Smart Innovation, Systems and Technologies 177

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New Metropolitan Perspectives

Knowledge Dynamics, Innovation-driven Policies Towards the Territories' Attractiveness Volume 1

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Preface

This volume contains the proceedings for the fourth International "*NEW METROPOLITAN PERSPECTIVES. Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*", scheduled from 26 to 28 May 2020, in Reggio Calabria, Italy.

The Symposium was jointly promoted by LaborEst (Evaluation and Economic Appraisal Lab) and CLUDs (Commercial Local Urban Districts Lab), Laboratories of the PAU Department, *Mediterranea* University of Reggio Calabria, Italy, in partnership with a qualified international network of the academic institution and scientific societies.

The fourth edition of "*NEW METROPOLITAN PERSPECTIVES*", like the previous ones, aimed to deepen those factors which contribute to increase cities and territories attractiveness, both with theoretical studies and tangible applications.

When the call for papers of New Metropolitan Perspectives was launched in September 2019, no one could imagine that in a few months we would find ourselves suddenly catapulted into a totally unknown future. And the papers sent in January 2020, of course, could not in any way reflect the dynamics caused by the spread of COVID-19, the outlines of which will all be discovered and deepened in the coming years: it is still too early to fully understand the extent of these changes.

Today, we are still dealing with what appears to be a cataclysm of planetary proportions; it will take time to "historicize" events and interpret their profound meaning and long-term impact, through the multilevel observation—through the interpretation of macro-data and the in-depth investigation of the different realities involved—that the scientific community will be able to develop when the health emergency is over. At that point, the scenarios can begin to be configured with scientific rigour, which are beginning to be intuitively delineated in constant events. It will be possible to appreciate the permanent (real and perceived) effects on the daily life of communities, on the organisation of work and logistics chains and in the system of social relations.

At present, we can only hypothesise scenarios, more or less well founded.

The common thread, that linked the different themes from the Symposium in its original conception, was technology, in particular the effects produced on the settlement systems by the relationship between man and technology, in two different aspects: the progressive replacement of man with machines in practically all production processes and the spread of ICT.

The pandemic and the policies and practices put in place to contain the infection have brought this issue to the fore with arrogance. The replacement of physical interactions with "virtual" contacts has used consolidated technologies but has accentuated their pervasiveness, generating impacts of different nature. The next few months will tell us how much of this acceleration will persist in our daily lives and how much it will be a transitory phenomenon.

Permanent changes are conceivable, for example, in the organisation of work, with the adoption of smart working as an ordinary way of carrying out various tasks, also in areas where until a few months ago it seemed a distant future, such as in teaching.

And these changes will probably also affect other areas, just think of the use of culture, in a broad sense, as the many virtual opening initiatives of museums and sites of cultural interest have shown us in this period.

As well as central issues for democratic systems will be those related to the use of big data and their impact on individual freedoms: the ongoing debate on tracking movements and personal preferences is extremely topical.

However, the data that seems to emerge with greater force from the phase we are experiencing is the progressive loss of relevance of the location factor: the pandemic has made even more evident the fall of many barriers to the global dimension of relationships and exchanges. This change brings with it, as a consequence, a change also on the plane of centre–periphery dualism: what is centre and what is periphery, when the two terms no longer refer to accessibility to physical places but, for example, accessibility to goods and services and, ultimately, to knowledge? And how do you measure accessibility if you can no longer measure in metres or hours?

The other phenomenon on which it will be increasingly necessary to reflect in the future is the speed of changes. As already underlined on the occasion of the past edition of the symposium, while society evolves with accelerations impressed by endogenous and exogenous factors (such as the pandemic COVID-19), the physical dimension of space adapts with extended times.

At the dawn of the studies on the impacts of ICT on the city, the "wired city" studied by the research group of Corrado Beguinot was divided into a system of three cities: stone, relationships and experience. To harmonise the development times of the physical city with the "liquid" city of human relations is, after thirty years, still a priority.

So how will our cities and, more generally, the settlement systems on a planetary level record these changes? Will the trend towards population concentration persist in hyper-equipped and congested metropolitan areas or will we see reflux? New perspectives open up towards what are now considered peripheral areas (such as the Inner Areas so dear to our Master Edoardo Mollica), in which perhaps some organisational processes are more easily managed and there are still values that could be appreciated by future generations.

The ethics of research, in the disciplinary sectors that the Symposium crosses, invites us to feed, with scientific rigour, policies and practices that make the territory more resilient and able to react effectively to events such as the pandemic that we are suffering in recent months: we hope to know the outcomes of these courses in the next editions of the New Metropolitan Perspectives Symposium.

For this edition, meanwhile, approximately 230 papers published allowed us to develop six macro-topics about "*Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*" as follows:

1 - Inner and marginalized areas local development to re-balance territorial inequalities
2 - Knowledge and innovation ecosystem for urban regeneration and resilience
3 - Metropolitan cities and territorial dynamics. Rules, governance, economy, society
4 - Green buildings, post-carbon city and ecosystem services
5 - Infrastructures and spatial information systems
6 - Cultural heritage: conservation, enhancement and management

And a Special Section, *Rhegion United Nations 2020–2030*, chaired by our colleague Stefano Aragona.

We are pleased that the International Symposium NMP, thanks to its interdisciplinary character, stimulated growing interests and approvals from the scientific community, at the national and international levels.

We would like to take this opportunity to thank all who have contributed to the success of the third International Symposium "NEW METROPOLITAN PERSPECTIVES. *Knowledge Dynamics and Innovation-driven Policies Towards Urban and Regional Transition*": authors, keynote speakers, session chairs, referees, the scientific committee and the scientific partners, participants, student volunteers and those ones that with different roles have contributed to the dissemination and the success of the Symposium; a special thank goes to the "Associazione ASTRI", particularly to Giuseppina Cassalia and Angela Viglianisi, together with Immacolata Lorè, Tiziana Meduri and Alessandro Rugolo, for technical and organisational support activities: without them the Symposium could not have taken place; and, obviously, we would like to thank the academic representatives of the University of Reggio Calabria too: the Rector Prof. Marcello Zimbone, the responsible of internationalisation Prof. Francesco Morabito, the chief of PAU Department Prof. Tommaso Manfredi.

Thank you very much for your support.

Last but not least, we would like to thank Springer for the support in the conference proceedings publication.

Francesco Calabrò
Lucia Della Spina

Cities and Regions Towards Transition

The fourth edition of the New Metropolitan Perspective Symposium took place in a period of global uncertainty that is calling into question the essence of the economic prosperity pursued in the last decades. It is recognised that what is urgently required is a policy shift from a primary push towards ever-increasing productivity and competitiveness goals to one that pursues a "renewed" concept of competitiveness—socially just and environmentally responsible—employing a reformed pan-economic approach. **The continuing and progressive changes due to the systemic impact of shocks and stresses at the global level need a convergence of efforts by all countries.** This is critical to balance the need to maintain economic prosperity generated by globalisation and to mitigate global crisis like climate change and the ongoing COVID-19 pandemic. The scenario that is emerging these days is similar to a post-war reconstruction economy, alongside climate change and the risks associated with it, the emergency of the pandemic has seriously questioned social stability at the urban level and the confluence of institutions in multilevel governance processes. Concurrently, the main question to be addressed can no longer be confined to how cities and regions can compete in a global context, but rather how they can survive in a world that must face the effects of continuous shocks by ensuring socially acceptable living conditions for everyone.

At European level, this need has been stimulating the debate for the revision of policies designed to build a better Europe for its citizens and a "restructuring process" of EU institutions in the light of anti-European, populist and sovereign political movements. These movements together with far-reaching global crises and shocks are threatening the future of EU and the Cohesion Policy grounded on the virtuous principle to reduce disparities by promoting social, economic and territorial cohesion. In response, the European Commission has recently introduced the European Green Deal, a set of policy initiatives to strive for a green transition based on solidarity and fairness. This marks a novel growth strategy that is comprehensive, ambitious and bold, integrating climate, environmental and social protection goals with economic ones. Such a transformative pathway helps set the stage for policy actions in the upcoming post-2020 programming period of the Cohesion

Policy. Arguably, these days the perspective of the EU mission will be redesigned, through new priorities and new tools launched for shaping the Conference on the Future of Europe.

In this context, the debate on how to prepare EU territories and cities to address the challenges of regional and global implications cannot be more relevant. The current development approaches need to be adjusted to formulate a new development pattern. Such a pattern is characterised by a more flexible approach in allocating investment, a more integrated approach to reach the goal of transition development and a more tailored, place-sensitive approach to regional development. It should facilitate a sustainable transition process towards transforming regional and urban socio-economic and technological systems. This process will be driven with an evolutionary approach in which knowledge and innovation dynamics can break path dependency and promote an effective regional diversification. This pattern should be underpinned by an integrated, multiscalar and multidimensional approach aimed to enhance the resilience capacity of territories to respond to the various crises and shocks they are exposed to.

To substantiate these arguments, the Symposium was also part of the TREnD (Transition with Resilience for Evolutionary Economic Development) research project funded by the European Union's Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie Actions—RISE 2018. Considering the above-mentioned unparalleled yet controversial complexity while responding to the European call for the green transition, TREnD proposes a new approach in the design process of place-sensitive, innovation-oriented development policies that can facilitate the regional and urban transition to sustainability while reinforcing resilience to shocks induced by transition economies (e.g. post-carbon economy). TREnD's approach is focused on how to strengthen the regional capabilities to trigger, implement and manage transition strategies towards driving "resilience-building" processes. The scope is to combine Transition with Resilience for Evolutionary Development in different territorial contexts towards a reforming process of Cohesion Policy for the next programming period 2021–2027. The TREnD, therefore, seeks to: 1) identify and examine the factors enabling or hindering the transition strategies at a governance standpoint; 2) assess the territorial characteristics critical to enable a resilient-building process; 3) unveil the unexploited potentials for "re-shaping trajectories" disclosed through the windows of local opportunities due to the external shocks cities and regions are continuously exposed to.

TREnD highlights regional diversification seen more as a process of co-creation of solutions and concepts to solve development problems through the enhancement of the resilience capacity of regions, which can be achieved by implementing tailored placed-based innovation policies with a transitional approach. Stemming from the current debates on regional diversification together with the emerging role of the city in pursuing local innovation ecosystem, the aim is to explore new development policy configuration within the evolutionary framework to help different territories effectively respond to continuous shocks. It is expected to gain a sound understanding of the triggering mechanisms conducive to frame a more inclusive S3 process for the post-2020 Cohesion Policy. This new framework, thanks to resilience-based process and transition management, will help define tailored S3 processes more sensitive to different regional contexts and needs. In so doing, it will reinforce innovation diffusion, facilitate diversification and tighten the linkages between advanced and peripheral areas (at regional and sub-regional levels) through more inclusive approaches.

Considering this vision, the Symposium tried to offer possible solutions to sustainable development as defined by the UN Agenda 2030, focusing on the complex and dynamic relationships between human society and technological development, and the latter's socio-economic, political, institutional and environmental impacts on territorial and urban systems. Indeed, investigating the nexus between the ever-changing societal needs and rapid technological development represents a valuable opportunity to achieve this ambitious goal. The desired shift towards a more sustainable knowledge-based economy and society since the beginning of the 2000s, especially in developed countries, is impeded by several challenges. In Europe, the Smart Specialisation Strategy (S3) represents the strong push to boost economic development through knowledge, research and innovation. The current academic and policymakers' debate are questioning its capacity to break down path dependencies and facilitate economic diversification. The difficulties in implementing and doubts about the effectiveness of this ambitious innovation-oriented policy—especially at regional level—suggest the need to revise the post-2020 Cohesion Policy and the approach beyond Regional Smart Specialisation Strategy (RIS3). Among the rising concerns, the controversial effect of innovation concentration on peripheral areas due to the new geography of knowledge is coming to the fore. The surging discontent shows how policymakers are struggling with continuous mutating scenarios characterised by more complex territorial dynamics. The pillar on which the current policy action seems to rest is represented by the potentials underlying knowledge complexity and innovation in reversing negative trends. However, recent studies have pointed out how such complexity is giving rise to inequalities in both core and lagging regions, making peripheral areas a common issue to tackle. More efforts are needed to address different aspects of inequalities connected with the new geography of knowledge. Therefore, a more inclusive and integrated approach is desirable to advance technological innovation while addressing social issues of health, environment, education and social exclusion.

Accordingly, the Symposium stimulated multidisciplinary discussions on the key elements of the debate on a shift in policy design and implementation, including transition management, resilience, diversification and quality of governance to leverage the potentials of peripheral areas and reshape the trajectory of economic growth for more equitable development. It aims to identify a new and balanced developed pattern, casting light on the multiscalar and multidimensional analysis of different perspectives, strategies, tools, objectives and impacts of local economic development and innovation processes. Such a pattern needs to be framed within the United Nations 2030 Agenda (TS25) and to reach the Sustainable Development Goals (SDGs).

The sessions have been organised around key elements affecting vertically (multilevel) and horizontally (cross-sectoral and multidisciplinary) the social, economic, institutional, organisational and physical/environmental dimensions of local economic development. The themes of sessions followed the key elements of the debate on a shift in policy design and implementation to drive transition-oriented structural change of regions. This echoes the EU's desirable smart transition that requires an economically prosperous and socially inclusive transition process to promote regional convergence. Sessions TS04T1, TS04T2, TS04T3 and TS04T4 altogether build up the overall theoretical framework of sustainable transitional development, offering insight into knowledge complexity, transition management, resilience, diversification and quality of governance to leverage the potentials of peripheral areas and reshape the trajectory of economic growth for more equitable development.

To achieve a smart transition, it is critical to reinforce the resilience of regions at different territorial scales, especially those expected to be more affected, to respond to the shocks that green and digital transitions are likely to trigger. In this regard, the Symposium undertook a multifaceted and multidimensional conceptualisation of resilience, for which sessions TS01, TS25 and TS26 investigated territorial systems resilience, urban resilience and sustainability. Session TS07 looked into smart and resilient infrastructures, and sessions TS09 and TS23 investigated urban and built environment with sustainability and resilience. Sessions TS02, TS06, TS10 and TS21 pay close attention to territorial and urban regeneration. Urban and territorial regeneration are considered as a useful tool to facilitate territorial and urban resilience-building processes by promoting positive physical transformations and thereby increasing cities' preparedness and response capacity to crises and shocks. Sustainable urban and territorial regeneration need to define new economic and territorial strategies within a period of financial constraints. Therefore, session TS21 casts light on the issue of circular regeneration, while session TS03 conducts a critical review of territorial dynamics and urban growth models.

The value-adding of local assets from the urban–rural perspective offers a chance to define alternative development patterns. In this respect, cultural heritage, as potential local assets, needs to be properly leveraged to drive sustainable local development. The Symposium, therefore, highlighted innovative approaches to heritage management. Session TS19 casted light on the enhancement of cultural heritage in fragile areas; session TS20 presents new management strategies for the value-adding of heritage in inner areas; and session TS22 relates heritage management to climate change, exploring integrated conservation strategies based on traditional and innovative technologies able to help mitigate the negative effects of climate change. The Symposium equally gives insight into the urban transition towards a post-carbon society, a key element useful for the discussions on the new objectives of the post-2020 Cohesion Policy and new strategies and tools. Accordingly, session TS23 investigated an ecosystem services approach to the evaluation of settlement transformations; session TS12 was focused on green building related to post-carbon transition, and session TS30 furthers session TS12 and proposed eco-design-based strategies and approaches.

As in the past editions, this year's Symposium has received generous support from and will see the participation of a high-quality international network of higher academic institutions and scientific societies. Therefore, it will undoubtedly serve as an important occasion for exchanging and disseminating research findings and stimulating a fruitful debate on global challenges among academics and policy-makers. All in all, the Symposium and the contributions to its different sessions contributed to deepening the discussions on a transition-oriented approach—on which the TREnD project is grounded—while offering insights into how to fill the existing gaps.

Carmelina Bevilacqua

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New Metropolitan Perspectives

Contents

Smart Specialisation Strategy (S3) and Social Network Analysis (SNA): Mapping Capabilities in Calabria

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Abstract. The concept of smart specialization strategy (S3) requires regions to have an extended knowledge of their institutional contexts in order for policy-makers to design the most adapted place-based innovation policies. In the context of the next programming period of EU Cohesion Policy 2021–2027, this paper explores the use of social network analysis (SNA) in mapping regional capabilities in Calabria. Using the CORDIS database, the paper finds that SNA can inform policymakers on key aspects of the enabling conditions for smart specialization such as governance, the entrepreneurial discovery process (EDP), priority setting, and interregional collaboration.

Keywords: Entrepreneurial discovery process · Interregional collaboration · Peripheral region · Horizon 2020 · Governance

1 Introduction

In the European Union (EU), the future programming period of EU Cohesion Policy 2021–2027 dedicates a substantial share of its budget to promoting a Smarter Europe through, notably, the confirmation of the Smart Specialisation Strategy concept (S3) after a first experiment during the 2014–2020 programming period [1]. S3 is a policy concept to support regional prioritization in innovative sectors, fields or technologies through the entrepreneurial discovery process (EDP), a bottom-up approach to reveal what a region does best in terms of its scientific and technological endowments [2].

In the S3 implementation, the European Commission (EC) and the European Parliament have pushed for synergies across EU funding, namely between the European Structural and Investment Funds (ESIF) and Horizon 2020 [3]. In the next programming period 2021–2027, synergies across EU funding are even more crucial to maximize investments in research and innovation at the regional scale.

Many regions have faced difficulties in designing and implementing their S3 in the programming period 2014–2020, most notably related to S3 governance, monitoring,

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and the entrepreneurial discovery process [4]. For the new programming period 2021–2027, the EC has requested national and regional authorities to update their S3 and respond to seven 'enabling conditions' under the new Cohesion Policy [5]. The European Commission encourages regions to use evidence-based approaches combined with a wide involvement of stakeholders coming from the quadruple helix—private sector, public institutions, universities, and civil society—to update their S3. Triple helix models of innovation involving the private sector, public institutions, and universities and increasingly quintuple models of innovation that incorporate the triple helix, civil society, and the environment are frequently used in S3 [6]. Depending on what helix is most appropriate at the regional institutional level to address regional challenges and priorities, regions must adopt an entrepreneurial discovery process (EDP), which is a bottom-up process involving a wide range of stakeholders to define regional actions and to identify regional technological opportunities.

S3 requires regions to have a comprehensive knowledge of their institutional contexts to design the most adapted place-based innovation policies [7]. This mapping exercise of scientific and technological capabilities is, however, often lacking. In southern Italy for instance, most southern Italian regions selected high-tech specialisation areas despite having little capacities in scientific and technological capacities [8]. The evolutionary economic geography (EEG) and regional innovation system (RIS) literatures have introduced tools to help policymakers to design innovation policies that are tailored to their regional institutional contexts. The RIS literature provides conceptual frameworks depending on the type of regions to support new industrial path development [9, 10]. In EEG, the concept of economic relatedness offers a robust tool for regions to prioritise and select the most relevant regional sectors [11].

The JRC S3 platform and H2020 project 'S3 Online' have listed tools to support regional policymakers in drafting and updating their S3. Some examples of quantitative tools are related variety analysis, extroversion analysis, and so on. Some examples of qualitative tools are SWOT analysis, benchmarking, foresight exercises, regional assets mapping, and so on. Social network analysis (SNA) is, however, not highlighted as a relevant policy tool for S3.

This paper explores the use of SNA in mapping regional capabilities in Calabria and its potential application for regional policymakers in the context of updating their S3 for the next programming period 2021–2027. The research question that this paper aims to answer is: how SNA could be used to map regional scientific capabilities and interregional collaboration opportunities to support the S3? The authors selected Calabria as it is a peripheral region in South Italy. In the regional innovation scoreboard, the region is defined as moderate- and is ranked 203 out of 238 regions in Europe [12]. Calabria has a gross domestic product (GDP) PPS per capita of €17,400 in 2017, compared with €28,900 in Italy and €30,000 in the European Union [13]. For the programming period 2014–2020, Calabria selected to prioritize for its S3 the following sectors: sustainable construction, healthy living care services and products (life sciences), reducing environmental impacts and harm from natural hazards, ICTs and new technologies for tourism and cultural industries, developing the ICTs and innovative services sectors, providing healthy and safe food (agri-food), technologies for logistics, and advanced technologies and solutions for manufacturing [14].

The data come from the CORDIS database, which compiled data on all EU research projects under Horizon 2020 (2014–2020) [15]. H2020 research projects are used as a proxy to map regional scientific capabilities to be mobilized in the S3. However, this approach has limitations since it only maps regional scientific capabilities in H2020 research projects. The Calabria Region participated in 51 H2020 research projects that have involved a total of 578 unique organizations. The paper finds that SNA can inform policymakers on key aspects of the enabling conditions for smart specialization such as governance, the entrepreneurial discovery process (EDP), priority setting, and interregional collaboration.

2 Methodology

This paper explores the use of social network analysis in mapping regional capabilities in Calabria and its potential application for regional policymakers in the context of updating their S3 for the next programming period 2021–2027. Social network analysis (SNA) is a research tool that has frequently been used to study European Framework Programs [16]. SNA is the study of the collection, management, analysis, interpretation, and presentation of relational data to analyze entire social structures (complete networks) or local networks (ego-centered networks) [17]. Our social network includes nodes (organizations or projects) and ties (interactions between the nodes) that connect them.

To build our networks, we use data coming from the CORDIS database, which compiled data on all EU research projects under Horizon 2020 (2014–2020) [15]. The CORDIS database of Horizon 2020 research projects offers many advantages for research purposes as it is well-structured and standardized. Moreover, Horizon 2020 is the biggest EU Research and Innovation program ever with nearly €80 billion of funding available over 7 years from 2014 to 2020 [18]. Other collaborative programs database could be used to map regional capabilities, such as EUREKA, Knowledge and Innovative Communities (KICs), or INTERREG. We only use the H2020 projects in which at least one organization from the Calabria region is present as a participant or coordinator. We consider the co-participation in the same H2020 projects as a tie within our network. We postulate that within the same H2020 project the organizations participating in the project are connected with one another. In total, 26 unique organizations from the Calabria region have participated in 51 different H2020 research projects, which involved a total of 578 unique organizations with 7438 ties.

Horizon 2020 research projects are used as a proxy to map regional scientific capabilities to be mobilized in the S3. To get funded, Horizon 2020 research projects are selected on a competitive basis. We thus assume that H2020 research projects represent the most competitive scientific knowledge in a region. However, this approach has limitations since it only maps regional scientific capabilities in H2020 research projects. To reduce these limitations, regional and national collaborative research projects and projects funded under thematic objective 1 “Research and Innovation” of the Calabria Operational Program 2014–2020 could be included in the SNA.

The authors use *R* and different packages such as igraph, sna, EconGeo, ggplot2… to graph the network and to calculate different network centrality measures such as degree centrality (number of edges per node), betweenness centrality (nodes bridging position between other nodes), closeness centrality (distance between nodes), and eigenvector centrality (nodes connected to highly connected nodes) [19]. In our networks, betweenness centrality is particularly useful to identify the actors or projects acting as brokers or gatekeeper between actors or projects. Networks are built for the H2020 research projects and for the organizations participating in the H2020 research projects. The networks are undirected and not weighted.

3 Findings

3.1 H2020 Research Projects Network in Calabria

In looking at H2020 research projects, SNA can inform on the links between projects, their centralities in the network, and the type of competitive research programs in the region. Networks in Fig. 1 represent the network of H2020 research projects that involve at least a Calabrian organization. The types of programs are coded according to CORDA Data Dictionary [20]. The sizes of the nodes in the network on the left represent the research project total cost while the sizes of the nodes in the network on the right represent the projects’ betweenness centrality score showing the projects acting as bridges among actors in the network. The network shows a large presence of programs related to research, namely Future and Emerging Technologies (FET) and Marie-Curie Sklodowska Actions. Compared to the priorities selected for its S3, Calabria has H2020 research projects related to climate actions, food and agriculture, and ICT that have high betweenness centrality scores and high budget confirming their relevance of the S3 priorities, namely TARANTO, E-SHAPE, or ERA-PLANET. The H2020 research project SuperScienceMe, a project to promote research and science, is coordinated by the University of Calabria and has the highest betweenness centrality score.

The implications for S3 of this network are to confirm the strategic regional importance of the S3 priorities, to highlight scientific capabilities in specific domains, and to underline central research projects.

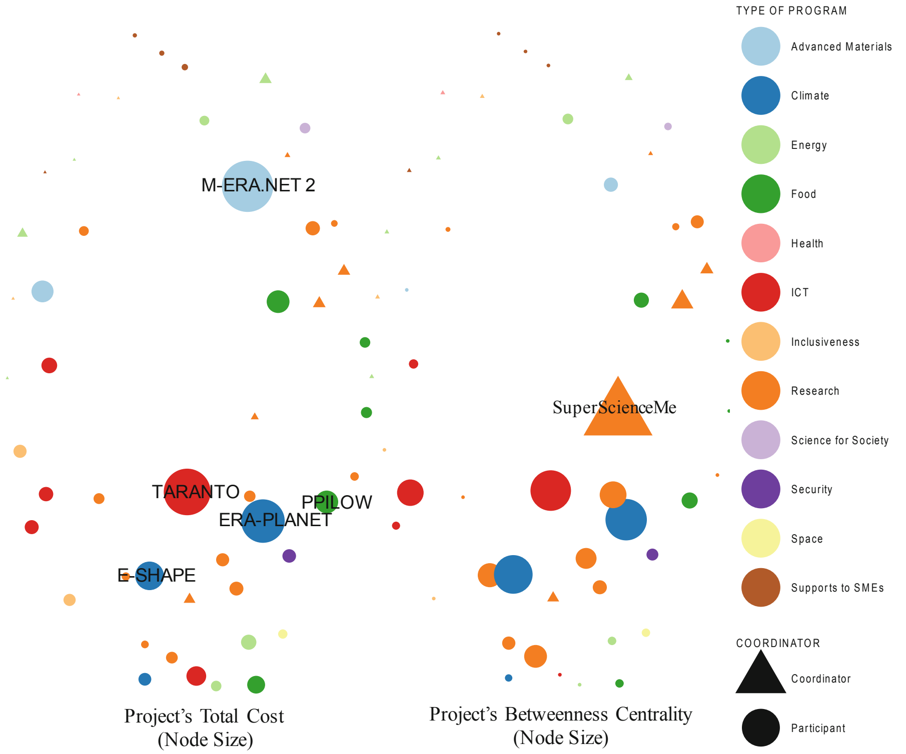

Fig. 1. Networks of H2020 projects in Calabria with their total costs (left) and betweenness centrality (right). Source: own design.

3.2 Organizations in H2020 Research Projects Network in Calabria

In looking at organizations participating in H2020 research projects, SNA can inform on the links between organizations depending on different parameters such as locations or activities, their centralities in the network, and their positions in the network. Figure 2 represents the unique organizations that have participated in a H2020 research project in which a Calabrian organization is also present. The size of the node represents the betweenness centrality score, which allows to identify the organizations that might act as brokers or gatekeepers among different organizations in different research projects. As a result, the network underlines the key organizations in the network. It shows that Calabrian organizations are not well connected in the network with the exception of the University of Calabria, the Calabria Regional Council, the Mediterranean University of Reggio Calabria, and Bioage SRL. Many Italian organizations are well-connected with one another but not with the rest of the network. There is a large number of higher or secondary education establishments (HES) in the network.

The implications for S3 of this network are to identify key organizations in the network, to identify extra-regional organizations that are central in the network that could potential work as brokers or gatekeepers, and to look at ties between regions and/or countries.

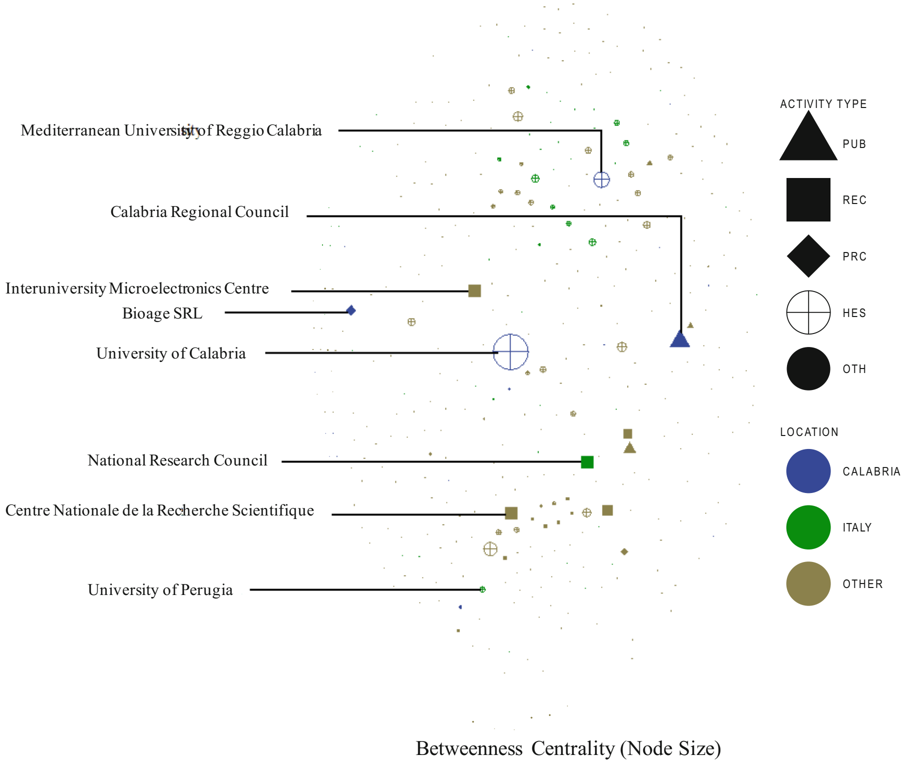

Fig. 2. Networks of organizations participating in H2020 projects in Calabria with their betweeness centrality. Public bodies (PUB), research organizations (REC), private for-profit entities (PRC), higher or secondary education establishments (HES), other (OTH). Source: own design.

Table 1 shows the five Calabrian organizations that are the most central in the network per network centrality measures (betweenness, closeness, eigenvector, and degree). The table shows the importance of universities and public organizations in the network. The only private company that is in the table is Bioage SRL, a high-tech private company.

The implications for S3 of these network centrality measures are to identify the most central organizations in the network. In Calabria, the University of Calabria, the Calabria Regional Council, and the Mediterranean University of Reggio Calabria are the most central organizations. The network centrality measures facilitate the selection of key organizations that must be involved in the entrepreneurial discovery process (EDP).

Table 1. Most central Calabrian organizations in H2020 projects. Source: authors

	Betweenness centrality	Closeness centrality	Eigenvector centrality	Degree centrality
1	Universita della Calabria	Universita della Calabria	Universita della Calabria	Universita della Calabria
2	Universita degli Studi Mediterranea di Reggio Calabria	Universita degli Studi Mediterranea di Reggio Calabria	Calabria Region	Calabria Region
3	Calabria Region	Calabria Region	Consorzio per il Lavoro le Attivita' Innovative e Formative	Universita degli Studi Mediterranea di Reggio Calabria
4	Bioage SRL	Universita degli Studi Magna Graecia di Catanzaro	Universita degli Studi Mediterranea di Reggio Calabria	Associazione Italiana per l'Agricoltura Biologica
5	Associazione Italiana per l'Agricoltura Biologica	Consorzio per il Lavoro le Attivita' Innovative e Formative	Associazione Italiana per l'Agricoltura Biologica	Agenzia Locale per l'Energia e lo Sviluppo Sostenible della Provincia della Provincia di Consenza SRL

3.3 Interactions Across Technologies Within H2020 Research Projects in Calabria

Interactions across technologies can inform policymakers on scientific relatedness across research topics. The Fig. 3 is a chord diagram that shows the interactions among the different H2020 research projects that are technology-related (from E.U.2.0 to E.U.3.7). An interaction between ICT and energy for instance, is created when an organization participating in a H2020 research project in ICT is also participating in a H2020 research project in energy. The Fig. 3 shows strong interactions between food and agriculture and climate action H2020 research projects and between energy and climate action H2020 research projects.

The implications for S3 of this chord diagram are to identify the connections between the technologies and also to support the prioritization process.

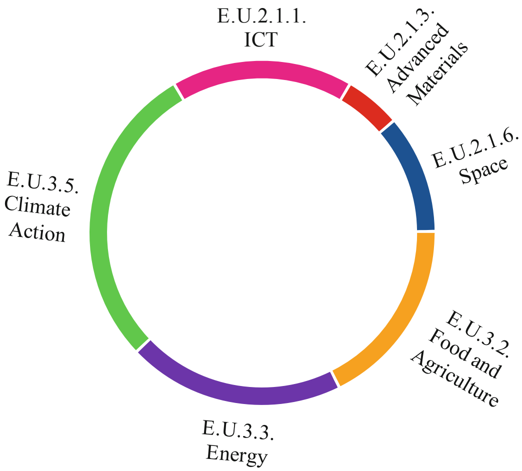

Fig. 3. Interactions across technologies in H2020 research projects in Calabria. Source: own design.

3.4 Interregional Collaboration in H2020 Research Projects in Calabria

Mapping interregional collaboration informs policymakers on up-to-date regional scientific collaboration activities within the network. Figure 4 represents the number of organizations per city participating in a H2020 research projects in which a Calabrian organization is present. The map shows that Calabrian organizations are well-connected with organizations located in Spanish cities, namely Madrid, Barcelona, Valencia, and Seville, and with organizations located in Paris, Brussels, and Vienna.

The implications for S3 of this map are to build-up on existing collaboration networks and identify cities and regions for interregional collaboration activities.

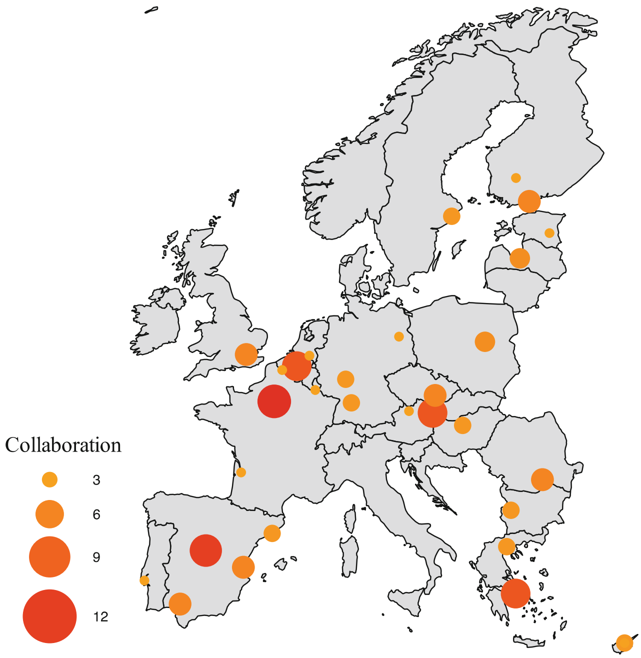

Fig. 4. Number of organizations outside of Italy collaborating with Calabrian organization in H2020 projects. Source: own design.

4 Discussion and Conclusions

Using CORDIS open database of H2020 research projects, social network analysis (SNA) offers some insights for updating smart specialisation strategy (S3) for the next programming period 2021–2027. For priority setting, it helps mapping existing scientific capabilities in H2020 research projects. Indeed, it can show strengths in scientific capacities such as in climate actions, food and agriculture, and ICT in the case of Calabria. For governance and the entrepreneurial discovery process (EDP), SNA supports the identification of key and well-connected organizations in the network as well as those working as bridges in the network. The identified organizations must play a role in the governance and in the EDP such as piloting working groups on prioritised sectors. The identification of actors is an important action to build an effective EDP, qualitative concepts embedded in places must rally actors together towards a common vision for the future [21]. For the interregional dimension, centrality network measures can support the identification of key and well-connected extra-regional organizations. Finally, a map can be produced to highlight existing collaboration and create interregional collaboration activities according to existing collaboration networks.

In Calabria, the network is characterized by the central role of public organizations and universities in the network and a weaker role of private companies. The SNA confirms the weak role of private actors in the RIS of peripheral regions [9]. One potential path to strengthen the network is to always involve a private company with a university in H2020 research projects thus allowing private companies to have access through a better connected actor, such as the University of Calabria or Mediterranean University of Reggio Calabria, to a larger number of ties in the network. Future research could use SNA for H2020 research projects and other collaborative research projects in different institutional contexts.

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Identifying Localized Entrepreneurial Projects Through Semantic Social Network Analysis

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Abstract. We propose a novel set of social network analysis, firm level and communication-based algorithms for mining the web to identify emerging entrepreneurial projects. These algorithms are implemented in a hybrid theoretical framework and tested in an on-line environment. The algorithms take account of entrepreneurship as the relational capability for innovation and learning, the central role of computer-mediated communication, the construction of 'dynamic' semantic networks, and the temporal computation of network centrality measures. The temporal calculation of betweenness of concepts allows us to extract and predict long-term trends for entrepreneurial projects. We illustrate our approach by considering the nodes in a network (based on our previous empirical analysis) as localized potential entrepreneurs in the cultural and creative context, and the inherent Instagram community, and analyzing the semantic networks emerging from sharing hashtags.

Keywords: Entrepreneurial project · Social media · Semantic social network analysis

JEL Codes: R11 · R15 · R58

1 Introduction

Claiming for renewed interpretation of local resource, the present paper suggests a novel set of social network analysis, firm level and communication-based algorithms for mining the web to identify emerging entrepreneurial projects. Based on a constructivist approach in social science, which seems knowledge as socially constructed, Berger and Luckmann (1969) suggest that the cognitive processes linked to entrepreneurial activities feature prominently in theories of opportunity recognition (Kirzner 1979; Beattie 1999). From this perspective, entrepreneurship can be considered a socially constructed phenomenon, which is reflected by the emergence of opportunities. These opportunities arise as individuals make sense of information and their actions and retrospectively 'discover' and 'recognize' business ideas (Gartner et al. 2003). Thus, entrepreneurship takes place in an 'enacted' environment (Weick 1995).

Compared to several other qualitative research methodologies, discourse analysis is more strongly based on social constructivist paradigm (Phillips and Hardy 2002). As known, it requires some contextualization (Cicourel 1981; Fairclough 1995); texts are the material manifestation of discourse but discourse exists beyond the individual texts

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that comprise them (Chalaby 1996; Phillips and Hardy 2002). Also, a discourse cannot be identified on the basis of a single text; rather discourse emerges from the interactions among different social groups, their ‘texts’, and the context in which these interactions are embedded. In the case of entrepreneurship research, the context is both proximate and distal, indicating the systemic (economic) and substantive (political and cultural) embeddedness of entrepreneurship (Johannisson et al. 2002) which is reflected in the overall institutional setting, norms, and values, and the entrepreneur’s political and social environment. Linking this to notions of context as discussed in discourse analysis, the proximate context and the distal context will reflect the entrepreneur’s respective micro- and macro-environments (Achtenhagen and Welter 2007).

Based on selected social theories and semantic social network analysis (as a specific type of discourse analysis), we draw on the highly interconnected world of social networking platforms (Instagram[1]) to conduct an empirical exploration of a localized entrepreneurial project. We select a localized group of nodes (entrepreneurs) and visualize their Instagram community. Network centrality measures contribute to explaining the role of specific nodes-concepts-business ideas within the discourse.

The paper is structured as follows: Sect. 2 discusses the notion of entrepreneurship, Sect. 3 defines semantic social network analysis (SNA), Sect. 4 provides a synthesis of the empirical survey, Sect. 5 gives the main evidences, and Sect. 6 concludes the paper.

2 The Localized Entrepreneur and Social Media

Contemporary regional policy is increasingly interested in encouraging latent localized innovation potential in the (intentional and/or effective) entrepreneurial projects carried out by local actors (Foray 2015). We are interested in the conceptual categories that describe the basic notion of ‘entrepreneurship’ in this literature.

Pragmatic application of the notion of entrepreneurship inspired by development economics considers its development as a self-discovery process[2] (Hausmann and Rodrik 2003). The entrepreneurial discovery is conceived as economic experimentation with new ideas, which emanate largely from scientific and technological inventions. This chimes with the cognitive theory of the firm and its specific focus on entrepreneurship as associated with different types of learning (Nooteboom 2009). Thus, entrepreneurship can be seen as a form (individual and/or collective) of dynamic capability. It consists of the ability to find and develop external partners, which are at a

[1] Instagram was launched in October 2010 as a mobile photo-sharing application. It is a social network that offers its users a way to upload photos, apply different manipulation tools (‘filters’) in order to transform the appearance of the images, and share them instantly with ‘friends’ (using Instagram’s application or other social networking sites such as Facebook, Foursquare, Twitter, etc.). To illustrate the pervasiveness of Instagram, in June 2013 the application had over 130 million registered users around the world who were sharing nearly 16 billion photos (Hochman and Manovich 2013). In absolute terms, although less diffused than some other social media, Instagram is more popular with high skilled Internet users, and with women.

[2] It is a particular type of learning: learning ‘what one is good at producing’.

distance[3], and the intellectual and behavioral capability to collaborate across this distance. It takes account of both competence and governance issues (Nooteboom 2009).

It is a fact that the new opportunities from participation in open-source communities and social networking platforms are contributing to a more complex notion of the entrepreneur. We are interested in the effects of textual meta-data matrices within the communication on social networks, in particular Instagram, and how these linguistic signs - verbal language fragments in a social platform strictly visual based - can express meaning for research especially from the perspective of the relational dimension of the focal network.

The approach to language introduced by Austin (1962) with his definition of performative utterance, suggests that language should no longer be considered a descriptive tool related to a state of affairs but should be understood as an act of creation - "performative" - of the real. Evoking the categories of thought through language is to create meaning, in the case of hashtags, commentary and description textual meta-data of the visual products issued by the users of the social. For each user it means building an individual identity, an individual biography. These individual biographies mediated by social-media when if shared, evolve into a value that is a more complex system which transcends the individual dimension of the individual user and is shared by multiple users[4].

The novelty here is that, in the utterance, the individual is performing an action of which the very act of uttering the sentence is an essential component. We propose to introduce *performative utterance* in an assessment of a corporate network empirically. This allows us to analyze what is imprinted in the statements of identity discourse generated through the hashtag, on the Instagram profiles of community actors, and what it means when placed in a relational intentionality typical of network dynamics. Our interest is in identifying the self-representation produced by the meta-data, and to investigate which metadata are most commonly shared by the actors in the network. The analysis is conducted in two phases to examine the universes of identity, values, and interests that characterize the network and its actors. This research extends the notion of entrepreneurship as the ability to find and develop outside partners at sufficient cognitive distance. Additional relational competencies are needed, and particularly the ability to compete in global knowledge networks.

[3] The way this literature considers the concept of 'distance' is interesting. It is not seen as fixed distance between two situated nodes (geo-graphical distance) but as a 'cognitive' gap, or a variable space resulting from the trade-off between the novelty value of cognitive variety and the need for some cognitive coherence to utilize the potential for novelty.

[4] These are precisely the forms of transmission, including the writing of social media, which determine the ability to generate ideas, because in this context, every statement is emancipated from its subjective and contingent character, to become a form of collective writing (Husserl 2015). The storytelling that daily produces a user through social is configured as a performative narrative, based on operational narratives of more performances.

3 Semantic Social Network Analysis

Grounded in the field of communication science, semantic network analysis (Popping 2000) can be considered an alternative to content analysis (CA) (Krippendorff 2004). Since CA is used to analyze the content of media messages, it tends to determine the value of one or more variables based on the message content. In other words, it infers relevant aspects of what a message (newspaper article, forum posting, personal e-mail, etc.) means in its context, and the communication research question determines both the relevance and the correct context.

Rather than directly coding the messages to address the research question, semantic network analysis first represents the content of the messages as a network of objects. This network representation is queried to address the research question.

Despite wide use of the technique, extracting the network of relations from the text can be more difficult than categorizing text fragments although there are no standards for defining patterns on these networks (van Atteveldt 2008).

New social media such as Facebook, Twitter, Instagram, and so on, are considered direct and indirect big relational data sets. Within these virtual places, huge amounts of content (photo and/or video posts and blogs) are shared socially at diverse levels with different motivations such as socializing, co-designing, etc. This kind of social sharing is considered semantic due to the nature of the shared objects. The strength of this kind of on-line semantic sharing lies in the network structure and in its power of viral transmission of the messages/content[5].

Even more trans-disciplinary technique, actually, there are three implication levels, as scientific fields directly involved in.

Firstly, 'computational linguistics' has seen drastic increases in computer storage and processing power in recent decades, leading to the development of multiple linguistic tools and techniques. Second, there is a need to alleviate the problems of combining, sharing, and querying these semantic networks, which requires a focus on 'knowledge representation'. This refers to the formal representation of the background knowledge used to aggregate the textual objects with the abstract concepts in a research question. Third, there can be the distinguishing manual and automatic extractions of complex and abstract concepts by these data sets[6]. A frequent application of automatic extractions is marketing trend analysis and political science. At this level, the basic research question is about measuring the concept's relative importance in the relevant information sphere (web, blog, on-line forum). If the concept (e.g. a hashtag) is a node in a network of links (e.g. sharing hashtag), then analysis of the network structure can reveal the relative importance of that concept. Thus, semantic SNA is an extension of the SNA method (Wasserman and Faust 1994). The concepts of high betweenness

[5] In these respects, Barabasi (2003) was pioneering research.

[6] Condor is a sophisticated semantic SNA tool (Gloor et al. 2009). It includes automated textual analysis functionality using standard information retrieval algorithms such as 'term frequency-inverse document frequency'. Also, it factors in the betweenness centrality of nodes to weigh the content by the social network position of the nodes.

centrality (BC) (the semantic, more diffused SNA indicator) become gatekeepers between different domains[7].

4 Exploring an Entrepreneurial Project (Ep) Through Semantic SNA: A Synthesis of the Empirical Survey

The empirical analysis is in two steps. The first is an interpretative firm-level case study to identify a localized Ep project[8].

The evidence includes the multi-relational external networks, corresponding to a specific learning investment.

Starting from these networks (A $\equiv$ 6 nodes and 8 links; B $\equiv$ 5 nodes and 8 links), we can parse the corresponding Instagram communities (research step 2).

The research dataset consists of the hashtags[9] emitted in the previous two years by all members (6 + 5) of the networks related to the case study.

The research on the Instagram database involved several stages: search of the content was enabled using the tool Iconosquare (http://iconosquare.com/) which, only giving information on the user's Instagram account, provides more objective research content since it is free of local and temporal constraints, which constrain search performed by users directly approaching a company.

In a subsequent step, data collection consists of gathering company information on companies and compiling it in a database record using the "trans-coding" language (Manovich 2001) 'python' which is a script that can extract data from Instagram through the API protocol[10].

[7] SNA provides a lot of measures for quantifying a member's interconnectedness within social networks. As is well known, each indicator can be critically analyzed according to its explanatory capabilities and the context of analysis (cfr. Landherr et al. 2010). If we consider centrality as the control of the information flow that a member of a network may exert based on his position in the network, the concept of BC is on the track. It is given by the quotient of the number of all shortest paths between actors in the network that include the regarded actor and the number of all shortest paths in the network (Freeman 1977).

[8] The case observed is the Fondazione Plart located in Naples, Italy. It is dedicated to recovery, restoration, and conservation of artifacts and design objects constructed from synthetic materials (plastics). It is a research and restoration lab, an event location, a training center, and a permanent exhibition site for its founder's historical plastics collection. The Plart's founder is largely recognized as a potential entrepreneur in the local cultural and creative context.

[9] It was decided to analyze the hashtags emitted in a 2-year period in order to even out the differences related to the longevity of the different Instagram profiles as well as the various geographical locations. We chose a period when all profiles and geographical locations were on the company in order to allow comparative analysis which would be chronologically balanced.

[10] Instagram provides API, i.e. the protocols for querying to extract information about the data, to be used in external applications such as external analytics tool platforms. The link below identifies all the endpoints, i.e. all types of calls carried including a direct link to the images, its statistics (likes and comments), and the set of accompanying text which then provides all the hashtag used - https://www.instagram.com/developer/endpoints/.

Before moving on to the phase of data mining, we performed some cognitive ergonomics operations aimed at avoiding redundant or insignificant data as follows:

1. We deleted from the dataset the "auto-tag", i.e. all those hashtags in which the issuer of the media content "tags you". This initial screening is necessary to avoid imbalanced data with respect to individuals who issue more content, and especially because the self-tag may not be construed as a given relational potential, given its self-referentiality;
2. We deleted from the dataset all the "omnibus" hashtags, i.e. all those metadata which act as a description or interpretation of the photographic content that accompanies them, performing a "channel function", i.e. referring to Instagram and its practices and operations. This category includes the meta-data "#instagram" "#in-stantmood" "#instantgood" "#igers" "#photosofthedayh" "#pi-coftheday" "#vso" "#vsocam" "#tagsforlikes" etc. This second filter was necessary to avoid drugging the results of the sampling with metadata not related to the specific of the analyzed subject but present in all or most of the Instagram content, a hashtag shared around the world used by users as a tool to cope with a greater amount of feedback and a greater rate of engagement. The dataset was split into two, coinciding with the hashtag inherent in the actor-network active first in the exploration phase (network A, with 6 detected users) and then in the exploitation phase (network B, with 5 detected users), within the learning cycle of the case study. To avoid redundancy, we aggregated the meta-data conceptually. To reduce redundancy and increase truth in substantive terms, we proceeded to a tag aggregation, both lexical proximity ("Naples" and "Napoli", "Milan" and "Milano", "graphic" and "grafica") and conceptual proximity (combinations of words that are synonymous or referring to a genus of the same species, e.g. "Arduino" and "Arduinolab"). We obtained a dataset of 734 records - 274 for the exploration phase, and 470 for the exploitation phase. Data visualization was achieved through a dual network visualization where the shared hashtags serve as bonds (marked with a circle) between network nodes (the actors in the network, identified by a square) (see Fig. 1).

Finally, to the aim of implementing the data analysis the research of proper centrality measures (i.e. Betweenness Centrality of vertices in complete Bipartite Graphs) could be absolved (cfr. Unnithan et al. 2014).

