10990.2	9065.7	21096	4993389 3.4	7066.4	1501.5	21096	19594.5	17618	8284.3	0.5	1.7	3478	21096
	surface_2024_km2	303	0	109.9	90.7	211	4993.4	70.7	15	211	195.9	176.2	82.8	0.5	1.7	34.8	211
	min_elev	303	0	187.5	124	69	16165.5	127.1	49	419	370	236	81.5	0.4	1.6	69	305
	max_elev	303	0	1009	1112	1112	56886.6	238.5	405	1300	895	263	47.4	-1.2	3.9	849	1112
	elev_range	303	0	821.5	775	1043	41974.5	204.9	356	1043	687	345	296.5	-0.6	2.7	698	1043
	elev_mean	303	0	500.7	398.9	398.9	38427.5	196	174.9	782.8	607.9	345.7	83.8	0.2	1.7	360.9	706.6
	elev_median	303	0	483.3	355	355	44170.1	210.2	175	792	617	370	86	0.3	1.5	345	715
	elev_std	303	0	166.4	169.4	203	1963.9	44.3	59	210.8	151.8	73.4	49.8	-1	3.3	129.7	203
	elev_center	303	0	715.7	770	909	29743.8	172.5	391	909	518	363	206.1	-0.4	1.8	546	909
	legal_pop_2021	303	0	1800.6	1287	3667	1634955	1278.7	290	3667	3377	2797	618.2	0.6	1.7	870	3667
	res_pop_2022	303	0	1764.5	1267	3586	1560945. 7	1249.4	285	3586	3301	2724	600.5	0.6	1.7	862	3586
	res_pop_2024	303	0	1725.9	1224	3513	1502046. 3	1225.6	275	3513	3238	2663	554.5	0.6	1.7	850	3513
	pop_density_2024_km2	303	0	16	16.7	16.7	22.5	4.7	7.7	24.4	16.8	3.5	3.8	0.1	2.7	14.1	17.6

Frequencies

Table 34: Table of frequencies for all categorical variables. Missing values for pa_remotework_dev, pa_innov_readiness, and ia_adv_tech_serv are included in the calculations, hence percentages for these variables change when compared to those in the Results section.

Section	Variable	Category	Count	Percentage
SD	years_old_bin	18–24	26	8.6%
		25–34	44	14.5%
		35–44	34	11.2%
		45–54	50	16.5%
		55–64	60	19.8%
		65–74	52	17.2%
		75–84	33	10.9%
		85–94	3	1%
		95–103	1	0.3%
	gender_binary	Man	157	51.8%
		Woman	146	48.2%
	household_size_bin	1	48	15.8%
		2	86	28.4%
		3	71	23.4%
		4	69	22.8%
		5	23	7.6%
		6–9	6	2%
	civil_status	Divorced/Separated	12	4%
		Married/Cohabitating	168	55.4%
		Single	103	34%
		Widowed	20	6.6%
	education_lvl	1 Compulsory education	84	27.7%
		2 Secondary school diploma	162	53.5%
		3 University degree	55	18.2%
		4 Doctorate, Master	2	0.7%
	sec_school_type	High School	34	11.2%
		Other	18	5.9%
		Technical School	55	18.2%
		Vocational School	55	18.2%
		NA	141	46.5%
	sec_school_name	Humanities	1	0.3%
		Teacher Training School	17	5.6%
		NA	285	94.1%
	university_type	1 Bachelor's Degree	12	4%
		2 Master's Degree	43	14.2%
		3 Doctorate, Master	2	0.7%
		None	246	81.2%
	sport_type	No	216	71.3%
		Yes, individual sports	57	18.8%