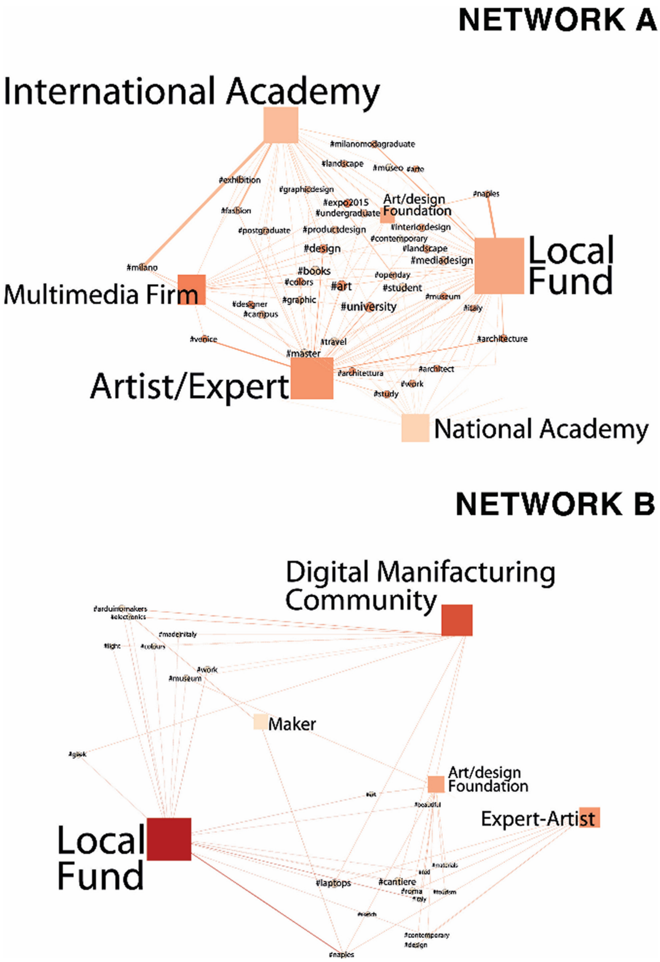

Fig. 1. Comparison - between Phase 1 (above) and Phase 2 (below) - of the importance in Instagram platform of the "shared hashtags" for each phase. Squares are Instagram users, circles are hashtags, and node size denotes betweenness.

5 Main Evidences

Results from the first research step (case study) are given by the description of the Fondazione Plart Ep. It is related to its dynamic abilities to capture the largest number of experts in the field of polymeric materials and the strategies of external consulting agreements, and indirect involvement of artists and experts in exhibition activities. The involvement of this expertise (and thus, structured inter-organizational links) at different degrees of cognitive distance, allows a larger training supply (e.g. in-depth teaching and laboratory activities replicable at home and in school for younger people).

Results from the second research step emerge by the semantic network analysis of a selected group of Instagram users formed by Fondazione Plart's external network nodes. A main evidences' synthetic view is in Fig. 1, where the network visualizations are scaled according to the betweenness centrality values[11]. This provides an understanding of which occurrences are the most shared by the users of the network in each phase.

When interpreting the data, it was clear that the evolution of the cycle of learning, the network concerned, at least as regards its narration on social media, evolves into an equally sharp. In the first phase, the network aggregates of semantic fields are related to architecture and design disciplines - all members of the network share the #architecture and #design hashtag. In the second phase, the network also aggregates on a geographical basis, and extends its domain epistemic to the world and the art market, tourism, new creative forms, such as the universe of 'making'.

6 Conclusion

This research has demonstrated that selecting a group of nodes that are connected by a learning logic based on cognitive distance allows social media (Instagram) to be used as a source of information for research in entrepreneurship.

This study contributes to our understanding of complex social networks by studying the modular structures of networks. Detecting the network modules, or communities, is becoming a critical issue and there is much discussion on the quality of the partition process. Our research testifies to the importance of aligning the research question and its theoretical background (finding a localized entrepreneurship project as a self-discovery process), with the research method (explorative), and thus, fixing the algorithm for mining the web (selecting Instagram users through a firm-level case study). To model the formation of a community (in our conceptual background) we used a learning-based entrepreneurial process, which treats each node as a player in a heuristic of invention (a dynamic cycle alternating the phases of exploration and exploitation).

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[11] In particular, it is possible to scale the values - for each phase - according to two statistical categories. I.e. we can take account of the phenomena of node degree (which correspond to the 'what' kind of information) and betweenness centrality (which approximates the influence of a concept, the 'who' kind of information, within a discussion) for each node and each link.

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Smart Specialisation Priorities of Less Developed Regions. A Critical Evaluation

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Abstract. This paper critically analysis the definition of smart specialisation priority areas of Romanian less developed regions, aiming to identify weaknesses in policy design that according to existing theories characterise such regions. Besides an empirical contribution to the literature, findings also have a practical relevance. They can be used by regions to redesign strategies in their preparation for the absorption of Cohesion Policy funds between 2021 and 2027. While in the definition of priority areas we could depict resemblance with the general practice presented in the literature, there are also shortcomings reported to the evaluation framework proposed in this paper based on official methodological and original theoretical aspects. These mainly refer to a less targeted approach within priorities, overlapping between priorities and horizontal character of vertically defined priorities. However, under these aspects, regional strategies present a high level of heterogeneity; thus, responsible institutions will need to invest different time and effort to revise policy documents.

Keywords: Smart specialisation · Less developed regions · Cohesion policy

1 Introduction

Smart specialisation strategies are policy interventions aiming to transform the economy by linking economic activities and market opportunities with research excellence and the potential of new technologies, taking into consideration local assets and challenges, as well as external sources of knowledge and local value chains [1–3]. Starting with the 2014–2020 programming period, such strategies have become ex-ante conditionality for declaring European Regional Development Fund (ERDF) expenditures in research and innovation under Thematic Objective (TO) 1. For the next financial exercise, strategies need to be revised in line with criteria under the enabling condition for Policy Objective (PO) 1 – *A smarter Europe by promoting innovative and smart economic transformation*.

A proper policy design contributes to the fulfilment of these criteria. Additionally, it is a pre-condition for the effective use of funds, maximising their efficiency [2], and ultimately their impact. Smart specialisation strategies, especially in terms of priorities and actions defined under the policy mix, are fed into Operational Programmes, setting the framework for financing operations. Priority selection in a vertical manner, reflecting a certain granularity level is one of the most important elements of a good

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policy design [2]. The impact of smart specialisation strategies is especially important in less developed regions, the main beneficiaries of Cohesion Policy funds. Implementation of these policies should contribute to the improvement of regional innovation performance and the reduction of development gaps. However, based on implementation experiences so far, the highest benefits of this approach are visible in developed regions [4]. Due to weaknesses observed in non-core regions, smart specialisation "may actually exacerbate regional imbalances and run counter to current EU cohesion policy" [5]. While there is a lot of reference throughout the literature regarding the problems such regions face [6–9], authors also note that each region presents particularities pending context, path dependencies and factors of structural, institutional and geographic character [10].

Against this background, the aim of our paper is to critically evaluate the definition of smart specialisation priority areas selected by Romanian less developed regions[1], as one of the main indicators of proper policy design. Additionally, where appropriate, we propose to identify weaknesses in priority area definition. For this purpose the consistency of selected priorities will be evaluated against a set of criteria derived from the applicable methodological guidance and early theoretical aspects related to smart specialisation, which represented the most important information sources available at the time regional strategies have been elaborated. Additionally, some aspects observed at the level of general European Union practice in relation to priority area definition will also be used. Our paper will bring empirical evidence in order to enrich the existing literature on smart specialisation in less developed regions. Research on regional priority areas in Romania has not been performed yet and altogether the smart specialisation processes in Romanian development regions has not gained a lot of attention. There are two notable exemptions, *i.e.* a study on the smart specialisation process in the North East Development Region [11] and another one on the positive effects of the smart specialisation process on the development of regional innovation systems [12]. Findings can also have a practical relevance since Romanian regions with different levels of experience in the smart specialisation process [12] need to revise their strategies for the next programming period.

To proceed, we will start with a literature review on the most important aspects concerning smart specialisation, its link with Cohesion Policy and aspects related to priority area definition, including problems less developed regions face in this process. We will continue with the description of methodological aspects. The next chapter will be dedicated to the analysis of regional smart specialisation priorities based on the content of strategies, starting with a short overview of the smart specialisation experience in Romania, focusing on the regional level. We will resume with discussions and conclusions, presenting the limitations of our study and defining further areas of research.

[1] Romania has eight NUTSII development regions, out of which one developed (Bucharest-Ilfov) and seven less developed (West, Center, North West, North East, South West, South Muntenia and South West Oltenia). Five of the latter are also considered low income, thus lagging regions (North West, North East, South East, South Muntenia and South West Oltenia).

2 Smart Specialisation, Priorities and Cohesion Policy

2.1 Smart Specialisation and Cohesion Policy

As a concept, smart specialisation refers to economic transformation, triggered by the agglomeration and spillover effects generated by new economic specialties [1, 2]. Emphasis is on new economic activities that rely on existing productive assets, exploit new technologies and research capacities and result from a process of entrepreneurial discovery [2, 13]. Smart specialisation strategies are designed policy interventions, with the aim to facilitate such a transformative specialisation through vertical prioritisation in a limited number of economic areas [2].

Resonating with the reforms generated by the Barca report [14, 15], starting from 2014–2020, these "innovation driven development strategies" [16] have been set as ex-ante conditionality for the use of ERDF under TO1 (*Promoting research, development and innovation*) and have gained a territorial dimension [2]. In the context of Cohesion Policy, such strategies are defined as integrated, place- and evidence-based economic transformation agendas, developed at the national/regional level, through a bottom-up process, in order to support research and technology driven economic development in selected priority areas, relying on local assets and capabilities, but also on external sources of knowledge and integration in global value chains [3]. To support strategy elaboration, the European Commission issued official methodological guidance and developed a dedicated platform [2].

Although major concerns have been raised regarding the efficacy of the concept, McCann [17] demonstrates that "smart specialisation emerges as being especially useful for many non-core regions as a way of prioritising policy initiatives and ensuring resource concentration". However, such regions face serious challenges linked to smart specialisation. Low capacity of institutions governing and participating in the process, weak innovation systems lacking cooperation culture and trust have negative effects on policy formulation [7–9, 18–21]. Success in the smart specialisation process is additionally hindered by the lack of technological diversification [21]. Dependence on declining industries, limited entrepreneurial and innovation capability especially affect the selection of priorities and the identification of new, transformative activities based on market opportunities [22]. While non-core regions face such challenges and they have less experience in such processes, they need to design and implement smart specialisation strategies based on an approach that presents weaknesses, since "it does not prescribe (…) specific tools for specific actions" [23] and it does not take into consideration the differences between different types of regions [22]. This may lead to a lack of understanding or misinterpretation of policy prioritisation and, in certain cases, to the selection of too many specialisation priorities and their too broad definition [24]. Inadequacies resulting from these bottlenecks represent "a significant challenge for Cohesion Policy" [25].

2.2 Smart Specialisation Priorities

According to the methodological guidance, a smart specialisation strategy should contain specialisation priorities, a policy mix with actions based on the analysis of socio-economic and research-development-innovation context, as well as input of stakeholders and monitoring and evaluation mechanisms [3]. An appropriate priority selection, which includes the results of entrepreneurial discovery processes, as a method of stakeholder involvement, is a criterion of good policy design [2]. Smart specialisation priorities can be defined as technologies or economic activities and should be limited in number [3]. Besides the vertical ones, horizontal priorities are recommended to be included, referring to the diffusion of novel technologies, organisational or social innovation. However, according to the same guidance, these can also be part of the policy mix [3].

Vertical priorities should reflect a middle level of granularity that is between the level of economic sectors and individual projects, pointing towards new, transformative activities matching or combining scientific or research, technological and economic strengths, market potential and opportunities [2]. This level of granularity reflects smart choices or niches, representing a precise expression of areas that would impact the economy most, such as: "*ICT based innovation for active ageing*", "*wood-based solutions for eco-construction*" [26], *"nanotechnology applications for the pulp and paper industry"* [27]. Furthermore, priorities should be about particularisation and they should be anchored in existing economic strengths or assets – identified at the level of clustered or correlated activities - taking into consideration emerging opportunities as identified by key actors possessing entrepreneurial and market knowledge [2].

Reflecting the experimental character of the policy, neither the theory, nor the methodological guidance offer detailed advice or a set of criteria to be used for priority selection. This is especially relevant in relation to the problems regions with less capacity and experience face when designing a strategy. Lack of selection criteria led to various approaches taken by regions in their priority area definition. A recent analysis of 39 regional and national strategies identified four dimensions used in different combination in order to define smart specialisation priorities, *i.e.* (1) sectors or value chains that reflect economic activities, (2) key enabling or general purpose technologies that activate transformation, (3) societal challenges that need to be overcome at European or the specific territorial level, (4) specific resources that can be exploited, like natural and cultural ones [28, 29]. However, the same authors acknowledge that matching all these dimensions within one smart specialisation area might be limitative and consider that combining at least two out of the four dimensions would be a proper approach [29]. Generally, priorities, defined through such a combination of different dimensions, are presented from one up to three levels [29].

The most important information on national and regional smart specialisation priorities is presented in a database hosted by the dedicated smart specialisation platform developed by the Joint Research Centre of the European Commission. The RIS3 database[2] contains two levels for each priority - the name of the priority and its description, including granularity level expressed through several niches – as well as policy objectives. As dimensions or areas linked to one specialisation priority there are

[2] The EYE@RIS3 database can be accessed on the following link: https://s3platform.jrc.ec.europa.eu/map.

economic and scientific domains, using NACE[3] rev.2 and NABS[4] 2007 codes. Except for the name of priority area and its description, all other types of information can be selected from pre-set lists.

3 Methodological Aspects

To critically evaluate how priorities are defined in the smart specialisation strategies of Romanian less developed regions, we have developed a set of criteria based on methodological aspects from the official guidance [3] and interpreted them together with early theoretical aspects linked to smart specialisation [1, 2, 13]. Additionally, we also took into consideration the general practice at the EU level, deriving from existing studies [28, 29] and the architecture of the RIS3 database. Thus, from a methodological point of view, by priority area definition we understand the following aspects: (1) the vertical or horizontal character of priority areas, perceiving under (a) horizontal ones, priorities that refer to technology diffusion or aspects related to social, organisational innovation, and by (b) vertical ones, priorities that present a combination or intersection of at least the economic dimension with research or scientific strengths and potential use of key enabling or general purpose technologies; (2) the name of the priority area, which should reflect economic activities or technologies and (3) the granularity level of vertical priority areas in terms of niches that point towards new activities that are below the level of a sector and above the level of an individual project. Additionally, we have analysed if - in terms of economic area or activity[5] – the economic dimension taken into consideration covers correlated or interlinked activities or areas. Moreover, we searched for other aspects taken into consideration during priority area definition, such as challenges, cultural or natural resources.

Our research based on the above-mentioned elements was carried out on the final Smart Specialisation Strategies of the Romanian less developed regions, approved by the Regional Development Councils, the governing body of Regional Development Agencies. These secondary documents were collected through desk-research from the official web-pages of the Agencies at the beginning of September 2019. The same strategies are in force at the moment and will undergo revision for the next programming period. We did not include in our research data from the RIS3 database, since, for the information presented, various sources, including unofficial ones (final strategy, draft strategy and/or other sources and studies) are referred by regions[6]. Only the chapters describing the selected smart specialisation priority areas and those

[3] Statistical Classification of Economic Activities in the European Community.

[4] Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets.

[5] While generally the literature refers to the economic dimension in terms of economic sector, we differentiate between economic areas in terms of 2 or 3 digit NACE divisions and economic activities in terms of 4 digit NACE divisions.

[6] Out of the seven less developed Romanian regions registered in the RIS3 database, two (Centre and South East) provide information based on the final strategy, two (North East and South West Oltenia) refer to other sources and studies besides the final strategy, one (North West) gives as a source the draft strategy and one (West) other study and source.

describing the method of priority area selection were analysed. If there were separate documents containing additional information, they were also included in our research. This is the case of the Centre region, which has an annex to the strategy that contains a more detailed analysis of the specialisation priorities.

Based on the existing literature, our assumption is that priority selection might be less targeted in terms of number of priorities selected and their granularity level. Additionally, we expect to find differences between regions, pending their experience in smart specialisation processes. Two regions (North East and North West) have a higher degree of experience compared to all others [12].

4 Smart Specialisation in Romanian Regions

Romania, a Member State since 2007, is preparing for its third financial exercise. For the first two programming periods all Operational Programmes (OPs) have been developed centrally, relying on national strategies and policies. Currently, the Regional OP that has a separate budget for each of the eight NUTS II development regions represents a partial exception. Regional Development Strategies were also prepared by Regional Development Agencies (RDAs) for this programme. RDAs are organised as non-governmental organisations at the level of the NUTS II regions, out of which seven are less developed (West, North West, Centre, North East, South East, South Muntenia and South West Oltenia) and one – Bucharest-Ilfov – developed. These Agencies are the only regional level organisations that have tasks connected to strategic planning, but they are not officially responsible for research-development-innovation policies [12, 30]. They also act as Intermediate Body for Regional OP, managed centrally by the responsible line ministry.

In order to substantiate interventions for TO1, selected for the Regional and Competitiveness OPs 2014–2020, Romania has elaborated and submitted as ex-ante conditionality the National Research-Development-Innovation Strategy 2014-2020. The document represented a partial fulfilment of the conditionality[7]. In parallel, even if not linked to the programming process, by 2014, some RDAs voluntarily developed Smart Specialisation Strategies [11, 12]. This was the case of the North East, West and Centre regions. By 2016, the strategies of South Muntenia and South West Oltenia were also finalised and North West started the process. In early 2016, two regions, namely North West and North East, were selected to receive support from the Joint Research Centre of the European Commission [12]. The pilot project "*RIS3 support for lagging regions*" was finalized in mid-2018, resulting in the revision of the strategy in the North East region and the elaboration of the strategy in the North West region. At the moment, these two regions are the most experienced in smart specialisation [12].

In March, 2016, the ROP 2014–2020 was amended, introducing the necessity to elaborate Framework Documents (Concept Notes) for Regional Smart Specialisation, to fundament the implementation of Priority Axes 1, financing technology transfer in

[7] Further information is to be found in the Partnership Agreement of Romania approved by the European Commission on August 14, 2014. Section 2.3. https://www.fonduri-ue.ro/acord-parteneriat#varianta-%C3%AEn-englez%C4%83.

less developed regions. This amendment was also linked to the fulfilment of the ex-ante conditionality [11, 12]. The Concept Notes were elaborated based on a methodology issued by the Regional OP Managing Authority, following the official EC guidelines and proposing general criteria for priority selection [31]. Thus, by 2018, all regions elaborated the Framework Document, including South East and updated or finalised their strategies. The West, South Muntenia and South West Oltenia Development Regions were exceptions, not performing an update of their existing policy document. For the next programming period, decentralized Regional OPs are proposed and RDAs need to revise strategies to meet the fulfilment criteria under PO1.

5 Smart Specialisation Priorities of Romanian Less Developed Regions

All seven strategies analysed have a chapter referring to the methodological aspects taken into consideration for the definition of priority areas. Generally, regions started with the analysis of economic potential in terms of critical mass, competitive and comparative advantages based on indicators, such as number of companies, number of employees, turnover, productivity, exports, and clusters. Such indicators were looked at on the level of economic areas or the level of interlinked, complementary economic activities. Only the North West region gives a clear definition of such activities, in terms of clusters of correlated industries, according to the definition of Cluster Observatory. As a second step, RDAs took into consideration the research-development dimension in terms of infrastructure, patents and licences, R&D projects and in some cases publications. Results of economic and scientific or research specialisation resulting from the first two steps were completed by an analysis of technological specialisation only in the case of the South Muntenia region and with the potential of using new technologies in the North West region. Additionally, all regions mention correlation with other assets (such as labour force, education) and/or dimensions (natural resources, societal challenges). The North West region also included global and European development tendencies. Potential priority areas resulting from the analysis were tested and validated in entrepreneurial discovery processes and modified according to their outcomes. In the case of the South East and South West Oltenia regions, these were preceded by gathering input from key stakeholders through interviews and questionnaires.

Most regions identified 6 smart specialisation priority areas, except for South East and Centre, which selected 7, respectively 9 priorities. In most cases regions defined only vertical priorities, except for the North West region defining "ICT" and the South Muntenia region selecting "High Tech Industry" as both a vertical and horizontal priority area, and South West Oltenia defining "ICT" and "Eco-technologies" as horizontal areas[8]. These horizontal priorities refer to the diffusion of general purpose

[8] The South East region mentions five additional horizontal priorities, including the diffusion of key enabling and information and communication technologies, besides those that refer to support RDI or cluster development. Since based on the strategy these can also be interpreted as being part of the policy mix, they were left out from the analysis. In the case of the North East region the priorities defined as horizontal ones are clearly part of the policy mix.

technologies or other groups of technologies that also include key enabling ones, in all or most vertical areas. Regarding vertical priorities, two regions – West and Centre – named them strictly in terms of economic activities, while other two – North West and South East – have priorities with names referring to both economic activities and technologies or groups of technologies. Besides reference to economic activities and technologies, South West Oltenia, South Muntenia and North East also use other name categories like "Bio-economy", "Smart localities", or "Energy-environment".

Priorities have an economic dimension in all seven strategies. In terms of four digit NACE codes, clear reference is only made in the strategies of the West, North West and Centre regions. In all other cases the economic area targeted can be deducted from the name and/or the description of the priority or the niches proposed. Generally, priorities are linked to areas of economic activities in terms of two or three digit NACE division, or groups of correlated economic areas or activities, but there are some exceptions. For example, under "Industrial engineering and transport", the South West Oltenia region included automotive, electrical, railway, rolling stock industries, constructions, as well as chemical and metallurgical industries. North West, under "New materials" refers to furniture, paper, plastic and packaging industries, as well as to metal working technologies. Full reference to corresponding research or scientific domains and technologies is to be found only in the case of the North West region, while South Muntenia emphasises corresponding technologies. The North East region highlighted corresponding research fields for all smart specialisation priority areas. As for the South West Oltenia region, only one priority has a declared research dimension. Two out of six priority areas have a rather weak research or technological dimension in the strategy of the West region, while one priority has both. However, in most cases, when no clear reference is made, a link between the targeted economic areas or activities and corresponding research areas and/or technological domains can be deducted from the name of the area and/or the proposed niches. The strategy of the Centre region presents a particular case, since several cross-cutting themes were defined in relation to the vertical priority areas. In some cases these indicate technologies and in all cases they refer to economic systems (circular economy) and/or principles (sustainable economy, energy efficiency). Such principles are referred to in general, at least at the level of objectives, in many of the strategies analysed. Other dimensions taken into consideration by all regions in relation to at least some of the priority areas refer to natural and cultural resources, societal or economic challenges.

The mid-grained granularity level or niches are missing from the strategy of the Centre region, from two priorities of the South East region, and are very limitedly referred to by the West region. In other cases there are generally several, *i.e.* two to fourteen niches that are listed under each specialisation priority. Except for North West, there is a certain overlap between the niches under the priorities that are defined vertically and those that are defined horizontally, or between those defined in economic and technological terms, or using other types of names. For example, in the case of the South West Oltenia region, new technologies in agriculture appear both under "Eco-technologies" and under "Agriculture and food industry". In the strategy of the South Muntenia region, fertilizers as a niche appear under "Agriculture and food industry", as well as under "Bio-economy". Additionally, while advanced production technologies appear under the "High-tech industry" priority, intelligent production equipment is listed under "Construction of vehicles, component and equipment". Sustainable development of crops and new plants resistant to climate change, as well as new technologies in agro-food and precision agriculture are overlapping niches between "Agro-food" and "Energy-environment" priorities in the strategy of the North East region. Based on the proposed niches, in the case of the West region "ICT" rather represents a horizontal priority while "ICT, High-tech and advanced materials" represents both a vertical and a horizontal priority in the case of the South East region. The niches under these smart specialisation priorities refer to the diffusion of technologies in other vertical priority areas.

6 Discussion

In the seven regional smart specialisation strategies analysed, there were 6 to 9 priorities named in economic, technological, or other, more general terms. Priorities are mostly vertically designed. Only two regions assign both a vertical and horizontal character to some of their technologically named priorities and one region defines two solely horizontal priorities. Nevertheless, based on niches or granularity level, at least one of the vertical priorities chosen by three other regions has a horizontal character.

In terms of economic activities at the level of 4 digits NACE codes, the economic dimension of priorities can be clearly identified in three strategies. In all other cases reference to this dimension is weak, however information can be deducted. In most cases this dimension covers interlinked activities, except for one priority of North West and South East that encompasses several types of economic activities without a clear link between them. Reference to the scientific, research, or technological dimension of priorities is only made in the strategy of the North West region. North East focuses on the research dimension and South Muntenia on the technology dimension. In all other cases, such dimensions can only be deducted from the name of the priority area or niches, if defined. Granularity level or niches are almost or completely missing from the strategies of the West and Centre regions, while in all other cases several such niches are defined. Except for the North West region, there are overlaps between niches defined under different priority areas.

The main bottlenecks identified can be grouped under two aspects. One is the vertical definition of smart specialisation priorities, taking into consideration relevant dimensions and the other one is the targeted approach. Regarding the first aspect, we can mention the horizontal character of vertically defined areas, in some cases interlinked with a less proper naming of priorities, as well as overlaps between niches proposed under different priorities within one strategy. As for the second aspect, we can mention the rather big number of priorities, the lack of granularity level in some cases, or the multitude of niches identified under a priority area, as well as reference to several, not clearly interlinked economic areas or activities within one priority.

Although most of the smart specialisation priorities lack correspondence with the three dimensions taken into consideration in our methodology - economic, research or scientific and technological - a resemblance with the practice of other European regions can be observed, as presented by Gianelle, Guzzo & Miezkowski [29]. Romanian less developed regions clearly link their priorities to at least an economic and a research or technological dimension, in many cases adding aspects linked to natural, cultural resources, societal or economic challenges, economic trends and principles.

Despite the apparently similar methodological approach taken by regions, outcomes in terms of priority definition and their granularity level differs from one strategy to another. While we have expected to find such differences based on the degree of experience regions have linked to smart specialisation as related by Ranga [12], strategies show a greater heterogeneity within the groups with more (North West and North East) and less experience (West, Centre, South East, South Muntenia and South West Oltenia). If we were to set up a hierarchy from the point of view of the quality of priority area definition, the North West region would have the fewest problems, followed by the North East and South Muntenia regions, than by South East and South West Oltenia, and finally by the Centre and West regions (Table 1). From a practical point of view, this means that redesigning strategies and priority areas will imply different effort and time invested by each region. When there are several niches under one priority, revision will be easier and will need to focus on selecting niches that could lead to new activities, triggering economic transformation as proposed by Foray [2]. When there are also overlaps between niches and thus between priority areas or niches lack completely, revision will imply a re-definition of all priorities.

Table 1. Synthetic presentation of main findings

Specialisation priorities	Main findings
Smart Specialisation Strategy of West Region (2016)	
automotive components, textiles, ICT, agro-food, constructions, tourism	*strong economic dimension of priorities; niches are generally missing; ICT, a vertical area, has a horizontal character*
Smart Specialisation Strategy of North West Region (2018)	
agro-food, cosmetics & food supplements, health, new materials, advanced production technologies, ICT	*priorities reflect all three dimensions; 2 to 12 niches under priorities; ICT is both a vertical and a horizontal priority*
Smart Specialisation Strategy of Centre Region (2017)	
automotive & mechatronics, aerospace industry, agro-food, textiles & leather, sustainable built environment, forestry & woodworking & furniture, IT & creative industries, health & pharmaceuticals, wellness tourism	*strong economic dimension of priorities; no niches have been identified (accent on cross-cutting themes)*
Smart Specialisation Strategy of South West Oltenia Region (2016)	
industrial engineering & transport, sustainable energy & environment, basic & experimental innovative medicine, agriculture & agro-food, tourism & cultural identity, ICT, eco-technologies	*mainly economic dimension of priorities; 2 to 12 niches under priorities, in some cases presenting overlaps; ICT and eco-technologies are defined as horizontal priorities*

(*continued*)

Table 1. (*continued*)

Specialisation priorities	Main findings
Smart Specialisation Strategy of South Muntenia Region (2015)	
construction of vehicles, components & equipment, agriculture & food industry, bio-economy, tourism & cultural identity, smart localities, high tech industry	*strong technological dimension of priorities; 5 to 9 niches under priorities, in some cases presenting overlaps; high-tech industry, a vertical area, has a horizontal character*
Smart Specialisation Strategy of North East Region (2017)	
agro-food, bio-technologies, textiles & new materials, ICT, energy-environment, health & tourism	*strong research-scientific dimension of priorities; 5 to 14 niches under priorities, in some cases presenting overlaps*
Smart Specialisation Strategy of South East Region (2017)	
naval engineering & transportation, clothing industry, agro-food & fisheries, bio-technologies, eco-technologies, tourism, ICT/high-tech & advanced materials	*priorities only have a rather weak economic dimension; 2 to 10 niches under each priority; ICT, high tech and advanced materials, defined vertically, has a horizontal character*

7 Conclusions

The aim of this paper was to critically analyse the smart specialisation priorities of Romanian less developed regions as indicators of proper policy design, based on a set of criteria derived from the existing methodological and early theoretical aspects concerning smart specialisation and taking into consideration the general EU level practice. Analysis was performed on regional level strategic documents developed during the 2014–2020 programming period by Romanian less developed regions. Empirical findings may contribute to enriching literature on smart specialisation in less developed regions, shedding light on problems faced by non-core regions in policy design. Last but not least, our aim was to point out some concrete aspects that need to be overcome by regions when redrafting strategies for the next programming period.

Romanian less developed regions present heterogeneity in their priority area definition in terms of a) dimensions used, *i.e.* economic, research or science and technological; b) vertical character of vertically defined areas and c) targeted character of approach, *i.e.* proper definition of niches or granularity level and limited number of economic activities or areas considered. The main shortcomings that can be considered as indicators of weaker policy design refer to the definition of several priorities and many niches within one priority or lack of such niches. Additionally, there are overlaps between niches corresponding to different priorities, as well as a lack of clear separation between vertical and horizontal priority areas. However, it must be acknowledged that, priority definition mainly follows the general approach taken by other European regions, which means that at least two dimensions are taken into account in the process of defining priorities. Romanian regions combine the economic dimension with a technological or a research-scientific dimension, or with other aspects such as resources, principles, challenges.

A revision of the strategies for the next programming period in order to reach a more targeted approach in priority area definition and thus a greater impact of funds spent will require different levels of effort from each region, pending on the number of weaknesses identified. As a first step, regions might consider matching the three dimensions proposed in this paper with each priority area. Results should than be further tested with stakeholders to reach the appropriate granularity level. For this purpose, some regions, especially those that make reference to other sources and studies in the RIS3 database of the smart specialisation platform, might already possess additional data.

Besides these practical aspects, our analysis and results may contribute to the existing literature, by pointing out some specific problems linked to strategy design in Romanian less developed regions. For a more accurate picture, research should be expanded to cover the exact reasons of the weaknesses identified, with emphasis on the capacity of institutions managing the process and that of stakeholders involved in it. Results of systematically conducted analysis in other areas concerning the use of Cohesion Policy funds may also be considered, such as the impact of bad policy design on the success of the National Growth Pole Strategy [32, 33]. Additionally, the results of entrepreneurial discovery processes should be fed in. Not covering these aspects represents one of the main limitations of this study, but at the same time it sets further research objectives.

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Sustainable Development and Transition Management: A New Approach for European Peripheral Areas

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Abstract. This paper on Europe as a sustainable economy and its policy for peripheral areas contributes to the analysis on the relationship between Transition Management and new approaches to regional development. It follows that regions are different ecosystems which require not only conventional macroeconomic visions for development processes, but also a precise spatial approach based on different levels of geographical aggregation. The physical environment, therefore, becomes a useful element not only to analyse the transition mechanisms, but also as a constitutive part of economic, social and environmental changes in the short, medium and long term. A number of interesting aspects are examined and the concept of Living Labs as a *modus operandi* of Transition Management is indicated according to the Quintuple Helix model, which requires large-scale public participation, both in the structuring of problems as well as the dynamic change in political agendas. The authors underline how, in an era of constant transformation, ecosystem management contributes to ecological and economic resilience as well as social flexibility needed to deal with and challenge the economic crisis as well as the mistrust that citizens have towards the European institutions. This paper, founded on an ecosystem approach, aims to contribute to the debate on the review of the European Cohesion Policy.

Keywords: Transition management · Living labs · Cohesion policy

1 Introduction

This study, by taking into consideration the growing inequalities across Europe, offers a first analysis on how to intervene on the Cohesion Policies of the European Union for the period 2021–2027. Horizontal policies, such as infrastructure, human capital and a property rights system, have shown to have positive effects only in developed regions, whilst this has not been the case for the less developed ones. The same quest for "good policies" of the Smart Specialization Strategies (S3) was an important element of the EU 2020 innovation plan whose popularity led to a wide dissemination of concepts and applications in regional contexts. Foray [1] (p. 6) observed that "the high flexibility of the concept of Smart Specialization also entails a great risk": terms such as S3 and entrepreneurial discovery are now routine in EU cohesion policy, however its

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implementation and true impact has shown no significant results on the less developed regions. A variable however that is somewhat overlooked is that of the physical environment, being an essential element of the Quintuple Helix Model.

In this study we address the documented lack of a clear European Cohesion Policy that highlights the need to analyse the link between the transition period after the Great Recession and envisage new guidelines for development in lagging regions. As a prerequisite for said analysis, the first step is to trace Europe as a sustainable economy. In doing so, we aim to establish a new Transition Management concept that could assist as a mixing framework for quality analysis, addressing the role of new notions for sustainability transition and thus allowing for more accurate policy recommendations.

Recent empirical results on the Great Recession Annoni [2] indicate how European regions diverge in their ability to recover from economic shocks. In particular, the core developed regions experience significant growth and spill-over effects to neighbouring regions due to higher investment shares, the presence of an economic structure based on advanced value-added sectors, as well as high quality institutions. In marginal regions, the increase of higher education and training level as well as advanced expertise in information and communication technologies (ICT) all have an influence on the regional GDP *per capita*.

European policymakers, most likely reassured by these results, confirm the EU's previous Cohesion Policy yet the large economic gap and social discontent in Europe illustrates a different approach. In the second paragraph, we therefore illustrate how Europe is an ecosystem based on its territorial elements. The Transition Management approach is then presented in the third paragraph illustrating it as a sustainable innovation system capable of reacting to a dynamic timeframe. In this setting the implementation of a Quintuple Helix Model together with the Territorial Living Lab are designed to implement an improved and multi-dimensional approach to regional development. In conclusion, the authors explore how certain aspects of a more active role of the environment as a cross-setting variable for growth.

2 Europe and Peripheral Areas: Sustainability and Local Strategies for Growth

In September 2015, the United Nations (UN) General Assembly adopted a global development agenda for all countries and stakeholders to use as a blueprint for progress on economic, social, and environmental sustainability. The 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals (SDGs) bound 193 Member States to ensure sustained and inclusive economic growth, social inclusion, and environmental protection, fostering peaceful, just, and inclusive societies through a new global partnership.

Europe intends to adopt the objectives outlined in the 2030 Agenda. The implementation of these objectives involves the evolution from a linear to a circular economy, the sustainability from farm to consumer, creating a global food and agriculture system, a clean and resilient energy sector, as well as a regulated social investment system, which includes education, healthcare, gender equality and rural development. We are therefore obliged to balance out the different aspects such as economic, social, environmental, as well as institutional sustainable development. In this perspective, Cohesion Policy at European level should play a key role by further promoting integration and economic and social equality.

The main objective of the European Cohesion Policy is the reduction of structural gaps, at both international as well as intranational level. Growth differentials are at the heart of the continuing European debate which questions the mechanisms underlying the growing gaps as opposed to the supporters of automatic economic convergence processes.

EU regional and urban development policies defined as Cohesion Policies account for approximately a third of the EU's multiannual budget. A fundamental characteristic is that Cohesion Policy is managed according to a multilevel governmental scheme that includes national governments, regional administration and local communities [3].

In recent years the economic and social results have been widely discussed with opposing views: one study indicates that the differentials have increased [4], whereas other authors believe that they have diminished [5]. Cohesion policies in particular, tend to favour the most competitive European areas by increasing regional gaps. The new Cohesion Policy 2021–2027 appears, however, to place resources where they are most needed. The new criteria include the areas that have higher levels of youth unemployment, low levels of education, measures related to climate change and the level of migrant integration. The 2021–2027 Cohesion Policy framework goes even further at a local level: it supports the development of local growth strategies by urban, local or other territorial authorities, which are now expected to be put in charge of, or at least involved in, the selection of EU-funded projects. It also supports the continuation of "Community-Led Local Development", namely the creation of local growth strategies by action groups involving local authorities, civil society and business partners.

The socio-economic inequalities between different geographical regions are a challenge faced by many countries. The core-periphery model links the interrelated gaps in demographic and economic conditions to the spatial fields. Since the "core" is a highly urbanized region in which both population and economic activity are concentrated, the "periphery" is distinguished from the core by its sparse population and lagging economic development [6]. The concentration of long-term unemployment, education deficit, growing poverty and outward migration of residents, are often associated with peripheral and low-growth regions. Such regions can be found in both developed as well as less developed countries.

It is therefore necessary to look at the growing disparity between central and bordering or rural areas. In the European Union (EU), rural regions cover 57% of the territory and include 24% of the population [7].

Rural regions face significant challenges in comparison to other regions [8]. Rural territories are characterized from distance to markets and services [9] as well as from a decline in employment in dominant agricultural sector [10]. The major difficulties encountered in these areas are the absence of employment opportunities, [11] and limited access to public services such as education and health [12]. The question of rural development is on the agenda of various governments and institutions like the European Commission, OECD and the United Nations [13]. The progressively rising depopulation of rural areas has led European governments to devise strategies to encourage the development of these areas and their connected sectors. Unbalanced development is a typical feature of the European economic landscape. It is for this reason that it remains essential, in line with the principle of solidarity, to promote discussions on territorial production and wealth in Europe. The initial structural characteristics and diverging dynamics in terms of industry decline, and growth of high productivity services, explain the presence of distinctive regions which require specific economic policy action needed for recovery and structural change.

Recent empirical studies based on a neoclassical growth modelling approach [2] demonstrate how the core European regions have better institutions, and an economy specialised in higher-value-added sectors significantly boost domestic growth, and how increased investment also induces positive spill-over effects to neighbouring regions.

In other words, macroeconomic approaches to growth presuppose the existence of unique models, abstractly conceived and applicable to any territorial context. In doing so, economic laws overlook the territory that exclusively represents the place which causes the effects of general development process, that is a "container space" of economic and social processes.

It is therefore possible to say that regional policies play a leading role particularly in those regions that are in disadvantaged areas. The involvement of local actors becomes fundamental in the development of their territory. Sociological and economic theories confirm the existence of possible synergy effects in the implementation of development policies, deriving from the dialogue between institutions and civil society, expanding the number of subjects participating in the definition of a local growth strategy [14]. An ongoing debate is that of the quality and hierarchy of government related to the degree of administrative decentralization. The accountability for regional prosperity may be managed at central or local level, suggesting, in the second case, a transition towards a neoliberal vision of the governance process as a guarantor of the citizens' well-being and autonomy.

In this context, the place-based related to new regional development ideas [15] open new aspects of analysis. A place-based strategy may be used to identify positive elements for territorial development to decipher the main configurations of the social and relational structures existing in the territory [16].

At local level, the founding elements of development, the availability of natural resources, input factors and infrastructure, namely the presence of a combination of advantages, open new distinctive means of growth with significant a level of entrepreneurial creativity and discovery. An innovative combination of local factors determines synergies and agglomerate new ways of cooperation processes [17]. Furthermore, the presence of public-private networks, attractive cultural and natural environments, as well as the presence of processes which increase innovation, are all crucial elements in the low-income areas. In this way an eco-system innovation approach becomes a key factor in the development of marginal areas, both in terms of diversification and increased competitiveness, as well as in relation to new forms of governance [18].

3 Transition Management: A New Vision for Sustainable Development

The European Union has spoken of ecological transition by treating it at as a challenge for the future of the Union as well as the whole world, and treating it as a fertile ground for new economic possibilities [19]. The transition can be defined as an emerging approach to facilitate the processes of change and innovation towards a more sustainable future. Sustainable Transition is becoming increasingly popular to study and develop multi-dimensional and long-term systemic innovation processes towards new methods of production and sustainable consumption. Sustainable Transition must embrace a systemic approach that, in addition to considering individual problems and sectors, must be positioned at a wider level to solve complex problems and facilitate the identification of connections and feedback between the various components; [20, 21].

Sustainable development goals can be achieved through a shared vision and a structured process, meaning a Transition Management approach could potentially change society in the middle and the long term. The current policy of innovation processes has not brought the expected results as demonstrated by the widening of territorial gaps between EU Member States. The unidirectional approach of development policies has not achieved the expected results. Transition Management disrupts the old planning technique and it implements a model with a more process-oriented approach. The Transition Management method can be considered as a model that combines growth, innovation, and the environment. These topics are currently the centre of political debate in an era of economic, social and cultural transition such as the one we are experiencing.

The operational structure of Transition Management is divided into four phases: strategic, tactical, operational and reflective [22]. It is a cycle that includes collective structuring of problems, controlled experimentation and an evaluation of the policies in place. The structure is cyclical, there is no starting point, yet these phases can follow one another without a consequential order.

The Transition Management Cycle, [23, 24] is based on the interaction of theoretical reflections and practical experiments.

Transition Management provides transversal tools for solving specific problems. It is characterized by a dynamic vision of social phenomena and a multilevel approach to problem-solving. Its theoretical structure based on dynamic and complex systems is reinforced by an operating system divided into four phases which directly involves the social players (Fig. 1).

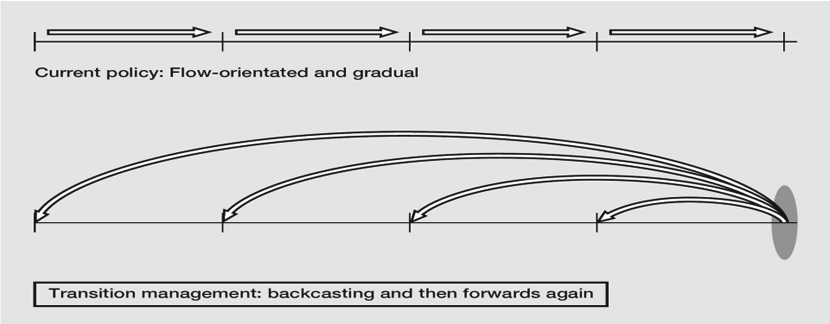

Fig. 1. Short-term linear versus long-term dynamic policy. (Rotmans, 2001)

In this context Living Labs are "new ways of managing innovation processes. The underlying idea is that people's ideas, experiences, and knowledge, as well as their daily needs of support from products, services, or applications, should be the starting point in innovation" [25]. The Living Labs can be designed as a tool for a more effective implementation of the new Cohesion Policy 2021–2027 inside the Quintuple Helix Innovation System Framework [26].

In this way, the Quintuple Helix adopts the formation of a constructive state encompassing ecology, knowledge and innovation, and creating extensive synergy between economy, society and democracy.

The implementation of the Quintuple Helix Model requires the innovate to issues regarding the socio-ecological context in which we live and (co-)develop our common socio-technological future [27]. By implementing a Quintuple Helix Model via the territorial Living Labs, broader issues raised by the scientific debate could be tackled. In the territorial Living Labs, all innovative areas aim to improve the living conditions of local communities. The local system is also considered as an active subject of the lab with which it fully cooperates. Living Labs is a tool capable of developing and generating tacit and codified knowledge within a specific socio-economic context.

By implementing the Quintuple Helix Model the intrinsic potential of peripheral or lagging areas could be identified and utilized to their advantage. A successful territorial Living Lab can facilitate and balance top-down governance with bottom-up initiatives in the regions. The incorporation of different stakeholders and interest groups in policy-making processes can be a way of creating durability in the decisions made and the territorial Living Lab, constructed as open innovation model, facilitating the connection among the areas of the different European regions

Living Labs with their operational concreteness capture the dynamism of modern economic and social systems thanks to the flexibility that makes the implementation of the Transition Management Cycle feasible. Operational, experimentation, reflection, monitoring and control phases are managed directly in the areas involved. The Living Lab is a tool that can develop, generate and transfer tacit and codified knowledge within a specific socio-economic context.

The Living Labs and the Quintuple Helix indicate the ability to bring user, technology and business into an ongoing ground-breaking development process that creates real-life environments. These concepts support long-term cooperation, co-creative research, and development by involving the user in the innovation process for 'sensing, prototyping, validating and refining complex solutions in multiple and evolving real-life contexts. The long-term cooperation between researchers, companies, and end-users revert traditional methods and the Quintuple Helix is able to boost assets which in a classical non-spatial economic model tend not to be valorised.

4 Conclusions

This paper on Europe as a sustainable economy and its policy for marginal areas contributes to the analysis on the relationship between Transition Management and new conducts of regional development in three ways.

First, the Quintuple Helix Innovation Framework identifies the importance of the environment within the processes of innovation and regional development. It follows that regions and local areas are different ecosystems and therefore require not only conventional macroeconomic visions for development processes but also an ecosystem approach. Second, the paper aims to define Transition Management as a specific ecosystem change process. The environment, therefore, becomes a useful element not only to analyse the transition mechanisms, but as a constitutive element of economic, social and environmental changes in the short, medium and long term. Third, we acknowledge that intervention policies cannot be linear but follow a complex trend, with continuous backward induction processes, requiring a high degree of flexibility.

In this regard the paper aims to underline certain aspects of the role of policy in sustainable transition, and some motives for which the European Union decided to review its approach for the 2021–2027 programming period. The main reason, in short, is a common discontent amongst citizens regarding increased inequality across areas. The environment, therefore, become a cross-setting variable for change.

The results suggest some interesting trends. First, the approach of continuous adjustment is more suitable in economically and socially vulnerable areas, much more sensitive and less resilient in the presence of external shocks. Second, the peripheral areas may exploit new opportunities deriving from the economic and social innovation in their respective specific territories, avoiding any exogenous model of innovation. Third, Transition Management is a *modus operandi* that fits easily as an open model: it adapts to local economic systems and captures the dynamism and complexity of economic and social phenomena. It also proposes a multi-layered structure with the involvement of different social actors. Finally, it is a model that makes democracy a necessary condition for its application, requiring broad public participation both in the structuring of problems and in the control of the political agenda.

On the other hand, there appears to be an imminent limitation at this stage of analysis. As a policy tool, the building capacity of lagging regions to adopt a flexible approach related to the logical framework of Transition Management requires a specific governance method able to quickly re-evaluate all different paths of development. A corollary of this potential drawback is the implementation of reliable and well-defined indicators needed to support the decision-making process.

The authors underline how we are now in an era of a deep transformation in which ecosystem management must build and maintain ecological and economic resilience, as well as the need for social flexibility in order to cope with economic and territorial issues, innovate, and adapt.

At this stage precise results cannot be portrayed. However, it is clear that a successful environmental Living Lab can facilitate and offset top-down governance with bottom-up initiatives in a local area. This study most likely outlines an operating method as opposed to indicating a model of analysis. Nevertheless, certain observations may prove useful in the wider debate about the difficulty of applying policy in terms of its ability to reduce economic and territorial disparity between and within European regions, which remains a significant challenge for Europe and its Cohesion Policy.

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Contextualizing Transition: A Multiscale Approach to Making Resilience-Oriented and Place-Sensitive Strategies

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Abstract. The widening of regional disparities remains a critical concern in the political and academic debate at global scale. Given the scope of the phenomenon, recent evidence indicates how growing regional divergences are increasingly jeopardizing social cohesion, fueling inequalities even within regions. The dichotomy between less developed and core regions seems to lose the centrality in the political agenda. An example is provided by the new geography of knowledge that is giving rise to a complex divergence that rests also on the different internal regional contexts' conditions. Regions are exposed to multidimensional shocks and stresses questioning territories' resilience and their ability to manage the transition process. The paper argues that regions need to enhance their resilience to transition-induced shock (dynamics) understanding this internal complex divergence. The paper introduces the multiscale approach as a dynamic factor in the policy-making process to capture the sensitiveness of places to adaptation, resilience-oriented performance, and the disruption of path dependency - which may be considered as the main obstacle for an equitable distribution of competitive advantage derived from innovation - and lead the post-carbon transition required by the European Green Deal. The analysis conducted rests on the conceptual framework of the Open Access Toolkit conceived for the TREnD Research Project funded by the Horizon 2020 Program. The conceptual framework adopted, underpinned by sets of indicators that couple context conditions with innovation performance, can be used to explore and identify in further studies EU settings that are more exposed to systemic risks associated with the transition process.

Keywords: Transition · Resilience · Peripheral areas · Context conditions · Multiscale approach

1 Introduction

The widening of territorial disparities remains a major concern in the political and academic debate in the European Union (EU). Recent evidence indicates how growing territorial divergences are increasingly jeopardizing social cohesion, fueling political instability and raising populist waves [1]. Technological progress and the associated

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new geography of knowledge reveal how disparities between and within (core vs periphery) regions are increasing. A growing literature advocates a reform of the current place-based approach to regional development, which is no longer effective especially for peripheral areas [2, 3]. The widening of these disparities across EU is opening the discussion on how to couple distributive development policies with the benefits arising from agglomerations - to source new competitive advantages - for peripheral areas [1]. At the same time, the need to tackle the pressing climate change side-effects issue pushed the EU Institutions to frame and launch the European Green Deal. A new growth-strategy that "aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use" [4] (p. 2). The Green Deal is part of the European Commission's Strategy to achieve the UN 2030 Agenda for Sustainable Development and target four major domains of transition: i) climate, ii) energy, iii) circular economy and iv) construction [4]. This requires a bold and comprehensive policy response to maximize benefits for health, quality of life, resilience and competitiveness [4]. The ability to respond to such pressing challenges is calling the attention of the EU policy debate on the concepts of "change" and the "transition" that it implies. EU has already recognized the need to ensure socially fair and just transitions of climate neutrality, digitalization and demographic change [5]. However, building a resilient society characterized by social fairness and prosperity through the post-2020 Cohesion Policy requires a conceptual and policy paradigmatic shift able to target effectively regions' disparities between core and peripheral areas. Despite territorial cohesion is one of the main objectives of the Cohesion Policy, it seems that investments (structural funds) in peripheral areas have not generated territorial convergences. Truly, peripheral areas - showing demographic, labor market and economic disadvantages [6] - remain at the same development stage despite long-term structural funds in research and innovation. Such a paradox leads to find an answer to the following question: Why peripheral areas are not able to transform technological innovation into economic development opportunities as the core areas do?

Three factors appear accountable to answer this question. First, peripheral areas tend to be locked in an innovation paradox. Their need to increase R&D intensity and innovation activities has long been recognized so as to catch up with their advanced counterparts [7]. Peripheral areas commonly underinvest in R&D and innovation activities due to lower capacity to absorb public funds earmarked for the promotion of innovation and to invest in innovation related activities [7]. This apparent contradiction makes them unable to leverage their assets and potentials to boost R&D and thereby build up competitive advantages. Second, peripheral areas show a mismatch between R&D activity (knowledge creation) and economic development during the innovation process (knowledge transfer) in peripheral areas. This mismatch and the differences in regional capabilities to cope with technological resilience are widening the gap between core and peripheral areas [3]. The focus of EU Research and Innovation policies to drive structural change towards knowledge and innovation has worked well in filling the gap on the "R&D" side but not on the "development" side - as R&D developments are not transformed into productivity gains [8]. This effect raises policy questions regarding knowledge transfer processes [9]. Third, a new geography of development characterized by spatially concentrated technological innovation is ever growing. The economic integration process, both regionally and globally, has favored agglomeration economies, fueling the concentration of higher-level economic activities and services in major cities [10]. This effect is seemingly intensified with the rise of high tech-led innovation, leading to a new geography of knowledge more concentrated in metropolitan areas [3, 11, 12]. Whereas knowledge is an increasingly critical dimension of competitive advantage [11], its concentration in core areas - where productivity increases thanks to the concentration of skilled labor forces, companies and capitals - hinders the innovation diffusion process. This results in a "new landscape" of regional disparities characterized by not only inter-regional but intra-regional divergences [13, 14]. Conversely, innovation diffusion can act as driver of industrial renewal and productivity growth, helping regions in industrial transition "catch up" with the more productive core/advanced areas [15].

This paper argues that on the one hand, during the transition to knowledge economy, regions' innovation and development performance and their resilience to transition-induced shocks are subject to their context conditions at different scales. On the other hand, addressing the more complicated issue of regional disparities requires a more nuanced recognition and understanding of places and relative context conditions at multiple territorial scales and typologies. Therefore, the multiscale approach to the analysis of territorial contexts allows sustaining regional economic agents to adapt and reconfigure their industrial, technological, network and institutional structures in an ever-changing economic system [16], thereby improving their resilience. In the light of the aforementioned factors, the multiscale approach is introduced as a dynamic factor in the policy-making process to capture the sensitiveness of place to adaptation, resilience-oriented performance, and the disruption of path dependency - which may be considered as the main obstacle for an equitable distribution of competitive advantage due to concentrated innovation. The paper is grounded on a complex European project, Transition with Resilience for Evolutionary Development (TREnD) – funded by the Horizon 2020 European Research Framework - aiming to: build an analytical framework of the context conditions of EU regions at different scales and the related trajectory of transition; and define how innovation can support transition-oriented regional/urban transformations and which factors can facilitate or hinder it. The multiscale approach proposed in this paper results from the logic behind the Open Access Toolkit (the analytical framework envisioned by the TREnD project) based on sub-regional units of data analysis likely to introduce sensitiveness measures of adaptation towards transition. In so doing, the paper first provides the research background and review of the literature on regional resilience, transition, territorial scales and territorial characteristics from the perspective of evolutionary economic geography. Then, it explains the multiscale approach by proposing an example consistent with the logic of the Open Access Toolkit in combining two indicators as explanatory variables respectively of context conditions and innovation performance. The results of the analysis of covariance on a metropolitan and urban-rural territorial basis are the starting point for a conceptual model to contextualize transition with resilience with a multi-scale approach and characterize and an territorial contexts and related transition propensity of regions.

2 Literature Review

2.1 Resilience and Transition

Resilience has become a very common and fashionable concept in the academic and political agenda. The responsiveness of economies in absorbing major global shocks (e.g. the economic crisis of 2008, environmental risks due to climate change) has been the focus of several studies [16, 17]. It is recognized that socio-economic systems need to be resilient to economic shocks to ensure both present and future economic stability, competitiveness, and high quality of life [18]. Resilience is a useful concept for analyzing how regions and localities respond to and recover from shocks, and how the spatial dynamics of economic growth and development are shaped over time under such shocks [19]. Increasingly, resilience is conceptualized not only as regions' ability to accommodate shocks but also for their long-term ability to develop new growth paths [17, 19]. This means that resilience represents a trade-off between adaptation (changes within pre-existing paths) and adaptability (ability to develop new pathways) in a situation of structural change [17, 20]. To operationalize the concept of resilience and thereby to better support policymaking and implementation, resilience needs to be properly measured. However, this is not a simple task. Currently, there is no mainstream approach to the measurement of resilience and, therefore, no uniform strategies for strengthening the resilience of economies [21]. One big challenge is the difficulty in adopting the conceptual framework of resilience for its application in the analysis of territories and their processes of change [22]. Indeed, developing indicator frameworks to measure resilience is a complex activity considering the diversity of context conditions at different territorial scales, the different geographical typologies and the continuous socio-economic changes due to rapid technological processes. Consequently, it is difficult to make a straightforward measurement of territorial resilience capacity [23]. Nevertheless, different groups of factors were proposed by scholars that may indicate and affect regional resilience (Table 1).

Table 1. Academic definitions of factors that may indicate and affect regional resilience [20].

Author(s)	Resilience factors
Martin (2012)	– regional dynamic growth – structure of the economy – regional export orientation & specialization – human capital – innovation rate – business and corporate culture – localization of the region – institutional arrangement in the region
Foster (2006)	– regional economic capacity – regional socio-demographic capacity & community's capacity

(*continued*)

Table 1. (*continued*)

Author(s)	Resilience factors
Briguglio et al. (2009)	– macroeconomic stability – micro-economic market efficiency – good governance – social development
Koutský et al. (2012)	– main macroeconomic indicators – labor market indicators, etc.
Stanickova and Melecký (2018)	– community links – human capital and socio-demographic structure – labor market – economic performance – innovation, science and research

Also, international organizations developed and proposed different approaches and indicators frameworks with different metrics to measure resilience capacity (Table 2). It is worth noting that the factors and indicators listed in Table 2 generally show no territorial perspective with the exception of the development resilience analytical approach that considers different categories of indicators according to various spatial contexts.

Table 2. Resilience metrics [22]

Resilience aspect	Definition	Example approach	Organization (year)	Metrics
Socio-ecological	The ability of a system to absorb disturbance, learn and adapt, and self-organize	Resilience Assessment Workbook for Practitioners	Resilience Alliance (2010)	No use of specific indicators, attributes of factors that enhance or erode resilience
Development	The way households, communities, nations etc. can cope with various stressors to avoid poverty	A Common Analytical Model for Resilience Measurement	FSIN (2014)	Provides different categories of indicators that depend on context
Socio-economic	Shock-absorption or shock-counteraction effects of policies on an economy	Economic Resilience: Definition and Measurement	World Bank (2014)	Provides a list of indicators that can be used to build a resilience indicator
Community	The process of a community to adapt to a positive trajectory of functioning after a disturbance	Community-based resilience analysis (Co-BRA)	UNDP (2013)	Participatory process, quantitative indicators linked to human, natural, social, financial and physical capital

Regional "resilience resonates with the growing importance of an evolutionary perspective within economic geography" [24] (p. 2). It helps conceptualize regions in a dynamic, holistic and systematic way [25] and understand the dynamics behind regional change [26]. It is recognized that the response to major shocks may exert a formative influence over how the economic landscape evolves, and - as an indicator of long-run regional growth patterns - regional resilience "can help understand the existence, persistence and evolution of long-run regional disparities" [24] (p. 4). This evolutionary perspective allows perceiving current regional disparities as the outcome of the long cycle of: 1) development in the economic structure, consisting of a major wave of technological innovation that began in the 1970s; and 2) regional evolutionary features, consisting of place-specific endowments of people and skills, firms and industries, formal and informal institutions, innovation capacities, and their reaction to change [1]. In this perspective, it is possible to formulate policies aimed at fostering a transition to a sustainable development, offering insights into the mechanisms that underlie innovations, structural change and transitions [27]. Sustainable transition calls for fundamental shifts in socio-technological systems that result from "system disrupting innovations" [28]. Tödtling and Trippl [28] propose systemic and multiscale policy concepts for new regional industrial path development, paying more attention to the direction of innovation and change. The EU has long pursued a structural change towards the knowledge-based society through the focus of public policies on Research and Innovation. However, such a policy approach is criticized for the lack of a systemic perspective and the disregard of untraded interdependencies and synergetic effects among firms, other organizations and policy makers [28]. Less developed territories have channeled fewer resources in this direction - as a proportion of GDP - despite their need to increase their R&D intensity and innovation activities [7]. In addition, the limited interregional diffusion of technology and efficient production practices account for the large and persistent divergences in economic development across EU subnational regions [29].

2.2 Territorial Scales and Territorial Characteristics

As a response to the persistent socio-economic gaps among regions, the EU Cohesion Policy emphasizes the need to foster territorial development by capitalizing on territorial intrinsic attributes and strengths [30]. The different territorial scales (regional, sub-regional, metropolitan, city) reveal a stark difference between rural and urban regions and between rural regions close to cities and remote ones, which suggests a differentiated policy approach to address different challenges [31]. Moreover, economic systems are always prone to perturbations and shocks, such as recessions, major policy changes, currency crises and technological breakthroughs that can all disrupt and destabilize the path and pattern of economic growth [19]. It is within regional, urban and local economies and communities that such shocks and disturbances work out their effects and consequences [19]. Therefore, approaching territorial scales is relevant to regional development as it implies: 1) a shift from reaching convergence through redistributive regional policies towards endogenous approaches designed to foster territorial features in pursuing growth and competitiveness; 2) the deployment of interventions designed for different spatial scales, and an emphasis on the networking and connection of places; and 3) the strengthening of sub-national governments, through the devolution of political powers, or the adoption of multi-level governance [32]. During the 2014–2020 programming period, EU instruments introduced territorial and scalar varieties into the use of Structural Funds to address in an integrated way the territorial development needs of different regions and sub-regions, allowing interventions to be tailored to specificities of place and scale [30]. Many scholars argue that the need to territorialize policies and funds allows that innovation process is not blindly replicated across European regions, as replication without considering local conditions and broader regional network characteristics would produce a duplication of innovative efforts and fragmentation [33]. "With fragmentation, regional critical mass is barely attainable, the potential gains from scale and agglomeration vanishes, and the potential for complementarities within Europe diminishes" [33] (p. 6). Ultimately, this is likely to damage the sustainability of new regional pathways and reduce the effectiveness of the innovation policy deployed. It is no longer viable to assume that the same drivers of change are effective everywhere, and the appropriate drivers will respond and deliver required outcomes once the right levers are activated [26]. In this direction, an integrated multiscale approach is useful to provide meaningful information for policy-making, as it highlights local contexts features and potentials, integrates spatial scales, and addresses the local capacity of adaptation and transformation [34]. Together with territorial scales, regional characteristics have been increasingly considered as a factor pertinent to persisting regional disparities in the EU. First of all, the specific socio-economic characteristics of each region affect the allocation of EU funds [35]. It is also recognized that local endowments and unique characteristics of regions are important territorial capital for regional development, and that the underdevelopment of lagging regions occurs due primarily to a failure to deliver effective investments and institutions [30]. Also, regional characteristics that affect resilience-related outcomes generally demonstrate an evolutionary feature, as it takes a long time to change them [21]. Regional characteristics, such as geographical, social, and institutional conditions, are considered closely related with the geographical heterogeneity of R&D investments' productivity in the EU by an extensive literature [36]. These elements suggest how regional characteristics prove to be a relevant issue to be considered in designing more tailored strategies sensitive to local contexts. EU regional policies are generating disparate effects on different regions due to the joint force of multiple factors, such as the characteristics of the intervention, the structural characteristics and the specific nature of the territories involved, and finally the kind of context, meaning institutional skills, the social culture and policy-related objectives [37]. Indeed, countries showing an evident regional heterogeneity, including the ability to use structural funds and identify winning regional development strategies, are more likely to evidence the differentiation of the effects of the EU Cohesion Policy on different regions [37]. This is especially true at a time when the EU regional policies are centered on structural change. The changing structure of the economy interacts with the characteristics of regions to generate a pattern of development over time, which has increasingly resulted in divergence among regions especially since the new millennium [1]. Technological progress has increasingly stimulated output in advanced technologies, finance and advanced services sectors dependent on agglomeration economies concentrated in large metropolitan areas [1]. Consequently, regions vary not only in terms of technological and industrial competences, but also in terms of potential evolutionary trajectories [38]. This suggests that the potential evolutionary pathways of an innovation system depend on its inherited structures and existing dynamics including the adaptation or even radical transformation (ibid.) [37].

3 Methodology

To capture both the characteristics of different contexts from a multiscale perspective and their conditions for innovation, we use official statistics of different territorial typologies based on the Eurostat database. The multiscale approach proposed in this paper results from the logic behind the Open Access Toolkit (the analytical framework envisioned by the TREnD project) based on sub-regional units of data analysis likely to introduce sensitiveness measures of adaptation towards transition. It has been recognized that regional statistics alone cannot reveal the full and sometimes complex picture of what is happening at a finer level within the EU. Moreover, statistical information at a sub-regional level is an important tool for highlighting specific regional and territorial characteristics [39]. Therefore, a broad range of territorial typologies were integrated into the NUTS Regulation underlining the importance of subnational statistics as an instrument for targeted policymaking and a tool for understanding and quantifying the impact of policy decisions in specific territories [39]. The different typologies that constitute the building block for official statistics within the EU [39] follow a rigorous methodology in coupling the source of data from a plethora of administrative boundaries, according to each member State, and the need to ground the statistical observations beyond and inside the regional level, namely the NUTS 3 level. Three territorial typologies and their territorial characteristics are investigated: cluster types, local typology, and regional typology including other regional typologies (see Table 3).

Table 3. Definition of territorial typologies according to Eurostat [39]

Classification	Territorial typology	Definition
NUTS3	Urban-Rural typology	Urban-rural typology is applied to NUTS3 regions by identifying three types of region based on the share of the rural population: predominantly rural, intermediate and predominantly urban regions
	Metropolitan regions	These regions are defined as urban agglomerations (NUTS3 regions or groups of NUTS3 regions) where at least 50% of the population lives inside a functional urban area (FUA) composed of at least 250,000 inhabitants
Local Administrative Units (LAU)	Degree of urbanization	The local administrative units (LAUs) is codified as cities, towns and suburbs or rural areas based on a combination of geographical contiguity and population density

(*continued*)

Table 3. (*continued*)

Classification	Territorial typology	Definition
	Cities, commuting zones and Functional Urban Areas (FUA)	A city is a LAU where a majority of the population lives in an urban center of at least 50,000 inhabitants A commuting zone contains the surrounding travel-to-work areas of a city where at least 15% of employed residents are working in the city A FUA consists of a city and its commuting zone
Cluster types	Urban Cluster, urban centers, rural grid	Based on a grid of 1 Km^2 grid cells, the statistics are collected based on urban cluster, urban centers and rural grid defined according to the density of population

From the literature review, we find how developing indicator frameworks to measure resilience is a complex task due to the complexity of each (territorial) system, making difficult a straightforward measurement of territories resilience capacity [23]. We argue that a multiscale approach is important to reveal the variance of the context conditions at different territorial scales. The set of indicators available from the Eurostat database are grouped into different categories, according to the territorial units' typology. The territorial units based on regional statistics, metropolitan regions and urban-rural typology are analyzed through six categories that include several indicators consistent with the main phenomenon explained by each category: 1) demography statistics; 2) economic account; 3) intellectual property; 4) business demography; 5) transport statistic; 6) labor market. The degree of urbanization based on Local Administrative Units (from cities to suburbs) provides information more oriented on explaining the local conditions: health, lifelong learning, education attainment, living condition, labor market, tourism, digital economy. The multiscale approach introduced in this paper plays a crucial role in building the conceptual framework of the TREnD project aiming to: i) understand how different context conditions at different territorial scales suggest different regional responses to innovation-induced shocks, ii) to achieve an effective innovation-oriented development through the transition management of shocks/stresses towards the post-carbon economy. This approach intends to gain a better understanding of regional contexts' diversity by indicating how territorial scales may respond to shocks stemming from socio-economic transitions. Besides, it is equally important to track the longitudinal behavior of territorial scales over time so as to help regions maintain long-term economic growth by facilitating the transition process [40]. Therefore, the multiscale approach is consistent with a fine database – developed for the TREnD Project Open Access Toolkit - organized in such a way to apply data analytics methods and combine longitudinal and territorial trends of selected indicators. The aim of analysis conducted for this paper is twofold: 1) Providing evidence on the need to approach the issue of structural change, transition-oriented, of regions by highlighting the conditions and their potentials at different territorial units; 2) Coupling the multiscale approach with innovation policy in conceptualizing transition towards place-sensitive strategies.

3.1 Territorial Units and Multiscale Approach

To provide evidence on the need to investigate regions' context conditions at different territorial scales concerning regional innovation performance we selected two indicators and two different territorial units, according to the NUTS Regulation [39]. The figures below show the consistency of metropolitan regions (see Fig. 1) and cities, towns and suburbs (see Fig. 2) by the degree of density. These units represent the geographical base maps to investigate the distribution of the two factors, selected from the TREnD project database for this paper. Figure 1 shows the distribution of metropolitan areas in EU Member States based on the degree of population density, and how they are mainly concentrated in the central-northern Europe.

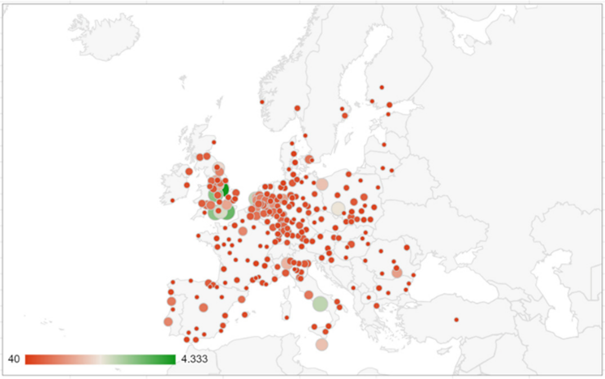

Fig. 1. Degree of population density per metropolitan areas 2016. Source: elaboration of the Authors from Eurostat [41]

Figure 2 shows the degree of population density according to the urban-rural typology. The value follows the territorial distinction in predominately urban areas, intermediate urban areas, predominately rural areas.

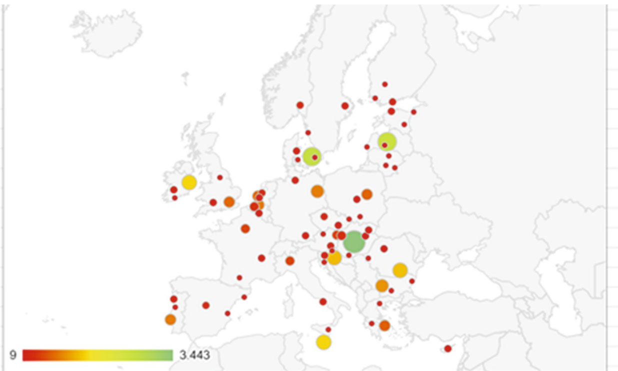

Fig. 2. EU Urban-rural areas: Degree of population density year 2016. Source: elaboration of the Authors from Eurostat [41]

The two indicators selected are consistent with those factors that may indicate and affect regional resilience (Table 1) as explained in the literature review. We use the GDP per capita in 2017 and the European Union trade mark (EUTM) applications in 2017 at metropolitan and urban-rural levels to reveal the disparities in a multiscale perspective, investigating the macroeconomic conditions with innovation capacity. First, we organized the data in terms of frequency distribution with respect to the metropolitan areas and urban-rural areas (see Fig. 3).

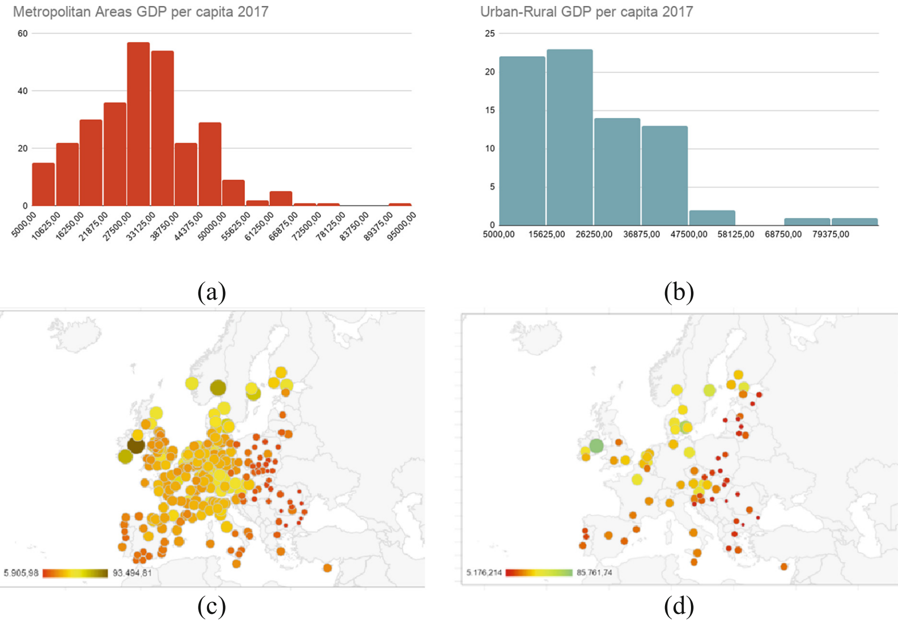

Fig. 3. GDP per capita distribution (2017) per metropolitan areas (a, c) and urban-rural typologies (b, d). Source: elaboration of Authors from Eurostat [41]

The frequency histograms for GDP per capita (see Fig. 3a, 3b) show how the distribution is different according to the territorial unit (see Fig. 3c, 3d), namely more concentrated in the medium range of values for metropolitan areas whereas more concentrated in the low range of values for urban-rural areas. With the aim to reveal a measurement of disparities, the distribution of GDP per capita is investigated through the GINI coefficient. The panel data is formed by metropolitan areas and urban-rural typology partitioned according to Member State. The GINI coefficient is a gauge of economic inequalities, based on population and income, and has several shortcomings in investigating the source of inequalities. To estimate the level of concentration, the GINI coefficient filters the two-dimensional area, the gap between the Lorenz curve and the equality line ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality. Despite the limitations of the explanatory nature of the coefficient, we adopted it to provide a first, general overview of disparities beyond the traditional dichotomy of less developed and advanced regions. The panel data is compressively constituted by 344 observations. The investigation was first conducted to cover the overall European territory (344 observations) by considering the metropolitan areas and urban-rural areas independently from the Member States. The investigation was then directed to each Member State at metropolitan areas (268 observations) and urban-rural areas (76 observations) levels. The overall GINI coefficient calculated for GDP per capita and Population in 2017 among metropolitan and urban-rural areas in Europe is 0,64, whilst the values calculated for each Member State change in a range from a minimum of 0.06 to a maximum of 0,59 (see Table 4).

Table 4. GINI coefficient metropolitan and urban rural areas GDP per capita 2017. Source: Elaboration of the Authors from Eurostat [41] data and TREnD dataset.

State	GDP per capita (EUR)	Highest metro region (EUR)	Non-metro region (EUR)	GINI coeff.
Bulgaria	7.274,57	13.589,88	4.851,30	0,39
Romania	9.545,78	21.761,49	5.905,98	0,41
Latvia	13.862,28	17.796,99	8.301,18	0,17
Poland	12.302,62	26.663,96	9.372,95	0,39
Hungary	12.661,35	19.417,82	9.638,77	0,18
Croatia	11.792,73	16.315,20	9.994,75	0,12
Lithuania	14.814,70	20.567,84	10.481,56	0,20
Estonia	17.949,59	25.754,05	11.725,19	0,19
Slovakia	15.610,95	36.964,16	12.705,78	0,59
Greece	16.319,02	22.065,96	13.296,87	0,16
Czechia	18.123,17	27.277,47	14.420,92	0,27
Malta	24.538,22	25.238,12	14.695,40	0,20
Portugal	18.876,97	24.684,62	16.257,66	0,22
Slovenia	20.814,06	29.404,51	18.036,41	0,09
United Kingdom	35.651,07	54.791,24	22.304,55	0,51
Spain	25.067,02	37.261,51	24.817,64	0,12
France	34.301,92	58.104,84	24.817,64	0,18
Italy	28.469,55	47.935,34	24.906,11	0,27
Ireland	61.472,95	93.494,81	26.060,10	0,27
Belgium	38.686,05	52.576,15	32.534,43	0,12
Germany	39.623,51	64.482,23	33.676,21	0,15

(*continued*)

Table 4. (*continued*)

State	GDP per capita (EUR)	Highest metro region (EUR)	Non-metro region (EUR)	GINI coeff.
Netherlands	43.148,89	54.413,93	35.795,03	0,14
Austria	42.164,01	54.949,19	37.271,75	0,33
Finland	40.674,34	66.166,69	39.837,66	0,23
Denmark	50.933,69	62.971,07	44.265,03	0,11
Norway	61.530,46	76.323,25	57.214,29	0,06
Sweden	47.545,47	66.166,69	39.837,66	0,23

The GINI coefficient as measure of disparities offers interesting insights under the lens of the multiscale approach. Table 4 aggregates the results by member states, whilst the figure below (Fig. 4) shows how the value of the GINI coefficient increases according to the disparities between metropolitan and urban-rural areas within each state.

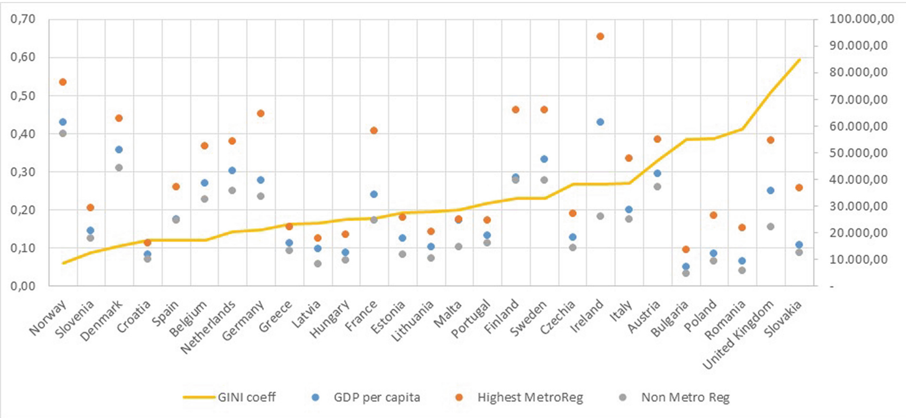

Fig. 4. GINI coefficient for territorial typologies. Source: elaboration of the Authors from Eurostat [41]

The second indicator selected for the investigation rests on the European Union Trade Mark (EUTM) applications in 2017. Eurostat provides a set of indicators based on trade marks - a process that allows creators to establish protection for their industrial property - reflecting also the non-technological innovation in every sector of economic life, including services. In this context, indicators based on trade mark data can provide a link between innovation and the market [42]. For the purpose of this paper it was selected the number of EUTM per millions of inhabitant’s indicator.

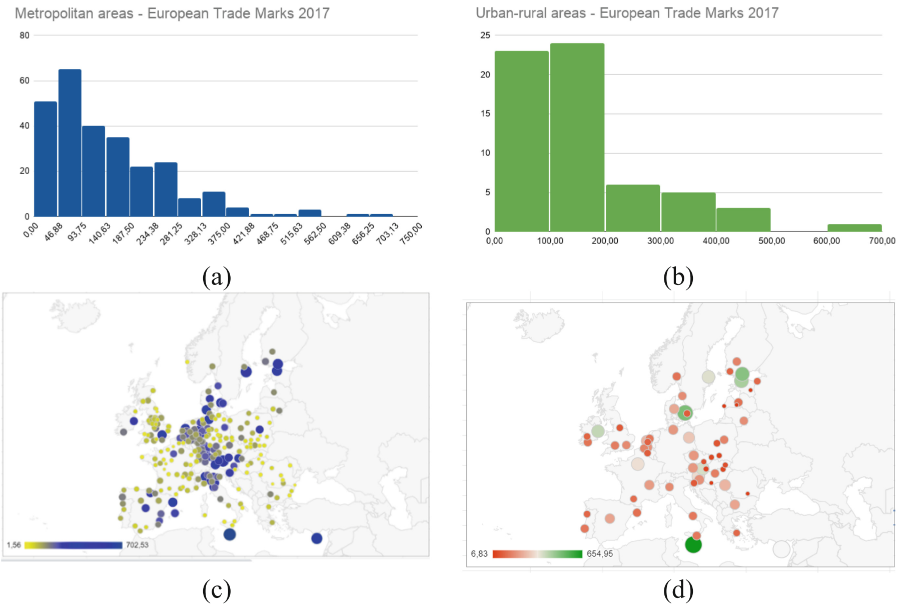

Fig. 5. European Trade Marks (2016) at metropolitan (a, c) and urban-rural scales (b, d) (number per millions of inhabitants). Source: elaboration of the Authors from Eurostat [41]

Figure 5 shows the distribution of the EUTM indicators by metropolitan areas and urban-rural areas. Based on the frequency distribution of the indicator across the two territorial scales, we applied a cluster analysis to classify the values according to: i) low, ii) medium, iii) medium-high, and iv) high performances in terms of number of EUTM per million of inhabitants with respect to the territorial units, in a range of values between 0 and 1. The two figures below (see Fig. 6, 7) display the results of cluster analysis aggregated by Members States against the EUTM indicators analyzed by Metropolitan areas (268 observations) and urban-rural areas (76 observations).

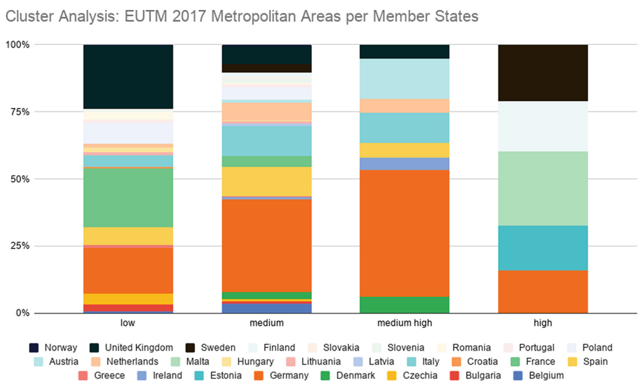

Fig. 6. Cluster analysis aggregated by Member State against the EUTM indicators analyzed by Metropolitan areas (268 observations). Source: elaboration of the Authors from Eurostat [41]

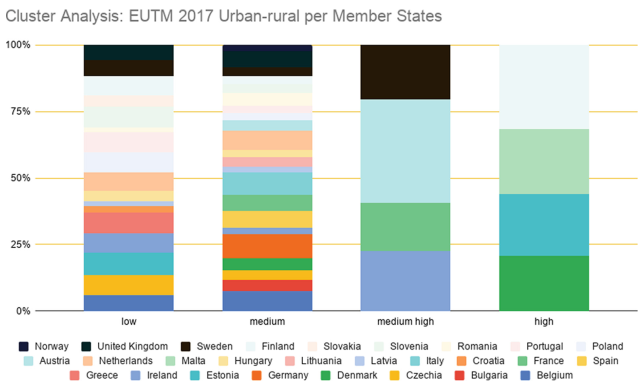

Fig. 7. Cluster analysis aggregated by Member State against the EUTM indicators analyzed by urban-rural areas (76 observations). Source: elaboration of the Authors from Eurostat [41]

To reveal how the proposed multiscale approach explains the relation between conditions and innovation performance, we applied the covariance analysis to express the degree of correlation between the conditions, described by the territorial disparities against the GDP per capita at metropolitan and urban-rural areas, and the innovation performance values from the cluster analysis. Each level of performance was correlated with the level of internal regional disparity according to the metropolitan and urban-rural areas to identify the position of each Member State with respect to the level of inequality and the corresponding level of performance. The figure below (Fig. 8) displays the results concerning the urban-rural areas. Each quadrant identifies the location of States based on the correlation between the level of performance and the level of disparities in terms of urban-rural areas.

The first bottom left quadrant (Fig. 8a) shows the correlation of low level of performance with the disparities inside the urban-rural areas of each state. Next, the second bottom right quadrant (Fig. 8b) shows the correlation of medium level of performance with the disparities inside the urban-rural areas of each state, the third top left (Fig. 8c) quadrant concerning the medium-high level and the fourth quadrant (Fig. 8d) the high level.

3.2 Results and Discussions

The objective of the analysis conducted was to introduce a multiscale approach to target policy actions based on contexts' characteristics and needs unleashing their potentials according to the TREnD Project Open Access Toolkit. The analysis takes into account two indicators as explanatory of context conditions and innovation performance to frame the multiscale approach. Context indicators provide simple and reliable information on context's variables [43]. Moreover, as an instrument of monitoring and assessment for measuring the achievement of a specific objectives' set and aggregated by sector or macro-area of intervention (demographic, social, environmental and economic), context indicators are important to enable an integrated reading of territorial dynamics [44]. The European Commission adopts context indicators to

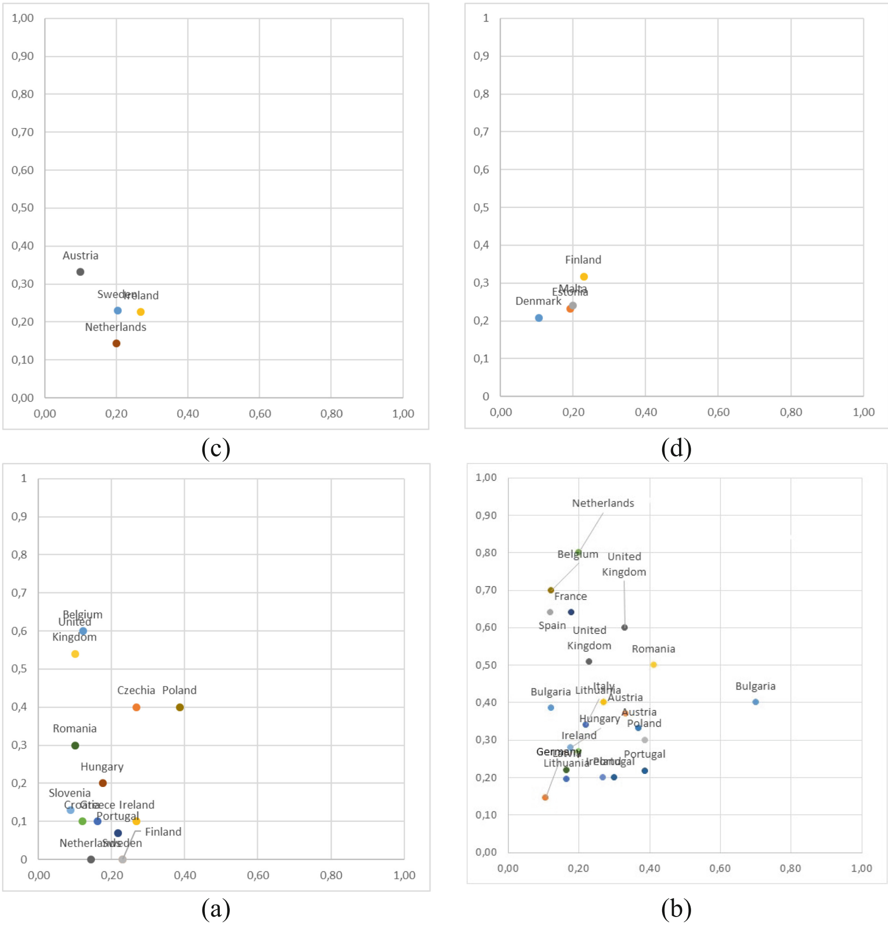

Fig. 8. Relationship between conditions and innovation performance in Urban-Rural areas by member states. Source: elaboration of the Authors from Eurostat [41]

monitor changes of countries' specific variables focusing on the basis of macro-categories of indicators [43]. Innovation performance indicators concern both R&D indicators and technological transfer related to business and entrepreneurial capacity. The methodology used to explain the multiscale approach is articulated in different steps consistent with the logic underlying the construction of the Open Access Toolkit within the TREnD project rationale. Results suggest how the interregional disparities, analyzed against metropolitan and urban-rural areas, coupled with the clustered level of innovation performance, depict different geographical patterns, which move forward the traditional dichotomy between lagging regions and core regions. Based on the level of performance (innovation) at urban-rural level, the results in the Fig. 8 display how the position of Member States varies across the different quadrants by taking into account the internal disparities. Although the paper proposes the multiscale approach by analyzing only two indicators, the results may converge on revealing the phenomenon of how the new geography of knowledge concentration is giving rise to a complex divergence that rests on different conditions within regional contexts. It could be argued that the multiscale approach can help make effective place-sensitive strategies for the transition towards the achievement of the Green New Deal objectives. It can capture the divergence of capabilities to cope with shocks stemming from technological progress both among and within regions.

3.3 Conclusions

The paper is aimed to introduce a multiscale approach – grounded on the TREnD Research Project Open Access Toolkit - to address the issue of transition-oriented structural change of regions by highlighting the context conditions and their potentials at different territorial scales. The European Green Deal has introduced a new "growth" strategy for the European Union [5]. It is a comprehensive, ambitious and bold plan whereby climate, environmental and social protection goals permeate its five "building blocks": global competitiveness, sustainable growth and digital growth agenda, socially just, empowering and inclusive growth strategies. Such transformative pathways help set the stage for policy actions in the upcoming post-2020 programming period [5], making a sharp – and yet much needed – shift in the EU policy-making approach. A paradigmatic shift from a primary push towards productivity and competitiveness goals to the pursuit of a "renewed" concept of competitiveness – socially just and environmentally responsible – by means of a reformed pan-European economic model. The adoption of a new growth and development strategy underpins a strong Transition, which can and will eventually pose additional challenges. Despite addressing climate change issues, environmental risk and other pressures is a common endeavor across Member States, not all regions – and sub-regions – will be equally impacted by and able to react to the multi-faceted Transition-induced shocks ahead. To this end, the "Just Transition Mechanism" [4] comes to the fore to sustain European regions displaying high degrees of dependence on traditional modes of productions and consumptions schemes (e.g. carbon-intensive activities, consumer choice and routines) in several domains, hence scarcely resilient. From a spatial and temporal standpoint, both inter- and intra-regional resilience is intra – is highly fragmented and sharply influenced by the complexity of contexts' characteristics that vary over time and across spatial scales. Therefore, we argue that the proposed multiscale may guide the identification of the specific context conditions that can be embodied within the Just Transition Mechanism, allowing peripheral regions to be more resilient to transition-induced shocks [1]. The multiscale approach, indeed, embraces the concept of regional resilience as the long-term aggregated ability of socio-economic systems to withstand transition-induced shocks by rapidly re-organizing their socio-political, institutional, economic, knowledge structures and networks, whereby developing new growth paths [17, 19, 20]. To this end, the multiscale approach intends to integrate and bridge two concepts/approaches which we posit as being inter-dependent: i) scale-sensitive recognition of territorial features and conditions [1, 3, 45] and ii) resilience to Transition-induced shocks [5]. Our framework, enriched by sets of indicators that couple conditions with performance, can be used to explore and identify in further studies EU settings – profiled and classified using a place and scale-sensitive and evolutionary approach (longitudinal) – that are more exposed to systemic risks associated with the transition process.

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Smart Specialisation 2.0: Driving Public Funds Towards Platforms and Ecosystems

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Abstract. The paper negotiates two main questions of the methodology of EDP in Smart Specialisation. First is the granularity level of detail in the analysis and the assessment of dynamism of economic activities. We argue that NACE three-digit codes offer the best combination of homogeneity of statistics and sectoral studies. Still, all NACE three-digit codes are not cadets for discovering business opportunities and new innovation activities and therefore, further research for the selection of priority fields is necessary. Second question is about the collective nature of interventions and investments developed through EDP. We argue that business ecosystems that unite large number of enterprises may exceed the risk of priority investments for specific businesses and groups. The demarcation of investments in relation to platform-based ecosystems as well as of ecosystems which are developed on top of value chains is of particular importance. Both methodological principles which are proposed in the paper (selection of three-digit NACE code ecosystems and platforms based on functions/needs of such ecosystems) can complement the theoretical weaknesses that reasonably exist in terms of discovery and innovation.

Keywords: Smart specialisation · Platforms · Platform ecosystems · Investment priorities · Entrepreneurial discovery process

1 Introduction

In Europe, Smart Specialisation emerged as a leading political instrument of cohesion policy during the 2014–2020 programming period (Foray 2014; McCann and Ortega-Argiles 2015). The overall objective of RIS3 is to create innovative, but place specific and evidence-based capabilities, which take advantage of available resources and competences within a process of diversification and transformation. In particular, diversification and industrial transformational strategies should foster cross-sectoral links and/or cross-border cooperation (Landabaso 2014). These capabilities have to be identified and revealed through an Entrepreneurial Discovery Process, in short

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EDP. This new policy instrument was embraced and massively implemented by European regions (Foray 2019) despite the conceptual misunderstandings and difficulties in operationalisation. Today, both the policy and the core principles remain valid and regions will have to repeat this exercise for 2021–2027 since smart specialisation remains a core element of the next period of cohesion policy.

A core element of Smart Specialisation Strategies (S3) which drive the European Structural Investment Funds (ESIF) in European cities and regions is the Entrepreneurial Discovery Process (EDP). The EDP, which is considered the cornerstone of smart specialization (Kyriakou et al. 2017), aims to highlight areas of the regional economy that offer the highest potential for future development and to deal with the difficult problems of selecting and hierarching investment priorities and of allocating the ESIF to specific priorities. During the EDP business stakeholders enter a government-led participatory process and a collaborative dialogue that integrates their fragmented and dispersed knowledge, setting common priorities for intervention and investments for growth. The existence of such an open participatory process together with the use of reliable data, guarantee that the selection of priorities will not be defined based on the interests of specific stakeholders and the region will not lock-in to traditional activities.

Guidance on Entrepreneurial Discovery Process (EDP) was provided by the RIS3 Guide and other official documents on aims, contribution to prioritisation, and methods of implementation.

- EDP "aims to build a systematic understanding of the areas in the economy and society that have the greatest potential for future development" (p. 20) & "mobilise talent by matching RTD + I capacities and business needs through an entrepreneurial discovery process" (p. 17).
- "Smart Specialisation should address the difficult problem of prioritisation and resource allocation based on the involvement of all stakeholders in a process of entrepreneurial discovery, which should secure a regionally and business-driven, inclusive and open prioritisation process" (p. 52).
- "There are different methodologies for organising such processes, e.g. surveys, seminars with participatory leadership methods, crowdsourcing, etc. Such an open, participatory process, together with reliance on robust evidence based on regional assets, are the best guarantees to avoid both the risk of capture by interest groups and the risk of lock-in into traditional activities" (p. 52). "An effective appreciation of dynamic EDP can only be performed if entrepreneurial actors and management and governance bodies responsible of RIS3 engage in direct discussion" (p. 20).

Despite the guidance provided, serious gaps and open questions still remain in the theory and methodology guiding EDP (Komninos et al. 2018). Related variety offers a reference framework, but not the methodological background for the choice of related or unrelated specialisation and, afterwards, for the selection of investments within priorities' activities. These questions come again to the front, as regions have to initiate a stage (or wave) 2.0 of smart specialisation, this time focusing more on interregional cooperation and good governance (CoR 2018). The S3 in the next programming period will focus on a number of enabling conditions, for good governance, such as (1) Analysis of challenges including bottlenecks for innovation diffusion, (2) Existence of competent regional/national institution or body, responsible for the management of the smart specialization strategy, (3) monitoring and evaluation tools to measure performance towards the objectives of the strategy, (4) Functioning of stakeholders cooperation (entrepreneurial discovery process), (5) Actions necessary to improve national or regional research and innovation systems, (6) Support industrial transition, and (7) Actions for internationalization.

The next section provides a short review of the current literature presenting the background of RIS3 implementation and existing challenges. The third section is an analysis of the methodology used for a survey on ecosystems in Greek NUTS-2 regions while the last section provides a discussion of the survey's results and also gives some policy recommendations for the future programming period.

2 Smart Specialisation in Practice: Past Challenges and Future Questions

The Research and Innovation Strategy for Smart Specialisation (RIS3) requires EU regions to leverage private research and innovation expenditure towards a limited set of priorities. Such priorities are "*areas of investment which regional or national authorities identify as 'key', in order to build competitive advantage by developing and matching research and innovation own strengths to business needs and to address emerging opportunities and market developments in a coherent manner*" (Official Journal of the EU 2013). Selection of priority areas is viewed as a process of entrepreneurial discovery through a permanent process of navigation, continuous monitoring and adjustments (Foray 2019).

Achieving an effective prioritisation through EDP has proven to be a challenging task, undermined by a number of issues, among which is the weak understanding of the S3 concept (confusion between prioritisation of industry sectors and clusters or on technological specialisation, KETs and value chains) (Reid et al. 2012; Komninos et al. 2014; Iacobucci 2014); the translation of theoretical guidelines and methodologies into practice (e.g. the identification of technological priorities in peripheral areas with low level of patents (Griniece et al. 2017; Panori et al. 2017; Gianelle et al., 2019); the actual process of prioritisation (the dilemma of diversification, i.e. the identification and selection of tradjectories for future related diversification) (Boschma 2017; Balland et al. 2019); the existence of bottlenecks in the selection of priorities due to different institutional settings and governance capacities (with EDPs leading to lock-in) (Kroll 2015; Hassink and Gong 2019) and the fulfilment of the EC's ex-ante conditionalities (lack of consistency, no clear demarcation between the national, macro-regional, and regional scope of action and responsibility) (Piatkowski et al. 2014). The effectiveness of prioritisation has also been linked to 'the governance of RIS3', i.e. the elements in the institutional setting, the organisation and processes of RIS3 which contribute to the improvement of RIS3 management, monitoring and evaluation, the effective functioning of EDP, but also to the effective industrial transition and international collaboration.

Existing literature and policy reports on prioritisation focus on the categorisation of RIS3 priorities (degree of homogeneity, clustering or taxonomy of priorities) and less on their selection method (McCann and Ortega-Argilés 2016; Iacobucci and Guzzini 2016; Gianelle et al. 2019; Pavone et al. 2019). Evidence shows that there is a large variety of priority setting approaches among EU countries and among EU-regions (McCann and Ortega-Argilés 2016) although these can be grouped into coherent clusters of key activities (e.g. agro-food, life sciences etc.) (Pavone et al. 2019). According to the European Commission (EC 2012), priorities could be determined in terms of knowledge fields, subsystems within or across sectors, clusters, or technologies. Gianelle et al. (2019) based on their analysis of 39 policy documents from Italy and Poland argue that S3 priorities can be defined as a distinctive combination of four dimensions: (1) the sectors or value chains of primary interest for the intervention, (2) the transformative processes to be activated (technology applications), (3) the societal challenges to be addressed, and (4) the natural and/or cultural resources to be used. Classification methods may vary, ranging from sectoral classification to text mining or multi-dimensional analysis. This wide range of definitions/interpretations was due to a gap in the S3 theory of what an investment priority should be but also in the methodology guiding EDP.

Regardless of the actions taken for simplification and the widespread experimentation, a significant gap remains between theory and practice. The specifications of S3 make clear that the objective is diversification and industrial transformation towards higher added value activities. Diversification may be intra-industry, when research and innovation change and improve products and processes of an industry or inter-industry, when innovation leads to branching of an industry towards other sectors. Inter-industry diversification may be "related" to existing skills and know-how or "unrelated" towards new skills and know-how. Empirical evidence suggests that knowledge spillovers within a region, or smaller country, occur primarily among related sectors, and only to a limited extent among unrelated sectors. It is the related variety in a region that feeds branching out new activities from technologically related activities, not regional diversity nor regional specialisation per se (Boschma and Frenken 2011, p. 67). Therefore related variety can guide the selection of priority activities for inter-industry related diversification, but to our knowledge there isn't so far any theoretical guidance about the diversification of industries in the case of intra-industry change or inter-industry un-related change.

This discussion brings EU countries and regions with three main challenges. The first refers to the actual identification of priority areas which reflects a clear policy direction. This selection should be based (a) on the detection of existing (knowledge, technological, market-related) capabilities and specialisations and (b) the selection of the most promising ones for potential diversification which are expected to unleash a highest potential for the future. The identification of such capabilities, especially through a collective process of EDP entails a high level of risk and should therefore be evidence based. This requires the employment of custom-made policy intelligence that draws upon the correct type of data depending on the country/region. The focus for example on patents underestimates other types of capabilities and is not relevant for less developed regions. Also, there is a delicate balance in the sense that priority areas should not be too general or too specific (Foray 2019).

The second challenge refers to the actual design of the strategy. Even after the selection of priorities how can a country/region best utilize funds in order to maximize the potential? What are the best actions that should be taken to unleash the potential of these sectors and how can theory orientate policy mix? The indication of bringing a critical level of investments on a few set of priorities might orientate funds towards ventures with limited beneficiaries which contradicts the actual notion of public policy.

These questions are accompanied by a methodology gap regarding the EDP granularity. Granularity allows defining the level of detail in modelling industries or decision-making processes. The greater the granulation, the deeper the level of detail and the better understanding of trends. Statistical data on industrial activities are given at four levels of granularity, classifying industries in 21 Sections, 88 Divisions, 272 Groups, and 615 Classes. We don't dispose any methodological guidance about the best granularity level to perform EDP. For instance, is it better to perform EDP at the level of industry sections, industry divisions, industry groups, or industry classes? The JRC application Eye@RIS3: Innovation Priorities in Europe which depicts S3 priorities across Europe shows that most member-states and regions have selected priorities (thus performed EDP) at the level of industry section or division. This is rather a low granularity EDP, which obstructs a clear outline of industrial diversification, because sections and divisions include a mixture of industrial activities with very different future trajectories. Dealing with the above three challenges is crucial for any country/region implementing their smart specialisation agenda, yet it becomes more daring for peripheral or less developed regions and for regions with low institutional capacity and advanced governance mechanisms, such as Greece.

3 Ecosystem Discovery: A Survey for Greece

We focus our analysis in the thirteen NUTS-2 level Greek regions. Greece is a peripheral country in the EU with below average GDP per capita and only a moderate innovator. The country, which is mainly based on tourism and the overall services sector, has one of the lowest levels of patent applications in Europe. Given the low levels of growth and the significant effects of the recent economic crisis in the country's economy, Smart Specialisation has a higher significance as a chance for achieving cohesion and catching up more developed countries.