Section	Variable	Category	Count	Percentage
		Yes, team sports	30	9.9%
	work_type_des	Fixed-term employee	37	12.2%
		Not working	55	18.2%
		Occasional worker	11	3.6%
		Other non-professional status	7	2.3%
		Permanent employee	83	27.4%
		Retired	49	16.2%
		Self-employed	30	9.9%
		Unemployed	20	6.6%
		Unpaid domestic worker	11	3.6%
	work_type_group	Fixed-term employment	37	12.2%
		Not employed	142	46.9%
		Occasional work	11	3.6%
		Permanent employment	113	37.3%
	work_publ_priv	Private	88	29%
		Public	43	14.2%
		NA	172	56.8%
	work_sector	Agriculture	27	8.9%
		Commerce	14	4.6%
		Industry	24	7.9%
		Other	7	2.3%
		Services	89	29.4%
		NA	142	46.9%
	work_sector_des	Construction	4	1.3%
		Craftsmanship	2	0.7%
		Fire brigade	1	0.3%
		NA	296	97.7%
	workplace_expected	Abroad	28	9.2%
		In Central-Northern Italy	43	14.2%
		In other regions in Southern Italy and Islands	2	0.7%
		In the Region	69	22.8%
		NA	161	53.1%
PA	pa_serenity	1	13	4.3%
		2	5	1.7%
		3	7	2.3%
		4	6	2%
		5	30	9.9%
		6	34	11.2%
		7	62	20.5%
		8	72	23.8%
		9	34	11.2%
		10	40	13.2%
	pa_community_bond	1	10	3.3%
		2	7	2.3%

Section	Variable	Category	Count	Percentage
		3	2	0.7%
		4	7	2.3%
		5	24	7.9%
		6	18	5.9%
		7	39	12.9%
		8	71	23.4%
		9	42	13.9%
		10	83	27.4%
	pa_small_env	1	4	1.3%
		2	3	1%
		3	5	1.7%
		4	8	2.6%
		5	14	4.6%
		6	28	9.2%
		7	44	14.5%
		8	87	28.7%
		9	36	11.9%
		10	74	24.4%
	pa_relational_qual	1	3	1%
		4	3	1%
		5	4	1.3%
		6	6	2%
		7	11	3.6%
		8	70	23.1%
		9	65	21.5%
		10	141	46.5%
	pa_covid_support	1	28	9.2%
		2	5	1.7%
		3	10	3.3%
		4	5	1.7%
		5	39	12.9%
		6	26	8.6%
		7	39	12.9%
		8	68	22.4%
		9	32	10.6%
		10	51	16.8%
	pa_assoc_involv	1	55	18.2%
		2	21	6.9%
		3	9	3%
		4	19	6.3%
		5	56	18.5%
		6	26	8.6%
		7	41	13.5%
		8	28	9.2%

Section	Variable	Category	Count	Percentage
		9	15	5%
		10	33	10.9%
	pa_help_ease	1	38	12.5%
		2	15	5%
		3	17	5.6%
		4	10	3.3%
		5	41	13.5%
		6	34	11.2%
		7	43	14.2%
		8	44	14.5%
		9	27	8.9%
		10	34	11.2%
	pa_financ_stability	1	15	5%
		2	7	2.3%
		3	12	4%
		4	13	4.3%
		5	25	8.3%
		6	36	11.9%
		7	52	17.2%
		8	72	23.8%
		9	31	10.2%
		10	40	13.2%
	pa_conjunctural_stress	1	19	6.3%
		2	8	2.6%
		3	9	3%
		4	17	5.6%
		5	38	12.5%
		6	39	12.9%
		7	67	22.1%
		8	45	14.9%
		9	21	6.9%
		10	40	13.2%
	pa_jobmarket_stress	1	32	10.6%
		2	16	5.3%
		3	20	6.6%
		4	6	2%
		5	36	11.9%
		6	26	8.6%
		7	34	11.2%
		8	45	14.9%
		9	34	11.2%
		10	54	17.8%
	pa_soc_media_trust	1	53	17.5%
		2	37	12.2%