Stage 1 of our survey deals with the prioritisation challenge by adopting a method based on data than theory. We start from the statement that all industries of a country or region have potential for diversification and growth. Our intention is to test the feasibility of this approach for Greece. Instead of selecting a few industries and perform EDP in them, we examine the most important industries per region, in terms of size and specialisation. Two reasons justify this orientation of work: (a) the widely accepted S3 principle for place-specific innovation strategy or "one-size-does-not-fit-all", which suggests that the most robust theoretical prediction should be assessed with place-specific data, and (b) the probability of finding innovative solutions in less expected activities, a trend outlined by many aspects of innovation theory, such as the probabilistic and non-deterministic character of innovation, serendipity in innovation, and innovation outcomes by chaotic systemic combinations.

We test the feasibility of performing EDP at the level of NACE industry groups (272 groups) for all important industry groups per region of Greece, in four steps (a) starting with the regional distribution of industrial activity in Greece at NACE group level, (b) defining the most important industry groups per region, (c) defining the top-10 industry groups in the 13 regions of Greece, (d) assessing the diversity of industry groups in all regions of Greece and the needs for EDP exercises. More specifically, after listing industry groups per region, we produced four ordered lists of industry groups per region, by number of companies, number of employees, location quotient on companies, and location quotient on employment (top-40 industry groups). These lists which sort industry groups per size and specialization were used to select the first ten industry groups by size and specialisation. Top-10 industry groups in the 13 regions of Greece (Table Annex 2) belong to 51 categories, of which 26 categories appear in more than one region and 25 in one region only. These 26 industry groups hold 105 out of 130 (81%) top-10 positions in all regions of Greece. This finding indicates that with EDP at 51 industry groups we can cover all most important industries of Greece, while with EDP at 26 industry groups we can cover 81% of most important industry groups in Greece.

Stage 2 is a complementary survey which deals with the discovery challenge. Having included all important industry groups in the EDP process, our intention is to assess the conditions for diversification and transformation per industry group. The questions that appear here are “which is the potential for successful EDP in each of those 51 industry groups?”, “should we perform EDP in all cases or some industries don’t meet the conditions for a successful outcome?”, “can we state common problems to address through EDP in each and every of the 51 industry groups?”, “is there critical innovation capacity and motivation for innovation in all 51 groups?” and “is there potential for ecosystem building for the benefit of all companies of an industry group?”.

To answer these questions, we undertook a four-step study. We started with (a) an interview-based survey with business stakeholders and experts in the 13 regions of Greece to identify industry groups with potential for ecosystem building, (b) continued with a desk study of business and challenges per selected industry group (25 out of the 51 industries), (c) a survey on research and innovation demand per industry group, and (d) ended up identifying challenges and platforms that may orchestrate companies towards common goals and ecosystems. The latter is particularly important when it comes to maintaining EDP as a public policy exercise that promotes collective rather than individual goals.

We use the concept of platform and platform-ecosystem to bring together companies and stakeholders under the same challenges and objectives. By examining growth and innovation data and trends to define challenges, platforms, and ecosystems per industry group, we try to re-assess prioritisation with respect to capacity to define common problems and platforms for ecosystem building. Priority activities are those where a common problem allows for defining a platform, which in turn enables the transformation of the industry group. We examine growth and innovation trends per industry group and the potential for ecosystem building over platforms for industrial transformation. In such platform-based ecosystems, ecosystems that don’t pre-exist but are formed over platforms, which orchestrate both the supply and demand side of the respective industry (see Fig. 1).

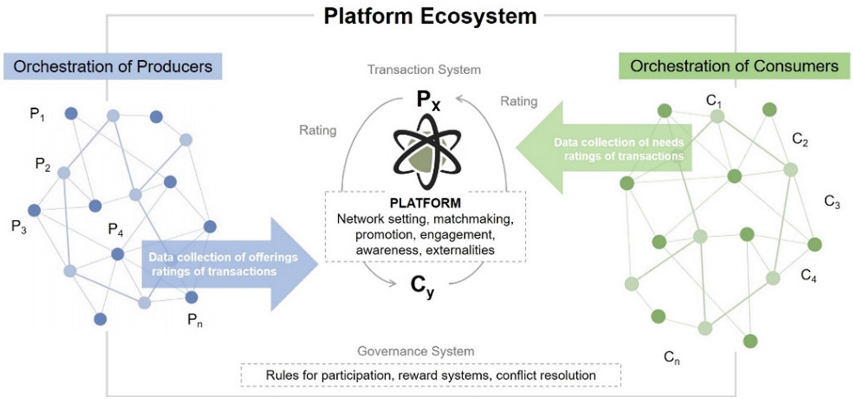

Fig. 1. Platforms driving the emergence of ecosystems.

Our analysis revealed about 25–40 industry groups which can cover the most important economic activities. Out of the 25 most important industry groups, 21 (85%) were included in the respective RIS3 priority domain with significant differences however in the level of analysis. Most of the identified industries face common challenges which reflect their problems in dealing with exports, eco-labels, new products, waste management, technology support from competence centres. Based on these challenges we identify 22 industry groups in which business and innovation ecosystems can be created under the guidance and orchestration of well-designed platforms (Table 1).

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Platforms and value chains can connect companies around such common challenges forming orchestrated ecosystems (Kakderi et al. 2018). The types of platforms identified are (i) market-driven, with emphasis on demand, market access, branding, product promotion; (ii) product-driven, with emphasis on new products, smart products, quality, certification; (iii) technology-driven, with emphasis on research, production processing, supply chain integration; (iv) infrastructure-driven, with emphasis on physical, institutional, equipment, tools and (v) materials-driven, with emphasis on new materials, raw material, waste, and materials recycling. The type of ecosystems these platforms can sustain is regional and national. The majority are mature ecosystems in traditional business activities, while there is also a small number of emerging ecosystems (20%) in ICT, pharmaceutical and research services. Also, we observe an

Table 1. Industry groups and ecosystems key features

Region	Industry group / ecosystem	Included in RIS3 2014–2020 priorities	Size of ecosystem	Mature or emerging ecosystem	Research and innovation demand	Initial identification of innovation platform	National/regional ecosystem	EDP for platform design
East Macedonia Thrace	22.2 Manufacture of plastics	Yes	Small	Mature	Medium	New product/materials	Regional	Yes
	23.7 Cutting, shaping of stone	Yes	Large	Mature	Medium	Brand/byproducts	National	Yes
	26.2 Manufacture of computers	Yes	Small	Emerging	High	No	Regional	No
Central Macedonia	10.3 Processing fruit and vegetables	Yes	Large	Mature	High	Brand/packaging	National	Yes
	14.1 Manufacture of wearing apparel	Yes	Large	Mature	Medium	Brand/design	Regional	Yes
	25.1 Manufacture of structural metal products	Yes	Large	Mature	Medium	Materials	Regional	Yes
West Macedonia	16.2 Manufacture of products of wood	No	Large	Mature	Low	Brand/eco-quality	National	Yes
	14.2 Manufacture of fur	Yes	Large	Mature	Low	Export	Regional	Yes
Epirus	10.1 Processing of meat	Yes	Medium	Mature	Medium	Brand/packaging	National	Yes
	10.5 Manufacture of dairy products	Yes	Large	Mature	High	Brand/packaging	National	Yes
Thessaly	22.1 Manufacture of rubber products	No	Small	Emerging	Low	No	Regional	No
	31.0 Manufacture of furniture	No	Large	Mature	Low	Commercial infrastr.	National	Yes
St Ellada	24.2 Manufacture of tubes of steel	Yes	Small	Mature	Low	New product	Regional	No
Ionian Islands	79.1 Travel and tour operator activities	Yes	Large	Mature	High	New products	National	Yes
Attica	90.0 Creative, arts activities	Yes	Large	Mature	High	Digital infrastr.	National	Yes
	62.0 Computer programming	Yes	Large	Emerging	High	Market/infrastr	Regional	Yes
	21.1 Manufacture of pharmaceutical products	Yes	Small	Emerging	High	New products	Regional	Yes
Western Greece	03.2 Aquaculture	Yes	Medium	Mature	Medium	Brand/product	National	Yes
	10.9. Manufacture of	No	Medium	Mature	Medium	Production/chain	National	Yes

(*continued*)

Table 1. (*continued*)

Region	Industry group / ecosystem	Included in RIS3 2014–2020 priorities	Size of ecosystem	Mature or emerging ecosystem	Research and innovation demand	Initial identification of innovation platform	National/regional ecosystem	EDP for platform design
	prepared animal feeds							
Pelo-ponnese	11.0 Manufacture of beverages	Yes	Large	Mature	High	Production/byproducts	National	Yes
North Aegean	10.4 Manufacture of vegetable oils and fats	Yes	Large	Mature	High	Brand/quality	National	Yes
	03.1 Fishing	Yes	Large	Mature	Low	Brand/infrastruct	National	Yes
South Aegean	50.1 Sea passenger water transport	Yes	Large	Mature	Low	Infrastructure	National	Yes
Crete	55.1 Hotels and similar accommodation	Yes	Large	Mature	High	Market access	National	Yes
	72.1 Research in natural sciences & engineering	Yes	Large	Emerging	Medium	Infrastructure	National	Yes

equal distribution of small with less than 100 companies in the region of reference and large ecosystems with more companies.

The above observations may clarify the inclusion of industry groups studied in EDP exercises. In 22/25 (88%) of cases, this preliminary investigation documents that EDP conditions are met and EDP should follow to reveal the features of platforms and other commons for ecosystem building. In these 22 cases, there is substantial evidence that EDP may drive actions proper to public policy, promoting collective rather than individual interests. All national ecosystems should be included for EDP, while 3 out of 10 regional cases do not meet the conditions for EDP, due to low innovation demand, small number of companies in the group, and mature than emerging industries.

4 Re-orienting EDP Towards Platforms and Ecosystems

This exercise revealed some important findings for Greece but also indicates some policy recommendations for other territories. Industry platforms address common challenges of companies belonging to an industry group and create favourable conditions for setting up business and innovation ecosystems (Panori et al. 2020). In every top-10 industry group we have identified production, trade, technology and environmental challenges. With respect to these challenges, EDP should focus on the design of platforms that drive the formation of business ecosystems.

The definition of common challenges and potential platforms is a pathway to platform-ecosystems. Research in the field of platforms shows that “industry platforms are technological building blocks (that can be technologies, products, or services) that act as a foundation on top of which an array of firms, organized in a set of interdependent firms (sometimes called an industry "ecosystem"), develop a set of interrelated products, technologies and services" Gawer (2010; 287). Equally, platforms can be understood as collaborative business models based on technology that engender ecosystems. A platform is "a plug-and-play business model that allows multiple participants (producers and consumers) to connect to it, interact with each other and create and exchange value" (Castellani, n.a.).

Platform-based ecosystems are created when an organisation launches a platform that becomes the foundation for products and services of other companies. Gawer and Cusumano (2002) call this relationship "platform leadership", a strategy that enables companies to exert influence over the direction of innovation in an industry, by engaging other firms in a joint effort for complementary products. Industry-wide platforms offer resources that third party organisations can use to develop their own complementary products, technologies, or services. They enable the creation of business ecosystems and has a disruptive network effect in many industries. They are foundations for setting up ecosystems of organisations that share resources, knowledge or access to markets (Gawer and Cusumano 2014). Working with an industry-wide platform typically results in a two-part structure: on the one side, there is the specific solution that is hosted on the platform, and on the other side, there is the platform with its infrastructure, hardware, software and data which communicate with the hosted solutions and organise collaboration according to established procedures.

Platforms must be designed as service providers. Their detailed design must define the model of service provision, the providers, services, and users, as well as the business model, the service operation model, and the quality model of provided services assessment. Failure of defining a sustainable service model is equal to EDP failure and no further policy support to the respective industry group should be provided. Platforms may be physical, institutional, infrastructure and digital. They can be market-driven, product-driven, technology-driven, infrastructure-driven or materials-driven. Platforms providing services for market making (access, branding, promotion), product development (innovation, quality, certification, standardisation) and technology development (materials, processing, value chain optimisation) are mostly needed to address growth and innovation challenges of business ecosystems. They give birth to business ecosystems created around common challenges. Platforms and ecosystems guarantee the public character of policy mix and actions deriving from EDP as they serve common needs of an industry group than individual trajectories and interests of companies. Such ecosystems do not need to exist prior to the platform, since it acts as an anchor orchestrating complementors. Ecosystems can be created in each and every industry group around a challenge and common assets that may deal with the challenge. The starting point is to recognize some form of externalities (conditions outside the market and inter-firm competition) and how a platform can engage the companies of the industry group and offer advantages in dealing with the challenges they face. It may be an e-commerce platform, a common quality control laboratory, a common treatment of production waste. It may be also a service developed by a group of companies, which is needed, without being a field of competition.

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Industrial Policies and Evolutionary Paths: A Case Study of the Impact of the Greek Investment Law to Effect Investment Decisions of Greek Firms

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Abstract. The main objective of the article is to test the difficulty of changing evolutionary paths, by studying the evolution of the sectoral outcomes of one of the basic regional and industrial policy tools in Greece, the Greek Investment Law (GIL), through a brief analysis the past and present experience of GILs. Based on a unique database of the past four GILS, I will try to comment on the effectiveness of the policies in altering the investment decisions of Greek firms, in the light of the national Smart Specialisation Strategy (3S), particularly focusing on the current law (for which there is some preliminary unpublished data), which incorporates - but is not limited to - the sectoral priorities of the Greek National 3S Strategy, and the degree to which this is visible in the preliminary data. More specifically, I will focus on the extent of visible changes in the sectoral distribution of the recent GILs and whether these seem to converge to the targets of the Greek National Smart Specialization Strategy and whether the lack of convergence can be ascribed to the workings of evolutionary mechanisms and in particular a political and cognitive lock-in.

Keywords: Investment laws · Greek 3S · Diversification

1 Introduction

Given the rather limited literature evaluating Smart Specialisation and – perhaps even more so – the entrepreneurial discovery process [1], which should, at least in theory identify the activities (sectors, clusters, ecosystems) to be assisted, through the participation of a wide array of local actors), this paper aims to critically evaluate at least two aspects of Smart Specialisation. The former is the conditionality attached to Smart Specialization requiring policies to comply to the priorities of national or regional 3S. What I will try to show is that adapting 'traditional' top-down industrial/regional policy instruments to fit 3S often yields very limited results. The latter (which is inextricably linked to the former) is related to the perceived effectiveness of the entrepreneurial discovery process. In particular, I would like to test the hypothesis that the sectoral priorities of Smart Specialisation strategies identify potential sources of growth, increased profitability and attractiveness to investors. If this is the case, then, these

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activities should emerge as preferred choices for both incumbent and nascent enterprises and investors even in the absence of specific or mission oriented policies. What I will argue is that in fact evolutionary paths often prove very difficult to change.

Further, I will try to probe into whether we can ascribe the stability of investment decision of Greek firms (and consequently the stable industrial structure of Greece) to the workings of evolutionary mechanisms and in particular a political and cognitive lock-in, or whether this, as Glasmeier [2] warns, would constitute an uncritical use of the concepts.

The paper will be based on the past and current experience of one of the basic regional policy tools in Greece, the Greek Investment Laws (GILs). By studying the evolution of the sectoral outcomes of past and present GILs I will try to comment on the effectiveness of the 3S, particularly focusing on the current law (for which there is some preliminary unpublished data), which incorporates - but is not limited to - the sectoral priorities of the Greek National 3S, and the degree to which this is visible in the preliminary data. More specifically, I will focus on the extent of visible changes in the sectoral distribution of the recent GILs and whether these seem to converge to the targets of the Greek National 3S.

2 Path Dependence and Lock-Ins

The notion of path dependence concerns the influence of past conditions, choices and policies on current outcomes, or as Walker [3] noted, the fact that *"... industrial history is literally embodied in the present"*. In anticipating the evolutionary turn in Economic Geography Storper and Walker [4] wrote that: *"Localized technological change in an industry can be understood, like all industrial development, as an evolutionary path in which each step moves one way from a past that cannot be recovered and that limits future directions*'.

The notion of path-dependence was introduced by the economists David [5], who wrote on the economic history of technology and Arthur [6], who was interested on self-reinforcing cumulative economic processes. During the recent years, path-dependence and various other concepts of evolutionary thinking have been elevated into one the dominant concepts of economic geography [7] employed on numerous occasions as the hermeneutic instruments to a wide array of issues related to uneven development, such as the persistence of regional disparities, the lock-in of regions to particular functional specializations [8] and cluster development [9].

Similar notions had been used in economics and economic geography in the past. First and foremost is Myrdal's [10] attempt to account for uneven development through the cumulative causation concept, which aimed at explaining regional divergence as product of circular processes, or a stream of events directly flowing from a random starting point in the recent or distant path. As Kaldor [11] noted, it is *"the cumulative advantages accruing from the growth of industry itself–the development of skill and know-how; the opportunities for easy communication of ideas and experience; the opportunity of ever-increasing differentiation of processes and of specialization in human activities"*. The idea that current outcomes are inescapably shaped by past choices is also dominant in the various stages of growth/lifecycle theories [12–15] which view growth as a sequential process of various stages which eventually lead to a final optimal stage. One of the main differences between stages/lifecycle theories and path dependence [16] is that the former appear to be overly deterministic, prescribing the exact stages that firms, milieus, regions or countries will go through, making the exact definition of stages (and their sequence) the *raison d'être* in such theories. In contrary, according to Martin and Sunley [17], in more recent approaches of Economic Geography ('evolutionary', 'institutional' and 'relational'), in path-dependence there is *"an emphasis on the context-specific, locally contingent nature of self-reinforcing economic development, particularly the "quasi-fixity" of geographical patterns of technological change, economic structures and institutional forms across the economic landscape",* implying that path-dependence is not a deterministic mechanism. Finally, concepts pertaining to path dependence have also been widely used by Marxist economic geographers (such as Harvey [18] and Massey [19]), who viewed uneven development as a historical process.

A lock-in is a situation where a number of factors will tend to maintain existing industrial structures, even when they have reached maturity delaying their obsolescence, along with the necessary industrial restructuring. According to the literature [8] there exist three types of lock-ins:

- functional lock-ins (stemming from close and stable linkages between firms),
- cognitive lock-ins (a common world view created through social reinforcement, that dictates how to interpret external signals) and
- political lock-ins (the politico-administrative system that keeps a region on course, even when this course is a dead-end).

Although the writings of Arthur and David are widely considered to be the starting points of the recent interest in lock-ins, there are some considerably older ideas closely resembling the lock-in concept [20]. Olson's [21] arguments on the negative impact of institutional sclerosis on economic development at the national level seem to fit the articles case study very well. Olson referred to the emergence of interest groups which can stimulate the rent-seeking behaviour of actors. Not only can institutional rigidities[1] hinder economic restructuring at both levels, in a worst-case scenario these rigid institutions at the regional and national level mutually reinforce each other. An even older idea is Checkland's [33] large and shady upas tree (a metaphor used in his study of shipbuilding in Glasgow until the 1950s) which prevents anything from growing beneath it, even after the tree has died. Similarly, a dominating local industry prevents any other new industry from growing beneath it. When the tree/industry dies there is nothing to replace it, which can severely damage the local ecology/economy.

There are at least two pressing questions around lock-ins: the first is whether lock-ins are inevitable. According to Setterfield [24] a lock-in *"is not inevitable either in the present, or at any point in the future"* since regions may switch to a new technological regime before the onset of lock-in, while the lock-in threshold is a variable and not a constant, depending on the type of regime and the perceived profitability of the new

[1] In fact, the role of institutions in shaping evolutionary paths [22, 23] is thought to be one the three main views regarding path dependency [17].

regime. On the other hand, although at a different scale, Pouder and John [9] claim that a number of forces accounting for the initial success of fast-growing geographic clusters of competing firms eventually lead to their adoption of suboptimal choices.

The second pressing question is whether there is a way out of a lock in. Even though there are reports of regions finding a way out of lock-ins [8], Martin and Sunley [17] claim that *"the precise meaning of regional 'lock-in' (…) is unclear, and little is known about why it is that some regional economies become locked into development paths that lose dynamism, whilst other regional economies seem able to avoid this danger and in effect are able to 'reinvent' themselves through successive new paths or phases of development"*. Hassink [25] argues that when it comes to political lock-ins, the notion of a learning region in which the main actors "*are strongly, but flexibly, connected with each other and are open both to intraregional and interregional learning processes*" may provide a way forward. Supposedly in learning regions policy makers should be involved in processes of identification of past errors, therefore forming policies which could allow for breaking out of lock-ins. However, he claims that due to (1) the fuzziness, (2) the normative character and (3) the fact that learning regions may get squeezed between NISs and GPSs limits their effectiveness in unlocking regional economies from lock-ins. Instead he proposes the notion of the "learning cluster" as capable of playing that role. According to Maskel and Malmberg [26] localised capabilities may decline because of asset erosion, substitution and lock-ins. Hence, firms and regions may have to 'un-learn', habits or institutions of the past, a process which is usually faced with considerable resistance from incumbent firms or elites, highlighting the central role of a resolute public intervention [24].

3 Industrial and Regional Policies and Sectoral Rigidities in Greece

During the last 30 years we have witnessed a major upheaval across the international economic landscape, resulting in a rapidly changing international division of labor (IDL). At the heart of this emerging new IDL is the growing industrial production in the developing world, which is reflected in the increasing competitive pressures and the resulting de-industrialization of most developed economies. According to UNCTAD-stat data, the share of developing countries in the global manufacturing value added increased from 27% in 2000 to 50% in 2014. This change is due to the particularly dynamic growth of specific countries (BRICS and SE Asia) and the significant expansion of global trade through the dramatic growth of global value chains. The rapid upgrading of businesses, sectors, regions and developing countries enables them to overcome significant traditional barriers to entry high value-added activities, sectors and markets, transforming them into the main challenge of the global economy.

In the context of this changing environment, the European Union has set up a broader strategic framework for the next decade, known as Europe 2020, comprised of three complementary priorities: - smart growth based on knowledge and innovation; - sustainable growth to promote more efficient use of resources, a greener and more competitive economy, and inclusive growth, with high employment, social and territorial cohesion. At the same time, according to recent European Competitiveness

Reports (European Commission, 2013, 2014), Europe is in dire need of restructuring, as it appears to be losing ground relative to its main competitors, namely the US and SE. Asia. In addition, the recent crisis has had a major impact on the European economy, which seem to be recovering more slowly than its main competitors.

The Greek economy was the biggest victim submitted to more than six years of continuous recession and a consequent restructuring of the Greek production system, which led to a decline in GDP reaching more than 25% and unemployment rates at similar levels. At the same time, during the 2006–2016 period, gross capital investment fell by −64.6%. The extent of the devaluation of invested capital in the productive economy was (and still is) unprecedented and raises questions about the practical possibilities of recovery. Indeed, since 2011 the evolution of the annual net private capital formation has been clearly negative and much lower than other EU countries that experienced a disinvestment problem during the global financial crisis (Italy, Portugal). By the most conservative estimates to meet capital requirements of at least € 70 billion (AMECO/ECFIN, 2016), in order to raise the level of private capital formation to 2010 levels.

In part, this picture was attributed to the weaknesses of the Greek growth model, which relied too heavily on consumption and the abundance of cheap credit, especially from foreign banks after Greece's entry into the euro. This has led to the country's over-indebtedness, but also to the decline in the importance of productive investment.

Apart of the challenging external environment, the Greek economy is characterised by a number of endogenous weaknesses which can be summarized as follows [27–29]:

- The problematic structure of the productive sector (e.g. prevalence of micro and small businesses, low export propensity, limited performance in innovation and R&D activities, the strong dualism of Greek businesses and the relative absence of manufacturing and tradeable services).
- The problematic role of the state. This includes a range of issues such as the low capacity to produce public goods, the inefficient organization of the education system, the complex institutional framework and the frequently changing tax regime. The way in which the state contributes to shaping the country's vision and strategy for development is also considered ineffective.
- The problematic form of public-private cooperation (cooperation to generate oligopolistic revenue rather than new production/wealth).
- The relatively low propensity for entrepreneurship, and
- low social capital stocks.

3.1 The Greek Smart Specialisation Strategy

It is clear that the Greek economy is in dire need of a competitiveness boost and the approval of the national 3S strategy in August 2015 provided a much-needed framework which is based in three main strategic options intersected by four priority axes (see Table 1).

Table 1. Main features of the Greek national 3S strategy

3S Strategic choices	Investment in creating and spreading new knowledge	Investment in RTD	Developing innovative mindset, and institutions and RTD networks in the society
Intervention axes	Areas of intervention		
Capacity building	Building RTD capacity in the specialization sectors	Breeding new business actors	Support mechanisms and institutional framework
Support of RTD activities	Supporting RTD activities and excellence niches	Supporting inhouse research and innovation in enterprises	Boosting demand for innovation by the public administration
Support mechanisms and structures	Supporting network (infra) structures	Infrastructure and support mechanisms of innovative entrepreneurship	Mechanisms of entrepreneurial discovery
Extroversion and networking	Cooperation in RTD	Business extroversion	Developing innovative culture

Source: https://www.espa.gr/el/pages/staticRIS3.aspx

Further, as a result of a national entrepreneurial discovery process, the following sectors were identified as priority activities in which the country occupies or may develop considerable competitive advantages and by funneling available resources, achieve considerable development outcomes:

(1) Agri-food, (2) Health – pharma, (3) Information and communication technologies, (4) Energy, (5) Environment and sustainable development, (6) Transport, (7) Materials – construction, (8) Tourism - Culture - Creative industries.

Although the underlying logic behind identifying priority sectors is to leverage the strengths of countries and regions in specific activities by diversifying into related activities [30], in reality, the identification of related activities as well as the capacity to measure relatedness remains understudied, at best [1]. To make things more complicated, even if we assume that territories can discover the appropriate (in terms of relatedness, complexity, or any other characteristic) activities to diversify into, the ability of industries, regions or countries to alter evolutionary paths is hindered by a variety of lock-ins [8] which may often cause severely limited rationality in terms of both investment and location decisions.

In the following sections I will study the investment decision of Greek firms assisted by the Investment Laws in an effort to evaluate the capacity of the instruments to guide investment decision and therefore alter the sectors' evolutionary path. I will comment on the effectiveness of the three previous investment laws, with some emphasis on the current law, which prioritizes the sectors identified in the national 3S.

4 The Greek Investment Laws

The investment law is historically the most significant policy tool with objectives that pertain to regional policies as well as industrial policies [31, 32]. During the last fifty years numerous laws have provided various types of assistance (predominantly direct grants, but also tax reliefs and other types of aid) to firms investing in Greece or abroad with aid intensities that allow for more support to firms investing in least developed regions of the country.

The last three laws were Law 2601/98, Law 3299/05 and Law 3908/2011, while the current law (Law 4399) was enacted in 2016.

4.1 Objectives of the Laws

All four laws explicitly aim at the restructuring of the Greek economy. in particular, the older law aimed at '…the restructuring of sectors and branches of production' with very little information concerning the exact or approximate direction of this restructuring. In turn, the three more recent ones were more specific is setting priorities linked to 'promoting technological change and innovation' (L. 3299/05), while L. 3908/2011 was even more explicit, aiming at: a) improving competitiveness, b) technological development c) promoting the Green Economy. Finally, the current law is perhaps the more detailed and at the same time the more ambitious one, aiming at (adopted from the explanatory statement of the law):

"the gradual shift of priorities from the production of low value-added products and low knowledge-intensive products and services to a new direction, which - without ignoring the country's comparative and competitive advantages (sectoral or horizontal) - will invest in the discovery of new sources of value and competitive advantage. Its main features will be:

- *The effort to re-industrialize the country while shifting to higher value-added marketable services.*
- *Increasing the technological content of products and services, as well as innovative processes.*
- *Facilitating the entry of new entrepreneurs.*
- *Creating tools that allow the development law to be better adapted to the specific characteristics of specific areas and economic activities.*
- *Strengthening the extroversion of Greek businesses."*

Furthermore, as was already mentioned, the current law explicitly prioritizes the national 3S sectors.

4.2 The Sectoral Distribution of the Laws and a Discussion

Most of the approved projects in all laws are characterized by relatively low technological content and knowledge intensity (Fig. 1). Specifically, 95% of the projects involved investments by enterprises in low tech (29% – e.g. food, tobacco, garments, wood, paper etc.) and medium – low tech manufacturing activities (19%, e.g. petroleum, plastic, non-metallic mineral products, basic metals, repair and installation of machinery, etc.), provision of less knowledge-intensive services (35%, e.g. hotels, transportation, travel agencies, etc.), as well as primary sectors (10%) and energy (1%).

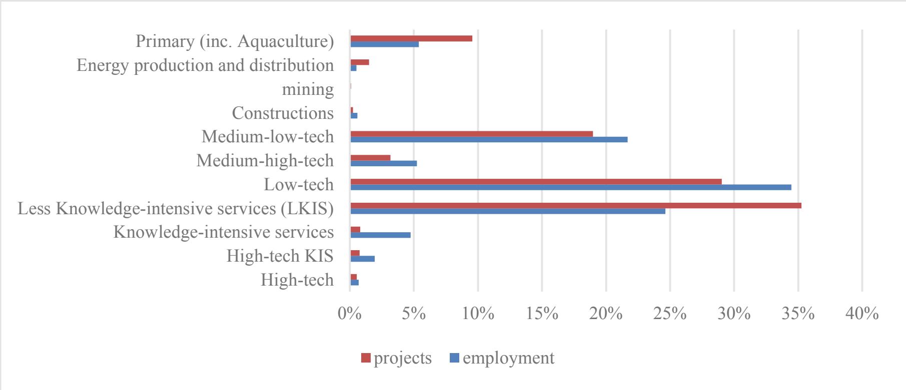

Fig. 1. Technological and knowledge content of projects (l.3299)

On the contrary, high or medium – high-tech sectors accounted for 4% of total projects. As an indication, of how Greece compares to the rest of Europe, in 2010, EU industry was almost equally divided in terms of technological intensity in two main groups (53% for low-tech/medium-low tech and 47% for high-tech/medium-high tech).

In terms of sectors, the priorities of all four laws were to varying extents clearly not fulfilled, while the current law, which pertains to the national 3S strategy the most does not seem to diverge from the norm, which is an overwhelming majority of projects in the hotel sectors (ranging between 40%–50%). An interesting point here is the fact that the hotel sector is a very mature one, while most projects were concentrated into the core activity of hotels with very little (if any) diversification to related sectors.

An even more convincing characteristic of the current law regarding the difficulty of path switching or upgrading is the relative collapse of the most innovative schemes of the Law and those that could signal an upgrade or a diversification of the Greek economy. For example, the scheme of innovative new enterprises managed to attract very little interest, while the networking scheme turned out to be a total failure, failing to attract a single application!

The situation could be attributed to all kinds of lock-ins. Functional, since (mainly in the insular regions but also progressively in the large urban centers) tourism and the related activities account for the vast majority of economic activity, embedding local and regional productive systems; cognitive, since the sector is widely considered as the country's "heavy industry" and the optimal activity to capitalize on the country's comparative advantage. Nevertheless, it is foremost a political lock-in and has consistently been so since the early 1980's. In fact, the functional and cognitive lock-ins seem to fuel the political one, which is evident, not so much in the existence of a "thick institutional tissue" [25], but mainly in the state's reluctance to view tourism for what it is, i.e. a relatively low productivity sector absorbing scarce resources which could be better employed in higher value added activities. The exact mechanisms, as well as the relations between the various types of lock-in constitute very interesting issues for future research.

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Exploring Territorial Imbalances: A Systematic Literature Review of Meanings and Terms

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Abstract. Within the framework of the EU Strategies of Territorial Cohesion, a relevant role is played by policy design focused on a more balanced and equal development of regions pursued by regenerating and improving endogenous resources. A place-sensitive instead of place-neutral approach can be useful to overcome weaknesses, innovation gaps and social-economic issues related to asymmetric and unequal development between and within regions. This paper deals with the complexity of territorial imbalances and spatial inequalities by focusing on lacking, declining and marginal areas. By developing a Systematic Literature Review, a first mapping of terms, practices and issues related to those areas has been developed in order to investigate scenarios in different geo-political contexts and at various spatial scales. The Systematic Literature Review approach has permitted the systematization of a multitude of terms referring to gaps between core areas and areas suffering from territorial imbalances, as well as the exploration of disciplinary sectors, geographical contexts, document typologies, frequency of terms, and to develop a preliminary geo-localization of practices. The findings of this first step are relevant to providing a systematic knowledge base within a complex field in which a clarification of meanings, scales and processes is needed.

Keywords: Cohesion policy · Place-based approach · Inner peripheries

1 Introduction

The European Cohesion Policy 2014–2020 has been strongly dedicated at improving Knowledge and Innovation as drivers to overcome the development issues affecting regions and cities and to build an operative framework for smart, sustainable and inclusive growth [1]. Regions have been invited at playing an incisive role in designing tailored policies toward the current challenges of our society, by valorising endogenous resources. At regional level, following a place-based approach, a policy design focused on a more balanced and equal development has been strongly encouraged via the Smart Specialisation Strategies (S3) aimed at improving competitiveness in the globalised market starting from local resources and competencies [2]. Nevertheless, at the end of the last programming period, there are still regions with unsolved structural

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weaknesses, highlighting an innovation gap, and the spread of shrinking and marginalisation processes in urban peripheries, small cities, and inner areas. Therefore, across many countries, in last decades, models of economic growth have generated an increasing polarisation between attractive core areas and areas suffering decline and deprivation processes, making them lagging and peripheral [3–6]. Starting from this evidence, the new steps of EU cohesion policies (2021–2027) are geared to a more tailored approach to regional development under the flagship of solidarity and spatial equality, targeting the complexity of territorial imbalances through regeneration processes. During the Italian Presidency of the EU Council (July–December 2014), the debate about this issue has been encouraged [7], according to the Italian National Strategy for Inner Areas SNAI (2014) which is part of the European Cohesion Policy and promotes a place-based approach [8].

Within this scientific debate and political agenda, the ongoing research project "Territorial Imbalances and Marginalisation Processes. The Landscape as a Driver for the Regeneration of Small Villages and Inner Areas" at CNR IRISS deals with place-based regeneration strategies in areas that suffer inequality development processes, with a specific in-depth focus on Italian context, starting from the framework of the SNAI. By contributing to the working group "Aree interne e dintorni" (Inner areas and surroundings) within the Italian Planning Society, the researchers focus on the Italian scenario by observing inequalities not only in the areas defined as "inner" by the SNAI, as well as launching a critical debate on policies and practices. By analysing the Italian scenario, researchers registered a relevance of the Italian role within the European debate, but also a very specific perspective, which does not permit generalization in an international framework. For these reasons, research activities are focusing on:

- Deepening the Italian scenario implementing a first empirical case study (Irpinia area in Campania Region) with an Action Research protocol finalised to build an action arena – coherent with the place-based approach [9, 10].
- Understanding the phenomenon of areas suffering territorial imbalances in an international framework. Geographic and economic remoteness, negative economic and demographic trend as well as exclusion from economic, institutional and cultural networks and from decision-making [3, 6, 11–14] are recurring conditions that affect local development, triggering the risk of progressive territorial de-generation processes [15].

This paper regards the process to decode this complex issue, considered relevant within the political and scientific debate. A preliminary screening of literature highlighted the multidisciplinary character of the debate including regional and urban studies, economics, social science and environmental studies. The main evidence of this activity has been the identification of a multitude of terms referring to areas affected by conditions of decline or inequalities, and has stimulated the following research questions: How do you intend these areas in different geo-political and disciplinary contexts? Are the different terms synonymous or do they refer to different situations?

Starting from these questions, research activities have been aimed at decoding different meanings and collecting practices and issues in an international scenario by developing a Systematic Literature Review (SLR). Having built a database and tested the SLR method on the first 100 eligible documents, researchers widened the application of the method to the entire database to implement a quantitative analysis.

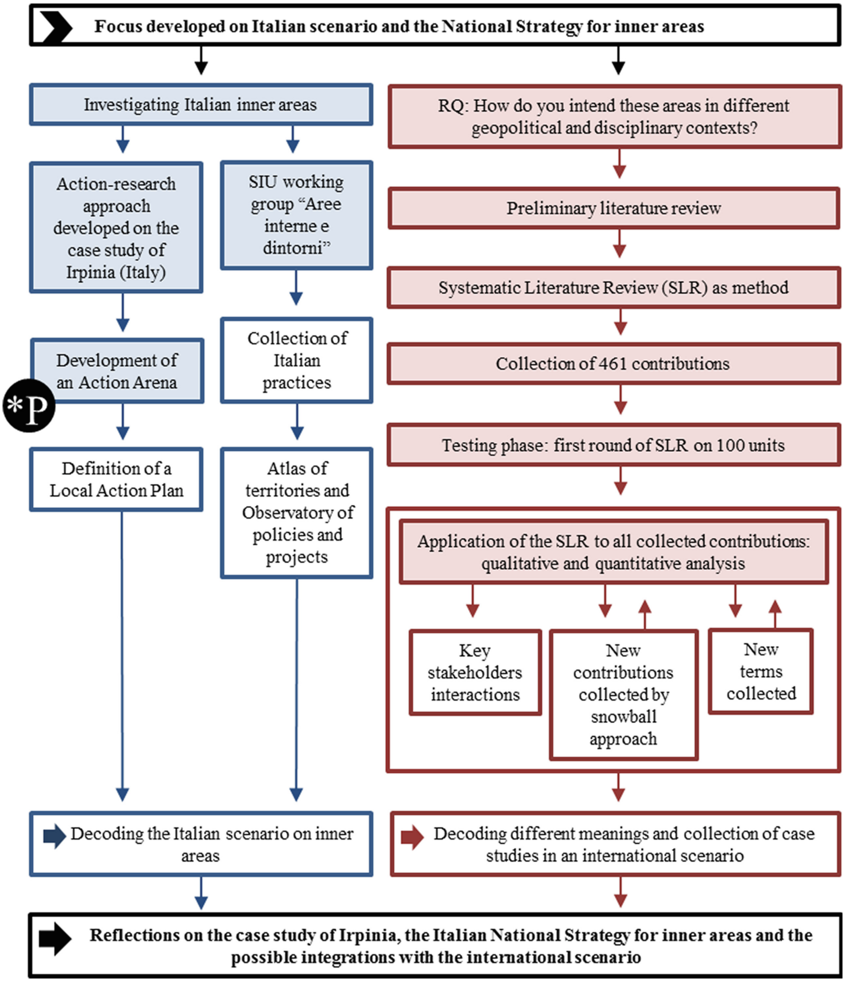

Fig. 1. Phases of the methodology (Author's elaboration)

The Fig. 1 shows phases of the methodology to achieve the comparison between the Italian scenario (left column of the Figure) and the international scenario (right column) in order to generate reflections and possible integration. The boxes with the coloured background represent stages of research already developed or in progress and the symbol "P" refers to a step of scientific dissemination. Following this introduction, the paper describes the SLR, illustrates the data collection, analyses the first findings and discusses the research follow-up.

SLR to Investigate the Multitude of Terms

The Systematic Literature Review (SLR) is a theoretical framework used to map existing studies related to a specific topic. This method represents the way to be exhaustive within the huge amount of documents collected in scientific databases [16]. Specifically, a codified systematic review consists of «[…] a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyse and summarise the results of the included studies» [17]. In this research, the SLR has been used to explore, deepen and systematize the multitude of terms referred to areas suffering for territorial imbalances.

After a testing phase of the proposed methodology presented at the 2019 AESOP Congress [18], this paper deals with the application of the SLR to all collected documents by analysing them in a quantitative manner and preparing the next phase of qualitative analysis. According to Bramer et al. 2017 [19], a combination of databases is needed to conduct efficient SLR. Nevertheless, the specificity of this research, which observes a multitude of terms and not only one main topic, led to use Web of Science (WoS) as selected database, in order to develop, modify and save structured advanced search through field tags, Boolean operators, parentheses, as well as to frame query within the WoS Categories, filtering subject categories of every source covered by WOS Core Collection. The data collection has been recorded in the database in which every set of data emerged from WoS were migrated to Mendeley (for avoiding redundancies) and then to Excel. The database was structured including each information available in Mendeley [18] and additional five columns to filter disciplinary sectors, geographical contexts, document typologies, emerged items, and location of practices. The emerged items were analysed by forming the highest level of alternatives made by combining all adjectives (inland, inner, interior, internal, marginal*, non-core, peripher*) with multiple substantives (area*, context*, territory*, and landscape*). Researchers obtained seven queries like this one:

ts = [("inland area*") OR ("inland context*") OR ("inland territor*") OR ("inland landscape*")]

Table 1. Filter used to launch the advanced search in WOS

Filter	Characteristic
Language	English
Time span	1965–2018
Typology of document	Scientific articles, books/chapters and conference proceedings
Database	Web of Science Core Collection (Citation Indexes)
Subject category	Agricultural Economics & Policy, Regional & Urban Planning, Social Issues, Cultural Studies, Demography, Urban Studies, Development Studies, and Economics

Each query was investigated by structuring the advanced search with the filters presented in the Table 1. Once the database was formed, an analysis of the documents one by one was carried out, then additional information was archived, such as frequency analysis, focus on the most used items and focus on practices location.

First Findings

The flow chart in Fig. 2 describes the adopted SLR approach coherently with the PRISMA Statement [20], which includes 4 phases: identification, screening, eligibility, and inclusion; the infographic presents percentage emerged.

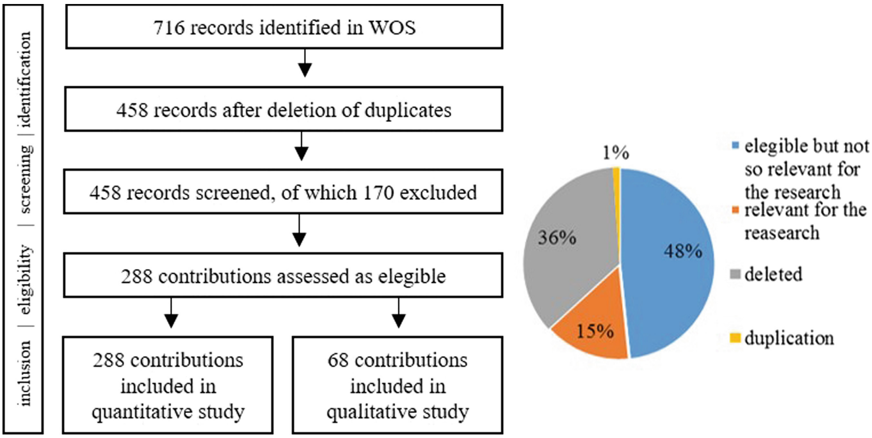

Fig. 2. Flow chart for a SLR (Author's elaboration starting from Moher et al., 2015)

Following frequency analysis, a focus on the most used items and on practices location was developed on the eligible 288 documents. Following a scientometric approach, the relevance of the topic overtime has been appreciated through the distribution on the timeline (Fig. 3). During the investigated time span (1965–2018), the first documents were published on 1978, following the institution of the European Regional Development Fund (ERDF), set up in 1975 to correct regional imbalances due to predominance of agriculture, industrial change and structural unemployment.

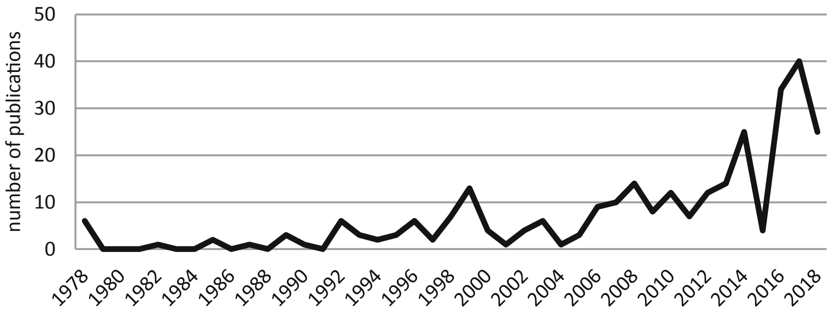

Fig. 3. Distribution of publication overtime (Author's elaboration)

The main part of the documents is concentrated in the period after the 1999 and presents four main steps in time: 1999, 2008, 2014 and 2017. The first one could be referred to the resulting interest in the 1993's Maastricht Treaty, which introduced the Cohesion Fund, the Committee of the Regions, and the principle of subsidiarity; and to the doubled resources for the structural and cohesion funds for the period 1994–99 (ECU 168 billion). The second step could be linked to the third block of cohesion policies (2007–2013) in which the budget was €347 billion focused on research, innovation, environmental infrastructure and measures to combat climate change. On 2014 the Italian Presidency of the EU Council promoted a vibrant debate about inner areas, the Italian SNAI was launched, and started the fourth block of the cohesion policies (2014–2020). During the year 2017, there was a massive scientific production emblematic of the success of the topic within the political and scientific debate.

Secondly, the scientometric approach recommends observing the document typology. In the case of this search, journal articles are 214 units, conference proceedings 59 and book/book Sect. 15. The low number of book/book section, which is considered the public approved science, tells us that these topics are still in process and that there is an explorative approach in which initiatives and practices are presented.

First findings referred to the additional filters are presented below. With regard to the disciplinary sectors (Fig. 4) that were observed, Urban and Regional Studies is the most populated together with the Economics and this testify that the issue of territorial imbalances is mainly a challenge between these two areas.

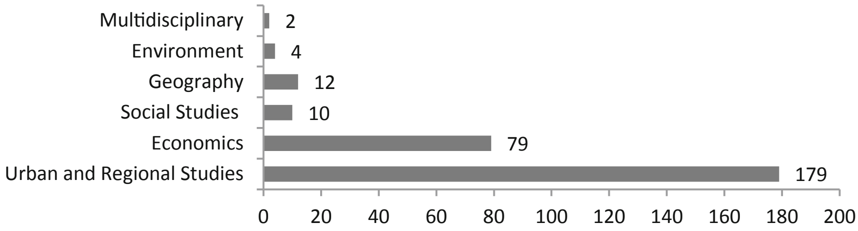

Fig. 4 Disciplinary sectors (Author's elaboration)

Analysis of the geographical contexts shows the dominance of Europe and Asia (Fig. 5). The fact that Europe is more present than the bigger continents suggests its greater sensitivity to this issue, a different commitment in terms of policies and a historicity of phenomena related to territorial imbalances. Asia is the second with half the points compared to Europe and this could be representative of the complex asset of Chinese territories that suffered for recent and strong development policies.

The screenshot related to the document typologies, in which the practices are more than the 70% of the products, is quite predictable due the objects of the analysis (Fig. 6) and help understanding location and contents of practices at international level.

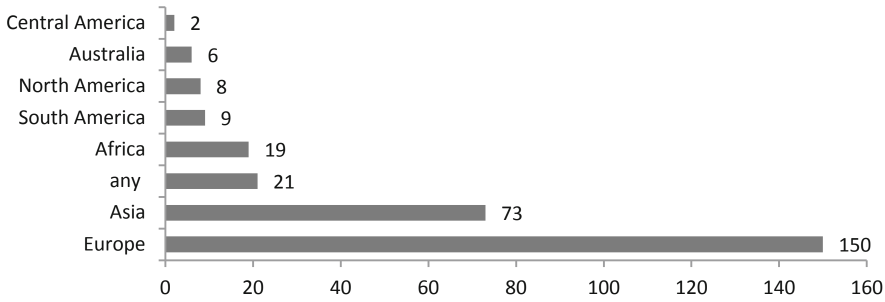

Fig. 5. Geographical contexts (Author's elaboration)

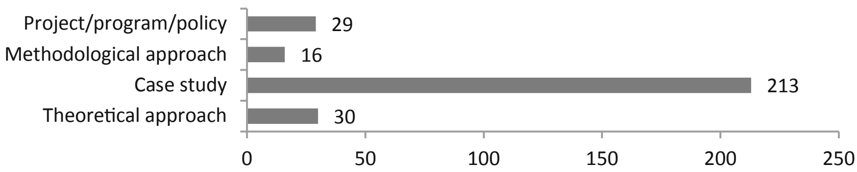

Fig. 6. Document typologies (Author's elaboration)

Four items on eighteen emerged as dominant and are all terms consisting of the substantive "area": peripher* area* (121), marginal* area* (59), inland area* (46) and inner area* (22). The term peripher* area* is the most present in the database representing twice as much as the second term for presence. Authors developed two analyses on this set of data. The first one is referred to the use of these terms overtime (Fig. 7) and shows the constant increasing of the term peripher* area* with one decreasing period (2001–2005). It is noticeable the increasing in the use of inland area* since 2011, the massive presence of marginal* area* during the two periods 2006–2010 and 2011–2015, the consolidated use of the term inner area* in the period 2016–2018.

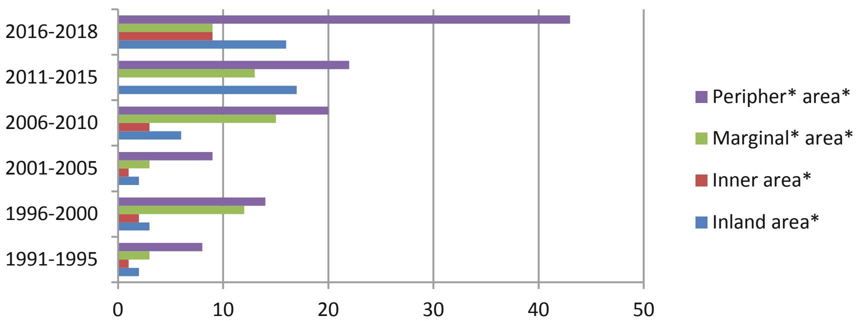

Fig. 7. Presence of emerged items overtime (Author's elaboration)

The second one is referred to the use of these terms worldwide (Fig. 8) and shows that in Asia the terms inland area* and peripher* area* are more frequent, in Africa marginal* area* and in Europe peripher* area. For the Europe case, the influence to use this term could be related to the promotion of ESPON's GEOSPECS program where the topics of this research are discussed under the "Inner Peripheries" umbrella concept. The term inland area* is more present in Asia, while inner area*, marginal* area* and peripheral* area* in Europe.

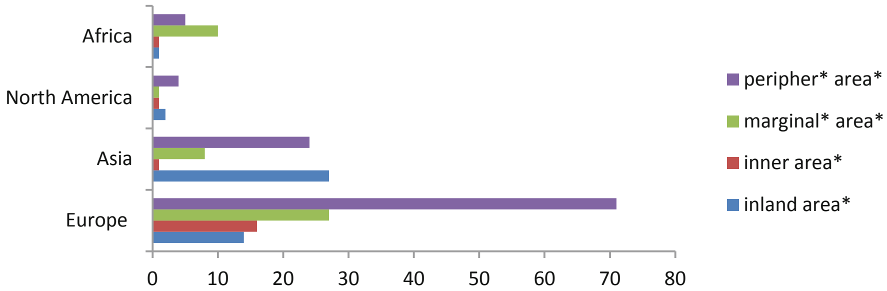

Fig. 8. Presence of emerged items around world (Author's elaboration)

Considering the massive number of practices, a geo-localization has been developed in order to observe the distribution and the trend of the phenomenon of territorial inequalities. The first four countries most populated in terms of practices are China (43), Italy (21), United Kingdom (14) and Spain (10) (Fig. 9).

Fig. 9. Mapped practices in China, Italy, UK and Spain (Author's elaboration)

In China, it is possible to observe that the whole concentration of published practices regards the eastern side of the country of which the cost is rich. A different situation is showed in Italy where the SNAI recognises the phenomenon of territorial imbalances in those territories far from the main core areas and then localised along the central Apennine. In UK, the location of practices is a mix of coastal and internal areas. In Spain, there are only two separate areas in which the practices are located, Catalonia and Seville. Resulting from the analysis, new terms have been detected: northern peripheries, resource peripheries, peripheral rural areas, marginalised community, peripheral centrality, fringe areas, less developed areas, inland locations, inland people, borderland region, peripheral region, peripheral cities, northern peripheries and non-core regions. In the next steps, these terms will be implemented in the database in order to cover a wider range of disciplinary sectors and geographical contexts.

Preliminary Discussion

As highlighted in the Barca's Report [21], a shift toward a place-based approach, if well implemented, could be useful to improve the capacity of a region to exploit its territorial potential and to achieve equity principles among their citizens [22]. According to this, a place-based approach – by combining peculiarities of territorial capital and social innovation opportunities – could represent the next step for re-thinking S3 as cohesion and balancing tool to overcome development gaps among catalyst and lacking areas [23].

In the ongoing research, the selection of SLR method has permitted to systematize the multitude of terms referred to gaps between core areas and areas suffering for territorial imbalances and to explore disciplinary sectors, geographical contexts, document typologies, frequency of terms overtime and around world, and a preliminary geo-localization of practices. With regard to the follow-up phase, the research agenda includes the implementations of emerged terms in the SLR database, the collection and analysis of new documents derived from the snowball approach and from the engagement of stakeholders, and finally the qualitative analysis.

Relevant documents have highlighted that the scientific debate about areas suffering for territorial imbalances as result of complex processes producing social-spatial disparities «[…] reflected in the growing use of terms such as "peripheralization" and "marginalization"» [6: 368]. A sector of literature links the peripheralisation processes to the lack of innovation in terms of economic polarization theory, to the production of socio-spatial disadvantages in terms of social inequalities theory, to the conditions of dependency and exclusion in terms of political theories [6].

The research agenda includes a focus on peripheralisation and marginalisation processes that enriched the decoding phase with methodological and theoretical approaches as well as projects, programs and policies to be added to practices already collected by previous research activities. Additional reflections could be dedicated to identify where are located research centres and networks involved in these issues, to photograph in time practices, projects, programs and policies and highlight possible correlation between them.

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Toward Nature-Based Solutions (NBS) Approach in Integrated Segment Reporting of Placed-Based Organizations

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Abstract. This paper aims to focus on the contribution of the approach by segments of place-based organizations to planning and reporting social and environmental performance along with economic and financial dimensions. The literature review is about Nature-Based Solutions (NBS) and segment reporting. In the context of scientific contributions regarding the NBS approach, an important issue is to evaluate the impact of NBS about different social and environmental challenges. Raymond et al. (2017) propose a framework to identify how NBS can produce both synergies through ecosystem services and co-benefits in a NBS view. Moreover, the paper analyses the logic underlying the technique of segmentation in the "space", the social performance of the operating segments over "time" and the synergies between segments. In the case examined (a Farm), we will demonstrate how the case manages to achieve significant economy with the production of electric energy deriving from the biogas obtained by fermentation of manure, therefore it does not incur the cost of purchasing electricity and it doesn't incur in the disposal costs of the manure, but to translate them into raw material to produce electricity and also to sell the energy in excess to its needs. Besides, the Farm generates benefits for the environment inside and outside of it.

Keywords: Nature based solutions · Segment reporting · Environmental impact · Farm analysis · Value added

1 Introduction

In the past, the debate had developed with fierce criticisms over the behavior of transnational companies, which have given rise to and continue to perpetrate greenwashing behaviors without highlighting an effective change in production systems. Systems that are not yet able to guarantee respect for the environment and its improvement. In practice, instead, a marketing process oriented towards greenwashing is developed, which is also accompanied by a "discreet" intervention strategy at the

This paper is the result of joint research; however, M.G. Baldarelli wrote the Introduction, Sects. 2, 4 and the Discussion and Conclusion; D. Nicolò wrote Sects. 3 and 5.

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political level and also by international organizations to make it possible, however, to make a greater profit for each company with the illusion that they implement them in environmentally friendly projects [1].

Since some classic business economics authors analyzed farms, including Giannessi [2] and Besta [3], the situation in which they operate has completely changed and requires reflection on the company-environment relationship. For this reason, we try to interpret NBS within a territorial context as well as it relating to farms, despite being a theory applied to urban areas through the correlation with the NBS. In this context, the role of accountability [4–9] is very important, because it is a process that allows all companies to acquire legitimacy from the stakeholders who employ certain tools, including segment reporting, which are outlined in this work.

Moreover, this paper has the objective of answering the research question: How to write segment reporting by NBS perspective?

The research design involves the deductive [10] and inductive approach [11]. The deductive approach is analyzing the literature review in two ways. The first step is the presentation of Nature Based Solutions (NBS) to create a wider framework to construct further analysis. The second step is considering the presentation of the theory of segment reporting. The inductive approach regards implementation of segment reporting using the research case of Fattoria della Piana (Italy).

The research case is very important, because it involves a vast area of the territory and for this reason may be termed: a place-based organisation. The research case, that is a farm, is based on internal and external NBS, as it can simultaneously relate cost savings and the supply of production factors, because it will be demonstrated how bio-gas allows for the direct production of electricity for self-consumption. In the case examined, we will demonstrate how the case manages to achieve significant economy with the production of electric energy deriving from the bio-gas obtained by fermentation from animal excrement, therefore it does not incur the cost of purchasing electricity and it does not incur disposal costs of the excrement of the animals rather to use them as fuel to produce electricity and also to sell the energy in excess relevant to its needs. Similarly, with waste-water that the firm refines by phytodepuration and uses to irrigate the fields that produce animal feed. The circularity of the economy is put on the net, creating differential economic, social and environmental advantages. In addition, the Farm generates benefits for the environment, creating a NBS both inside and outside of it.

The paper is divided into the following sections: the first one concerns the literature review relating to NBS; the second section regards segment reporting analysis; the third section concerns the results of the case analysis and the forth section regards discussion and conclusion.

2 Nature Based Solutions (NBS) as Framework to Pass from Greenwashing to Green?

NBS is primarily designed for nature-based and eco-system solutions at an urban level in order to create improvements in the harmony existing among: environment, space, structures and human beings. It is a very wide framework to place our analysis in and which involves an interdisciplinary approach and in this paper we are going to use only some areas of the this theory. To introduce NBS the definition framework indicates that: "NBS explicitly address societal challenges. The solutions are not aimed at addressing only environmental challenges or minimizing only environmental impacts, although these may be part of what the NBS is targeting "produces societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation" [12].

Among the different themes and guidelines, that are proposed by Raymond et al. 2017, we focus our attention mainly on two areas. The first area concerns: "benefits and co-benefits for human health and well-being" and the second area regards: "integrated environmental performances; costs, trade-offs, benefits and co-benefits for biodiversity, economy and community" [13]. The meaning of the first area is to create improvement in the quality of life using relationships and co-creation opportunities to create an emancipatory change. The meaning of the second area is that of developing the emancipatory change that is necessary to activate the process in order to measure, record and monitor the performances of project implementation. Especially for companies this process is very important to avoid green-washing and to move to real environmentally friendly change. These areas are divided into other more specific ones, because the objective is to create projects that implement this general theory and to develop indicators that will be able to monitor the level of application of the theory. The first area involves deeper specific sub-areas, which allow for a better articulation and possible, subsequent control of the qualitative and quantitative information that may derive from them. Among the specific areas, we can highlight that one relating to water management, which represents a fundamental resource for agricultural companies both as regards food and also regarding irrigation. The second specific area, of special interest for this paper, is also attention to human health and quality of life which, in the case of farms, extends to that of animals. The third specific area relates to the management of the impact on the climate, which requires cutting-edge technologies for the recycling of materials, the reuse of the same as also suggested by the integrated and NBS. Moreover, NBS is primarily designed for nature-based and eco-system solutions on the urban level. In this paper, on the other hand, we want to extend the reflection that derives from NBS to the level of even rural territories. Actually, as regards measurement and monitoring of the first NBS area, it is necessary to underline the importance of organic production and breeding that respect both the size of the spaces for animals and the rhythm and natural seasons that we will find in the research case. This means that the criteria for using natural fertilizers and cultures are respected in the production chain, even those used as food for animals follow the logic of the biological circuit. The second area, which is related to integrated environmental performances, requires the structuring of an information system [14], that is described in the case analysed, to be able to quickly and reliably measure the external and internal impact of the aspects related to cultures and breeding considering the costs and benefits deriving from respect of the environment. Within this, the management of the agricultural territory is particularly relevant, which is in close connection with the company and therefore the protection of the same is important to make it usable with the same effectiveness for future generations too. To reach this objective some more specific drivers and models are required. We will involve the following drivers: reduce, reuse, recycle and recover [15, 16] and the segment reporting model that we are going to analyze in the following paragraph.

3 Segment Reporting: An Integrated Perspective of Analysis in "Space" and in "Time" of Financial and Social Performance of the Companies

The operating segments are companies' subsystems resulting from a process of segmentation in "space" in correspondence with the different products, markets, groups of customers, geographical areas, with similar characteristics. Segmentation in "space" leads to the definition of the "map of the segments" and can be carried out according to one of the abovementioned criteria or even a combination of them. The choice of the segmentation criterion (or criteria) depends on the information needs of the management which uses information on the performance of the segments to take decisions and to evaluate the results of the segments and the company as a whole.

Segmentation in "space", by geographical areas and/or by lines of business (LOB), highlights if are there not good performing segments, or even that produce losses. Good performance of the company may hide a bad competitive and/or economic performance of one or more segments. Segmentation in "time", moreover, allows the management of companies to promptly perceive if some segments have an unfavorable financial and/or economic trend, highlighting the need to improve the current trend through targeted choices [17].

Reporting by segment is a source of analytical financial information very useful both for strategic management and external financial disclosure of the companies. Originally to satisfy the information needs of top management, interested in measuring with high frequency (quarterly, monthly) the performance of the segments [18–23], segment reporting has also become a very important part of external financial disclosure [17, 24–27].

Since the international accounting standards (SFAS: 14 and 131; IAS 14 and 14-R; IFRS 8) introduced segment reporting as a mandatory external financial disclosure tool for listed companies, a rich research area has developed on this subject.

The IFRS 8 (Operating segment) has introduced the management approach according to which external reporting by segment for the stakeholders must be based on the same segmentation criteria used for the internal segment reporting addressed to the top management. The underlying idea of this principle is: if a segmentation criterion delivers significant information for management control, it will also be significant to meet the information needs of stakeholders [17, 24, 28–34].

This paper highlights a very important function that can be performed by segment reporting, not yet examined by the literature: measuring the social performance of each segment of the company is very useful in understanding the drivers of the social performance of the company as a whole. In this way, it is easy to find out if there are segments with sub-optimal performance, not only from an economic perspective but also from a social one. The same can be said for the environmental and social dimension of their performance. Furthermore, disclosing the social performance of the segments allows stakeholders to know how much value the company produces and distributes, with specific reference to each of their segments as well. Adopting a similar approach, it is also possible to report and manage the company's impact on the environment, with high frequency (monthly, quarterly). In this paper, both from a theoretical point of view and through a case study, these important functions of segment reporting are analysed. The research line suggested by this paper is to combine the social and economic information by segment into an integrated segment reporting [35]. To this end, a segment reporting scheme is proposed. This model is innovative because it integrates two performance dimensions of the segments: both the economic one, highlighted by the operating result of the distinct segments and the social one, expressed by the added value produced by each of them and intended to satisfy the interests of the stakeholders. The value added is assumed as a synthetic indicator of the social performance of the companies and their segments because it shows the wealth distributed to stakeholders (workers, financiers, public administration, shareholders).

The contribution of this paper is to highlight the relevance to measure the contribution of each segment to overall company worth. By measuring the value added created by each segment with high frequency (monthly, quarterly), the management can be informed promptly if some segment does not contribute adequately to the total value added of the company as a whole and set tailored choices to correct any unfavourable trends. For this reason, we propose a reporting by segment scheme which highlights not only the operating result but also the value added created by each segment. This scheme is general and must be tailored by the companies to their specific needs. This model is then applied to a case study in the agri-food sector. In other papers we have presented general reporting schemes for segments that can be adopted by companies operating in other sectors: transport and healthcare [36, 37].

Another contribution of this paper is to propose segment reporting to investigate the synergies between segments and thus highlight the elements of internal synergy (i.e. between segments) and of the ecosystem (between each segment and the environment) that derive from the NBS model adopted in the case-study examined in this paper.

In the case study examined the synergies between the segments are evident: the waste produced by some segments becomes raw material for other segments thus creating a double economic advantage for the company: on the one hand, the costs of waste disposal are eliminated (in both the dairy and the farmhouse) on the other, the costs of purchasing raw materials and consumables of some segments are reduced since they are obtained by recycling, converting and reusing waste materials from other segments. There is also an NBS advantage that is achieved with other companies (farms operating within the same ecosystem) from which the company under examination purchases manure to transform it into electricity through the biogas plant. In addition to minimising their environmental impact, these transactions generate significant reciprocal economic benefits. In particular, those that use manure and wastewater from stables not only generate revenues by selling electric energy but also do not pay waste disposal expenses. The company examined in this paper achieves the advantage of obtaining raw materials at a very low cost, i.e. manure and wastewater from the stables, which is needed to produce electricity using the biogas plant that enters the national electricity grid, achieving substantial revenue flows (on average €2.1 million per year).

Integrated segment reporting allows measurement of the added value of these segments, that is, the wealth they produce, and which may be distributed to meet the interests of stakeholders. Furthermore, when integrated segment reporting is prepared by a company that implements an NBS model, it highlights the benefits that derive from it in terms of costs and revenues for each distinct segment. Following the literature review, in the next section, we will examine the case study.

4 The Research Case of Fattoria della Piana: Methodology, Mission and Governance

Methodology

This section presents a research case [38–40], the analysis of which is performed through a qualitative approach [41]. The case was chosen because it is a "critical case" [39]. In fact, it is of significant importance for the positive results that the company has achieved to date in the concrete implementation of an NBS model. These results derive from the transformation of agri-food and zootechnical production waste into resources in an efficient and economical way. This process demonstrates the concrete possibility of combining the reduction of the environmental impact of production activities, good economic, social and environmental results. To this must also be added the satisfaction of the stakeholders through the distribution of a substantial added value and the adoption of NBS.

The research was conducted by adopting the participant observation method, a variant of the case method, which leads the researcher to observe the reality by interacting with the key players of the company. The results are also based on documentary analysis, used to collect, classify, measure and interpret information [42]. The examined documents made it possible to give definition to the map of the segments and to allocate costs and revenues to these centres and in this way to measure their gross and net added value and operating result. Accounting and non-accounting information was used, acquired directly from the managers. The latter also assessed the consistency of the results of the segments reached through the allocation of costs and revenues to these result centres. We are fully aware that general theories, valid for all companies, cannot be inferred from cases [42, 43]. In fact, this study does not aim to build a "theoretical case" [38] from which to derive a theory by means of a statistical generalisation or mathematical modelling [39, 44, 45], but it has more limited objectives: establishing a theoretical framework of reference for companies operating in this sector who intend to carry out reporting by segment for management control and also external communication needs and demonstrating the economic convenience of adopting an NBS model in the agri-food and zootechnical fields. In fact, the segment report presented in this paper can also be adopted, with the necessary adjustments, by other companies operating in the same fields of activity. By carrying out a similar activity they face similar management problems, the adaptation of the report schemes by segment presented in this paper to the needs of each company is minimal. For the description of the case we use the mission, governance and accountability scheme proposed by Matacena.

Mission and Governance

For the description of the case we use the mission, governance and accountability scheme [46]. Fattoria della Piana is a cooperative of agricultural products, established in 1986, with registered offices in Candidoni (RC-Italy). The company's mission is to produce mainly dairy products with the aim of respecting the traditions of the Calabrian territory with the combination of modern technologies to respect the environment, giving life to the NBS aspects related to: Reduce; Reuse; Recycle[1] [16].

It operates in the dairy sectors, collecting the milk produced by the members of the cooperative and transforming it into dairy products that it distributes daily using fresh products, its agritourism activity and energy and heat production chain through a biogas plant and a photovoltaic plant. The cooperative created an efficient NBS model by transforming the problems of the disposal of livestock rubbish and dairy processing residues into resources to produce electricity and heat, through a biogas plant with a power of 998 kW, in water that can be used to irrigate the fields in which food for farm animals is grown, through a phytodepuration plant, in fertilizer to fertilize the fields in which forage for animals grows.

The company has obtained ISO 14001 certification, which is issued to companies that are able to control the effects of their production activities, minimizing the environmental impact and won a lot of awards (fattoriadellapiana.it). The cooperative's governance considers the typical aspects of these companies, namely: mutuality, democracy and solidarity, which are reflected in the active participation of employees at various levels. After the brief analysis of mission and governance, we can consider the different dimensions of NBS and add the segments that will be explained in the following section.

5 The Case Study "Fattoria della Piana": NBS and Integrated Segment Reporting

In the case study examined, Fattoria della Piana, the segment with the highest turnover in 2017 and 2018, is a "Dairy", together with the segments of: "Electricity production from biogas plant", "Electricity production from a photovoltaic plant" and "Farmhouse".

The biogas plant collects the manure of the livestock farms in the area, especially one located in an area adjacent to the farm examined in this case study, and the discharges of the dairy processing (mostly whey) into two large fermentation tanks that

[1] "Today ours is the largest farm in the province of Reggio Calabria and one of the largest in Southern Italy. A reality that continues to grow, always respecting the environment and transforming what is normally waste into a resource. Our organic fertilizer returns to the soil all the nutrients necessary to obtain quality productions. We replicate natural cycles by generating more energy than is necessary for the operation of the company, helping to reduce the environmental impact. We have a photovoltaic system that powers the entire farm and allows you to cut costs. We have a biogas production plant powered by different processing residues, which allows you to create biomethane. Finally, there is our phytodepuration plant, the largest in Southern Italy. The electricity produced by biomethane, equal to 998 kW/h, is fed into the national grid, covering the energy needs of 2,680 families." (www.fattoriadellapiana.it).

transform these waste materials into biogas. The biogas thus obtained is burned to produce electricity which is sold to the national electricity company. The "Dairy" and the "Farmhouse" segments are self-sufficient as regards electrical energy and heat need thanks to the photovoltaic plant, built using solar panels applied onto the roofs of the farm. The fermentation residue of the biogas plant is transformed into fertilizer which is used to grow fodder. Biomasses (basically manure and sewage deriving from cattle breeding and milk processing) pose the ecological and economic problems of their disposal. The NBS model adopted by the company examined allows these problems to be transformed into profit and cost-saving opportunities. On the one hand, there are substantial cost savings since the companies participating in this NBS model do not pay the following costs: disposal and treatment of manure, sewage and discharges from the farm and dairy, since they are used as raw material for the biogas plant; water for irrigation purposes, provided by the phytopurification of waste water and farm and dairy drains; fertilizers, obtained as a residue from the fermentation of biomass in the biogas production plant; electricity and heat of the dairy and the farmhouse, thanks to the photovoltaic plant.

By reclassifying the accounting data, the following reporting by segment scheme was developed. It is based on the value-added model, which highlight the gross and net added value and the operating result of the different segments and which make synergies between segments deriving from the adoption of the NBS model evident (Table 1).

Table 1. The reporting by segment scheme adopted in the case study

Revenues and costs	Biogas plant		Photovoltaic plant		Dairy factory		Farmhouse		Total	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Sales										
Segment sales/Total sales	26%	27%	2%	1%	70%	70%	3%	2%	100%	100%
Net value added of the segment/Sales of the segment	16%	37%	26%	17%	12%	11%	61%	64%		
Net value added of the segment/Total net value added	29%	50%	3%	1%	58%	41%	10%	7%	100%	100%
Operating result of the segment/Sales of the segment	15%	33%	26%	17%	4%	0%	10%	−2%		

The biogas production plant also generates an annual turnover of more than €2.1 million (26% in 2017 and 27% in 2018 of the total sales of the company) through the transfer of electrical energy to the national electricity grid. In addition, the photovoltaic system also feeds electricity into the national electricity grid, generating a turnover of just over €120,000. While the dairy contributes a very high percentage to the corporate added value, only a low percentage of the revenues become operating profit. This means that added value is mainly used for employee remuneration.

It is evident the relevance of this integrated segment reporting which highlights for each segment the economic performance, in terms of operating result, and the social performance, in terms value-added, provided for management (internal reporting by segment) and for stakeholders (external reporting by segment).

6 Discussion and Conclusion

This paper has the objective of answering the research question: How to implement integrated segment reporting using the NBS perspective? Following the initial implementation of integrated segment reporting in the "Fattoria della Piana" case, we can find that the dimensions underlined regarding NBS find the case very interesting result regarding the surrounding area in which the case is. This is shown by the certifications that represent annual recognition of the activity of this farm. Concerning the different dimensions of NBS: reduce, recycle and reuse, in the case analysed we found a very interesting relationship among them. The implementation of segment reporting is confirming the increase of the value added in each segment and the positive trend of environmental behavior using the value added by segment (Table 2).

Table 2. Segment Reporting, NBS initial results from "Fattoria della Piana"

NBS indicators				
Climate mitigation and adaptation	H It produces energy by burning non-polluting biogas	H It produces energy and heat using the sun's rays	M-H Heat and electricity are of photovoltaic origin	N
Integrated environmental performances	H It produces energy by burning non-polluting biogas	H It produces energy and heat using the sun's rays	H Heat and electricity are of photovoltaic origin	H Green building uses energy and heat from photovoltaics
Costs, tradeoffs, benefits and co-benefits for biodiversity, economy and community	H They have already recovered their investment in biogas	H They have already recovered their investment in photovoltaics over a few years	H They have already recovered their investment in photovoltaics over a few years	H They use energy and heat from photovoltaics
Public health and well-being	H It produces energy by burning non-polluting biogas There are no polluting emissions	H It produces energy and heat with the sun's rays There are no polluting emissions	H Km 0 There are no polluting emissions because they are used to produce energy and heat through the biogas plant	H Km 0 They use energy and heat from photovoltaics
Reduce	H It is reducing waste using it as fuel for biogas	H Because it is creating new energy for the other segments	N	H It is using products and energy that are produced by the farm
Reuse	H	N	H For production it is using milk of the farm and energy that is produced by photovoltaic	N

(*continued*)

Table 2. (*continued*)

NBS indicators								
Recycle	H Manure waste water use and whey and other liquids from the dairy		N		H		N	
Recover	H		N		N		N	
SEGMENTS	**BIOGAS PLANT**		**PHOTOVOLTAIC**		**DAIRY FACTORY**		**FARMHOUSE**	
Net value added of the segment/Sales of the segment	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**
	16%	37%	26%	17%	12%	11%	61%	64%

Source: our elaboration (H: high; M: medium; N: neutral)

The combination of the drivers and dimension of NBS [16, 47] defined the qualitative approach and analysis of the case and we gave some explanations regarding how the management of each area is developing. Moreover, it is interesting to add the quantitative measurements by segment and we consider the added value determined by them, that is important in order to give such information as accountability of the economic implications of NBS behaviour of the farm. Therefore, to consider them in terms of NBS, we can affirm, regarding the answer to the research question, that the company is improving its environmental protection aspects through the segments and therefore of climate mitigation and adaptation.

The first results are limited because more information is needed to deeply analyse the environmental and social impact of “Fattoria della Piana”.

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Making a Step Forward Towards Urban Resilience. The Contribution of Digital Innovation

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Abstract. Starting from 'wicked problem' theory as the landmark for framing disaster events in terms of policy issue for city governments, this paper highlights the contribution provided by Big Data analytics and digital innovation in dealing with disaster risks. The research aims at answering the following question: *what is the role that 'smart technologies' play in strengthening urban resilience to disaster risks?*

To answer the question, the study devotes attention to some applications of data analytics for enhancing cities resilience towards disaster risk reduction.

Exploiting the transformative power of digital innovation for the enhancement of city 'smartness' could be a valuable path for boosting urban resilience facing 'wicked problems. However, it is debatable whether cities can effectively overcome these problems without a clear understanding of the need to merge smartness and resilience in a broad policy framework and to apply these principles into consistent operational disaster risk reduction plans.

Keywords: Smart cities · Resilience · Disaster risk reduction · Big data analytics · Smart technologies

1 Introduction

Enhancing the 'smartness' of cities and boosting the 'resilience' of their communities in the face of 'wicked problems' are key contemporary challenges for local governments that ask for, adaptive, collaborative, and long-term oriented policy approaches.

These challenges drawn the attention of both academic and politicians, arriving at the fore of the agenda of UN Institutions, national, local Governments, and NGOs, in light of the pivotal relevance they assume for the achievement of Sustainable Development Goals. A major concern of the Agenda, in fact, is to "*ensure responsive, inclusive, participatory and representative decision-making at all levels*". Likewise, the Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) have strongly emphasized the need for "*strengthening disaster*

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risk governance and coordination across relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels".

For 2018, the UN 'High-Level Political Forum on Sustainable Development' (HLPF) will focus on transformation towards sustainable and resilient societies, with a major attention, among others, to SDG 11 named "Make cities and human settlements inclusive, safe, resilient and sustainable", confirming the pivotal role played by Cities, Local and Regional Governments in pursuing sustainability and disaster risk reduction challenges.

Adopting a 'smart approach' that "*makes use of opportunities from digitalization, clean energy and technologies, as well as innovative transport technologies, thus providing options for inhabitants to make more environmentally friendly choices and boost sustainable economic growth and enabling cities to improve their service delivery"* is a basic principle of the UN New Urban Agenda.

City transformation processes must therefore be rethought to mitigate the effects of extreme events on the vital functions of cities and communities.

In light of these challenges the paper debates on how the dissemination of 'smart technologies' strengthens urban resilience to disaster risks.

The remainder of the research is structured as follows: Sect. 2 presents the literature review which embraces two major strands of research: public policy and ICT management; Sect. 3 briefly describes method and discusses preliminary findings; Sect. 4 highlights conclusion and limitations of the study.

2 Framing Cities in the Era of Complexity and Vulnerability to Disaster Risk. A Literature Review

The public governance literature has illustrated how organizations and communities could deal with the dynamic complexity that characterizes today's societies [1–6].

From the perspective of public policy issues, 'wicked problems' [7] are those unpredictable, complex, undefined, open-ended and non-linear problem [8, 9], that 'have no technical solution, involve multiple stakeholders, and create ripple effects' [10].

In their pivotal work, Rittel and Webber [7] listed ten properties of wicked problems[1], whose essence has been effectively summarized by Head [11]: complexity, uncertainty and divergence.

Looking at these features, which are cumulative and mutually reinforcing, disasters can be easily labeled as 'wicked problems' due to their wide nature (storms,

[1] For every WP: 1. There is no definitive formulation of a wicked problem. 2. They have no stopping rule. 3. Solutions to wicked problems are not true/false, but good/bad. 4. There is no immediate and no ultimate test of a solution to a wicked problem. 5. Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial and error, every attempt counts significantly. 6. They do not have an enumerable (or exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan. 7. Every wicked problem is essentially unique. 8. Every wicked problem can be considered a symptom of another wicked problem. 9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's solution. 10. The designer has no right to be wrong.

earthquakes, volcanoes, heat waves, droughts, epidemic, floods, landslides, wildfire, collision, terrorist attack, nuclear accident, etc.), causes (natural vs. man-made, mixed), scale (local, national, super-national), and to the variety of interpretative criteria applicable to these catastrophic events (technical, social, economic etc.), [12–15].

The frequency and intensity of disasters and extreme weather events occurred in the last decade posed critical issues that forced policy makers to prioritize disaster risk management and community resilience in the policy agenda [16–18], defining effective strategies that might spread a common sense of preparedness, adaptation and awareness through the communities.

From an urban governance perspective, disasters determine devastating effects to critical infrastructure and basic service disruptions, generating mistrust and insecurity through the community.

Moreover, the whole disaster risk management cycle poses problems in terms of scales of governance, decentralization of tasks and resources, legitimacy, collaboration paths between public and private organizations [19–21].

As for Harding et al. [22], these problems 'involve complex interconnected systems linked by social processes, with little certainty as to where they begin and end, leading to difficulty in knowing where and how constructive interventions should be made and where problem boundaries lie'.

Disasters that occur at city level determine also transboundary effects that request collaborative approaches [23] to mitigate disaster risks, to create capacity and resilient culture [24–28] to coordinate emergency responses and provide recovery actions [29, 30].

Among public institutions, cities are those organizations that appear increasingly vulnerable: catastrophic events have seriously harmed them, their communities and the network of connections that has constituted the vital fabric on whom they are founded and developed.

As stated by Khan & Zaman [31], planning for future cities demands greater attention in coping with disaster risks and in facing the changing socio-economic and safety landscape of the urban reality.

A plethora of labels, brands and definitions of city are competing for attention in the academic debate of last decades [32].

Most of them are conceived within the ICT domain [33–36]. Digital technologies, especially with data analytics, have transformed the services and the relationship between governments and their stakeholder [37].

As noted by Kitchin [38], the development of 'smart cities' around the globe has been driven by 'technically inspired innovation, creativity and entrepreneurship. However, a technocratic focus will not necessary create more liveable and safe cities.

Some authors have properly underlined the risk connected to a short-sighted approach in considering smart cities as a merely ICT phenomenon [39–41].

None of the label here referred fully meet the idea of a city that might cope with urbanization threats, disaster risk reduction and sustainability targets.

Moreover, there are a multitude of cases where cities – supposed to be smart – have failed to plan for future threats, showing significant lack of planning and preparedness which have determined extraordinary damages and losses as results of catastrophic events [42].

3 Method and Discussion of Preliminary Results

Through a desk research, we focus on some best practices of public institutions that have applied smart technologies for the enhancement of service quality to citizens as well as to increase the level of safety and security of the communities.

Data are gathered from international reports and studies that clearly demonstrates how smart technologies for emergency significantly contributes to timely response and has reduced the number of people affected or deaths during disaster situations

In this sense, valuable examples come from Africa Region where the use of early warning systems (EWS) in flood-prone villages of Zambia allows to send alert messages to local residents, urging them to evacuate to higher ground in the event of flooding. EWS system' has helped in saving lives during annual seasonal floods and has provided governments and humanitarian agencies with information on where relief efforts are needed, thus demonstrating how ICT tools play a key role in pursuing resilience and sustainability targets.

The positive impact of ICT networks on safety and security of communities has been stressed in the literature and its effectiveness repeatedly proofed, among others, in disaster situations occurred in Mexico, Japan and among ASEAN countries where threats posed by natural disasters and extreme weather events are constantly presents.

Monitoring and communication systems, hazard mapping platforms, live crisis map are key tools of the whole disaster risk management process [43, 44].

More recently, direct participation of citizens in disaster situations via social media, videos, photos, text messages and chats (Twitter, Facebook, Instagram, Snapchat, YouTube, WhatsApp etc.), is of pivotal importance for activating emergency responses and recovery actions. These innovations have, to some extent, redesigned the process and structure of service provision. Each citizen/user is like a sensor that provides data for filling the gaps in the availability of real-time information about disasters [45, 46].

One of the main routes of innovation in enhancing cities resilience towards disaster risk reduction refers to the use of Open data innovation, Mergel [47] and Big Data as both strategic and operational tools that may bring fundamental changes to disaster risk management chain' [48, 49]. As noted by Papadopoulos et al., [50] current trends are to investigate theory using structured data to develop mathematical models [51, 52], or to use social media to study how people respond to disasters and how appropriate measures are taken to enable recovery [53–56]. There are several examples of the employment of open data infrastructure for coping with resilience and sustainability targets at local level. Maps originally produced to provide developers and planners with infrastructure and housing related information, have been updated with data on flood risk areas and critical infrastructure that are of key importance for disaster risk management and emergency plans (i.e. the Greater Manchester Open Data Infrastructure Map (https://mapinggm.org.uk/gmodin/), the Coastal Resilience projects developed in the US and the Carribean; the Cape Town Disaster Risk Management Centre etc.).

On the other hand, Big Data Analytics (BDA) enables smart cities to acquire incredible insights from immense volume of data generated via heterogeneous sources such as Internet-of-Things (IoT) integrated sensors, Radio-Frequency Identification (RFID) tags, Global Positioning Systems (GPS), smartphones, Bluetooth devices, etc. [57, 58].

Big data are here seen not as large datasets, some of which have been used for decades in climatology, but as a ‘new socio-technological phenomenon resulting from the emergence and development of an ecosystem made up of the new kinds of data ‘crumbs’ about human behaviours and beliefs generated and collected by digital devices and services’.

The impact of Big data in boosting resilience of urban communities to disaster risk could be remarkable, providing clear and timely operational information to policy designers and ensuring prompt response during recovery actions.

Data analytics are categorized into four major strands: predictive, descriptive, prescriptive and discursive.

Predictive analytics allows understanding trends and forecasting future outcomes. Especially in natural hazard studies these data analytics are of key importance to ‘enabling granular, early, and accurate weather forecasts and can increasingly predict both sudden and slow-onset disasters’ [59].

Descriptive analytics refers to the exploitation of available data coming from several sources (satellite, social media etc.), in order to obtain a full comprehension of the situation. On the operational side, descriptive analytics allows to understand, monitoring and detect hazards in the pre-disaster phase, defining and coordinate timely emergency response and to assess recovery actions needed in disaster aftermaths.

Prescriptive analytics goes beyond description and inferences to examine likely scenarios by identifying causal pathways. It provides multiple forecasts developed under different scenarios to gain insight into citizen’s behaviour and identify issues and optimization paths under disaster constraints situations. Table 1 summarizes the contribution that data analytics functions provide to disaster risk management.

Table 1. The role of Big data Analytics in Disaster Risk Management. Our elaboration

Disaster risk management			
Data analytics function	Pre-disaster prevention	Disaster phase	Post-disaster recovery
Predictive	Forecasting Simulating Modelling Data Assimilation		
Descriptive	Understanding Monitoring Detection Comparison	Planning Coordinate Response	Assessment Relief Rehabilitation
Prescriptive	Nudging Behavior Analysis Sensitization		

As noted by Baker [60], policy responses and efforts for boosting resilience at urban level depend on the perception of disaster risks and community awareness.

The availability of real-time data and information which can be verified from a variety of sources supports real-time decision-making process, enhances community awareness and perception of incoming threats and guarantees a timelier response in disaster situations, creating the premise for 'transforming urban governance into Smart city governance' [61, 62].

The above reflections offer interesting hints for some preliminary conclusions and for the analysis of limitations and future perspectives of the research.

4 Conclusion and limitations

Cities can be depicted as complex, dynamic and manifold organisms, which evolve, flourish and regenerate as part of a broader ecosystem. Cities worldwide are exposed to a wide range of risks; many of them are attributable to natural hazards. In facing these unprecedented threats, urban governance has to develop a deep understanding of the systems that are critical to the life of the city [63], focusing on mutual interdependencies that exist among various components of each subsystem (natural, socio-technical, economic etc.). At this stage of the analysis it can be stated that successful innovations, such as the use of digital sensors that improve controls and safety networks in smart cities, early warning systems for disaster alert, highlight the credibility and feasibility of the pursuit of certain notions of "smart" cities. Smart cities have to seek to process and manage the real-time data flowing from new digital infrastructure [64], not only for the provision of high-quality services to the community, but also as valuable tools to make working the concept of resilience into the vital fabric of the communities.

Enhancing city 'smartness' as a path for boosting the 'resilience' of their communities in the face of 'wicked problems' seems to be the right answer that urban governments have to adopt for coping with current threats posed by natural hazards, climate change and urbanization trends.

Smart city governance asks for transformative, adaptive, sustainable, collaborative, responsive and long-term oriented policy approaches where all the actors involved interact through the facilitating medium of innovative ICTs, to help to meet the challenges of urban problems.

The 'smartness' and 'resilience' are irreplaceable pillars of future cities. However, it is debatable whether cities which are now facing an endless sequence of hazardous events, can effectively overcome them without a clear understanding of the need to merge the two concepts in a broader policy framework and to apply these principles into consistent operational disaster risk reduction plan.

In the current scenario, cities have to exploit the transformative power of ICTs that might stimulate learning processes and strengthen urban resilience to disaster risks.

Big Data Analytics are of pivotal importance in boosting resilience and providing in depth and earlier understanding of natural and man-made hazards, and for knowledge enhancements about citizens' actions, behaviors and attitudes in both safe and hazardous situations.

Despite the above-mentioned 'pros' for the exploitation of digital innovation to enhance resilience to disaster risks, some limitations have to be highlighted:

- The concept of resilience has a great appeal in the academic debate and in social media. It gives us useful insights about the broader categories of activities that should be improved (learning, adaptability, awareness, collaboration,), but 'without providing any clear operative indications to policy designers' [65];
- Academics have to suggest clear and consistent directions on how to make this shift towards smart and resilient cities, highlighting how resilience can be really impactful for future cities well-being.
- While it is important that smart technologies foster innovation and resilience through the community, on the other side it is strictly needed that citizens perceive the disruptive value of this concept in an era of vulnerability, overcoming some mental biases (myopia, optimism, inertia, and amnesia, as in the s.c. 'Ostrich paradox' proposed by Kunreuther and Meyer [66], that people show when considering disaster risks.
- The desired 'cultural shift' towards urban resilience cannot be evermore "event driven"; it rather must originate from nudge initiatives and awareness from all stakeholder involved, perceiving the scope of the threats that urbanization, environmental and natural hazards pose on our heads and on those of future generations.
- The massive use of rough and unstructured data coming from a wide number of sources (social media, twitter, YouTube, snapchat, etc.) in addition to those already gathered from 'official tools' (satellite, risk platforms etc.) can lead to noises and misinformation [67];
- Strong privacy concern, security issues, and data protection, along with open data, big data, and network/ubiquitous, remind us of the importance of finding the right equilibrium/balance among these;
- Training and education in engaging with smart technologies and their limitations and potential will help bridge the gap between availability and effective adoption for urban smart governance purposes.

As the topic has great potential for further discussion, the research will benefit from a broader review of the literature, mainly focused on policy and managerial implications of digital innovation facing disasters at local level and from a well-structured comparative case study analysis.

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Evaluating the Priorities of the Calabria's Coast FLAGs for the Improvement of the Quality of Life of the Fisheries Communities

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Abstract. In this study we attempt to evaluate, using a multi-criteria decision making methodology, the priorities of the directors of the six Fishery Local Action Groups (FLAGs) in Calabria Region coastal areas on some dimensions of quality of life. More specifically, the focus is on the role of the FLAGs as a policy instrument, in the context of the Community Led Local Development (CLLD), aimed at improving the quality of life of the small fisheries communities. The results have highlighted the strengths and meaningful weaknesses of the level of the perception of the quality of life of the areas where the FLAGs operated in the previous EU programming period.

Keywords: Fishery Local Action Group · Analytic Hierarchy Process · Community-led local development · Quality of life

1 Introducing

Starting from the 80ies, the European Union through the Fishery Common Policy (FCP) has adopted some specific measures aimed at favoring not only the implementation of the sustainability criterion by boosting the reduction of the fishing boats but also at helping the economy of the seafaring communities (Simon 2008). This because one wants to reach "an efficient equilibrium among the firmness of the ichthyic resources, number of the fishery staff, the profitability of the sector and the interest of the consumers" (Simon 2008, p. 55). To such an aim the 1198/06 Reg (E.U.) has introduced new institutional organizational mechanisms able to promote the local development making use of a bottom-up participative approach. The Fishery Local Action Groups (FLAGs) born on the course of the Local Action Groups (LAG), represent the instrument of territorial governance of the ichthyic development involving a plurality of local actors coming from the public, private and no profit spheres. They are appointed to manage the network of the involved parts and play a central role for the sustainable development of the fisheries areas under economic, environmental and social perspectives. Through the local Development Plans (LDP) they adopt policies of development which have to take into account the effective needs and characteristics of the territory (Marcianò and Romeo 2016).

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In this research we have verified the priorities that the FLAGs responsible managers and other privileged observers have on some dimensions of the quality of life (QL). They, representing the local institutions[1], know the economic and social peculiarities of the fishing sector and may be able to improve the living conditions of the small fishing communities in the region of Calabria.

From the operational point of view, the first step was to translate the concept of QL into measurable dimensions/criteria and sub-dimensions/sub-criteria. Regarding the choice of the dimensions and sub-dimensions, we have considered that QL is an integrative part of sustainability, in the sense that it is inclusive of the environmental, economic, social and cultural dimensions of sustainability. In such way, the level of QL or of well-being is explainable as an expression of the synthesis of the main dimensions of sustainability. The sustainability of development expresses itself in the inter-generational satisfaction of the needs, which does not only include welfare but also well-being, i.e. the set of the "primary goods" (Rawls 1971), the rights and the values. It is well-known that the level of well-being is the result of factors linked to the persons behaviour and their ways of living. When these conditions happen, a certain level of well-being has been reached. With reference to the small communities, we should take into account that the level of QL depends also on the bonds and conditionings linked to the traditions, customs and habits of a specific territory, i.e. to their culture. In order to follow such conception, the reference to the capability approach (CA) becomes necessary (Sen 1985, 1999). This approach allows to assume that, through the concept of the freedom to be and to act both at subjective and social levels, the level of QL may be increased by improving the capabilities of the individuals (Nussbaum and Sen 1993). Another critical issue concerns the reciprocal relationships between QL and sustainable development at local level (Distaso 2008).

The content of the above highlighted arguments will be shown into four sections. The second section is constituted of two paragraphs: in the former the framework of the determinants of QL is analysed, in the latter we examine the methodology used for their weighting; the area of study and the discussion of the results, are the object of the fourth section while some conclusive considerations are outlined in the fifth section.

[1] The same *European Fishing Fund* establishes that, in order to create new sustainable sources of both income and QL (Capgemini et al. 2014a), the most adequate temporal and spatial dimension is the territory. This because it presents common characters and, thus, under certain aspects, it can be considered an homogeneous unity. In such a context, it is relatively easier to implement some policy guidelines able to better understand, according to the bottom-up approach, the needs of the fishing communities. The E.U. regulation by forecasting the *Plan of implementation* should reply to such requirements and be based on a bottom-up approach. In such a way, it helps the local partners addressing both the short run effects of the common fishing policy and the economic, social and environmental impacts of the progressive exhaustion of the fishing stocks.

2 Methodology

2.1 An Analytical Description of the Dimensions of the QL

Dealing with an evaluation of intrinsically complex concepts such as QL (Distaso 2007), requires to take into account a multiplicity of factors. We do not intend to make a list but to distinguish into meaningful categories the main elements contributing to create QL. These categories comprehend: 1) the economic dimension; 2) elements expressing the sense of belonging of the individual in the society, which is represented by social capital; 3) the realization of the set of the personal capabilities and the social opportunities, in order to point out that well-being is determined not only by the capability to be (substantially by the personal characteristics or endowment of human capital) but also by the capability to do, i.e. functionings; 4) elements connected to QL, such as the search for a relationship between economy-environment, or between the perception of the vulnerability and capacity of experiential acquisitions able to cope with the risks. The introduction of the concept of resilience allows to reach a dynamic view of well-being and to distinguish between well-being achievement and agency achievement. In order to implement an empirical analysis following the above mentioned theoretical framework, the concept of QL has been shared into five macro-criteria/dimensions to which 27 sub-criteria have been assigned (Table 1).

We have chosen such criteria and sub-criteria because they constitute the most relevant fields of the cultural, social, environmental, economic sustainability beyond concerning issues which are nowadays at the centre of the political and scientific debate. In short, these dimensions regard:

a) **Economic variables (income and employment)**, as main sources of production of wealth. Income is surely an instrument to reach well-being, but it is not an index of well-being. However, if we consider also employment together with the level of income, these economic variables assume a relevant role in the evaluation of the level of QL (ARPA 2015; Le Gallic 2002). Being difficult to know the levels of income in our empirical evaluation, we limit ourselves to obtain information from the possibility of diversifying the activities through the integrated commercialization of the fishing, hand-crafted and agro-industrial products, and the adequacy of the boats aimed at the fishing tourism. With regards to employment, the inquiry is limited to the ascertainment of possible ways of employment in other areas of the economy in order to evaluate the perceived degree of the availability of the employees to the flexibility of the job market.
b) **Resilience**, here considered not in physical terms but as the capacity of each individual or the group to overcome, resist and survive to a critical situation. The concept of resilience that is based on the shocks which, when they happen, undermine a steady state, and if a system finds itself in a situation of instability, mechanisms bringing it to a new stability are produced (Alinovi et al. 2009). In general, resilience may be defined as a "process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance" (Norris et al. 2008, p. 130). In short, we consider it as an intrinsic ability of a system or the community to resist to the impact of a natural or social event.

Table 1. Criteria and sub-criteria of the QL

Criteria	Sub-criteria
C1 **Income and Employment**	1.1 Average income
	1.2 Incentives
	1.3 Opportunity of employment in other sectors of the economy
	1.4 Investing into financial resources for adequacy of touristic boats
	1.5 Integrated marketing
C2 **Resilience**	2.1 Overcoming the shocks through institutional helps
	2.2 Overcoming the shocks through helps from relatives/family
	2.3 Overcoming the shocks through an alternative employment
	2.4 Diversification through direct selling of the product
	2.5 Diversification through ichthyic tourism and fishing tourism
	2.6 Diversification through a reallocation of the factors of production
C3 **Social Capital**	3.1 Accountability
	3.2 Trust and reciprocity
	3.3 Trust towards institutions
	3.4 Shared values
	3.5 Decisional processes
	3.6 Efficiency and efficaciousness
	3.7 Knowledge of social capital
C4 **Social Capabilities**	4.1 Micro-credit
	4.2 Group work among fishermen
	4.3 Reduction and/or prevention of the conflicts
	4.4 Organization of conferences/workshops
C5 **Environmental and socio-economic sustainability**	5.1 Reduction of fishing effort
	5.2 Adequate control for conservation of biodiversity
	5.3 Activities for the regeneration of environmental systems
	5.4 Local, national, international institutional recommendations
	5.5 Market of discards/Landing obligation

It deals with identifying not only the global risk but also the set of the capacities of reaction in front of the possibilities to resist to the negative effects of the change. In other words, what counts more is not only the single defensive or offensive reaction in front of a risk, but the evaluation of how the individuals manage the risks over the long run. Once evaluating a risk, it is necessary to consider the resilience either as a single act of reaction to a negative event or as a capacity to choose the most adequate strategies to face it. In such a way, since this capacity is founded both on the active and reactive behaviour of the agents, we may deduce that it is the consequence of the capacity of choice of the persons in front of the perceived risks. Then, the derived conceptual framework is based on the relation risks-resilience-capability. An increase of the capabilities make individuals less vulnerable in case of risks. This means that the concept of vulnerability refers back to the endowment of the capacities of the persons or a social groups, and, thus, to the capabilities. In fact, on the one hand, a low level of resilience indicates that the agents demonstrate a limited disposal to strategic choices and express a will to act in the short run. On the other hand, a higher level of resilience is an index of the possibility of modifying the contingent situation pointing out perspectives of long run. We have to specify that when evaluating the conditions of life, resilience is the contrary of vulnerability since it reduces the probability that the level of well-being decreases owing to a shock. Socio-economic resilience does not only mean a certain degree of resistance to a shock but also a durable preservation of the level of well-being.

c) **Social capital or relational capital** as an expression of the existing link between the quality of social relationships and individual and collective well-being. It is straightforward that this link, briefly named social quality, contributes to a higher level of QL. Its level is as much as higher as networks of interpersonal relationships and shared values able both to produce social norms, moral obligations and to create associations facilitating the coordination among the members of a community and the collective action, are developed. Several researches have proved that a social environment rich in terms of interpersonal relationships and participatory opportunities creates those specific conditions favourable both for the diffusion of information and a higher level of trust and shared values among the members of the community. Since economic development is strongly stimulated (or prevented) by the structure of social relationships, the economic activity is more dynamic in those situations where social interactions are intense and where reciprocal trust and the observance of rules are customs. These processes find their implementation in social capital as a shape of capital aimed at evaluating the possible individual and collective benefits coming from the social relations among persons. The benefits obtaining from the social relationships are of different nature. It deals with familiar relationships, belonging to associations, good neighbourhood, but also sharing norms or common values translating themselves in trust. Shortly, if the capacity of collaboration in a community increases in order to reach shared rules, we cannot neglect social capital in the evaluation of the QL since it represents the dimension which characterizes social sustainability. For this reason, social capital is also recognized as a relevant analytical category in the dynamics of local development (as for a deepening of this issue, see, Distaso and Distaso 2015).

d) **Social capabilities**, as a set of capacities through which it is possible to ascertain if individuals are able to act together and cooperate. This in order to face risky situations. The concept of social capability aims at pointing out that belonging to a social group completes individual freedom because this is not limited to the private sphere. In such a way, one considers that the individual does not only have private but also social purposes. With regard to the relation between development and freedom, Sen emphasizes that the different types of freedom (*positive* and *negative* or *freedom to* and *freedom from*) strengthen economic facilities which, on their turn, generate resources for social facilities. Besides, he points out that social opportunities facilitate participation to community life and that there is always a systematic capability of a local community (Sen 1999)[2]. However, we think that capability is a broader and complex concept such as to contain, for instance, human capital and to go beyond the usual conception of the individual capacity to be and to do. According to some authors, such as Stewart (2005) and Ibrahim (2006), the CA analyses the consequences of the *embeddedness* of the individuals in both relationships and social structures. Accepting this point of view, we may include issues related to identity, culture, life style, beliefs.