Section	Variable	Category	Count	Percentage
		3	28	9.2%
		4	37	12.2%
		5	63	20.8%
		6	33	10.9%
		7	30	9.9%
		8	11	3.6%
		9	6	2%
		10	5	1.7%
	pa_remotework_dev	1	27	8.9%
		2	17	5.6%
		3	14	4.6%
		4	20	6.6%
		5	43	14.2%
		6	38	12.5%
		7	37	12.2%
		8	45	14.9%
		9	22	7.3%
		10	25	8.3%
		NA	15	5%
	pa_innov_readiness	1	25	8.3%
		2	16	5.3%
		3	21	6.9%
		4	25	8.3%
		5	58	19.1%
		6	52	17.2%
		7	49	16.2%
		8	21	6.9%
		9	6	2%
		10	12	4%
		NA	18	5.9%
	pa_wellbeing	1	7	2.3%
		2	6	2%
		3	4	1.3%
		4	8	2.6%
		5	28	9.2%
		6	35	11.6%
		7	64	21.1%
		8	84	27.7%
		9	29	9.6%
		10	38	12.5%
	pa_internet_use	1	39	12.9%
		2	73	24.1%
		3	59	19.5%
		4	31	10.2%

Section	Variable	Category	Count	Percentage
		5	14	4.6%
		6	23	7.6%
		7	27	8.9%
		8	12	4%
		9	25	8.3%
IA	ia_financial_serv	1	30	9.9%
		2	26	8.6%
		3	15	5%
		4	19	6.3%
		5	50	16.5%
		6	53	17.5%
		7	38	12.5%
		8	34	11.2%
		9	13	4.3%
		10	25	8.3%
	ia_consult_serv	1	24	7.9%
		2	21	6.9%
		3	19	6.3%
		4	17	5.6%
		5	65	21.5%
		6	57	18.8%
		7	53	17.5%
		8	24	7.9%
		9	12	4%
		10	11	3.6%
	ia_adv_tech_serv	1	35	11.6%
		2	25	8.3%
		3	23	7.6%
		4	21	6.9%
		5	51	16.8%
		6	42	13.9%
		7	36	11.9%
		8	23	7.6%
		9	5	1.7%
		10	13	4.3%
		NA	29	9.6%
	ia_gov_support	1	43	14.2%
		2	18	5.9%
		3	14	4.6%
		4	33	10.9%
		5	54	17.8%
		6	44	14.5%
		7	45	14.9%
		8	27	8.9%

Section	Variable	Category	Count	Percentage
		9	13	4.3%
		10	12	4%
	ia_transport_link	1	105	34.7%
		2	42	13.9%
		3	27	8.9%
		4	41	13.5%
		5	41	13.5%
		6	10	3.3%
		7	19	6.3%
		8	14	4.6%
		9	1	0.3%
		10	3	1%
	ia_intangible_link	1	18	5.9%
		2	15	5%
		3	13	4.3%
		4	22	7.3%
		5	47	15.5%
		6	49	16.2%
		7	51	16.8%
		8	42	13.9%
		9	15	5%
		10	31	10.2%
	ia_labor_avail	1	30	9.9%
		2	21	6.9%
		3	26	8.6%
		4	29	9.6%
		5	68	22.4%
		6	58	19.1%
		7	39	12.9%
		8	22	7.3%
		9	6	2%
		10	4	1.3%
	ia_local_benefit	1	25	8.3%
		2	14	4.6%
		3	19	6.3%
		4	24	7.9%
		5	52	17.2%
		6	66	21.8%
		7	42	13.9%
		8	37	12.2%
		9	10	3.3%
		10	14	4.6%
MU	**geo_area**	MOMA	303	100%
	municip_name	Accettura	41	13.5%