The concept on the basis of the CA is to assume that the capabilities of persons are also determined by the conditions of the society and the context in which they live. On this regards, Sen points out that "the circumstances determining different modalities of converting income into the different life styles adopted by the persons are influenced not only by the personal and environmental differences but also *by the differences of the social environment and relational perspective*" (Sen 2009, p. 264). Among the differences determining the effective life styles, an important role is also assumed by the relational differences, particularly, by "the quality of relations belonging to the community" (Sen 2009, p. 264). Thus, we may define social capabilities as the set of the actions coming from the efficacy of the social interaction. Despite some methodological limitations concerning the passage from the set of indicators of human development to social relationships (Narayan 1999), the concept of social capabilities can be useful in order to define social capital. Indeed, the CA has an heuristic effectiveness due both to the instrumental and intrinsic values which it gives to the *relational goods* (for a further deepening of this topic, see, Gui 2005; Donati 2011; Donati 2007). Conceiving social capital in a relational perspective means giving value to goods and services which express relationships of social reciprocity. More specifically, investments in social capital have an instrumental value in the cases in which social relationships are established in order to increase the probability to obtain benefits from the interpersonal relationships (Lollo 2011). While, by referring to the intrinsic value of social capital, it means to contribute to improve both the personal and social conditions of well-being. The use of an oxymoron as social capital and social capabilities can be justified (Durston 1998).

By pointing out the implications of social capabilities on the theory of social capital, we can affirm that the comparative analysis of both concepts may lead to overcome both the excessively instrumental idea of social capital and the

[2] The importance of the participation of the community life and the impact that the belonging to a social group may represent for the improvement of QL and the increase in the level of well-being go back to the original frame of the CA (Nussbaum 2000; Robeyns 2003, 2005). Sen himself (Drèze and Sen 1995) introduces the concept of social opportunity and he points out that the individual, in order to practice his/her freedom of choice, cannot be considered isolated from the social relationships and out of the institutions offering the possibility of real choices alternative to the personal ones.

individualistic view of the capabilities. In this framework, social relationships can be now considered a structure constituted of social resources (Lin 2001), and social capital is considered as a set of rights allowing each person, beyond his/her interpersonal relationships, to have access to common resources. If such rights are accumulated and transformed in other resources, social capital is an endowment which each individual can mobilize in case of need. Thus, social capital offers an integrated structure "capable of thinking" in terms of access to the resources (Bebbington 1999). Furthermore, the expansion of the foundations of the economic analysis that the approach of capabilities allows, brings new elements to the theory of social capital, such as, for instance, the evaluation of the impact of the social policy not only in terms of the economic advantages but also in terms of functionings[3]. And, if the informative ground of the CA can be extended to include evaluations of value of social structures, social capital may provide a valid structure for the identification of social capabilities.

From what above, we have noticed that social capital and social capabilities, being complementary, are synergic concepts in the sense that they are both a combination of material and immaterial resources available for the individual, since their possession or not determines the effective ability to engage himself/herself in some valuable activities. It should be pointed out that social capital may be considered as an economic reification of capabilities (Lollo 2011). At the empiric evaluation aim, social capabilities may be defined as those individual capabilities through which agents have the possibility to put at their disposal human capital in terms of education, culture, competences, *savoir faire*, directed at obtaining, through some training a higher level of collective well-being.

e) **Environmental and socio-economic sustainability**. We refer to that paradigm of sustainable development according to which sustainable development can be explained through the optimal growth expressing the search of an equilibrium between economic growth and environmental degradation" (Siebert 1998, p. 266). In this view, development can be evaluated as the process where the well-being of each individual and the improvement of his/her capabilities are the main aim of the several changes produced. Therefore, sustainable development becomes synonymous of human development (Anand and Sen 2000). Furthermore, accepting the idea of a socially sustainable development, we can state that development is sustainable in social terms if it considers social interactions and their economic, ecological and social implications at the level both of the persons and society (Lehtonen 2004). This because it deals with both improving individual capabilities and social capabilities. The concept of capability integrated with the concept of social sustainable development may lead to the issue of the inter-generational transmission of the capabilities. According to the CA perspective, socially sustainable development guarantees the possibilities of improvement both for the present and future population. Social sustainability means that development should allow, on the one hand, an intergenerational progress of QL and a reinforcement of both individual and social capabilities of

[3] Functionings can be defined as those possibilities of implementation which become effective through the capabilities of "doing" and the achievement of the "states of being and doing" (Sen 1985).

well-being, on the other hand, the research of the possibility of a more equal intra-generational distribution of these capabilities (Ballet et al. 2003). We think that this approach is the most adequate one for the empirical investigations, especially in the fishing area where the effects of the interactions between man and environment are among the most tangible ones. An example is given by the consequences deriving from the methods of illegal fishing, by the use of sophisticated instruments aimed at the exploitation of limited resources or overcoming the rate of regeneration of the same resources (Seijo and Salas 2014). Thus, we should consider the interventions of the European Commission mainly aiming at determining the conditions which make economically resilient and ecologically sustainable the development of fishing sector (Capgemini Consulting et al. 2014b).

2.2 The Weighting Method

In order to evaluate how the FLAGs directors could give their priorities on the above mentioned dimensions, we have implemented the Analytic Hierarchy Process (AHP) which allows to decompose complex situations in a hierarchical structure articulated in more levels. The AHP, which is a basic approach to decision making, is designed to carry out a pair-wise comparison judgments which are then used to develop the weight vectors (Saaty 1988). This methodology allows the integration of both tangible and intangible criteria and it is useful in those situations where the subjective judgments are a fundamental part of the decisional process. The AHP presents other advantages. Above all, its application reveals itself adequate when performance evaluations have to be expressed. Furthermore, it allows to deals with a composite set of data, some of which, being of qualitative nature, concern opinions of the individuals, in our case of the privileged observers (Adrianto et al. 2005; Romeo and Marcianò 2014). In the cultural context linked to fishing economics, the contradictory information and the inevitable misunderstandings are perceivable also to the external observer since maybe the natural phenomena and the social events are often understood as complex and stochastic concepts. Last, but at not least, such a method may be structured in order to make possible a system founded on collaboration and thus adequate for taking decisions. As regards as the procedure of application, the AHP is articulated into three phases:

1. To the identification of both the aim and the factors to evaluate, it follows the decomposition or hierarchically structure of the decisional problem into levels and sub-levels, each one of these is characterized by determined components;
2. Formulation of the comparative judgements through the pair-wise comparisons between the identified components identified for each level. The crux of the AHP is the determination of the weights specified on the grounds on the subjective judgements which the FLAGs experts have expressed through the questionnaire. Assuming n elements at each level of the identified components,, the procedure establishes the building of the square matrix of the two by two comparisons "A", in which w_{ij} points out the importance of the i element compared to the j element, through the attribution of a numerical score which goes back to a semantic (numerical/linguistic) evaluation which, in our case study, varies between 1 and 5 (Saaty 1988).

w_{ij} value Linguistic Judgments Interpretation

1 Equal importance; *i* and *j* are equally important
2 Moderate importance; *i* is moderately more important than j
3 Strong importance; *i* is strongly more important than j
4 Very strong importance; *i* is definitely more important than j
5 Extreme importance; *i* is extremely more important than j

For the property of reciprocity, when $w_{ij} = k$ it automatically follows that $w_{ij} = 1/k$, while for the property of symmetry all the elements on the diagonal are equal to 1, as in the following matrix:

$$\begin{bmatrix} 1 & w_{12} & \cdots & w_{1n} \\ w_{21} & 1 & \cdots & w_{2n} \\ \cdots & \cdots & \ddots & \cdots \\ w_{n1} & w_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1/w_{12} & \cdots & 1/w_{1n} \\ 1/w_{21} & 1 & \cdots & 1/w_{2n} \\ \cdots & \cdots & \ddots & \cdots \\ 1/w_{n1} & 1/w_{n2} & \cdots & 1 \end{bmatrix}$$

The data for pair-wise comparison matrix are collected through survey which has involved mainly the Directors or the Presidents of the six FLAGs of the Calabria region and other privileged observers. The 6 interviews, which were carried out during the period July-August 2015, took place through a direct relationship, i.e. *face to face* interviews, while only one was through the telephone. In this phase, the five criteria and the 27 sub-criteria, have been submitted to the subjective comparisons of surveyed experts.

3. Numerical determination of the weights through the normalization of the vectors weights identified with the matrix “A”. In analytical way, we proceed through the calculation of the geometric mean of the *iesima* row given by the following equation:

$$GM_i = \prod_{j=1}^{n} w_{ij}$$

where: $i, j = 1,2, \ldots,$
w_{ij} = value of the judgement of the value of the matrix
n = number dimension of the A matrix

The next step is the normalization of the weight vector obtained from the ratio between every single element of the column with the values of the geometric mean and the total of the column, as it is expressed in the following equation:

$$\overline{W}_i = GM_i / \sum_{j=1}^{n} GM_i$$

In order to verify the consistency of the obtained results, the auto-value associated to the auto-vector of the maximum coefficient of the matrix of the two by two comparisons "A" which is denominated $\lambda_{\max}$:

$$\lambda_{max} = \overline{W}_i * \sum_{j=1}^{n} w_{ij}$$

which allows to determine the index of consistency given by the following equation, in which n represents the number of the considered criteria:

$$CI = \lambda_{max} - n/n - 1$$

By dividing the consistency index per the Random Index (RI), whose value is derived by a pre-constituted table and associated to the number of the n considered criteria, we obtain the consistency ratio (RC):

$$RC = CI/RI$$

Higher is the value assumed by such an index, minor is the consistency of the subjective judgements which the policy maker expresses. In general, the threshold of tolerance of the CR is of 10%, but values of the 20% may be tolerated (Saaty 1988).

3 Results

3.1 The Area of Study

The FLAGs are private-public partnership activated in the Fishery Common Policy, and are constituted of the partnership among representatives of local public institutions, associations of fishing producers, private persons or associates farms of aquaculture and transformation, economic agents dealing with activities regarding the coastal area of relevance. The FLAGs, according to the inter-industrial view of local development, is an instrument born to create a team. This case study has specifically examined the FLAGs operating in Calabria Region (Fig. 1).

Concerning the territorial aspect, the break-down of the Calabrian FLAGs results to be homogeneous and respects the requirements of the Italian Operative planning. The six FLAGs in Calabria Region, representing more the 70% of the Calabria's seamanship, constitute an important share of the 43 FLAGs nowadays approved at national level. In fact, the FLAGs are strategic instruments of development and their action responds to the needs and crucial priorities in order to overcome the fish chain in Calabria Region. In fact, the IV Fishing European Fund (FEF) forecasts the implementation of some measures for the sustainable development of the fishing areas aimed at:

- strengthening the economic and social well-being of the coastal areas and increase the level of both the fishing products and aquaculture;
- maintaining and increasing the level of employment promoting the diversification connected to the changes in place in the fish sector;
- promoting the quality of the coastal environment.

In general terms, a substantial differentiation about the complex strategies elaborated by the FLAGs regarding the extremely varied choice among the different Measures, and the incidence of the structural interventions on the territory, in comparison to the promotional and immaterial ones, is found.

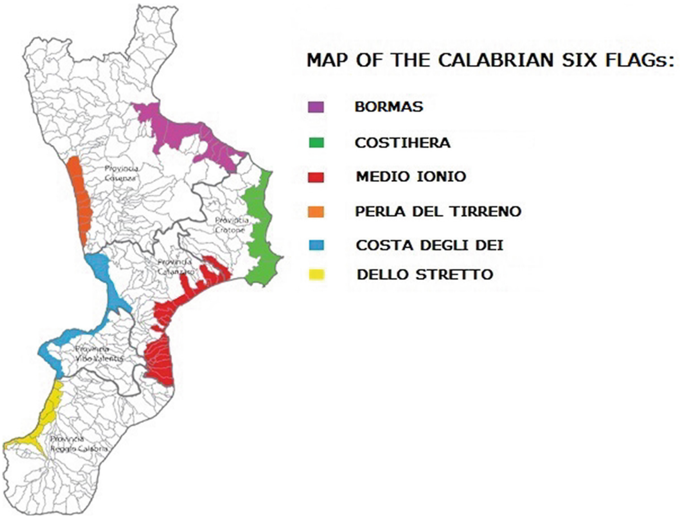

Fig. 1.

3.2 The Weight of the Dimensions of the Quality of Life

From the analysis of the obtained results (Fig. 2), it comes out that a relative importance among the macro-criteria is recognized to both the social capabilities (C4) and social capital (C3) with weights respectively equal to 0,25 and to 0,23. This points out that the directors consider both dimensions as a main priority and that FLAGs pursue the aim to increase the level of the collaborative spirit. Both categories represent the scarcest human resource of the active population not only in the fishing economic sector but also in other sectors. Since the development of capabilities is considered fundamental in order to increase cooperative relationships, the pursue of such an aim is a process whose effects are not immediate having influence on the modalities of formation of the human capital.

As regards the sub-dimensions of social capabilities, such as the participation of conferences and workshops, the directors give a medium importance to it with a relative weight equal to 0,32 and to the group work among fishers with a relative weight equal to 0,27. With reference to the sub-dimension of social capabilities reduction and/or prevention of conflicts, the value of 0,24 is meaningful, while the directors do not attribute to the micro-credit a high importance. The value equal to 0,17 is the highest among those attributed to the social capital sub-criteria. This means that the FLAGs attribute a remarkable importance to the *accountability,* i.e. that they adopt and recognize the principles of responsibility, thus undertaking to answer for their actions and behaviours. It is well known that trust has a relevant importance in the evaluation of the dimension of social capital. The perception that the privileged observers have with reference to the shared values, i.e. keeping of the civic virtues, such as the capacity to follow the agreements, to be sincere in the social and/or economic relationships, the capacity to place confidence in the others and to responsibly act in the respect of the law- is averagely low in the fishing sector with a value equal to 0,14. The perception of trust and reciprocity among the actors is as much as low, with a value equal to 0,14. Thus, in general, the reciprocal trust among the agents is considered to be rather low, even if they give a certain importance to the decisional processes, with a value equal to 0,14. On this purpose, the same directors of the *Costhiera and Perla del Tirreno* FLAGs think that the situation could improve if the institution of the Calabria Region would allow a sufficient period of time for the implementation of the Local development Plans (Marcianò and Romeo 2016). It follows the scarce trust also towards the government institutions (the value results equal to 0,12). Despite the knowledge about social capital is scarce (the average value is only 0,14), although some of the interviewed privileged observers do not know the concept of social capital, they declare to indirectly promote it through specific activities aimed to its increase in value. The values of the sub-criterion of social capital effectiveness and efficacy is averagely higher and is equal to 0,15. This data indicates that the FLAG role is not always well understood among the population, even if, according to some interviewed *stakeholders*, they are enough integrated in the territory.

The economic criteria represented by income and employment, whose average weight is equal to 0,21, result meaningful. A relative importance is attributed to the sub-dimension related to integrated commercialization among fishing, handcrafted, agro-industrial products and touristic services with an average weight equal to 0,28. In order to boost the integrated marketing, the FLAGs action, which is aimed at the promotion of exhibitions and festivals, may be incisive since they would give a significant contribution to the increase of the added value of the fishing products.

With reference to the fishermen's income (which has an average value equal to 0,21), the interpretation is more uncertain as, on the one hand, the FLAGs leaders think that it is sufficient for a dignified life; on the other hand, the interested persons think that it is insufficient. Beyond the fact that the fishermen have a innate reluctance to declare the level of their income, there is the issue about the incentives which are not always promptly supplied. Although the averaged value is equal to 0,18, we have to point out that, even the small loans to handcrafted fishing are not effectively supplied because, despite the public notices of the Calabria Region to favour fishermen, are considered as bank loans with all the conditions which the banks establish. We can state the same issue regarding the investment of the financial resources for the adequacy of the boats aimed at touristic aims or for employment opportunities in other sectors of the economy.

The weights of the obtained average values are indicative of some evaluations, such as that of the Director of the *Costhiera* FLAG, according to whom the increase in income due to the fishing-tourism is uncertain since it previously needs an adequacy to the boats and, thus, an adequate investment. In fact, what counts more is a cultural change which a passage from a merely productive activity to a service activity requires. In his turn, the Director of the *Bormas* FLAG asserts that the fishing-tourism is an activity which only the professional fishing can practice and not those who practice the trawling fishing. However, behind these evaluations, a generational issue is emerging, since the new generation does not have any longer the same motivations as the previous generations to exercise an always handed down activity. Furthermore, not even the fact that the norms are becoming more restrictive for the small boats, with the consequence of excessive costs, can explain this change. It is useful to highlight that, in the area of the *Stretto*, owing to the different conditions due to the beauty of the landscape, the fishing tourism could constitute a source of integration of income (Nicolosi et al. 2016; Romeo and Marcianò 2019; Musolino 2018). With reference to the sub-criterion opportunity to carry out another kind of job, the relative low value explains not only the preference from the fishermen to be employed in the fishing activity since they feel professional but also for the enjoyment of the beauties of the marine *milieu*.

The average value of sustainability has got a little significance. Most probably the relative low weight attributed to sustainability is explained by the fact that the FLAGs focus more on the dimensions of sustainability of the fisheries communities through the diversification of the activities rather than on the fisheries stocks. With reference to the average value (0,19) of the sub-criterion *market of the discards,* the FLAGs are involved into the interventions aimed at the rational use of the catch normally discarded in order to improve both the marine habitat and the average incomes of the fishermen. However, regarding the *Bormas and Costhiera* FLAGs, that minimum quantitative of discards adequate for making the relative market convenient, is not produced. The sub-criterion about the capacity of the operators of the fishing sector to consider the advice coming from the local, national, and/or international institutions assumes a minor relevance. This in order to ensure a sustainable management of the fishing areas and its relative ecosystems as well as the reduction of the fishing effort which the FLAGs leaders believe it is a minimal measure to pursue the sustainability in the fishing sector.

With reference to the resilience, the low value indicates that not all the directors give a relevant importance to it. From the interviews it emerges that the perceived level of resilience of the fishermen is very low. The FLAGs could intervene in order to increase the resilience of the fishermen through the diversification of the activities, such as the ichthyic-tourism or the fish tourism. In particular, the mission of the FLAGs is to increase the added value of the downstream productive section (i.e. fishery itself) through the catering service, tourism etc. Also, they do not attribute a relevant importance to the same sub-criterion wide activities of reallocation of the factors of production, such as community, social, recreational services, probably because they think that this activity is not well practised owing also to the inadequate equipment such as the boats, while diversification through the sub-criterion direct selling of the products may be a more efficient way to increase the level of resilience (the weight is equal to 0,27). On this purpose, the questions of the schedule regarding the diversification have been formulated on the ground of the *Local Development Plan* of each FLAG and taking into account the most recent literature (Brugère et al. 2008; Carrà et al. 2014; FARNET 2016). For an analysis of the real conditions in which the agents operate, the issue should go beyond the correct conception of resilience exposed in the dimension (b) of the previous section. We have noticed that the condition of the fisherman is heavily influenced by a controversial character and external to his activity, such as that of the second-hand dealer. The action of this figure should be included in that of the intermediation, but operating as a monopolist auctioneer, gains the excellent fishes and he sells it again to the retailers. This condition explains also the economic difficulties of the fishermen owing to the modernization of the boats in case of negative events. Furthermore, according to the President of the *Bormas* FLAG, if the fishing net or the boats are destroyed, the boats owners although members of the cooperatives, bear the relative costs. This because the cooperatives are formal. Thus, there is possibility for actions aimed at favouring shapes of organization and increase the level of the resilience of the fishermen. Alternatively, fishermen replenish the shocks through loans obtained from the family and relatives, rather than to apply to the external loans. The value of overcoming the shocks through an alternative employment is irrelevant. Vice versa, a way to increase the level of resilience is to boost strategies of diversification of the activities in the fishing sector.

The value inferior to 1 of the standard deviation points out that the privileged observers agree about the evaluations of the different environmental and socio-economic conditions. The meaning is immediate: the lower is the standard deviation, more the values are close to the average and there is less dispersion of data. In other words, a lower standard deviation indicates similar opinions among the interviewed *stakeholders*. Among the macro-criteria taken into consideration, the minor weights of the standard deviation equal to 0,05 regard social capital and resilience. Ecological or environmental sustainability follows with a weight of 0,06. Social capabilities have a weighted medium average of the standard deviation equal to 0,10. While, regarding the level of income and employment, the value of the standard deviation denotes that the opinions are divergent, the higher is the standard deviation, more different are the opinions.

Lastly, the description above mentioned has allowed to express what has resulted from the inquiry and the elaboration of the information through the building of the Table 2.

Table 2. Main strengths and weaknesses of the level of perception of QL

Strengths	Weaknesses
• High accountability • Presence of a collaborative spirit • Scarce presence of conflicts • Discrete integration of the stakeholders in the territory • High perceived level of integrated marketing • Discrete perceived level of income • High perceived level of activities of regeneration of environmental systems • Good possibility of overcoming the shocks through helps from relatives/family • High level of diversification though the direct selling of the product • High tendency towards the market of discards	• Scarce perception of the presence of the shared values • Marginal presence of trust towards institutions • Scarce trust and reciprocity among actors • Marginal presence of institutional helps • Scarce knowledge of social capital • Marginal presence of incentives • Inadequacy boats for fishing-tourism • Scarce possibility of employment in other sectors of the economy • Excessive control of the small boats • Low possibility of considering the recommendations coming from the local, national and international institutions

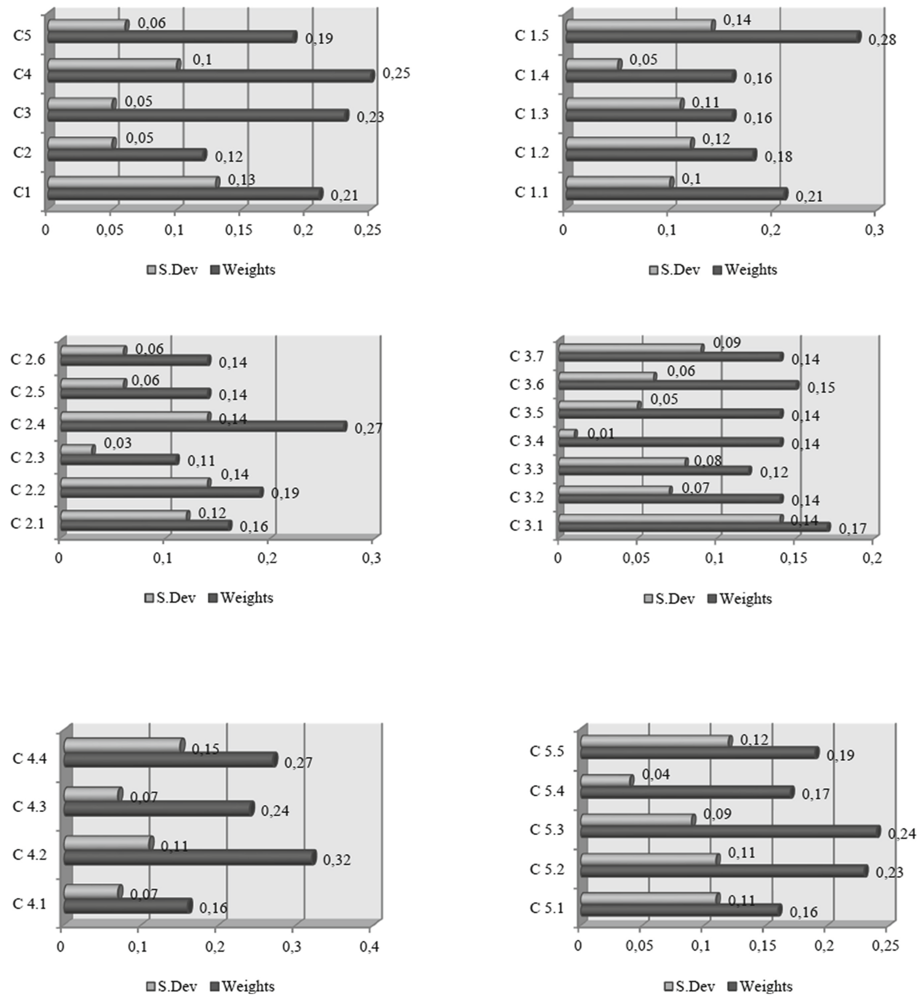

Fig. 2. Average values of the weights of the criteria and sub-criteria of the QL

4 Concluding Remarks

In this research we have evaluated the main role of the FLAG as a policy instrument aimed at the improvement of the QL of the small fisheries communities in Calabria Region coastal areas. In this way, by intervening in the field of political, social and environmental economy, the forecasted actions 2014–2020 of the actual planning may be implemented.

From the methodological point of view, since the data of the issues which we have dealt with are of qualitative nature, the multi-criteria analysis has revealed itself an efficacious instrument. To such an aim, we have taken into account five macro-criteria determining QL: income and employment (as more merely economic parameters), resilience, social capital, social capabilities, environmental and socio-economic sustainability. These chosen dimensions have been specified into 27 sub-criteria, which are integrated parts of the macro-criteria. Through the employed methodology, the weaknesses and strengths which the coastal areas where the FLAGs operate present, are specified.

The results have highlighted the minor or major importance that the Directors of the FLAGs in Calabria give to the different selected dimensions. For instance, a relative major importance is attributed to the *intangible aspects* of the QL. This indicates that the FLAGs directors are aware that both social capital and social capabilities are important in those communities especially in a period of crisis of the *welfare state*. It is necessary that innovative ideas have to be pursued so that well-being may grow in those belonging to the community. Furthermore, the importance attributed to social capital, as the results show, lessens on the ground of the scarce frequency of the interpersonal relationships of trust, and, consequently of shared values. This is a privileged field where the FLAGs could intervene through a major organization of seminars/conferences, team work among fishermen, etc. in order to improve a not very positive situation.

It should be necessary that the FLAGs could give more importance to the resilience, by inducing fishermen toward the diversification of the activities through the direct selling and the marketing of the ichthyic products. Such a kind of diversification gave positive results so far, while lacks are noticed about the activity linked to the fishing-tourism owing to the inadequacy of the boats. This activity is efficiently practised only in some areas. The level of efficiency may increase if incentives are given to the hand-crafted fishing, if the micro-credit is instituted and if the public institutions are closer to the effective needs of the fishermen.

From our research it emerges that the FLAGs should follow some policy lines of intervention aimed at increasing for instance the level of both social capital and social capabilities if their target is the improvement of the level of quality of life of the fisheries communities. The FLAGs should promote to a greater extent both social capital and social capabilities through cultural meetings, workshops, and activities supporting associationism such as the practice of the micro- credit and by orienting the *iter* of the started public notices. In such a way, the interpersonal relationships within the small fisheries communities and between them and the FLAGs could be permeated of a higher level of trust. Furthermore, it is necessary to make more efforts in order to let the small fisheries communities comprehend the positive effects deriving from an increase of such capital. This could be easier if all the subjects representatives of the territory and the stakeholders who play a central role in the local context are involved. In fact, we think that the regional institutions should have a relevant position which allows continuity and innovation in the *policy* guidelines.

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Socio-Economic Impacts of the Common Fisheries Policy on South and Central Tyrrhenian Sea (GSA 10) Demersal Trawl Fisheries

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Abstract. European and national fisheries policies aim at reverting toa sustainable exploitation of fish resources and to ensure the economic and social sustainability of fishing activities in the medium to long term (Art. 2 of Regulation [EU] No. 1380/2013).

The aim of this study was to assess the socio-economic impact of national and European management measures, implemented in the past ten years, on demersal trawl fisheries in South and Central Tyrrhenian Sea (GSA 10).

An effectiveness and efficiency evaluation was performed to establish whether the objectives of the management policies were achieved (effectiveness) and at what cost (efficiency).

The economic and social effectiveness of the measures of the Italian management plans showed a limited performance, particularly in economic terms, due substantially to reduced landings, increased operating costs and reduced labour productivity. The efficiency assessment, which involved analysis of the results of the EU cohesion policy financed by the structural funds, demonstrated that despite the considerable financial out lay the measures failed to mitigate the economic and social impact of the Common Fisheries Policy.

Keywords: Common Fisheries Policy · Socio-economic impact · Demersal trawl fisheries

1 Evolution of the Main Demersal Trawl Fisheries Management Measures

In 1982, Act of17 February 1982, No. 41, approving the “Plan for the rationalization and development of marine fisheries”, introduced a first comprehensive framework for the management of fishing activities. Forty years on, the objective of Art.1– to promote the rational utilization and enhancement of marine biological resource through an equal development of sea fishing – is still topical. The Act laid the foundation of a system based on effort regulation, an approach that has been considered as the most appropriate for its features of Italian as well as Mediterranean fisheries and which has characterized their management for several decades [1]. However, the current state of

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demersal resources demonstrates that effort management through input measures has failed to achieve the expected results [2, 3]. The adoption of input control measures, which include control of the fishing capacity, can lead to various disadvantages in comparison to regulation through output control; the main disadvantage is that it only addresses one of the components that determine fishing mortality, i.e. capacity. In this case, operators would be inclined to replace the regulated factor with those not subject to control for example by increasing the level of technology used in order to improve catches and reduce the time they require (overcapitalisation and increasing of vessel "catchability") [4]. That approach is now being criticized by the scientific community and the introduction of measures based on output, like the quota system, are suggested also in the Mediterranean Sea [5].

The entry into force of Council Regulation (EC) No. 1967/2006 "Concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea" and of Regulation (EC) No. 1198/2006 was followed in 2008 by the adoption of a new approach based on Management Plans, which the Mediterranean Member States were required to adopt for a number of fishing activities in their waters. The aim of the European Commission was to introduce a national and EU-level multiannual management plan system combining effort management and specific technical measures based on a decentralized decision-making process [6].

The Malta MedFish4Ever Ministerial declaration on the protection of Mediterranean fish resources (30 March 2017) accelerated the adoption of management measures for Italy's demersal stocks. The declaration laid down a detailed work programme for the next 10 years, including the objective of ensuring proper data collection and enhancing the knowledge on stocks to achieve sustainable management of stocks. In June 2019, Regulation (EE) No. 2019/1022 established a multiannual plan for the fisheries exploiting demersal stocks in the western Mediterranean Sea. The first five years of the plan envisage a substantial reduction of fishing activities in terms of days at sea.

2 Economic and Social Sustainability

The evaluation of the socio-economic impacts of the Common Fisheries Policy (CFP) on demersal trawl fishing in GSA10 was conducted by selecting appropriate indicators to analyse the economic, social and labour productivity dimensions. The selected indicators are those used in the Italian Management Plans and in Impact Assessment concerning the Commission's proposal for the 2012 reform of the Common Fisheries Policy [7] to evaluate if the objectives have been reached or not.

In particular, the economic sustainability is oriented to increase the long-term resilience of the sector and to encourage fishing on species that produce high price commodities [7]. The economic indicators included: a) medium and long-term profitability in terms of gross profit margin; b) short-term profitability in terms of the ratio of current revenues to break-even point (CR/BEP) and in terms of the value of production and average landing prices, which provide valuable information on market and production trends.

The social sustainability could be reached increasing the quality of employment (wages, safety and working conditions), making the sector an attractive source of employment and giving alternative development options to coastal communities [7]. The assessment of the social dimension was performed in terms of social stability by using the average cost of labour per employee and employee number. The importance of this indicator relies on the fact that labour remuneration provides purchasing power to the society at large. To this aim it is important to assess if the sector under consideration (the fishing sector in this case) is paying "the right level" of wage to workers. Finally, labour productivity was assessed in terms of gross value added/full-time equivalent (GVA/FTE), which provides information not only on the economic growth and competitiveness of the sector, but also on employee wellbeing. The indicators used for the analysis are listed in Table 1.

Table 1. Indicators used for trend analysis

Dimension	General aim	Indicators
Economic	To promote the profitability of the fishing industry	Gross profit margin (medium to long-term indicator)
		CR/BEP (short-term indicator)
	To improve sale channel sand ex-vessel prices	Value of landings Value of landings/volume of landings
Social	To promote social stability	Cost of labour/employee
		Number of employees
Productivity	To increase labour productivity	Gross value added/number of full-time employees (GVA/FTE)

Analysis of the trends of the indicators highlighted a substantial decline of long-term profitability (Fig. 1); the gross profit margin and short-term profitability (CR/BEP) showed a slight improvement in the last few years of the series even though they failed to return to the values they had reached before the crisis of 2008.The profit reduction that affected the sector, particularly demersal trawl fisheries, is not merely the consequence of reduced average production, but can also be ascribed to exogenous factors such as increased production costs and sales system in efficiency, which underpin the ever-widening gap between production and consumption prices, all to the benefit of intermediaries [8]. The shrinking employment figures have affected demersal trawl fisheries in a generalized manner. Notably, the loss of job shas been associated with a limited increase in average labour costs, while GVA/FTE highlights a persistently low productivity [9].

Fig. 1. Demersal trawl fishery indicators, GSA 10

3 Evaluation of the Effectiveness of the Measures Envisaged by the Italian National Management Plans

The sustainability objectives – not only environmental but also economic and social – are key elements of the national management plans for Italian demersal trawl fisheries. The earliest plans for these fisheries were implemented in 2010 (Director's Decree No. 44 of 17 June2010) [10] and were subsequently updated and implemented in 2011 (Director's Decree of 6 September 2011). Although the first generation of management plans for demersal trawl fisheries should have covered the period 2011–2013, they were extended several times and remained in force until 31 December 2017. The chief measure envisaged by these plans was capacity reduction through vessel decommissioning associated with a range of technical measures like temporary cessation and technical stops, to reduce stock exploitation and promote sustainability. The Director's Decree of 30 January 2018 introduced a new generation of management plans (2018–2023) [11] to address the overexploitation of the remaining stocks, some of which were in even worse condition than before the introduction of the first-generation plans. Again, the measures were substantially based on effort reduction as measured by days at sea. Either generation of management plans set general objectivesboth for the economic and the social dimension that were to be achieved viaspecific objectives in the framework ofan integrated management and overall sustainability approach. The economic and social objectives set by the plans are reported in Table 2.

Table 2. General and specific objectives set by the two generations of demersal trawl fisheries management plans (MPs) for the economic and social dimension

MPs	Dimension	General objectives	Specific objectives
2011–2017	Economic	To improve the economic status of fisheries workers	1. To keep fishery profitability above the inflation rate
	Social	To maximize employment opportunities in fisheries areas	1. Based on the biological targets, to develop job opportunities in fisheries-related activities
2018–2023	Economic	To promote a profitable fishing industry	1. To increase fleet profitability 2. To ensure that current revenues exceed break-even revenues
	Social	To mitigate the social impacts of effort reduction	1. To keep the cost of labour at the guaranteed minimum wage 2. To preserve current FTE employment levels

3.1 Evaluation of the Effectiveness of the Management Measures

Within management policy impact assessment (IA), the ability of a measure to meet management objectives through the management plans is defined as effectiveness. The latest EU guidelines [12] regarding IAs require ex-ante and ex-post evaluation of management measures in terms of effectiveness. Some recent studies have tried to adapt these guidelines to EU-wide fisheries management and have proposed specific indicators –the Target Effectiveness Indicator (TEI) and the Limit Effectiveness Indicator (LEI) –to evaluate the effectiveness of CFP socio-economic measures [13]. The LEI and TEI have recently been employed to assess management measure effectiveness in the framework of the integrated management of coastal areas [14].At present, the ex-post evaluation of results can only be performed for the 2011–2017 plans, since those that came into force in 2018 (and were updated in January 2019) have not yet produced measurable results due to the lack of relevant data. The reference points (RPs) laid down for the first-generation plans should be considered as threshold values (LRPs, Limit Reference Points) and are best analysed by the LEI, which allows assessing whether and to what extent an objective has been met and involves a comparison with baseline data, to provide a measure of the direction of change (Table 3).

Table 3. Range and interpretation of LEI (Limit Effectiveness Indicator) values

LEI	LEI value	Interpretation
LEI = A/B A = indicator/reference point B = indicator/baseline	LEI = −1	Worse than both the baseline condition and the reference point
	LEI = 0	Better than the baseline condition but worse than the reference point
	LEI = 1	Better than both the baseline condition and the reference point

Source: Processing of SOCIOEC data [15].

One or more indicators were developed for each specific objective to measure their achievement. Two indicators identified for two specific objectives, respectively the economic dimension and the social dimension, and their RPs (the % variation on baseline, calculated as the average value of the indicators in 2004–6) are reported in Table 4.

Table 4. Dimensions, specific objectives, indicators and reference points for the demersal trawl fleet as envisaged by the 2011–2017 national management plans for GSA10

Dimension	Specific objective	Indicator	Baseline	Reference point
Economic	To improve fishing fleet profitability	Gross profit per vessel (€)	68,700	+86%
Social	Based on the biological targets, to develop employment opportunities in fisheries-related activities	Cost of labour per employee (€)	27,500	+39%

Source: Processing by NISEA of MiPAAFT data (2011).

For the ex-post evaluation of the socio-economic effects of the management plans 2011–2017 on GSA 10 demersal trawl fisheries, the indicators were calculated and compared to their RPs at three time points of the reference period: 2010, the year the plans were drawn up (baseline); 2013, their intended expiry date; and 2017, the last effective date after the repeated extension of the plans, and the year the second-generation plans were drawn up. The results of the evaluation using the LEI are reported in the next table.

The consistently negative LEI (−1) reflects poor economic and social sustainability and shows that the management plans did not perform well in GSA 10 (Table 5).

Table 5. Ex-post evaluation of the economic and social effectiveness of the measures of the national management plans 2011–2017 on the demersal trawl fleet operating in GSA 10 using the Limit Effectiveness Indicator (LEI)

Year	Economic dimension Gross profit/vessel (€)				Social dimension Cost of labour/employee (€)			
	Baseline	LRP	Outcome	LEI	Baseline	LRP	Outcome	LEI
2010	68,700	127,782	47,399	−1	27,500	38,225	13,980	−1
2013	68,700	127,782	16,349	−1	27,500	38,225	11,309	−1
2017	68,700	127,782	49,796	−1	27,500	38,225	10,669	−1

Source: Processing by NISEA of MiPAAFT data (2011) and National Fisheries Data Collection Programme 2010–2017.

The management plans 2018–2023, as updated in January 2019 [11], aim at reducing mortality from fishing (F) in direct proportion to the percent reduction of fishing capacity (2018) and effort (2019–2020). At variance with the first-generation plans, the new plans provide for ex-ante evaluation of the effectiveness of the measures through a simulation of their biological, economic and social effects both in 2020 (the end of the first period of plan implementation and the year when measure effectiveness is to be evaluated) and in 2023 (final year of plan validity).

According to the ex-ante evaluation (Table 6), the management plans 2018–2023 should achieve a fairly satisfactory economic performance, since all the economic indicators included in the simulation show an improvement compared to 2015. As regards social sustainability, the number of FTE jobs is expected to decline as a result of fishing effort reduction.

Table 6. Expected values of the economic and social indicators in 2020 and 2023 and comparison with current situation (demersal trawl fisheries, GSA 10) *Source*: MiPAAFT (2018).

Trawlers 06-24m GSA10	Average value 2013-15				2020				2023			
	Gross profit margin	CR/BEP	Cost of labour/FTE	FTE	Gross profit margin	CR/BEP	Cost of labour/FTE	FTE	Gross profit margin	CR/BEP	Cost of labour/FTE	FTE
Scenario 0_Status quo	-3.08	0.95	11,107	660	7.61	1.30	11,919	648	7.67	1.30	11,913	648
Scenario 1_F-5%					11.64	1.45	16,270	456	22.83	1.85	16,188	315

4 Evaluation of the Efficiency of the Management Measures Envisaged by the Italian National Management Plans

The IA of structural fund efficiency is directed at establishing the adequacy of the public resources allocated to support the sector, i.e. whether the desired effects have been achieved at a reasonable cost [16].

The final results of the two most recent (expired) programmes, FIFG 2000–2006 and EFF 2007–2013, are summarized in the next two paragraphs.

4.1 Evaluation of the FIFG 2000–2006 Programme

Within the FIFG 2000–2006 programme Italy spent a total of €934 million, accounting for a utilization rate of 88%; about 25% was used to finance the adjustment of the fishing effort (Priority axis I). The performance indicators identified for the evaluation of the FIFG displayed a positive trend (Table 7). However, the increment of value added per employee was affected less by improved productivity than by the job cuts in the sector, which in 2000–2006 were particularly harsh.

Table 7. Indicators and results of the evaluation of the impact of the FIFG 2000–2006 programme

Indicator	Baseline	Target	Results on 31/12/2006
Value added per employee in the fisheries sector	€19,000	20% increase	€31,000
% Coverage of domestic seafood consumption with farm products (value and quantity)	9.8% (value)	15% in value	12% in value
	16.3% in quantity	20% in quantity	19% in quantity
% Coverage of domestic sea food consumption with preserved products	14.9% in value	18% in value	16% in value
	9.1% in quantity	13% in quantity	11% in quantity (2003)

Source: MIPAAF, EFF Operating Programme (updated April 2010)

Overall, the FIFG measures directed at the fleet proved effective to the extent that they contributed to speed up the capacity reduction, thus making the measure more "acceptable" despite the fact that it affected jobs and social conditions in several areas.

4.2 Evaluation of the EFF 2007–2013 Programme

At the end date, the total public outlay accounted for more than €710 million in terms of commitments, equalling 93% of the Operative Plan budget; payments were about €690 million, equal to about 97%. Approximately 44% of all funds were used to finance Axis 1 measures; the cost of permanent cessation was about €166 million.

According to the European Commission's ex-post evaluation [17] the measure involving permanent cessation was inefficient, because the objective of reducing overcapacity could have been reached by other management measures. The compensations envisaged for temporary cessation are also considered inefficient, because they were provided as a partial mitigation of the consequences of protracted stops. Only about 1600 fishers received socio-economic compensations in Italy. The figure was lower than expected and was due partly to the limited attractiveness of the sector to young fishers, to fishers' age, to the lack of real diversification opportunities and to the availability of other EU funds financing retraining.

According to OpenCohesion data on the EFF impact on employment, the EU-level targets were not achieved (Table 8).

Table 8. Fisheries employment levels outcome indicators (OpenCohesion)

Outcome indicators*	EU target value	Italy target value	Final value
FLAG jobs created	4,619	1,920	139
Fisheries jobs created	6,930	3,200	111
FLAG jobs maintained	26,530	23,099	355
Fisheries jobs maintained	52,437	32,400	2,860

Source: https://cohesiondata.ec.europa.eu/2014-2020/ESIF-2014-2020-Achievement-Details/aesb-873i

In general, jobs declined sharply during the EFF programming period (European Commission, 2017). The fact that the funds were channelled towards Priority axis 1, especially permanent cessation, clearly contributed to the job loss. The ex-post evaluation of the EFF highlights Priority axis 4, concerning the sustainable development of fisheries areas and the creation of fisheries local action groups (FLAGs). According to the "Study on the implementation of Axis 4 of the European Fisheries Fund" MARE/2011/01, Axis 4 seems to have contributed to preserve about 9,000 jobs and to create 6,000–8,000 more, although these data disagree with those of the EU OpenCohesion database. In Italy FLAGs began operating late; therefore, at variance with other Member States like Spain, they did not exert favourable effects on employment figures on fisheries value added.

It may thus be concluded that, as demonstrated by the indicators, the socio-economic impacts of the CFP have not been mitigated by the measures funded by the EU despite the substantial outlay of the structural funds.

5 Conclusion

Eight years into the CFP and almost 10 since the adoption of the first national management plans for demersal trawl fisheries, the Mediterranean fish stocks are still exploited above the maximum sustainable yield [18]. The consistent overfishing is due to excessive effort. As a result, in the past 20 years the Italian fishing sector has undergone a reduction of fleet capacity and fishing effort, which has resulted inconsiderable job cuts. The 2018 update of the management plans for demersal trawl fisheries has also introduced effort regulation as the main technical measure.

The outcome of these policies has been a marked reduction in the volume and value of production in all areas from 2004 to 2017 [8]. The reduced production is due to the effort reduction as well as to economic factors (incidence of the energy cost), social problems (difficulty in finding specialized workers) and ecological issues (probable increase in the actual effort due to greater vessel efficiency and to increased fishing effort by the other Mediterranean fleets).

Effort rationalization has not enhanced profitability for the remaining demersal trawlers.

The ex-post evaluation of the economic and social effectiveness of the measures of the national management plans 2011–2017 demonstrated their poor effectiveness, particularly in the economic sector. The negative value of the LEI is to be ascribed to the use of high RPs and to a general deterioration of the profit indicators, due essentially to reduced catches and labour productivity and to increased operating costs.

The ex-ante efficiency evaluation of the second-generation management measures (2018–2023) leads to expect a marked reduction in FTE jobs, particularly in2023, due to the progressive reduction of days at sea.

As regards the support provided by the structural funds, the sums allocated for permanent and temporary cessation and socio-economic compensations have proved inefficient and have not improved fishers' conditions despite the substantial outlays.

One of the factors hampering the achievement of the biological, but also economic and social, sustainability targets is the poor sharing of objectives among management bodies (European Commission and national and regional administrations). The modes of management plan implementation should lead to the creation of a body with specific roles and responsibilities in plan management, surveillance and monitoring. The governance should be inspired to recent approaches in this field, especially as regards co-management and responsive management, with a broader stakeholder involvement in management, surveillance and monitoring.

A further obstacle hampering the recovery of the sector is the poor fisher and owner awareness of the changes that have affected fisheries in the past few years; this results in their limited ability to address and adjust to such changes by adopting a more entrepreneurial stance based on continuous training and a greater use of investment. The levels of activity are progressively declining, also due to the adoption of the recent management measures (national and multiannual management plans); average productivity is slightly improving, but it will be able to achieve levels that ensure economic sustainability only if it is accompanied by a consistent effort reduction. The direct effects of these changes will be lower employment levels in terms of FTE; since the cost of labour is proportional to revenues, due to the widespread application of profit-sharing contracts, incomes may increase only in presence of increased daily value added. In Italy, several local operators have adopted quality labels, have created or strengthened the role of Producer Organizations or have undertaken direct sale, thus promoting commercial strategies that improve the traceability and quality of fresh local products. However, the distribution network and sales system is still inadequate and inefficient, also due to fishers' typical business risk aversion and to the near absence of training opportunities directed at up grading their skills, which would enable the adoption of new sales technologies, like the exploitation of digital markets.

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Financial Targets for the Sponsee and the Sponsor in the Restoration/Recovery of the Historical and Architectural Heritage

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Abstract. The paper explores the theme of sponsorship for the restoration/recovery of the historical-architectural heritage. The goal is to propose a model that allows both the sponsee (often public institution) and the sponsor company (mainly private) to maximize the monetary return generated by the investment. The model is tested through the following case study: the sponsorship of the restoration works of the Don Tullio's Fountain located in the Villa Comunale of Salerno (Italy). In the logic of the model, the funding requested by the sponsee is necessarily inclusive of the amount equal to the cost of the restoration work but should also consider the financial advantage deriving from the advertising return to the sponsor company. These targets are estimated through the direct audience critical variable connected with the number of visitors of the location of interest. For the sponsor, on the other hand, assuming a Cobb-Douglas production function, it's possible to quantify under static conditions the optimal percentage of turnover to invest in sponsorship to maximize profits. Assuming, therefore, that several companies are interested in sponsoring the restoration of the monument, the application of the model makes it possible to determine which company would be most suitable to sign the sponsorship contract.

Keywords: Sponsorship · Advertising fees · Cultural heritage · Profitability of investment · Public-private partnership

1 Introduction

Local development understood as a process of valorisation of existing territorial resources is based on the dialectic interaction between endogenous and exogenous processes. Therefore, it's synonymous with mutual influence between the local and external dimensions. In this perspective, the challenge is to increase the value of the identity capital (natural, physical, human, social and symbolic) of a territory [1]. Among the identity resources that characterize local realities, cultural heritage plays a primary role. Policies to promote local development often include among their main goals that of improving the enjoyment of the historical-artistic heritage. This often happens through

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the elaboration of management models based on multi-level planning focused on forms of partnership between institutions and companies of the territory [2–7].

Among the main forms of public-private partnership, sponsorship represents a valid instrument for the enhancement of cultural heritage that offers several advantages to both public administrations and companies. The latter, taking on the role of sponsors, use cultural sponsorship to strengthen or rebuild their corporate image and corporate reputation as well as to achieve a variety of objectives: improving relations with customers, fostering relations with bodies and institutions, improving relations with suppliers, and generating consensus in society. Another important advantage is the monetary return generated by the investment in sponsorship. On the other hand, public bodies, taking on the role of sponsees, not only obtain from companies the financial or in-kind means necessary to organise and carry out a given activity but by interacting with the business world they contribute to the social and economic development of the territory [8].

The objective of the work consists in proposing and testing through a case study, set in the city of Salerno (Italy), a model that allows the sponsor to maximize the profits generated by the investment in sponsorship and, at the same time, the sponsee to optimize the amount of funding obtained by the company. The financing companies can thus establish the optimum percentage of turnover to be invested in sponsorships capable of generating the highest achievable profit. For Public Administrations, on the other hand, the model makes it possible to determine the financial resources deemed optimal to proceed with the signing of the sponsorship contract. These resources are considered to include not only the amount needed to carry out the restoration work but also an aliquot linked to the profit of the private lender and representative of the value that the candidate company intends to acquire with its offer.

2 Methods

The logical path of the proposed model can be divided into two phases. The problem of maximizing the economic return due to public administrations is addressed in the *phase of estimating sponsorship fees* [9], which is inspired by the *Technical Regulations on cultural sponsorship* [10]. These rules assume that the total cost of the sponsorship is established on the basis of the value of the work, services or supplies necessary for the restoration, plus an additional aliquot proportional to the value of the advertising return, expressed in both monetary and image terms, which the administration is able to offer the sponsor [11]. The mark-up, representative of the countervalue offered, is to be properly estimated based on the considered desirability of the sponsorship on the market. This allows the Administrations both to avoid, in case of overestimation, a total lack of interest on the part of the companies, and to avoid, in case of underestimation, the attribution to the private individual of services of too high a value compared to the consideration obtained. However, the monetary and image returns due to the company are in practice rarely estimated because of their difficult measurement [12]. It follows that Administrations are unlikely to maximise public return from the application of the instrument. To overcome the problem, when *estimating the sponsorship fees*, it's assumed that the advertising return offered to the sponsor is a function of various parameters, some referring to the property to be enhanced (name of the designer, time of construction, architectural quality, relevance of the property to the community) and others characterizing the sponsorship activity (media coverage, direct audience) [13]. In addition, the analysis of numerous cases of cultural sponsorship shows that the critical variable that most influences advertising fees is the direct audience, i.e. the number of visitors to the monumental locations affected by the restoration/recovery projects. The contribution of the other parameters is therefore in most cases negligible. A comparison of the examples analysed shows an almost linear relationship between unit fees and number of visitors. So, having estimated the direct audience for the location of interest and made a comparison with similar sponsorship cases, it's possible to establish a fee representative of the advertising cost with linear proportion.

The problem of maximising the business profits generated by sponsorship is addressed in the *static analysis phase* of the investment [14]. The latter consists in the re-elaboration of a model proposed by Bucci, Castellani and Figini [15], in which sponsorship is considered as that immaterial production factor that enters in each moment in time (static hypothesis) in the production function of the company. The model assumes a *Cobb-Douglas production function* [16]. Below is adopted the version proposed by Romer [17] used to explain the endogenous growth of production systems generated by *human capital*. In the present case, this input is replaced by the *stock of sponsorships* (S) accumulated by the company. Knowing the *revenues* (R) of the enterprise and the *capital* (K), *labour* (L) and *sponsorship* (S), the function is defined as follows:

$$R = K^{\alpha} L^{1-\alpha} S^{1-\alpha}. \tag{1}$$

Equation (1) shows *constant returns to scale* compared to K and L. However, when all three factors of production are considered, it shows *increasing returns to scale*. We also assume for the three factors considered individually *decreasing marginal returns*, being $\alpha < 1$ [18, 19]. The price of the good offered by the company is normalised to 1. This makes it possible to relate revenues directly to the factors of production. The total profit is represented by the following formula:

$$\pi = K^{\alpha} L^{1-\alpha} S^{1-\alpha} - rK - wL - sS, \tag{2}$$

where rK is the *cost of capital*, wL represents the cost of *labour* and sS identifies the *cost of sponsorship*. In addition, r, w and s represent the *unit cost of* K, L and S respectively. The *unit cost of the sponsorship* s is the link between the two phases. This parameter represents the cost of a single sponsorship and includes both the cost of restoration work and the cost of advertising. Therefore, estimated s in the *phase of estimating sponsorship fees*, this value is then reintroduced in the *static analysis phase* in the following formula obtained by deriving the (2) with respect to S and placing π equal to zero:

$$S^{*} = \left(s/(1-\alpha)K^{\alpha}L^{1-\alpha}\right)^{1-\alpha}. \tag{3}$$

$S*$ is the *number of optimal sponsorships* to be financed to maximize profit. Multiplying $S*$ by the *unit cost of sponsorship s gives* you *the optimal amount to invest in sponsorship*. Figure 1 shows the model's logic.

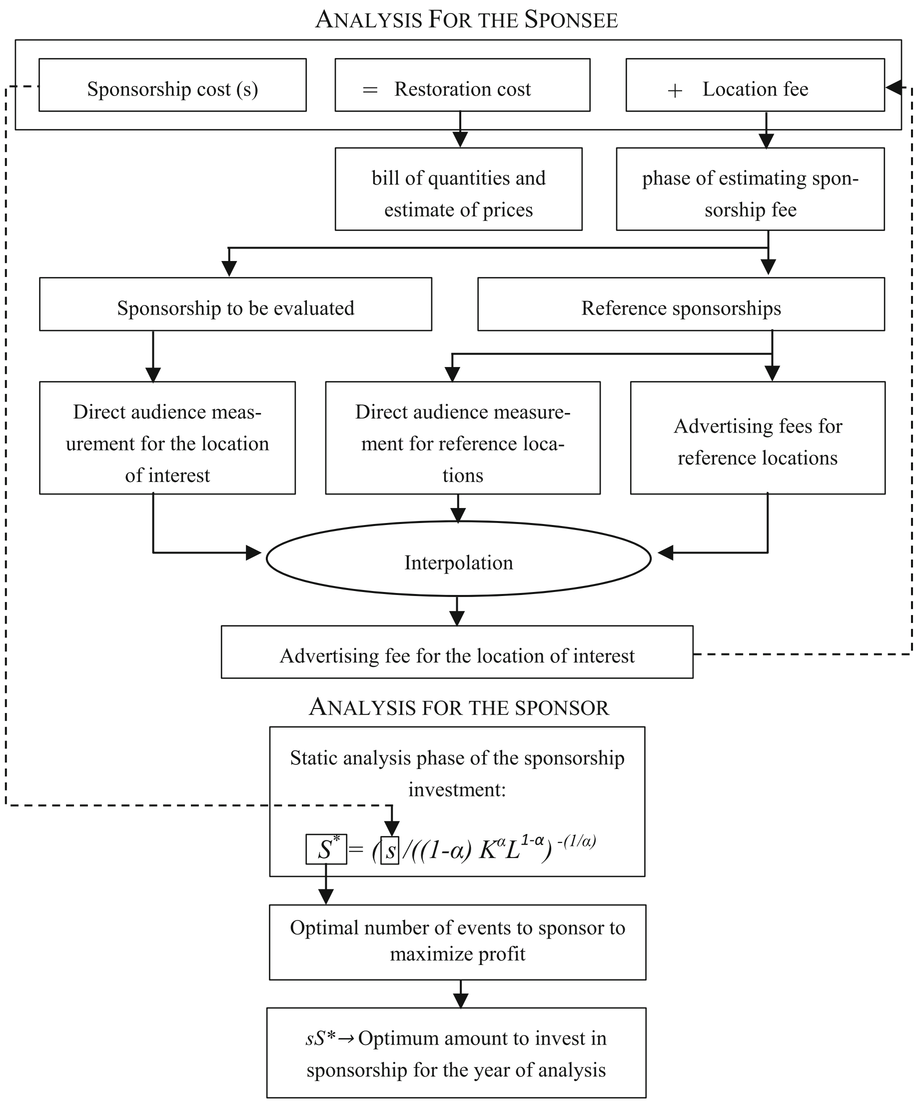

Fig. 1. Flow chart of the logical steps of the proposed model (own processing)

In the next paragraph the model is applied to the case study. Specifically, we respond to the need of the Municipality of Salerno (Italy) to find companies willing to sponsor the restoration of the Don Tullio Fountain's located in the Villa Comunale. Furthermore, it is assumed that two companies from Campania are interested in financing the initiative. The goal is to assess which of the two is best suited to sponsor the restoration. The sponsee can consciously take advantage of this information to optimise the contractualization phase of the agreement.

3 Application and Results

Below is the main information about the monument and its location.

3.1 The Monument and Location

Don Tullio's Fountain (see Fig. 2), located in the Villa Comunale, is one of the most characteristic fountains of ancient Salerno. It currently has a medium level of degradation caused by atmospheric agents and human action.

Fig. 2. Don Tullio's Fountain (own elaboration) and the Villa Comunale of Salerno during the Luci D'Artista event (source: Salerno Today, http://www.salernotoday.it).

The attractiveness for the sponsors of the location is very high. In fact, the Villa Comunale attracts many visitors during the winter period thanks to the *Luci D'Artista* event, which includes the installation of Christmas lights with a high scenographic value. For this reason, it's consistent to coincide the promotion phase of the company with the period (about three months) of the event. In addition, the sponsor is required to transmit its advertising message through the illuminations installed in the Villa Comunale. It's therefore a question of forcing the sponsor to integrate itself into the virtuous artistic process of the event, without losing effectiveness in the proposition of its brand. This allows both the company and the municipal administration to obtain various advantages. First, greater visibility for the sponsor is guaranteed. Secondly, a greater return on image for the company can also be an advantage for the Administration, since the latter is motivated to increase the advertising fee. Finally, avoiding the direct posting of billboards on scaffolding, a sponsorship method that respects the decorum and cultural value of the monument is preferred.

3.2 The Estimate of Sponsorship Fee

To estimate the advertising fee of the Villa Comunale, it was necessary to quantify the number of visitors to the location. The measurement of the direct audience was carried out during the last edition of *Luci D'Artista* in five days a week (Monday, Tuesday, Friday, Saturday and Sunday) and in two different time slots (morning and afternoon-evening). The results were then extended to the whole day. It has also been assumed that the number of visitors on Wednesday and Thursday is equal to the average number of visitors on Monday and Tuesday. The average number of visitors from Monday to Thursday (low turnout days), the average number of visitors on Friday (average turnout day) and the average number of visitors from Saturday to Sunday (high turnout days) were therefore estimated. Finally, the average number of visitors per month has been estimated.

The pedestrian flows were recorded following video recordings made for each day and time slot in the location of interest. The camera has been positioned to frame all the access roads to the Villa.

In order to estimate the advertising fee of the Villa Comunale di Salerno it's necessary to make a comparison with other territorial realities in which restoration works have been sponsored. In the case in question, two locations in Naples were selected for comparison, in each of which there is a monument that has been sponsored. The monuments chosen are the Temple of Virgil, whose location is the Villa Comunale, and the Via Chiaia Bridge located in the street of the same name. For the two locations in Naples, pedestrian flows were recorded in the same way as for Salerno. Table 1 shows the estimated visitor numbers for the locations in both cities.

Table 1. Average visitors for the locations of Naples and Salerno (source: own processing)

City	Salerno		Naples			
Location	Villa Comunale		Via Chiaia		Villa Comunale	
Morning (10:30–14:30)	Mon–Thu	812	Mon–Thu	712	Mon–Thu	483
	Fri	2,930	Fri	10,740	Fri	760
	Sat–Sun	5,765	Sat–Sun	26,465	Sat–Sun	2,115
Afternoon–evening (15:00–19:00)	Mon–Thu	4,540	Mon–Thu	3,870	Mon–Thu	315
	Fri	14,215	Fri	9,675	Fri	538
	Sat–Sun	27,835	Sat–Sun	19,530	Sat–Sun	1,620
Average daily visitors	Mon–Thu	5,352	Mon–Thu	4,582	Mon–Thu	798
	Fri	17,145	Fri	20,415	Fri	1,298
	Sat–Sun	33,600	Sat–Sun	45,995	Sat–Sun	3,735
Average monthly visitors	288,612		338,952		32,900	

Table 2 shows the fees of the locations in Naples extrapolated from the technical sheets drawn up and disseminated by the Municipal Technical Office.

Following an inspection of the Villa Comunale in Salerno, carried out during the last edition of *Luci D'Artista*, it was possible to quantify the square meters of lights convertible into exhibition space for the sponsor. Specifically, it's estimated that the total area of the lighting installations is about 1,000 m^2.

Table 2. Data related to the sponsorship for the restoration of the monuments of Naples

Location	Via Chiaia	Villa Comunale
Monument	Via Chiaia Bridge	Temple of Virgil
Exhibition area [m^2]	150	190
Exposure period [months]	8	4
Cost of sponsorship [€]	260,000	80,000
Cost of restoration work [€]	210,000	63,000
Advertising cost [€]	50,000	17,000
Unit cost of advertising (€/(m^2 × month))	42	22
Resale price [€/month]	120,000	80,000
Unit resale price (€/(m^2 × month))	800	421

The *fee* (*unit cost of advertising*) for the Salerno location, deduced in linear proportion to the number of monthly visitors, is shown in Table 3.

The *cost of the restoration work* on the Don Tullio's Fountain was estimated through the elaboration of an estimated metric calculation. The *total cost of the sponsorship s* is equal to the sum of the cost of the restoration work and the cost of advertising, as reported in Table 4.

Table 3. Unit and total advertising cost for the Villa Comunale di Salerno

Location	Exposure period [months]	Exhibition area [m^2]	Unit cost of advertising [(€/(m^2 × month)].	Total cost of advertising [€]	Total cost of rounded advertising [€].
Villa Comunale	3	1,000	39	117,000	120,000

The total cost of sponsorship *s* is used as a key figure in the second phase of the model, in which it is intended to estimate the optimal budget that the companies concerned should invest in sponsorship.

Table 4. Advertising costs, costs for the restoration works and total costs of the sponsorship activity for Don Tullio's Fountain

Monument	Advertising cost [€]	Cost of restoration [€]	Total cost of sponsorship *s* [€]
Don Tullio's Fountain	120,000	60,000	180,000

3.3 The Optimal Investment Estimate for Companies

At this stage it's assumed that two companies from Campania (Company A and Company B) are interested in sponsoring the restoration work on the Don Tullio's Fountain. Company A is active in the production and distribution of food products, while Company B is active in the clothing sector. The selected companies have already gained some experience in the field of cultural sponsorship. Table 5 shows the economic data needed to solve the optimization problem, extrapolated from the latest financial statements (closing date 31/12/2018) published by both companies. Company A did not invest in sponsorship in the year under review. Assuming therefore that it accepts the sponsorship proposal of the Municipality of Salerno we can put $S = 1$ and $sS =$ € 180,000. Differently, Enterprise B in the year of analysis has already invested € 12,000 in sponsorships, that is about 7% of the amount requested by the Municipality of Salerno. If you also accept the proposal of the Municipal Administration, we can put $S = 1.07$ and $sS =$ € 192,000.

Table 5. Financial statement data at 31/12/2018 for the two companies under analysis

Type of data	Symbology	Company A	Company B
Production value	R	€ 14,712,120	€ 153,166,000
Cost of production (including sS)	C_T	€ 13,749,998	€ 164,127,560
Earnings before interests and taxes (EBIT)	π	€ 962,122	− € 10,961,560
Cost of capital (excluding sS)	rK	€ 12,018,866	€ 136,684,846
Labour costs	wL	€ 1,551,132	€ 27,250,714
Cost of sponsorship	sS	€ 180,000	€ 192,000
Capital	K	€ 19,911,907	€ 167,727,663
Labour	L	42	1,068
Sponsorships	S	1.00	1.07
Unit cost of capital	r	0.6	0.82
Unit labour cost	w	€ 36,932	€ 25,515.65
Sponsorship unit cost	s	€ 180,000	€ 180,000

The log-linearity property of the *Cobb-Douglas function* allows to estimate the marginal productivity constant α, with the following formula:

$$lnR = \alpha lnk + (1-\alpha)lnL + (1-\alpha)lnS. \tag{4}$$

From (4) for Enterprise A you get:

$$\alpha_A = (lnR_A - lnL_A - lnS_A)/(lnK_A - lnL_A - lnS_A) = 0.977 \tag{5}$$

Also, from (4), for enterprise B we have:

$$\alpha_B = (lnR_B - lnL_B - lnS_B)/(lnK_B - lnL_B - lnS_B) = 0.992 \tag{6}$$

From the application of (3) for Company A we obtain S_{A*} = 1.92. Therefore, for this company the optimal amount to invest to maximize profit is sS_A* = € 345,884.98 (about 2.4% of turnover). By placing in (2) $S = {}_{SA*}$ we obtain the maximum possible profit for Company A, equal to $\pi_{MAX,\ A}$ = € 1,020,451.68.

On the other hand, applying (3) to Enterprise B results in S_B* = 6.59. So, in this case the optimal amount to invest to maximize profit is sS_B* = € 1,185,319.29 (about 0.8% of turnover). By placing in (2) $S = S_B$* we obtain the maximum possible profit for Company B, equal to $\pi_{MAX,\ A}$ = − € 9,812,193.61.

4 Conclusions

In Italy, sponsorship of cultural heritage represents one of the main forms of interaction between public and private with which it's possible to guarantee an efficient valorisation of the historical-architectural heritage [20].

The work aims to propose a model for estimating the profitability of sponsorship that is useful for both the sponsee and the sponsor. The implementation of the model in the case study made it possible to quantify the right amount due to the Municipal Administration, including not only the sums needed for the interventions but also the advertising return granted by the public body to the company. At the same time, for two companies in Campania, which are supposed to be interested in financing the restoration work, the optimal investment in sponsorship capable of maximizing entrepreneurial profit was estimated.

The application shows that for the first company, not only is the investment in sponsorship convenient, but its efficiency is maximised when the financing is doubled. In this case, a profit surplus of € 58,329.68 is generated, i.e. an increase of 6%. For this company, it's advisable to accept the sponsorship proposal of the municipal administration together with another possible offer structurally like the first one both in terms of characteristics and financial weight.

For the second company, which closed the year at a loss, sponsorship would seem to be uneconomic. Maximising profits requires a financial effort six times greater than that required by the municipal administration. Also, in the excellent condition, the profits remain negative. However, operating losses decrease by about € 1.15 million, or almost 10%. It would, therefore, be interesting for this company to analyse the effects of sponsorship in the long term (dynamic analysis), to see whether the investment made today contributes to a positive return in subsequent years.

The model analyses the profitability of sponsorship from both the sponsor and the sponsee's point of view, allowing for the alignment of their objectives. However, it has several limitations, due to the simplifying hypotheses adopted. To overcome them, in future research, greater importance will be given to the other parameters that influence sponsorship fees and a more complex production function will be adopted.

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Reaching Sustainability in Healthcare: Strategies for a Healthy Indoor Air Quality in Healing Environments

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Abstract. Indoor Air Quality (IAQ) is one of the main topics in which governments are focusing. In architectures for health, several researches are reporting a growing number of data analysis and research works in order to improve users' health. Although many studies have been conducted related to the biological and physical risks, the chemical risks have been less investigated and only in some specific functional areas of the hospitals.

Starting from some systematic reviews and research works, the paper aims to identify and list the best healthy practices for an adequate IAQ in inpatient wards. In particular, the handbook lists the solutions and strategies related to chemical pollution, starting from design and management, with a focus on (1) localization of hospitals and inpatient rooms, (2) hospital room, (3) microclimatic parameters, (4) ventilation systems, (5) materials and finishing, (6) furniture and equipment, (7) cleaning products and activities, (8) maintenance and (9) management activities, and (10) users and specific training of the workers.

The multidisciplinary approach emphasizes the need for interdisciplinary knowledge and skills aimed to find solutions able to protect users' health status. The design and management decision-making, ranging from the adequate choices of construction site and hospital exposure, finishing materials, cleaning and maintenance activities, etc., which can affect the IAQ must be carried out based on scientific research and data analysis.

Keywords: Indoor Air Quality · Hospital settings · Design and management strategies

1 The Indoor Air Quality

1.1 Health Promotion in Confined Spaces

Although the Indoor Air Quality (IAQ) has been already argued at the end of Eighties by Fanger [1], only recently it becomes a primary strategy to be considered. The topic needs to be focused because of the increasing of exposed population due to lifestyles and the permanence in confined environments (about 90% of the day).

Even European Community underlines the priority of energy efficiency strategies, in the same time it recommends to reach healthier indoor environments and the

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development of a specific European strategy on IAQ. Currently several EU countries have introduced in their legislations some actions relating to IAQ [2].

Since several years, critical factors due to the exposure to indoor air pollutants have been a matter of concern for EU legislators, and an increasing number of countries has been addressing policies regarding health promotion strategies. EU has often highlighted the importance to investigate IAQ, the relative impacts on health status and recommendations regarding actions and monitoring activities.

Although the current criticisms, in several countries air quality monitoring are carried out in specific professional workplaces in which chemicals are used, but also in some generic indoor spaces [3, 4].

1.2 The Environmental Quality of Healthcare Settings

The great importance of the issues connected with IAQ in the hospital settings, and all the other similar facilities, accredited or not by the National Health System (NHS), has urged several research and institutional bodies to investigate the topic and find solutions and strategies for healthy environments (especially in relation to the evaluation of the concentration levels in indoor air of the main chemical and biological pollutants) [5].

In such facilities with high managerial, technological and functional complexity, where the several functional units are designed with specific standards and needs (inpatient and outpatient areas, public ones, rehabilitation, etc.), where are carried out assistance and medical activities, diagnostics, training and research activities, etc., they are characterized by the presence of indoor air of chemical and biological components that can affect the health status of users [4–6].

In these healing spaces in which hospital staff interacts for various operational needs, but also users, specific preventive interventions are required, considering that the exposure of key-actors (from the daily users to the hospital staff), whose roles, knowledge and backgrounds, motivations and individual relationships have changed, becoming increasingly an active component to collaborate for improving the quality of the environments, medical services, takes on particular significance and importance, both for the vulnerabilities of the subjects and for the time spent in indoors [7–11].

In the specific case of the activities carried out, it is essential to consider the relationships between the behaviors and activities of the healthcare staff, and all the other users who live and work the healing spaces (outpatients, visitors, external workers for cleaning and maintenance activities, etc.) with their activities and behaviors [8, 12]. They are also affected by the quality of the building and daily relationships with the correct application of the organizational and management procedures of medical processes.

The use of technological and ventilation systems designed to perform and satisfy the various tasks in the best technical and economic conditions, the furnishings, the level of use, the ordinary and extraordinary cleaning and sanitization activities, maintenance, procedures and organic management of the regular prevention activities implemented and shared within the structures, etc. are all factors that affect significantly on IAQ and on the state of health and satisfaction of users [12, 13].

For this reason, these aspects are increasingly steps of the quality of services, therapies, healthcare services, activities and training program continuously provided, contributing to obtaining an effective and adequate quality of the indoor air that responds to the main references elaborated by the World Health Organization (WHO) [14], and which constitute a concrete contribution on a global scale. The WHO activities on air quality have boosted the legislative activities already in place in various European countries that set the maximum concentrations allowed in the indoor air of individual pollutants [2, 14].

2 Risks Correlated to Healing Spaces

2.1 Health Promotion in Confined Spaces

Indoor pollution is defined as "[…] *the presence of physical, chemical and biological contaminants in confined spaces' air does not present in outdoor air of high quality ecological systems*" [15].

Indoor air pollution is a public health issue. It is related to many of the major chronic diseases, related to respiratory, mucous membranes, skin, nervous and immune systems, such as asthma, fever by humidifiers, allergic alveolitis, legionellosis, etc. In addition to these well-known diseases, several symptoms, very frequently, characterized by neurosensory effects that determine discomfort, decreased wellness of occupants and negative perception of IAQ, may manifest. All the pathologies and diseases are caused by IAQ that affect mainly vulnerable population, in particular elderly, children and those who already suffer for chronic diseases [16].

As WHO highlights, the well-known concepts related to air quality are [17, 18]:

- people spend 90% of their time in confined spaces (working and living places, transports, etc.);
- indoor air is much more polluted than the outdoor, because additional factors related to the indoor space affect air;
- it is estimated that 50% of diseases are caused by an inadequate IAQ.

In average, an adult inhales and exhales about 8 L of air per minute, at rest. Therefore, in a day, totally, he breathes about 11 thousand liters of air [19]. Unhealthy air quality can cause several health effects [20].

In general, healing environments must be aimed to users' well-being but, paradoxically, sometimes they become unhealthy. The main factors of air pollution in healthcare facilities are substances used for therapeutic and diagnostic aims, maintenance and cleaning products, disinfectants, ventilation and air conditioning management, heating systems, building materials, furniture and finishing, equipment, etc. [5]. In addition, also the outdoor greatly affects the indoor air, because it is the sum of the outdoor one with the influence of internal factors [4, 12].

Starting from the merging of all these factors, the outcomes cannot be considered acceptable and consequently poor ventilation and inadequate air exchange can cause inadequate conditions. Indoor air in buildings is affected by outdoor and, therefore, by factories in the neighbourhood, road traffic, parking lots, warehouses of irritating substances or waste, construction sites or any other source of air pollution itself [12].

Therefore, to guarantee safety and air quality, it should be considered carefully the location of the outer air intakes for ventilation systems and their filters [19, 21].

The presence of contaminants within healthcare environments influences the IAQ compromising wellbeing and safety conditions that must be fundamentals in an adequate hospital complex [22].

Indoor pollutants concentration is inconstant during the time; it is related to the year of construction of the building, its dimensional aspects, the typology of the sources, such as the activities carried out by users, ventilation systems, procedures, cleaning and maintenance activities, etc. [6]. Indoor air, often characterized by a mixture of compounds very variable from outdoor one, can present concentration values of pollutants higher than those external environments and, sometimes, some indoor pollutants are not related to outdoor [4].

Italy lacks of legislations and norms about physical, biological, and chemical pollution of air in functional units. Currently the Legislative Decree No. 81 (2008) is used as a reference document, even if it states guidelines about workplaces [2, 5].

The healthcare facility, as a public infrastructure that hosts many and several users with different health conditions, cultures and origins, is the architecture with the highest number of risk factors and air pollutions [10]. Moreover, to traditional outdoor sources of pollution, occupants and building factors, it is important to add those relating to therapeutic and medical activities and products.

Since sources of chemical, biological and physical pollutants are several and many contaminants and pollutants can influence air quality in healing environments, it is fundamental to guarantee an adequate air-change through proper design of ventilation systems, that must also ensure to filter and enter the best outdoor air, minimizing pollution related to products and activities, materials and diluting the pollutant concentration and drain them [8].

2.2 Factors that Affect the IAQ in the Environmental Units

From the chemical pollution's point of view, hospital planners, managers and hospital staff therefore have the strategic role on defining strategies for maximum infection control. In case of design mistakes, it becomes strategic to ensure proper management of the facilities, in particular with the HVAC system with constant air change, choosing furniture and building material with low volatile organic compounds (VOCs) emissions [18], regular and conscious maintenance, medical activities and cleaning procedures (avoiding the use of sprays and other cleaning materials that generate VOCs, etc.) that take place inside the healing spaces [12].

Starting from these considerations, a research group gave rise to a monitoring activity of air quality in inpatient rooms, focusing on chemical pollution for understanding the current values and room features, maintenance activities and medical procedures [23]. For supporting the research project, the authors have done a systematic review on the current State of the Art and knowledge related to chemical pollution in healing spaces and the emerging strategies, supported by scientific data, for healthy inpatient rooms and their indoor air. The focus of the investigation is strictly related to inpatient wards.

2.3 How to Assess the Chemical Pollution in Healing Spaces

Indoor monitoring activities and the assessment of health risk factors are key-points for identifying the measures needed to prevent and/or to reduce pollutants' concentrations.

To program the monitoring activity and identify the appropriate sampling techniques, it is necessary to define the compounds that must be taken into account [5, 10].

Sampling methods vary, depending on the type of pollutant to be analysed and they can be subdivided in active, passive and canister samplings. These can be defined by a preliminary assessment through screening that allows to analyse the emission pattern of the sources, providing information for defining the type of sampling and analysis.

For a first analysis of air concentrations, particular attention is necessary for indoor pollutant classes of VOCs and Particulate Matter (PM).

WHO proposes a classification of VOCs in 4 groups (very volatile, volatile, semi-volatile, associated with particulate matter) based on boiling limits. These classes belong to species that have been identified as hazardous to human health, including pollutant by the International Agency for Research on Cancer 1 as certain carcinogens.

Determination of the main indoor pollutants can be done with passive methods, which involves sampling and subsequent laboratory analysis of collected samples, or active ones, in situ, with direct-fit systems. In addition, in relation to the duration of sampling, monitoring is defined as short-term (from a few seconds to a few hours) or long-term (generally over 8 h).

For each of them, it is in any case to use and adopt the correct guidelines by EN ISO 16000, because only with the use of efficient instrumentations and an adequate protocol the outcomes are trusted. Nowadays, the market offers several products that are not enough sensitive and with unreliable results (Table 1).

Table 1. Indoor air factors in inpatient room [6].

Criterion	Field of interest	Influence	Focus
Design factors	They refer to all the components that characterize the inpatient room (room dimensions, furniture, finishing, etc.)	Their emissions are constant, although in relation to their life the emissions may decrease over the time	• dimensional aspects, room configuration and door motion • finishing materials and furniture
Management and cleaning activities	They refer to the management and maintenance activities, ventilation systems, cleaning and disinfectant activities, etc. carried out in the room and in the functional units	They can highly affect the indoor air, but their emissions can be controlled through the Applications of strategies, and in the same time, they can be changes if their actions are dangerous for users	• cleaning and maintenance activities • ventilation systems • maintenance and operational strategies

(*continued*)

Table 1. (*continued*)

Criterion	Field of interest	Influence	Focus
Human presence and activities	They refer to the presence of users, their health status, and the medical activities carried out in the inpatient room	Their presence and application can vary, and therefore they can affect the indoor air in different modes. In general this component does not affect highly the indoor air performances	• human behavior • medical activities • medical equipment
Outdoor and microclimatic factors	They refer to the outdoor air, the solar exposure and microclimatic parameters	Although these factors can vary, they have a great influence on the indoor air and the performances of materials in the room and air fluxes	• outdoor issues and site localization • microclimatic parameters • solar exposure

3 The Handbook of Best Practices for Inpatient Room

3.1 Localization of the Hospital and Inpatient Room

The localization of the healthcare facility is strategic for the relationships between outdoor and indoor. It is clever that the concentration of pollutants in outdoor air is lower than in indoor ones. For this reason, for reducing the outdoor concentrations of chemical pollutants in hospital environments, the site selection is of primary importance [12].

In addition, air filtration and air intakes of ventilation systems, if adequately localized, can reduce the input of contaminants coming from outdoor into the hospital settings.

Typically, the inpatients areas are in the upper floors. They can be a double, triple or five-fold body, in which the inpatient rooms are localized on the external sides [19, 21]. The building typology and the organization of the project area can influence the solar exposures of the room and it can highly affect indoor air. As the scientific literature and several case studies demonstrated, in relation to the pollution in the neighbourhood and solar exposure, strategies in ventilation system, with high performances and filtering systems, and technological strategies for reducing solar intake can be applied [19].

3.2 Design of the Hospital Room

Inpatient room requires several attentions because they should respond to the patients, medical staff and visitors' needs. Well-designed rooms can speed up healing and, in addition, decrease the rate of errors in the process [22, 24]. As the scientific literature and several simulations evidenced, there is not any specific dimension of the double and single rooms. It is strongly affected by several variable defined by ventilation systems, human density, window openings, etc. and the layouts' design of the project [6].

For a good IAQ in rooms, it is necessary to pre-assess the possible factors that influence the performances and impacts related to selected furniture, finishing materials, microclimatic parameters, ventilation system, room's volume, and medical activities. The door and window openings can highly affect the performances of the healing unit [12].

3.3 Microclimatic Parameters

Microclimatic parameters (CO_2, temperature, relative humidity and air velocity) have a great influence in indoor air. As the scientific literature evidenced, the increase of microclimatic parameters can affect the performances of workers and patients, finishing materials and furniture, as well as the chemical emissions of cleaning products.

An adequate microclimatic parameters, supported by the window opening and efficient ventilation system, can guarantee good performances in IAQ and users' comfort [1].

3.4 Ventilation Systems

In inpatient areas, the influence of medical activities, high temperature for patient well-being, users' health status and behavior, etc. can affect IAQ performances. It is necessary an adequate ventilation system to control indoor pollutants through their removal by dilution, air purification and filtration [21]. As the scientific literature evidenced, insufficient ventilation and filtration contribute to poor IAQ for outdoor contaminants in the building, recirculation of indoor pollutants and dirt build-up in air handling systems [19, 21]. In general, ventilation systems should be designed specifically for the activities to be carried out, managed and well-filtered for guaranteeing the better performances during its functioning [19].

3.5 Construction and Finishing Materials

In order to minimize the sources of pollution, it is necessary to identify and define adequate materials that respond to the medical and hygiene requirements. Hospital planners should also consider that environmental conditions of the space can affect the release of pollutants, such as high-temperature or humidity that can increase material emissions, solar exposure, etc. [6, 25].

For achieving healthier environments, as some researchers have highlighted, it is necessary an adequate materials' selection with low VOC emissions, as less porous as possible for supporting the performances of cleaning activities and easy maintenance [25].

In general, finishing and furniture must comply with international certifications, and during and after their installation, they need of an adequate ventilation for diluting their emissions, for several days (at least 72 h) [12].

3.6 Furniture and Equipment

In order to reduce the sources of pollution, it is important to select furniture and equipment that respond to hygiene requirements and medical activities to be carried out. As the scientific literature evidenced, it is necessary an adequate selection of furniture with low or zero VOC emissions, as less porous as possible to facilitate easy maintenance and cleaning procedures. Furniture should be placed in indoor environments after the site construction have been completed [12]. Furniture must comply with international certifications, and during and after their installation, they need of an adequate ventilation for diluting their emissions, for several days (at least 72 h) [25]. In order to avoid the emission of contaminants due to deterioration, finishing materials and furnishings must be periodically checked and maintained for ensuring that equipment and furnishings are placed in positions where they do not interfere with airflows [12].

3.7 Cleaning Products and Procedures

A clean space is an essential requirement for an adequate IAQ. However, inadequate detergents and/or cleaning procedures may cause adverse effects on air performances. Proper ventilation must be ensured during and immediately after cleaning procedures. Several studies suggest window opening for 10–15 min, in the absence of users [5].

Cleaning activity should be defined through specific protocols, and medical and non-medical staff should be trained on risks. It is recommended the selection of minimum emission cleaning products, adequate for the surfaces to be treated [6, 12].

3.8 Maintenance Activities

It is fundamental that hospitals, as well as well-designed and built to ensure adequate IAQ, must be regularly maintained in all its components, for high performances [6, 26].

As several researchers highlight, a regular and constant maintenance and management program can facilitate the coordination of the necessary activities to be carried out.

Therefore periodic and regular inspections and investigations in hospital settings and checks of the quality and efficiency, identification of potential air pollution by maintenance activities, analysis of datasheet of cleaning products, construction materials, furnishings, and medical equipment with low VOC emissions should be verified [12].

3.9 Management Activities

It is fundamental that hospitals, as well as well-designed and built to ensure adequate IAQ, must be well managed, for ensuring all the accurate work of hospital planners would not be productive, and to be health promoter [8]. An adequate IAQ management program can facilitate the coordination of the necessary activities to identify, correct, and prevent IAQ issues and to overcome critical factors with design and management strategies [8, 12]. Regular monitoring activities permits to the healthcare organization to know the performances of the healthcare facility. In addition, air samplings and the warranty of adequate values can guarantee to the hospital managers, in case of discomfort and a complaint from workers and patients, to have data that certify the correct provision of medical activities and the quality of healing environments [27]. An IAQ manager can guarantee a regular control and efficiency of the hospital [12].

3.10 Users and Workers' Behaviour

Every day, several users pass through the inpatient ward: from hospital staff (medical one, cleaners and maintainers) to patients and their relatives. Although the scientific literature evidenced that users' presence in the inpatient room does not highly influence chemical emission in comparison with other factors, but their actions and behaviours, as well as their behaviour and health status, can affect IAQ performances [6]. It is requested an adequate behaviour by all the users for guaranteeing the best performances of the room, without (in any way) affecting the health status of patients [12].

4 Conclusions

IAQ is a very broad topic in which any variable can affect the performances in indoor environments. Design and management strategies which may be adequate, in relation to different procedures, can decrease or increase the quality of performances.

The considerations emerged from the research are aimed at project managers, designers, technicians and all those who can contribute to the reduction of health risks.

It is clear that the decision-making in design and management issues ranging from the adequate choices of construction site and hospital exposure, finishing materials and furniture, cleaning and maintenance activities, etc., that can affect the IAQ, must be carried out on the basis of scientific researches and data [28, 29]. It is further necessary that the decision-maker should be composed by different professionals in order to guarantee a multidisciplinary and synergic design project in its various aspects.

Hospitals are complex, with different needs, users and requirement compared to other building facilities, and they work 24/7. For this reason, every action should be assessed in relation to their performances and to interrupt medical activities as little as possible.

The tools can be used autonomously and/or synergistically for supporting the decision making of chief medical directors and managers of the facilities, and the implementation of strategies during the time for permitting the best performances of the healing environments (i.e. adopting design strategies and verifying subsequently the room performances, verifying the procedures and monitoring the benefits of indoor air, etc.).

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Built Environment and Alzheimer. Quality Evaluation of Territorial Structures for Patients with Dementia

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Abstract. Sustainable, inclusive and resilient cities and urban settlements are fundamental in enabling people to live long and healthy lives. Elderly population is growing all over the world and in Italy is among the largest. Within this scenario, epidemiological data show that Alzheimer disease, a dementia which manifest with ageing, is also forecast to rapidly increase, up to 150 million cases in 2050. Within urban settlements, the health and socio-sanitary structures for elderly patients represent a fundamental social infrastructure that collects important investments but must be suitable to host people with dementia. The paper describes the methodology adopted for the definition of an assessment tool able to evaluate the indoor and outdoor qualities and characteristics of socio-sanitary facilities for Alzheimer and elderly people. In the first phase the analysis of scientific literature, international case studies and sustainability assessment framework led to identification of 4 criteria, 19 indicators and 71 variables validated by experts in geriatry, psychiatry and architecture. In the second phase the tool has been operationalized and tested on a sample of three territorial structures in Lombardy Region, Italy. The outcomes of the evaluation can lead to the definition of sustainable project strategies.

Keywords: Ageing society · Dementia · Evaluation tool

1 Introduction and Research Purpose

Sustainable, inclusive and resilient cities and urban settlements are fundamental in enabling people to live longer and in a good state of health. Today, a significant share of the world's population is composed by elderly people. Therefore, fostering Sustainable Development Goals in terms of Sustainable Cities and Communities (SDGs No. 11) require specific actions toward ageing population needs [1]. Within this scenario, healthcare and socio-sanitary facilities represent a social infrastructure of great importance in a country like Italy in which the elderly population is among the largest in the world, with an increasing life expectancy, from 78.1 years old for men and 83.7

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for women in 2005 to the 80.8 years old for men and 85.2 for women of the 2018 [2]. Those facilities need to be sustainable and resilient to social, economic and technological changes such as the increasing prevalence of dementia diseases within contemporary ageing society. In particular Alzheimer is a disease which manifests itself with aging and affects 4–6% of over-65 people [3, 4]. Epidemiological data highlight a continuous increase on a global scale and the trend does not show any drop with a forecast of 150 million cases in 2050 and an increase of 9,9 million every year [5, 6]. Alzheimer disease impacts on people memory, complex abilities and psychophysical abilities, therefore specific assistance need to be provided within specific healthcare infrastructures such as integrated domestic assistance, nursing homes, daily centres, villages or protected hospital wards which require high standard of quality and sustainability [7]. At the same time, healthcare is considered by developers and investors a valuable alternative asset class. Nursing homes and assisted homecare are indeed reported among the European and Italian top trends in real estate investments [8, 9]. A high level of quality, social inclusion and environmental sustainability is therefore requested both by the market and by the people that are supposed to spend several years in there, often in fragile conditions. Built environment characteristics can indeed provide positive impacts on patients affected by dementia through green areas, environmental quality and wayfinding, as shown by *Evidence Based Design* (EBD)[1] studies and the application of *Gentlecare Method*[2]. To the best of our knowledge, despite the growing importance of the topic, within the Italian regulatory system there are not reliable guidelines for what concerns the design, management and quality improvement of health facilities for the elderly. Therefore, the purpose of this research is to develop and validate an assessment tool for the quality evaluation of Italian socio-sanitary facilities and nursing homes for elderly patients affected by Alzheimer. The tool will be able to verify whether the existing territorial structures respond to the need of quality in terms of users wellbeing, sustainable management of spaces and activity provision. The tool will help stakeholders to understand where they should invest for improving quality and efficiency of their physical and organizational assets. This paper mainly explores the methodology adopted and briefly provide the preliminary results of the application.

1.1 Methodology

The methodological path has been developed in two subsequent phases. In the first phase an in-depth analysis has been conducted to understand the state of the art in terms of scientific production and physical realization.

[1] *Evidence Based Design* (EBD) can be defined as the process of explicitly use reliable evidence from research in making decisions about the design and management of built environment, together with an informed client. EBD related built environment qualities with medical or organizational outcomes [10, 11].

[2] The *Gentlecare Method* is prosthetic model of care and assistance that considers people, programs and physical space at the same time as resources for the assistance of dementia related diseases such as Alzheimer [12].

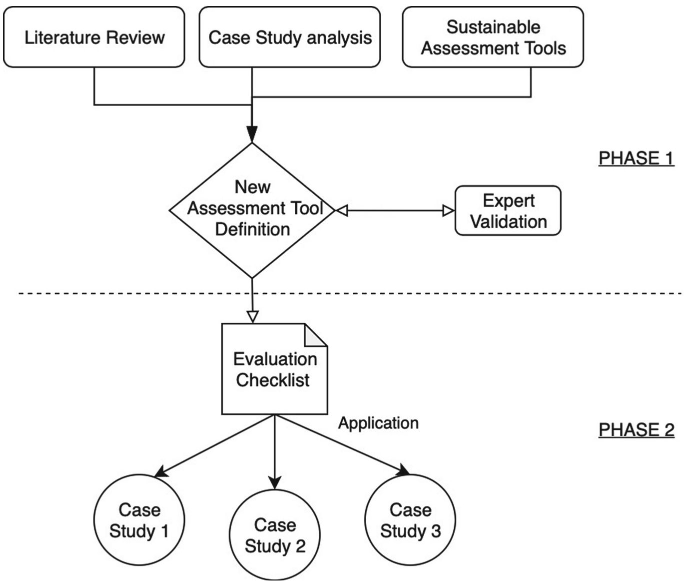

Fig. 1. Flow chart of the process followed in this study with the highlight of the two phases conducted

This phase includes the analysis of scientific literature, the evaluation and comparison of international case studies and the understanding of existing sustainability or quality assessment frameworks used in healthcare environments. From each of those analysis a series of criteria, indicators and variables have been collected to the definition of an assessment tool. The instrument has been reviewed and validated by relevant figures experienced on the topic. In the second phase an operative checklist for the assessment has been proposed and the tool has been tested on a sample of three territorial structures in Lombardy Region, Italy. A flow chart is hereafter provided to clarify the process followed (Fig. 1) and each phase is detailed described. As reported in empirical studies and literature reviews, there is strong evidence on the influence of specific physical features such as unit size, spatial layout, homelike character and domesticity on patients perception and wellbeing [13–17]. Other studies report that sensory stimulation, and environmental characteristics of social spaces also affect residents' behaviors [18–20]. Additionally, the importance of visual qualities improvement and noise and odour reduction is also highlighted in other studies [7, 19, 20]. People with dementia suffer disorientation and wandering therefore safety and orientation strategies are suggested by most of the papers collected, along with the provision of dedicated services and activities [21–24]. All the criteria that emerged from the literature have been collected and clustered in four macro-areas: *Quality, Spaces, Activities and Wayfinding.*

1.2 Case Study Analysis

At the same time, the search of case studies, best practices and benchmark of excellence in the treatment of Alzheimer's patients has been conducted. An investigation on five case studies considered excellent in the European panorama for the care and support of Alzheimer's disease has been carried out. The analysis includes three Alzheimer Village (Hogway Dementia Village in The Netherlands, Landais Alzheimer Village, in France and Il Paese Ritrovato in Italy), a Day Care Centre (Day Care Centre in Spain) and an Alzheimer department in Nursery Home (Foyer La Grange in France). The best practice comparison confirms the four macro areas previously identified. Additionally, relevant design strategies applied in the five case studies have been considered as assessment criteria and led back to the four macro areas.

1.3 Evaluation Tools Analysis

Furthermore, existing evaluation tools have been analysed in order to understand how far the four macro-areas highlighted in the literature review and case study analysis are present in the available assessment methodologies. Originally grounded on sustainability assessment, those instruments are very important for the evaluation and improvement of the existing assets in terms of sustainability values, organization performances or health-related outcomes [25, 26]. Eight evaluation tools have been selected due to their relevance to the topic: BREEAM Building Research Establishment Environmental Assessment Method Healthcare version (UK, 2008); CHD-CHC Center for Health Design Community Health Center Evaluation tool (USA, 2017); DQI Design Quality Indicators for Healthcare (UK, 2012); EAT Environmental Audit Tool (Australia, 2003); LEED Leadership in Energy and Environmental Design Healthcare version (USA 2011); SustHealth Evaluation Tool (Italy, 2015); WELL International Building Standard (USA, 2011); TESS-NH Therapeutic Environment Screening Survey - Nursing Homes (USA, 1991). Only two of them specifically assess environments for patients suffering from dementia (EAT and TESS-NH). The analysis confirms the accuracy of the four macro areas identified with the addition of environmental sustainability topic. It also provides an insight of the evaluation method from both qualitative and quantitative approaches. Figure 2 offers a summary of the analysis conducted.

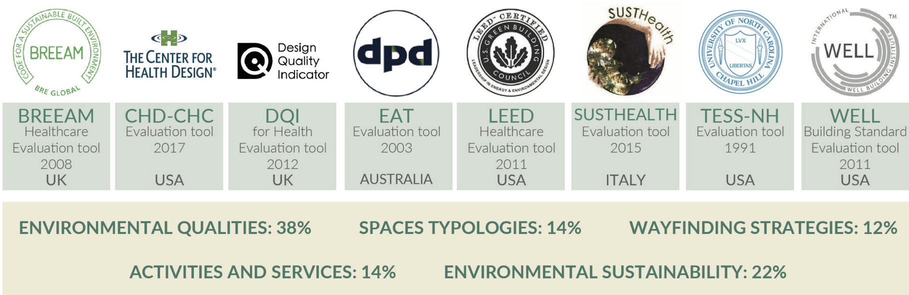

Fig. 2. Comparison of the international assessment tools selected. The percentage represent the number of indicators related to that specific topic retrospect to the total number of indicators. A fifth macro-area (environmental sustainability) emerges from this analysis.

2 The Assessment Tool

2.1 Tool Definition and Validation

Starting from the analysis 4 macro areas (*Quality, Space, Activities, Wayfinding*), 19 criteria and 71 variables have been selected to compose the assessment tool. Sustainability aspects have been highlighted in the analysis but not included into the new tool since the topic is very well covered by existing assessment methodologies (i.e. LEED, BREEAM). The full list of criteria with the number of allocated variables is reported in Table 1 and an example of the evaluation variables.

Table 1. Assessment framework of macro areas and criteria with the number of evaluation variables allocated (in brackets)

1. Quality	2. Space	3. Activities	4. Wayfinding
1.1 Views (5)	2.1 Room (4)	3.1 Garden (3)	4.1 Control (4)
1.2 Noise (2)	2.2 Garden (3)	3.2 Relations (3)	4.2 Paths (8)
1.3 Odour (1)	2.3 Common areas (11)	3.3 Physical activities (1)	4.3 Signage (3)
1.4 Colours (3)		3.4 Food (3)	
1.5 Security (6)		3.5 Community (3)	
1.6 Domesticity (3)			
1.7 Scale (2)			
1.8 Perception (3)			

A first version of the instrument was inspected and validated by recognized experts from geriatric, psychology, healthcare architecture and management sectors.

2.2 Application and Test on Italian Case Studies

The second phase of the study concerned the application and test of the tool on a sample of case studies. Here, in order to operationalise the assessment, a checklist has been proposed. A numerical value between 0 and 4 is assigned to each criteria thanks to the fulfilment of one or more variables assessed either with a binary (i.e. presence or absence of therapeutic gardens) or with a ranking scale (i.e. percentage of single rooms). The final score, later expressed in percentage, is the sum of the scores obtained in each of the 71 variables. An example of scoring related to the variables previously mentioned in Table 2, is reported in Table 3.

Table 2. Example of variables for the criterion 4.3 Signage in the macro area 4 Wayfinding

Macro area	4 Wayfinding
Criterion	4.3 Signage
Variables	4.3.1 Are there signs and symbols that indicate univocally each indoor space (i.e. toilet, rooms, common areas)? 4.3.2 Signages are present also in outdoor areas? 4.3.3 Private rooms are clearly identifiable by patients (i.e. names outside the room, personal belongings hanged at the door, different colors)?

Table 3. Example of different scoring methodologies

Variables		Score				Total (max)
4.3.1	Are there signs and symbols that indicate univocally each indoor space?	No (0)	Rooms (0.33)	Corridors (0,33)	Toilets (0.33)	1 point
4.3.2	Signages are present also in outdoor areas?	No (0)	Yes (1)			1 point
4.3.3	Private rooms are clearly identifiable by patients?	No (0)	Cards (1)	Colors (1)	Hangers (1)	3 points

The checklist has been applied to three structures which are all accredited to the National Health System and located in Lombardy region. They have been selected because they differ in terms of period of construction and typology. Indeed, the Case Study 1 is a dedicated structure for patients with Alzheimer disease, opened about 10 years ago; the second (Case Study 2) is a 20 years old Alzheimer department; the third (Case Study 3) is an Alzheimer department in a 40 years old nursery home. The tool has been applied by the authors and the information have been collected thanks to the support of the staff and strategic direction including medical doctors, nurses and building managers. The results of this first application are briefly discussed below.

2.3 Preliminary Results

Overall, the most recent structure (Case Study 1) obtained 92% of acquittal while the other two have obtained respectively 65% for the independent nucleus (Case Study 2) while the Alzheimer nucleus realized by the reconversion of an existing department has obtained score equal to 75% (Case Study 3). Looking at the evaluation more in detail, considering the macro area Quality, the Case study 1 position itself as an excellent practice thanks to the domesticity provided by the materials and the wide use of natural light and the innovation given by the use of smart technologies both for facility management and for patient safety. Additionally, outdoor high-quality spaces, views and collateral activities are present and contribute to the achievement. On the contrary, in the less relevant cases several drawbacks have been highlighted such as the absence of single rooms or therapeutic gardens. It is also important to note that the structure that obtained a higher score is also the one that reported a high level of coordination during the project phase between architects, doctors and managers. This highlight the benefits of multidisciplinary in the design process of such settings. The comparison between the three settings is shown in Fig. 3.

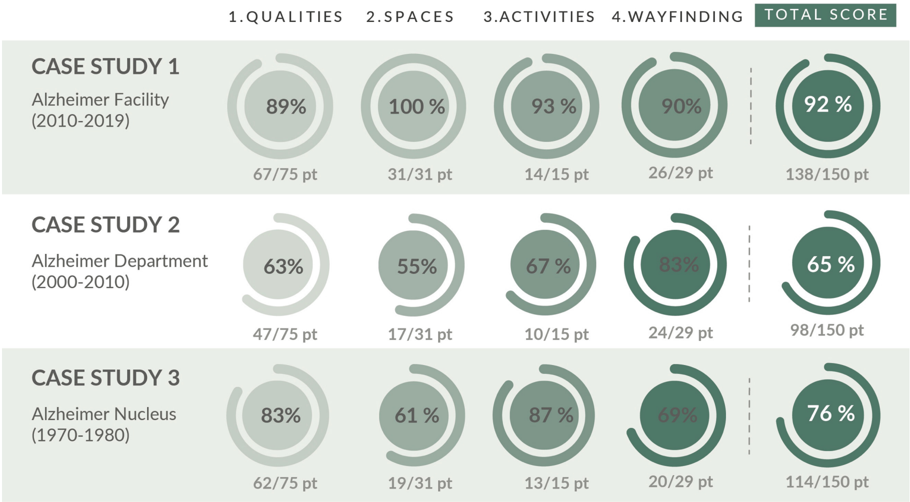

Fig. 3. Comparison of the assessment conducted on Case Study 1, 2 and 3

3 Conclusions and Future Developments

The preliminary results confirm and expand the knowledge in the field of healthcare architecture by defining a built environment quality assessment tool for evaluating territorial structures. This is the first study that use assessment methodologies for the quality evaluation of socio-sanitary facilities for Alzheimer in Italian context. The preliminary results on the three case studies can be further analysed in order to highlight the criticalities found and propose specific sustainable project strategies. In this way the tool can be very useful for supporting decision makers and facility managers in their strategic choices. Future tests on a wider sample are also encouraged.