Section	Variable	Category	Count	Percentage
		Aliano	22	7.3%
		Cirigliano	18	5.9%
		Craco	25	8.3%
		Gorgoglione	44	14.5%
		Oliveto Lucano	16	5.3%
		San Mauro Forte	46	15.2%
		Stigliano	91	30%
	territorial_unit_code	077	303	100%
	territorial_unit_name	Matera	303	100%
	region_code	17	303	100%
	region_name	Basilicata	303	100%
	surface_2024_ha_bin	(1,000–5,000] ha	78	25.7%
		(5,000–10,000] ha	134	44.2%
		(10,000–21,097] ha	91	30%
	elev_range_bin	[356–500] m	25	8.3%
		(500–1000] m	187	61.7%
		(1000–1500] m	91	30%
		[174–500] masl	184	60.7%
		(500–1,000] masl	119	39.3%
	elev_zone	1	119	39.3%
		3	184	60.7%
	res_pop_2024_bin	[275–500]	34	11.2%
		(500–1,000]	91	30%
		(1,000–5,000]	178	58.7%
	pop_density_2024_km2_bin	[7–10] persons/km²	47	15.5%
		(10–50] persons/km²	256	84.5%
	urbanisation_lvl_2018	3	303	100%

Conclusions and Future Directions

The findings of this doctoral research confirm that service ecosystems in rural and inner areas evolve as complex institutional systems where formal and informal dimensions co-determine the potential for social innovation, digitalisation, and collective well-being. Drawing on the theoretical foundations of the New Institutional Economics (North, 1990; Ménard & Shirley, 2025) and the service-dominant logic (Vargo & Lusch, 2016), the thesis has demonstrated that the regeneration of peripheral territories requires more than infrastructural investment or digital access: it demands the synchronisation of institutional arrangements, social relations, and collective capabilities.

The overarching argument emerging from the empirical analysis is that institutional complementarities, rather than isolated factors, explain differences in innovation readiness and socio-economic resilience among the case areas. In both the Montagna Materana (MOMA) and the Sele–Tanagro (SETA) territories, strong relational capital and social cohesion coexist with infrastructural and digital weaknesses. However, the outcomes differ depending on how local actors, institutions, and governance systems interact to reconfigure these complementarities. MOMA's dense social fabric supports community initiatives but struggles to scale innovation due to limited formal support and weak digital infrastructure, while SETA benefits from slightly stronger institutional coordination yet exhibits more fragmented social cohesion. This confirms that neither social capital nor formal institutions alone are sufficient to foster sustainable innovation (Bosworth & Turner, 2018; Fernandes & Ferreira, 2022).

Theoretical contributions

From a theoretical perspective, the thesis contributes to advancing the understanding of service ecosystems in non-urban contexts, where institutional and relational variables are often underexplored (Vargo et al., 2015; Barile et al., 2025). It extends the notion of service ecosystems beyond market-based logics, proposing a regenerative interpretation that connects service interactions with environmental and social sustainability. By integrating the concepts of formal and informal institutions, the work introduces the idea of institutional synchronisation—a condition where formal infrastructures (such as digital networks, mobility systems, and public services) align with informal structures (trust, cooperation, shared norms) to enable collective innovation.

This theoretical integration enriches both institutional and service research by highlighting the relational nature of economic coordination in rural innovation systems (Amendolagine & von

Jacobi, 2023). Moreover, it reinforces the argument that digital transformation in peripheral economies should be interpreted as a socio-institutional process, where technological adoption depends on shared meanings, relational trust, and community governance (Nambisan et al., 2019; Huđek et al., 2021).

By bridging New Institutional Economics and Service-Dominant Logic, the thesis provides a conceptual bridge that helps to explain how value is co-created and distributed within territorially embedded systems. This approach suggests that the resilience of service ecosystems emerges not only from diversity and interdependence (Elia et al., 2020), but also from the system's ability to regenerate its institutional foundations through continuous collective adaptation (Riva et al., 2020).

Empirical insights

Empirically, the study demonstrates that perceptions of institutional adequacy and well-being vary significantly across socio-demographic groups and territories, confirming that institutional performance is experienced differently by individuals according to education, gender, employment, and civic participation (Abulela & Khalaf, 2024). The multivariate analyses—based on Principal Coordinates Analysis and clustering—revealed that psychological well-being, trust, and perceived accessibility to services are strongly interconnected. These findings emphasise the relational dimension of institutional effectiveness, showing that formal and informal institutions operate as co-dependent layers of the same ecosystem.

The cross-regional comparison between MOMA and SETA further highlights how contextual diversity matters. MOMA's institutional fragility is partly mitigated by relational density and mutual aid, whereas SETA's relative infrastructural advantage is undermined by lower perceived cohesion and weaker informal networks. These patterns suggest that rural innovation ecosystems depend on the alignment of social capital and formal investment—confirming the logic of "institutional complementarity" proposed by North (1990) and refined in more recent empirical works (Webb et al., 2020; Zhang & Wei, 2023).

Such results have practical relevance for the design of policies targeting the digital and ecological transition in rural Europe. They suggest that efforts to expand connectivity and infrastructure must be accompanied by investments in social learning, participatory governance, and local capacity building, all of which reinforce the trust-based foundations of innovation (Ferrara et al., 2017; Moulaert et al., 2013).

Policy implications

The policy dimension of this research is closely aligned with the National Strategy for Inner Areas (SNAI) and the European Green Deal's place-based agenda (Barca et al., 2014). The empirical evidence points to three core recommendations:

1. **Institutional alignment and multi-level coordination.** Local development strategies should synchronise national and regional policy instruments with community-level initiatives. Fragmented governance structures reduce the efficiency of digital and social innovation programmes (Williams & Vorley, 2015).
2. **Investing in relational infrastructures.** Beyond broadband and transport, policy frameworks should explicitly recognise relational assets—trust networks, civic organisations, and local cooperatives—as part of a region's innovation infrastructure (Basile & Cavallo, 2020).
3. **Promoting digital inclusion as a social process.** Digital literacy programmes should be designed as community-based learning platforms that integrate technology adoption with social innovation practices (Huđek et al., 2021; Elia et al., 2020).

These recommendations converge on a broader principle: institutional synchronisation is a precondition for regenerative innovation. Without alignment between formal institutions and community dynamics, rural territories risk remaining locked in low-innovation equilibria despite new investments.

Methodological reflections

Methodologically, the thesis has shown how combining quantitative non-parametric analysis with multivariate mapping offers valuable insights for understanding complex institutional systems. The use of the RIOM dataset enabled a rich comparative exploration of subjective perceptions, bridging statistical robustness with territorial specificity. This approach supports the development of data-informed place-based policies, in which empirical evidence complements local narratives and participatory diagnostics (Colantoni et al., 2015; Content et al., 2020).

Furthermore, the methodological design demonstrates that even in data-scarce rural contexts, robust inference can be achieved by integrating non-parametric and multivariate techniques

(Abulela & Khalaf, 2024). Such mixed approaches could be replicated across other European inner areas to map the relational and institutional foundations of innovation readiness.

Future research directions

Future studies could expand upon this work by exploring at least four directions:

1. **Longitudinal analyses.** Monitoring the evolution of institutional perceptions over time would provide insights into how social trust and policy interventions co-evolve.
2. **Comparative research across regions and countries.** Extending the framework to other European rural regions would enable cross-national comparisons of institutional synchronisation dynamics.
3. **Integration of digital trace data and spatial analytics.** Linking perception-based data with geospatial indicators (e.g., broadband coverage, mobility flows) could enhance the precision of territorial diagnostics.
4. **Participatory modelling of service ecosystems.** Adopting participatory action research could translate empirical findings into co-created governance tools for local administrations and community networks.

By pursuing these lines of inquiry, researchers can deepen the understanding of how ecosystems evolve and regenerate under the pressures of digitalisation, demographic change, and ecological transition.

This thesis positions inner areas as laboratories of institutional and social experimentation, where the balance between tradition and innovation becomes the core of regenerative development. By analysing the interplay between formal and informal institutions, digital infrastructures, and social cohesion, the research contributes to both theoretical and applied knowledge in the fields of territorial innovation, service ecosystems, and institutional economics.

The results reaffirm that regeneration is not a spontaneous outcome of technological diffusion, but a process that depends on the collective reconfiguration of institutional systems. Only through such synchronisation can rural and inner areas move from a logic of assistance to a logic of co-evolution and shared value creation, enabling them to become fully integrated and resilient components of the broader European innovation landscape.

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