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Transforming the Built Environment Through Healthy-Design Strategies

A Multidimensional Framework for Urban Plans' Evaluation

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Abstract. According to the research grant titled *"Urban Health: good practices for health impact assessment of urban and environmental redevelopment and regeneration interventions"* and awarded by the Italian National Center for Disease prevention and Control (CCM) in 2017, this paper is aimed to describe the overall goal of the project: develop and disseminate experience-based practices among *Policy Makers,* based on *Health Impact Assessment* models, literature and case studies, mainly referred to healthy aging and equity in urban regeneration programs. The authors were involved in the development and application phases of a quali-quantitative assessment tool, capable of providing an effective and flexible support to the Local Health Agencies (LHAs) for evaluating the *Urban Health* strategies' integrations into urban plans.

The final framework is composed by 20 criteria, aimed to assess the propensity of urban plans to promote *Urban Health* strategies. The criteria are divided into 7 macro-areas: the first one including prerequisites *(0. General criteria)* while the other 6 constituting the assessment tool *(1. Environment; 2. Soil and subsoil; 3. Sustainability and hygiene of the built environment; 4. Urban and social development; 5. Mobility and transport; 6. Outdoor spaces).*

This research project could be considered a starting point to disseminate methods, tools and indicators to design and assess not merely the public spaces' environmental quality, but also foresee the urban plans' Public Health outcomes.

Keywords: Urban Health · Urban assessment tool · Healthy and sustainable environment

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1 Theoretical Scenario

1.1 State of the Art

The relations between the morpho-typological and functional features of the built environment and Public Health outcomes, open to a challenging scenario about the *Urban Health* research topic, considering the huge urbanization phenomena that characterizes contemporary cities and societies, both at european level than in developing countries. The United Nations (UN) Population Division Department states that today 54% of the world's population live in urban areas. This is expected to rise up to 70% by 2050, when the World's urban population will exceed 6 billion [1]. The increase of buildings density will be one of the main global trends, with significant impacts connected to the increase of environmental risk factors *(Urban Heat Island Effect; soil, air, acoustic and light pollution, in terms of inappropriate artificial lighting devices and low natural lighting of places; vehicular traffic conditions; urban safety & security; poor attractiveness of places)* affecting the contemporary cities [2], creating a gap between an healthy environment and alarming living conditions.

Referring to the Agenda 2030, the Sustainable Development Goals (SDG's) highlighted how cities today represent the most challenging context for quality of life, environmental sustainability, health and social inclusion and their strategic role in adapting to climate change. In particular, the 11th SDGs argue about *"Sustainable Cities and Communities"* [3] and state how urban development and renewal initiatives should be designed and organized to make cities healthier, smarter, resilient, safe and circular.

To summarize these concepts, the meaningful synthesis of the challenging relationship between urban planning and Public Health was recently stated by World Health Organization [4] into the following sentence: *"Health is the precondition of urban sustainable development and the first priority for urban planners"*.

In this scenario, in the last years, researchers and practitioners, both of technical and medical education, identified the need of inter-disciplinary approaches, in order to address the cities' key features to Public Health outcomes [5]. There's a need of joint actions in order to involve the communities [6], starting from the professionals themselves. *Urban Health* strategies should be considered since the early stages of urban planning [7], as vehicles of primary health prevention and promotion [8].

In order to promote health in urban areas through urban planning strategies, a first research was conducted in 2010 by Politecnico di Milano in collaboration with the Local Health Agency (LHA) of the Municipality of Milano (better known as *ASL Milano,* but nowadays called *ATS Città Metropolitana di Milano).* However, the new, emerging and disruptive environmental risk factors (i.e. Climate Change) together with the contemporary Public Health needs, such as social inclusion, equity, safety and Design for All, have highlighted the critical issues and the irrelevance of the strategies developed previously.

1.2 Research Opportunities

According to this scientific debate, the authors are part of a research group at Department of Architecture, Built environment and Construction engineering (ABC) of Politecnico di Milano still working on a research grant titled *"Urban Health: good practices for health impact assessment of urban and environmental redevelopment and regeneration interventions"* and awarded in 2017 by the Italian National Center for Disease prevention and Control (CCM). The overall goal of the research project CCM2017 was to develop and disseminate *experience-based practices* among Policy Makers, based on Health Impact Assessment models, literature and case studies, mainly referred to healthy aging and equity in urban regeneration programs.

The specific objectives of the CCM2017 project were six; the key one - the first - was to draft and apply a quali-quantitative assessment tool, capable of providing an effective and flexible support to the LHAs for evaluating the *Urban Health* strategies' integrations into urban plans. Even before the research proposal, it was highlighted the lack - in the national scenario - of evaluation tools capable to support, both designers and Policy Makers, in the achievement of Public Health purposes [9].

2 Methodological Framework

Given these premises and according to the experience developed in 2010 by Politecnico di Milano together with the LHA of the Municipality of Milano (better known as *ASL Milano,* but nowadays called *ATS Città Metropolitana di Milano),* the current research provided a deep revision of the overall structure of the tool previously framed by solving and implementing criticalities detected by its application and given the necessity to update the methodology and the contents.

The research developed in 2010 was divided into criteria too, but with a different purpose: in 2010 the objective was to evaluate the environmental hygiene aspects of urban plans; actually, the tool presented in this paper, aims to assess the level of adherence and development of the Urban Health criteria. Furthermore, in the current tool, the criteria are weighted according to importance and therefore contribute, in a different way, to the final score.

The final goal of the research is to define a quali-quantitative assessment tool, capable of providing effective and flexible support to the LHAs for evaluating the Urban Health strategies' integrations into urban plans. For this reason, the methodological framework has been divided mainly in 3 phases organized by following the scheme of [10] namely intelligence, design and choice (Fig. 1), that can be described as follow:

- the intelligence phase refers to the description of the main objectives, the analysis of the previous experience and a deep investigation of the state of the art.
- the design phase consists in the development of the framework, its validation and the criteria weight elicitation;
- the choice phase deals with the final validation of the tool and its dissemination.

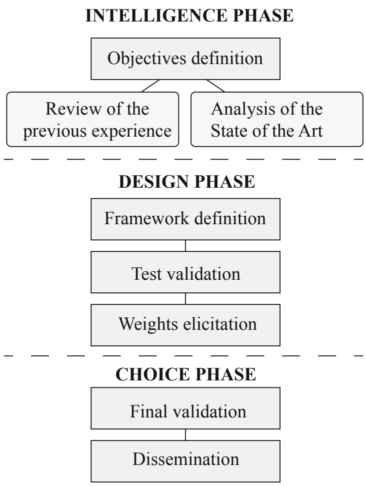

Fig. 1. Methodological flowchart

2.1 Intelligence Phase

Given the final objective to support LHAs in formulating suggestions to protect and promote Public Health into urban plans, considering an *Urban Health* approach, the research started with a deep analysis of the State of the Art. This step consisted of a literature review with special reference on *Experience Based Healthy Design and Urban Planning Strategies,* the analysis of existing urban-scale assessment tools and the revision of case studies of urban regeneration with health impacts on the context.

The literature confirmed the suitability of the MCA in supporting decisions about complex problems since allows to structure them in hierarchical phases and levels in order to be solved by having an overall view of the big picture. In particular, problems concerning the transformation of the environment are defined as complex [6], since they are characterized by a multidimensional nature where multiple trade-offs have to be found among several aspects. It is therefore essential to evaluate their impacts and effects on the environmental quality and the social well-being in order to guarantee transparency and legitimacy of those processes whose final decision is able to affect the entire community. In this context the transparency is ensured by the adoption of clear methodologies able to guide the decision-makers in the different phases of the evaluation process [11, 12].

Moreover the comparison with literature allowed to identify the most frequently used and validated assessment tools aimed to evaluate urban quality and sustainable features of urban projects and plans [*Green Star Communities,* Australia; *Global Sustainability Assessment System* (GSAS), Qatar; *Comprehensive Assessment System for Built Environment Efficiency for Urban Development* (CASBEE-UD), Japan; *LEED Neighbourhood Development,* United States; *British Research Establishment Environmental Assessment Method for (BREEAM) Communities,* United Kingdom; *DGNB System,* German Sustainable Building Council; *HQE for Urban Planning Development* (UPD), France]. From the analysis and comparison of the related indicators, it has been pointed out, in most of them, the absence of specific criteria directly connected to Public Health outcomes [13].

2.2 Design Phase

The previous phase led to the definition of criteria and indicators able to measure to which extent a town-planning plan is able to promote *Urban Health* strategies and to enhance a built environment aimed at satisfying social needs, improve people's quality of life and promote the adoption of healthy lifestyles, like Physical Activity.

Most of the criteria are a review of those defined during the previous experience [6] while others are the result of emerging needs reported by studies on *Urban Health* and Experience Based Healthy Design [14]. Moreover, within this context, the Multicriteria Analysis (MCA) has been considered as the most suitable methodology able to face the complexity of the decision context given by the presence of several and sometimes conflictual objectives and the co-existence of different dimensions to balance.

The framework underwent two different steps to achieve the final validation. The first moment involved the application of the multicriteria tool on existing urban plans and it has been carried on by the LHA of Bergamo, divided in two teams of professionals. Within this first step, a special attention has been given to the evaluation of the effectiveness of the tool and its objectiveness in formulating judgements. The second moment consisted in two meeting organized with the Welfare General Directorate of Lombardy Region and professionals coming from all the LHAs based in Lombardy Region, in order to have feedbacks about the tool.

Once all the feedbacks have been collected and processed, the final framework has been defined composed by 20 criteria (indicators), aimed to assess the propensity of urban plans to promote *Urban Health* strategies. The criteria are divided into 7 macro-areas: the first one including prerequisites (0. General criteria) while the other 6 constituting the assessment tool (1. Environment; 2. Soil and subsoil; 3. Sustainability and hygiene of the built environment; 4. Urban and social development; 5. Mobility and transport; 6. Outdoor spaces).

- Based on an idea of urban quality that diverges - significantly - from the traditional quantitative type, linked to the concept of urban planning standards, the proposed criteria are qualitative and performance. Each criteria is then assessed through a performance matrix. The attribution of the judgment to the criteria consists in verifying the level of adhesion of each urban plan/project to a set of performance requirements (presence/absence of specific Urban Health strategies) described in the matrix, according to the following scheme: Strong: it represents the performance most consistent with the objectives of *Urban Health,* with reference to the single criterion analyzed;
- Moderate: it is the intermediate level and refers to a consistent performance that can be improved;
- Low: it does not consider any *Urban Health* strategy, limiting itself to mere compliance with sector regulations.

The individual judgments correspond to numerical values in order to elaborate summary evaluations (evaluation by areas and the final overall evaluation of the project) and explanatory graphs of analysis.

When the final set of indicators has been structured (Fig. 2), it has been possible to weight their influence in achieving the main objective.

pre-Requisites	check-list
GENERAL CRITERIA	Demographic and epidemiological data
	Indoor and Outdoor coherence
	Forecasting building capacity
	Land destination (in term of urban functions)
MACRO-AREAs	**CRITERIA**
ENVIRONMENT	01 - Air and Smells
	02 - Water
	03 - Noise (acoustic pollution)
	04 - Ionizing and non-ionizing radiation
SOIL & SUBSOIL	05 - Land consumption
	06 - Soil permeability and *Water Management*
	07 - Geological, hydro-geological and seismic risk
	08 - Contaminated sites and areas with high environmental risk
SUSTAINABILITY & HYGIENE OF THE BUILT ENVIRONMENT	09 - Solid waste collection
	10 - Urban waste collection and disposal
	11 - Energy and reduction of emissions
URBAN & SOCIAL DEVELOPMENT	12 - Residential density
	13 - Functional and Social mixitè
	14 - *Universal Design* and Social inclusion
MOBILITY & TRANSPORT	15 - Street infrastructure network and parking system
	16 - Public transportation
	17 - Pedestrian and Cycling path system
OUTDOOR SPACES	18 - Outdoor space system
	19 - Urban green system
	20 - Lighting and visual comfort

Fig. 2. Assessment framework

In fact, considering the aim of evaluating the willingness of a town-planning plan to promote *Urban Health,* the SWING method has been selected as the most appropriate technique since explicitly incorporates the attribute ranges in the elicitation question [15]. In particular, it uses a reference scenario in which all the attributes get their worst level and the interviewee is asked to score (e.g. in the range 0–100) the scenarios in which one attribute at a time changes its status and moves to the best level. The weights are then elaborated and are proportional to the values assigned. For this phase experts of Politecnico di Milano and professionals from LHA have been involved.

2.3 Choice Phase

Once the multicriteria tool has been framed and weighted, it has been presented to a multi-disciplinary panel of experts with the role of final reviewers of the methodology applied and the contents described. Following the positive feedbacks received from the panel, the tool has been further integrated, so to better describe and explore some methodological steps. Finally, the tool was presented in public to potential

Stakeholders (urban planners, designers, Public Health experts, Policy Makers, Administrators, etc.) in order to identify any further aspects to be improved and to have an additional validation.

The LHA of Bergamo, local research unit of the *CCM2017 Project*, tested the assessment framework in its daily activities of urban plans and projects' evaluation. This approach, common to all the Public Health operators, will be helpful to be more effective and incisive in the opinions to be expressed about urban plans and projects, with a carefulness to the design sphere that consider more strategic the performances and that exceeds compliance with regulatory requirements. At the same time, designers can receive an effective support about the application of *Urban Health* strategies, inherent the wording of the framework indicators. The assessment framework has therefore been validated and the dissemination phase of which manuals, papers and workshops are part, has begun.

3 Evaluating the Built Environment

Within this context, as it has been already described, the multicriteria framework allows to give an overall evaluation of urban plans according to the *Urban Health* approach by considering external and design factors. What deserve to be explored is the role of the built environment in promoting or negatively affecting the wellbeing of inhabitants. In fact, among the selected macro-areas, one is focused in analyzing the role of buildings and the design process in achieving sustainable goals.

3.1 Sustainability and Hygiene of the Built Environment

The third macro-area, titled *"Sustainability and hygiene of the built environment",* is the which one that involves all the indicators aimed at assessing the possible interactions (positive or negative) of urban plans on the environment in terms of sustainable development and resilience to climate change. Here both the management dimension and the design one are considered. In fact, the first criterion *09 - Solid waste collection* consider all policies aimed at managing the entire waste process, from its production to its final outcome. Innovative systems of waste collection, like pneumatic networks, have direct impacts on hygiene, cleaning and sanitation actions of the city and its public spaces, whether they are close to residential dwellings [16], or closer to squares and public spaces in general. The criterion is also focused on the process of collection, transport, treatment (recovery or disposal) and also the reuse of waste materials, usually produced by human activity, in an attempt to reduce their effects on human health and the environment. The second one, *10 - Urban waste collection and disposal* considers the infrastructure or sewerage network as a complex and articulated system of underground canalizations that allows the collection and conveyance of domestic, industrial and urban wastewater. This wastewater is then purified and discharged into river mouths or directly into the sea. When disposing of wastewater, a distinction must be made between black water and rainwater (or white water). In order to design sustainable living environments that respect the natural water cycle, it is important to anticipate and encourage the following strategies: a) separate sewerage (rainwater and sewage); b) rainwater reuse system after separation of first rainwater. The last criterion, *11 - Energy and reduction of emissions* encourages greater awareness of consumption and sustainability regarding technological and plant engineering choices in order to improve the energy efficiency of buildings. In fact, the reduction of energy consumption leads to less local air pollution, with direct positive effects on the Public Health of the inhabitants. In addition, lower air pollution leads to lower impacts on the climate-environment, which in turn leads to further lower impacts on health. It is therefore important to reach performance certificate with high performance class or presence of further recognized environmental certification (LEED, BREAM, etc.); or adopt a balance between the following strategies:

- passive principles for sustainability (orientation and shape; thermal insulation and inertia; natural ventilation; shielding systems);
- active principles for sustainability in % above the legal minimums: (electricity and thermal energy from renewable sources, efficient plant systems).

It is important to underline how the role of humans is fundamental in achieving sustainable objectives even related to their own health, according to the *Healthy Cities* definition stating that urban settlements are *"those urban centers that continuously creating and improving those physical and social environments, encouraging the expansion of resources and making people in conditions to support each other in performing and developing all the daily activities."* [17]. All the instances discussed in this macro-area aim at improving the overall quality of life by providing strategies that could be adopted during the design phase.

4 Conclusions

This research project could be considered a starting point to disseminate methods, tools and indicators to design (if applied preliminarily to the project by architects and urban planners) and assess (if used from the LHAs) the public spaces' environmental quality, according to the international scenario [20], where several frameworks - mainly conscious about the urban quality assessment - are frequently used, like those one cited in the introduction. The research and application outlooks will take consistency in spreading the tool to all the LHAs, but also to the architectural and urban planning firms, in order to be applied - bilaterally - since from the early design stages.

It is necessary and crucial to evaluate the public space with qualitative frameworks and approaches, highlighting the urban context and public spaces features, experience-based oriented to promote healthy lifestyles.

Making cities healthier means to improve those physical factors - as network of public spaces, land use mix, street design, etc. - capable to create a more healthy, safe, comfortable and attractive places. Making the urban settlements more sustainable means also take care about the built environment, both in the design process and in the building features (construction materials, active and passive solar systems, environmental orientation of buildings; etc.).

The paradigm of Public Health needs to be changed, moving from a medical model, focused on the individuals, to a social model, where the health status is the result of various socio-economic, cultural and environmental factors.

A multidisciplinary approach is crucial [18–20], as it enable to put together different stakeholders, like epidemiologist and Public Health experts; urban planners, designers and construction technologists; Policy Makers, to enhance a direct interaction with decision-maker; and, finally, economists or valuation experts, dealing with the project feasibility studies.

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Assessing the Effectiveness of Public Investments in Cultural Built Heritage: The Case of the Umbertine Forts System in Italy

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Abstract. The paper deals with the topic of the allocation of resources and investment strategies in cultural built heritage. The valorization of cultural assets is often guaranteed by the intervention of public funding. The need to allocate these funds efficiently and effectively, together with the transparency duties to which public administrations are subject, necessitates a careful measurement of the economic, cultural, environmental and social effects. Accordingly, the paper outlines the starting framework of a study on the ex-post evaluation of the effectiveness of public intervention towards the restoration and valorization of three forts in the Umbertine Forts System, located in the Metropolitan City of Reggio Calabria, southern Italy.

The open remarks raised by the preliminary step of the study evoke questions both about the topic of evaluation tools and the methods used in the ex-post evaluation of the effectiveness of public intervention towards cultural built heritage restoration and valorization, and also on the topic of local governance, strategic planning and management of cultural heritage.

Keywords: Public investments · Cultural built heritage · Ex-post evaluation tools · Umbertine Forts System · Cost benefits analysis

1 Introduction

The enhancement of cultural heritage oriented towards segments of new demand and with increasingly sustainable use methods represents a fundamental pillar of the European strategy in favor of intelligent growth. In particular, culture has always played a primary role within the Italian economic system as an engine for the country's growth. In terms of policies, the interest in cultural activities is due both to the employment potential closely connected to the sector, and to the multiple

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interrelationships that bind it to other economic spheres, the agri-food, tourism, crafts, research activities and development.

This leads to the concept of shared value "which focuses on the connections between societal and economic progress" [1].

Furthermore, numerous European documents stress the potential of cultural heritage as an engine of growth in terms of: new and higher quality job opportunities, able to exploit and spread the use of new information technologies; b) redevelopment factors of urban environments and the driving force of development of rural areas and minor centers of architectural and landscape value; and c) drivers for social cohesion because the enhancement of local goods and traditions increases the awareness of the collective heritage and enables the strengthening of the sense of belonging in the communities [2, 3].

The valorization of cultural assets, notoriously characterized by poor profitability, is often guaranteed by the intervention of a public body or a third party interested in knowing how and with what effects the resources provided have been used. The need to allocate these funds efficiently and optimally, together with the transparency duties to which public administrations are subject, necessitates careful measurement of the effects of an economic investment [4, 5]. In this regard, the measurement of impact is becoming more and more relevant in investments with social spill overs, but, at the same time, it is really complex because of the lack of track record and historical data. In the literature and practice, as demonstrated in the following chapter, many instruments have been developed for the measurement of the impact of cultural projects. Almost all the tools are based on two-dimensional analysis: economic-financial performance and social and/or environmental impact. Because of the peculiarities and constraints of the cultural heritage sector, further steps should be taken in the development of methodologies suitable for the addressed field. A holistic approach should be chosen also for these methodologies and instruments to measure the spillover effects from cross-cutting issues regarding trans-categories, as well as trans-sectors, benefits [6].

The paper outlines the starting framework of a study on the ex-post evaluation of the effectiveness of public intervention toward the restoration and valorization of three forts of the *Umbertine Forts System*, in the Metropolitan City of Reggio Calabria, southern Italy. Regions like Calabria have been the target during the last three European programming cycles of substantial public investments, but interventions have not yet produced significant socioeconomic effects. Funding pressures reinforce the need for a better understanding of how local governments can invest in the mitigation of territorial disparities and what the communities get in return. The open questions raised by the preliminary step of the study presented here emphasize how the culture of evaluation is an essential step towards achieving the overriding key objectives of efficiency, transparency, and accountability, with the aim of determining both the costs and the benefits of publicly financed projects, and to improve the efficiency and effectiveness of that investment.

2 Cultural Built Heritage Public Investments in Times of Scarce Resources: Burdensome Encumbrance or Development Engine?

The allocation of resources and investment strategies are crucial issues for the cultural sector. In recent decades, the idea of cultural built heritage as a weight bearing on the public sector has evolved into the concept of a strategic asset capable of increasing the attractiveness and competitiveness of some territories [2].

This important evolution in theoretical terms encounters, however, a strong limit from the increasingly strict constraints placed on public spending, which have constituted a real, generalized collapse of investments. Although the need to attract private resources and skills to the sector and to enhance the synergies between cultural heritage and tourist accommodation has long been highlighted, it is clear that the role of public investment remains crucial [7].

Moreover, given the low absorption rate of EU Structural Funds, the debate in Italy continues about the extent to which, after decades of subsidies, the European Regional Policy is effective. This explains the attention to the programming strategies of these resources and to the selection of the territories and themes to invest in, so as to arrive at the methodologies for measuring the impacts actually obtained [8].

Far from finding an answer to the question, the study aims at contributing to the debate on the effectiveness of public investments in cultural projects and to identifying the roles and responsibilities of the multi-level authorities, by choosing the Umbertine Forts System of the City of Reggio Calabria (Italy) as an applicative case. As a preliminary step of the study, this contribution adopts an analytical and interpretive approach that could be easily exported to other public planning processes, to support local policy makers in defining systemic territorial strategies.

2.1 Cultural Sector Potentiality and Investment Strategies in Calabria

Considering the strategic role of culture and the scarcity of financial resources available to the Calabria Region (Italy), it is essential to develop and disseminate a culture of measurement in the cultural field that allows evaluating *ex ante* and *in itinere*, during the planning phase so as to allocate resources more effectively and to appraise *ex post* the cultural heritage investment effects on the territory. It is the authors' opinion that the developmental potential related to cultural heritage depends on the endowment of resources, but also on the effectiveness of the enhancement strategies [9, 10].

Regarding the first aspect, in 2014 Calabria was assessed to be among the regions with the most advantageous capital and cultural heritage assets in Italy[1]. Likewise, from a tourism point of view, there was notable improvement based on the seasonal

[1] "Big Data e Social Network per Istruzione e Cultura in Calabria", presented the 16th of October 2014 in Rome, Palazzo dell'Informazione, Sala Mastai.

adjustment of flows: the attendance indicator (days per inhabitant) in non-summer months in 1998 improved from 0.39 (Italy, 1.98) to 0.92 (Italy, 2.90) in 2018[2].

However, from a socioeconomic perspective, the Calabria region is characterized by a persistent gap both in relation to the national framework and the other Southern regions. Calabria, and the city of Reggio Calabria in particular, still lags behind the main employment objectives set by the European Councils of Lisbon and Gothenburg and possesses a structural condition that impedes the regional economy and creates a competitive gap concerning the main factors underlying territorial development [8]. This situation spans the gamut—from innovation, which is still substantially lacking in material (financial and human) means (% companies who have introduced technological innovations 23.2 (Italy, 35.7) in 2016), up to globalization and the difficulties related to access to foreign markets (export capacity 1.3 (Italy, 24.7) in 2016). Small and microenterprises are struggling, and the craft sector, the fundamental production sector, suffers from a thinning phenomenon. Building and agriculture are still, judging from the available data, in recession. The regional social framework reflects the difficult state of the labor market, indicating a level of social capital eroded by decades of migration. The phenomenon of emigration, especially of young people from Calabria, to the north of the country is structural, and immigration from outside the European Community does not compensate for the flow of Calabrian departing to other regions of Italy (Total growth rate −4.3 (Italy, −1.7) in 2017)[3]. In these conditions, the comparison with the other regions of the European Union is not favorable.

In terms of investments, the last two programming cycle have provided financing of 1,146 “culture and tourism” projects in Calabria, with about 500 million € of public cost, 248 € per capita financing and 377 million € of expenditures[4]. In this context, the three most recent “culture and tourism” projects related to the Forts System of the Metropolitan City of Reggio Calabria have been selected as focus of next year’s research studies.

The topic is introduced in the next section and the development of the preliminary research framework has proceeded through the following steps: (1) research question identification and context definition; (2) investments evaluation methods and tools in the field of cultural heritage; (3) illustrative cases of impact analysis studies; and (4) concluding remarks. After a descriptive analysis of the methodologies internationally used to verify the effectiveness of investments in the cultural heritage field, three example cases are identified to highlight the positive and negative aspects of the most frequent evaluation tools used. In conclusion, this preliminary study offers a contribution to the efficiency assessment, highlighting the need for an economic evaluation approach to support local authorities in addressing the challenge of fostering cultural assets as an engine for local sustainable development.

[2] Data for the study have been gathered via the “OpenCoesione” database, Italy’s national web portal on the implementation of investments planned in the 2007–2013 and 2014–20 programming periods by Regions and National Administrations via cohesion-policy resources.

[3] Report Regione Calabria, Dati e informazioni sullo stato e sull’evoluzione del profilo socio-economico del terriorio, 2019. S.I.S.PR.IN.T Project, Unioncamere: http://www.uc-cal.camcom.gov.it/, last accessed 2020/01/29.

[4] https://opencoesione.gov.it/en/territori/calabria-regione/, last accessed 2020/01/29.

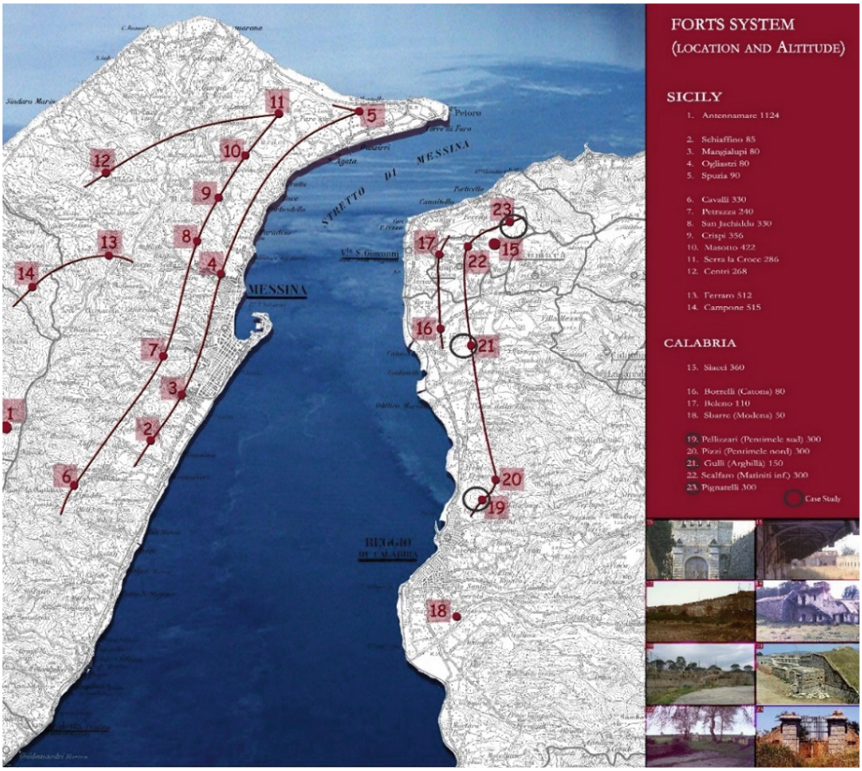

Fig. 1 Map of the Umbertine Forts System. Strait of Messina. (Source: author's adaptation of the exhibition leaflet "I fortini di Pentimele nel sistema della fortificazioni nell'area dello Stretto", co-edited by Alessandro Rugolo)

2.2 An Applicative Case: The Umbertine Forts System

The paper presents a preliminary framework of the study on the appraisal of the effectiveness of public investments towards the valorization of cultural built heritage. As a case study, the system of the Umbertine Forts located along the Strait of Messina, Italy. The so-called *Umbertine Forts System* was built between 1882 and 1892, after the unification of Italy, to support the expansionism of King Umberto I and to defend the Strait of Messina, which was considered an important strategic point in the Mediterranean zone and an important passageway to the north [11]. The defensive system of the Strait of Messina consisted in 22 forts, called batteries. Thirteen were built on the Sicilian coast and nine on the Calabrian coast. The forts system, unique of its kind for longitudinal development along a whole coastline and for the characteristics of its architectures, belong to the typology of the established field. The sites selected as the locations for the Sicilian and Calabrian constructions were intended to guarantee a field of view so that the principal fortifications, situated on the highest ground, dominated those below and, at the same time, protected the entire arm of the sea by the emplaced artilleries' field of fire (see Fig. 1).

The peculiarity of this cultural built heritage lies in its essence of being a serial asset that is configured as a unitary whole, even if articulated and complex in nature, both from a geographical/landscape point of view and from an architectural/built one. The study, at this stage, focuses on the Calabrian side of the fortress system and, in particular, on those subject to restoration interventions. In Fig. 1, these are identified as n. 23 the Poggio Pignatelli Fort, n. 21 the Fort in Arghillà and n. 19 the Fort in Pentimele.

The very first question arising from the study deals with the governance approach to the conservation and management of this cultural built heritage. Aware of the specific and unique cultural landscape evidenced by the Sicilian and Calabrian fortress system, why was it conceived as a sum of single buildings? In this first step of the study, no plans nor documents have been found regarding a strategic vision for the conservation and management of the forts as a system. As will be showed, more than 10 million euros of public funding have been spent for the conservation and valorization of three of these forts on the Calabrian side of the system. And, according to the first results, two out of the three are not in operation.

A brief description of the three forts and the infrastructure investments in question follows to outline the framework for further considerations concerning the allocation of resources and investment strategies.

The Fort in Arghillà. The Gullì battery, today known as Ecolandia, is located in Arghillà, a north suburb of Reggio Calabria. It was restored in the late 1990s, through the European URBAN I program, during the 1994–99 programming period (Table 1). In particular, the work involved the restoration of the fort, the construction of an amphitheater of about 800 seats and the renewal and valorization of equipped green spaces from 1998 to 2001. The fort has long remained unused and, since 2011, has been managed by a group of companies that have turned it into an Environmental Technology Playground Park. Due to the fact that the 1994–99 programming period was not well monitored, there are no public data on the timing and detailed public spending of the intervention. Accordingly, this part of the study needs to be further developed. Nevertheless, it's known that seven million euros have been invested and about six million and five hundred thousand euros officially disbursed (Table 2).

The Forts in Pentimele. These forts rise on the hill of Pentimele and are sit in a panoramic position over the city of Reggio Calabria. Due to the state of neglect, the area, despite being very close to the city, is not densely populated and does not host any type of accommodation (except from a bed & breakfast). The structural and architectural restoration of the Umbertino Fort was part of the 46 new restoration interventions in the regions of the Convergence Objective, 2007–2013 programming period. The planned interventions in the Calabrian territory were 14, and among them were the enhancement of the Pentimele Fort. It obtained an investment of three million euros, divided as follows: 10% EU fund, 3% Revolving Fund (national co-financing) and 87% Revolving Fund (Cohesion Action Plan). The work began in April 2016 and was completed in February 2017. An analysis of the data provided by OpenCoesione shows that the total expenditure at the end of the work was 71% of the programmed financing. While the inauguration of the fort took place in June 2017, nevertheless, the structure is not in operation to date.

Table 1. Framework of the public intervention on the forts (1)

Fort name	Municipality	Intervention	Programming period	EU fund	Program
Fort in Arghilla'	Reggio Calabria	Restoration and Valorization	P.P. 1994–1999	STRUCT. FUND*	Urban I Community Initiative
Fort in Pentimele	Reggio Calabria	Restoration and Valorization	P.P. 2007–2013	ERDF**	IROP Cult. and Tourism —CAP Cultural Heritage****
Poggio Pignatelli Fort	Campo Calabro	Restoration and Valorization	P.P. 2007–2013	ERDF	ROP Calabria*****
		System Valorization	P.P. 2014–2020	DCF***	Reggio Calabria Pact

*Structural Fund; ** European Regional Development Fund; ***Development Cohesion Fund; **** Integrated Regional Operational Program Cult. and Tourism - Cohesion Action Plan Cultural Heritage; *****Regional Operational Program

Table 2. Framework of the Public Intervention on the Forts (2)

Fort's name	Progr. period	Financial status	Project status	Procedural status	Tot. pub. investment	Tot. payment
Fort in Arghilla'	P.P. 1994–1999	Cleared	Completed	Executed	7,000,000.00 €*	6,500,000.00 €*
Fort in Pentimele	P.P. 2007–2013	In progress	In progress	Execution of works	3,000,000.00 €	2,134,264.00 €
Poggio Pignatelli Fort	P.P. 2007–2013	Cleared	Completed	Test	750,000.00 €	617,952.00 €
	P.P. 2014–2020	Not started	In progress	Preliminary project	800,000.00 €	0

* approximate amount

The Forts in Campo Calabro. Three of the forts of the Umbertine System are situated in the territory of the Campo Calabro municipality, in the settlement of Matiniti, on the hills above the town. Manned by Italian Army troops until 1984, the forts were decommissioned as military structures and have suffered a gradual decline due to the interruption of maintenance work and vandalism. The Poggio Pignatelli fort is located one km from the town, and its restoration and enhancement work began in June 2014 and ended in November 2015. Approximately € 618,000.00 was spent in the first instance, of which 75% came from European Union and 25% from national co-financing. The management of the internal areas and buildings of the fort was assigned to various associations that, after an initial phase of activity, stopped operating. A second round of funding has been committed within the 2014–2020 programming period. Eight hundred thousand euros is expected to be spent by the end of 2020 with the aim of enhancing the structure of the Umbertine fort with a specific environmental approach aimed at creating a museum.

In order to get valid results, it is essential to emphasize some aspects that will influence the methodology on the topic in the ensuing research steps. First of all, as previously stated, the restoration interventions were allocated to individual elements/buildings. This underlines a lack of planning and an absent overview of the Fortress System as a serial cultural built heritage—if not of the Strait of Messina Area, between the Sicilian and Calabrian coasts—located in the Metropolitan City of Reggio Calabria. Second, this study phase focuses only on public investments for restoration and enhancement interventions, falling under the “infrastructure” type of investment. For the record, over the years, Ecolandia, the fort in Arghillà, has received further and substantial (European, National and Regional) public funding for the implementation of cultural activities, social services and scientific activities. These funds are not counted in the study.

In summary and in a very rough way, it can be stated that around € 11,550,000 have been committed for the restoration and conservation of three military fortresses, and on average 80% of the programmed funds have actually been spent.

The question that arises from this first analysis, in need of further study, deals with the impact that this public investment had and will have on the territory. How do we evaluate the effectiveness of these interventions? What are the generated outcomes on the various stakeholders such as the community, local businesses, associations, administrations and potential tourists?

To deal with this topic, the following section will illustrate a series of evaluation tools used in various cases to measure the economic values provided by cultural built heritage.

3 Toward the Assessment of the Public Investments Effectiveness: Methodological Considerations

The most sensitive issue in the investments analysis is that relating to the measurement of the impacts obtained: for instance, the question refers to whether and how much the financed projects have actually contributed to increasing the tourist attractiveness of the concerned areas and if the expected effects in terms of promotion of jobs and income opportunities have actually been achieved. In economic terms, there is now a large literature on the available methodologies and the limits of each, and the analytical choices are adapted to the characteristics of the individual case [12]. More in depth, the assessment and measurement of economic values provided by cultural built heritage has increasingly been recognized as an essential part of cultural policy as underlined by Lichfield (1988), Pearce and Mourato (1998) and Ost and Van Droogenbroeck (1998) [13–15]. The former framed very clearly the evaluation tools that aim to predict, estimate and value the costs and benefits and their distribution among the parties involved in and affected by cultural built heritage: financial and social financial analysis (FA, SFA); cost benefits and social cost benefits analysis (CBA and SCBA); and community impact analysis (CIA).

In accordance with the latter, the interpretation of the processes of value creation and impact generation on the territory for all the stakeholders of an investment are central elements of a comprehensive and dynamic network system based on the measurement of shared value [1]. It is the authors' belief that it is necessary to represent the value of a project with the awareness that its impact does not only concern the financial sphere, but should be valued in a multi-attribute microeconomic perspective, considering the economic, social, environmental and cultural domains. Moreover, it is also significant to pay attention both to the concept of assessing the impact of the infrastructure investments and to the concept of measuring the outcomes. The latter has the aim of qualifying and quantifying the added value of the project with respect to the set objectives, taking into account the way in which the implementation process took place and the changes that may have occurred in the reference context. The former considers the persistence over time and the scope of immediate results. However, both evaluations deal with external effectiveness or with the degree of satisfaction of the needs from which the project was generated.

3.1 Tools and Methods for Evaluating Investments in Cultural Projects

Recent studies have highlighted pros and cons of various methods, bringing to light exemplary cases and possible connections. The CHCFE report commissioned by the European Union (2015) and David Throsby's study on Investment in Urban Heritage commissioned by the World Bank (2012) are two examples [16, 17].

These studies argue that many empirical studies have used stated preference methods such as contingent (CVM) to evaluate the welfare effects of cultural heritage investments by assessing the willingness of visitors, local residents or other stakeholders to contribute toward the costs of preserving the site of interest [18]. The improvement of experimental choice methods has resulted in an expansion of interest in the use of DCM as a technique for determining demand for various different attributes of a heritage site, such as its beauty, its amenity, its entry price, etc. [19].

Other researches relate the appraisal of the impacts of a cultural heritage investment based on a quantitative analysis of a statistical data approach. This is the case of the Guggenheim Museum Bilbao studied by Plaza (2006), who estimated the impacts of the Museum on overnight stays, employment, and fiscal revenues for the city of Bilbao [20]. Moreover, hedonic price studies of heritage values focus on real estate prices for listed property to ascertain the extent to which the heritage characteristics influence the market valuation [21]. A diverse form of empirical research is that aimed at assessing the benefits of investment in cultural heritage. Some studies look at the valuation of cultural landscapes and at environmental assets defined as cultural heritage [22]. Empirical assessment of the use benefits of heritage is usually straightforward, being based on measurement of observable financial flows generated by market transactions. Revealed preference data can also be used to determine a range of use and non-use benefits through the application of travel-cost methods [23].

Finally, there is cost-benefit analysis (CBA) in which the aggregated present value of the net benefits produced by the investment project is compared to the present value of the project's capital costs [24, 25]. Moreover, there is social cost-benefit analysis that captures the benefits of an investment with large spill-over effects [26, 27].

Given the purposes of the research, three case studies of impact assessment of cultural heritage projects are reported below. The cases involve cultural immovable heritage in three different European areas[5]: Belgium, Macedonia, and Poland. The case-study selection was based on the following criteria: (1) cross-geographical contexts; (2) focus on built heritage; (3) assessment approaches; and (4) results obtained.

3.2 Example Cases of Cultural Projects' Effects Evaluation

The first case study concerns the city of Mechelen (Belgium) [16]. The main research question of this study was how to assess direct and indirect impacts of immovable heritage on the economy, society, culture and environment in the case of the chosen object of study, the historic city center of Mechelen. The aim was to estimate the heritage spillovers in the fields of economy, society, culture and environment, and the chosen approach was qualitative, rather than quantitative, and the selected method was an indicator-based examination. The study is based on secondary data sources supplemented with evidence from stakeholder consultations and on the findings of the conducted survey. The results indicate that there is a correlation between the heritage and its impact on the society, but other factors also play a significant role in this process. The research highlights the lack of available data with regard to some of the indicators.

The second case study examined the impact of cultural heritage in Macedonia conducted by Throsby [17]. He applied an ex-post CBA assessing the economic impacts of heritage investment, in the historic town center of Skopje. This report proposed a procedure for conducting an ex-post economic impact analysis and quantified a series of indicators and other measures to enable an assessment of the results of the project. The most important lesson for project design arising from the research relates to the need for sound monitoring and evaluation provisions to be built into project implementation. Economic variables of importance in this respect include the output of goods and services generated by enterprises located in the project site, household incomes and expenditures, trends in employment, tourist numbers and levels of spending and induced investments attributable to the project. It may also be possible to include the means to track some social and cultural impacts.

Another example is the analysis of the modernization projects of the Gallery of 19th-Century Polish Art in Krakow [16]. The main challenge of analyzing this case lies in the lack of critical data that was collected neither by the museums nor by other bodies, or experts. Therefore, analysis has to be based only on existing research, results of surveys and the data already collected by several institutions. Even institutions that benefited from the EU financial support for cohesion or development do not seem to be sufficiently aware of the importance of the potential impact their projects might have. Consequently, data to verify potential impact are usually not collected. Apart from the lack of awareness, the question of costs and shortage of financial resources hinders cultural institutions from running a monitoring of impact. Therefore, the analysis had to be done based on the scarce data and comparison of the successful projects found in the literature on the subject. The other problem faced here is the one of isolating the impact of the projects from their very complex settings. In case of the Gallery of 19th-Century Polish Art, located in the heart of Krakow's Old Town, it is rather difficult to say

[5] Europe is considered from a geographical and not an administrative perspective.

whether the museum alone produces much impact—it is more likely the whole building of Sukiennice with its three parts, or even the whole complex of the Old Town, that in many cases could be analyzed as a whole.

As it is also assumed in Sect. 4, the brief comparative analysis of these three cases leads to an important lesson for conducting ex-post impact assessments: no matter where (the north, south, or east of Europe) or the specific approach (qualitative or quantitative), the primary constraint is likely to be the availability of data. The three research results deal with the need for comprehensive monitoring and evaluation tools to be integrated into the project implementation.

4 Concluding Remarks

There are many expectations placed on the ability of cultural heritage investments to have beneficial effects in terms of the generation of employment and income, especially for territories such as Calabria that combine an endowment of international appeal with still-low levels of enhancement.

The results highlighted by this first phase of the study raise questions both (1) on the topic of evaluation tools and methods to be used, and (2) on the topic of strategic planning and management of cultural heritage.

1.1 Availability of Data. On the former, it emerged that the choice of evaluation tools to be used for the assessment of the effectiveness of the public investment in the field of cultural built heritage is by no means simple. The methodology that can be applied in any economic analysis of a cultural heritage investment will be determined by the availability of data. In many cases, it has been proven that it is not feasible to carry out a fully articulated ex-post cost-benefit analysis along the lines described in the Thorsby case study. Nonetheless, a compilation of the types of indicators discussed by the author should be able to provide a useful picture of the project's effects, assuming that data relating to at least the most important effects can be captured.

1.2 Systemic Approach. In the literature and practice, many tools have been developed for the measurement of the impact of cultural projects. Given the likely significance of non-market benefits in the overall pattern of heritage project impacts, further steps should be taken in the development of methodologies adapted to the addressed field. A holistic approach should be chosen also for these methodologies and instruments to measure the spillover effects from cross-cutting issues regarding trans-categories, as well as trans-sectors benefits.

1.3 Heterogeneity and Comparability. A further issue concerns the heterogeneity and comparability of investments. The variability, in the case of the forts system, is linked at first instance to the financing/implementation timing. In the case of the Fort in Arghillà, there is a lack of availability of economic and financial data because the interventions were carried out in a European programming period (1994–1999) in which public expenditure monitoring was not yet foreseen. On the other hand, the other two interventions are too recent to have already produced visible effects. In fact, investments in cultural built heritage usually have a fairly long-time horizon. Furthermore, we can expect a distorting effect linked to the various characteristics of the territories affected by the investments, some concentrated in the suburban area of the capital city with more than 180,000 inhabitants (census 2017), the other in a municipality with less than 5,000 inhabitants (census 2017)[6]. The variability described makes the causal links to be sought unclear. The heterogeneity described make it particularly difficult to apply the counterfactual method, based on the comparison between actors/areas that have received or not received comparable treatments, both in terms of intervention type and intensity.

2.1 Regional Programs and the Evaluation Culture. Investments in culture and tourism infrastructure are therefore an excellent opportunity to test this relationship. There is a total of about 55 infrastructure projects, financed in the 2014–2020 programming period, for interventions ranging from urban regeneration to architectural restoration, from the enhancement of archaeological areas to the improvement of nature trails. In financial terms, it deals with more than 53 million euros of public investments, of which 35 million were made in the Metropolitan City of Reggio Calabria. It highlights the need for: an economic evaluation approach to support local policy makers in defining systemic territorial strategies that enable evaluating *ex ante* and *in itinere*, during the planning phase; where to allocate resources more effectively; and to appraise *ex post* the cultural heritage investment effects on the territory.

2.2 Local Strategic Planning and Management. As highlighted by this preliminary study on the Umbertine Forts System, the process of adding value to the assets has lacked strategic planning for the enhancement of this cultural built heritage. The critical issues that emerged are diverse: first of all, the idea of working on single elements without considering the value of the system as a whole. The peculiarity of this cultural built heritage stands in its essence of being a serial asset but configured as a unitary whole, even if articulated and complex, both from a geographical/landscape point of view and from an architectural/built one. Despite this being the year 2020, the re-functionalization of cultural built heritage still enshrines the restoration of cultural heritage as the main core of intervention, with little or no attention to management and functional objectives. The logic followed in these interventions is based on the idea that it is sufficient to restore and recover the physical structures of an asset so that all the conditions for an effective and positive impact on the local development of the territory are realized almost automatically: tourist and economic effects; enhancement of local productions; growth of the sense of belonging by young people; reversal of the exodus of the active population, creation of jobs, etc. The ineluctable result deals with a public funding of more than 10 million euros for the restoration of three forts of the Calabrian-side of the system, and two out of three forts are not yet in operation.

2.3 Research Implementation. As repeatedly pointed out, more research is needed to acquire a more comprehensive and detailed understanding of the heritage spillovers in the economic, social, cultural and environmental domains, especially in light of the lack of available data. Therefore, the research implementation will address the design of a social cost–benefit analysis towards the identification of the economic, social, cultural and environmental impacts (positive and negative) generated by the

[6] http://dati.istat.it/ last accessed 2020/01/21.

investments in the forts system valorization. The study's aim is to create useful technical support for operators who are preparing to plan and evaluate interventions for the redevelopment of cultural heritage.

The open questions raised by the preliminary step of the study presented here emphasize how the culture of evaluation is an essential step for achieving the overriding key objectives of efficiency, transparency, and accountability, with the aim of determining both the costs and the benefits of publicly financed projects, and to improve the efficiency and effectiveness of that investment. If well-resourced monitoring mechanisms could be routinely included when heritage projects are being implemented, the tracking of post-project performance in economic, social, and cultural terms would be greatly facilitated, and the quantity and quality of data available for ex-post impact analysis would accordingly be increased.

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Enhancing Heritage and Traditional Architecture Conservation Through Digital Technologies. Developing a Digital Conservation Handbook for As-Salt, Jordan

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Abstract. Heritage cities are facing unprecedented pressure, due to the combination of climate change impacts, rapid urbanization and uncontrolled growth. Historic urban centres in Middle East and North Africa (MENA) countries are particularly exposed. This paper discusses the benefit of applying digital technologies, and in particular Building Information Modeling (BIM), in supporting heritage conservation, by developing a proof of concept based on a purposely chosen case study, i.e. the traditional Jordanian city of As-Salt near Amman. Building on and moving forward the tradition of paper-based Conservation Handbooks for historic cities, this study aims at exploiting the potential of digital technologies for enhancing the development and implementation of Digital Conservation Handbooks. Documentation and promoting of As-Salt will be conducted through developing a set of virtual models (3D models and BIM objects) suitable to support the construction sector and traditional architecture and heritage, framed and delivered in form of Digital Conservation Handbook. This will be achieved by: developing a new set of BIM (Building Information Modeling) objects related to the traditional architecture heritage in Jordan, suitable to be used by engineers and architects in the development of interventions on the built environment; creating a library of 3D models of exemplar buildings (Jordan heritage and traditional architecture), suitable to be used to promote the tourist image of Jordan. This will set a precedent for further documentation and heritage conservation of traditional cities in Jordan, MENA countries and internationally. Finally, the paper will discuss issues and challenges of documenting traditional heritage and architecture in As-Salt and the impact that such process may achieve in raising awareness across the local communities, thus offering insights to the larger community of architects, conservationists, and planners.

Keywords: Heritage conservation · Conservation handbooks · Heritage and BIM

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1 Conservation of Historic Centres and Conservation Handbooks: Opportunities for Digital Technologies

Heritage cities are facing unprecedented threats. While almost unanimous consensus exists internationally on the need of safeguarding monuments and key-tangible heritage assets for the benefit of future generations, less relevant heritage assets, such as traditional housing, vernacular architecture, historic urban patterns and features, historic artefacts related to socio- economic systems, struggle to be adequately acknowledged and protected. UNESCO's recommendation on the Historic Urban Landscape (UNESCO 2011) describes the need for a shift from an emphasis on architectural monuments primarily towards a broader recognition of the importance of the social, cultural and economic processes in the conservation of urban values. Pressures on historic urban areas encompass rapid urbanization, uncontrolled growth, environmental issues related to the climate change impact on cities. Tools for managing successfully historic urban landscape conservation include participatory tools for engaging stakeholders and citizens, knowledge and planning tools, regulatory systems and financial tools (Bandarin and Oers 2012; UNESCO 2016).

This study aims at producing a novel tool positioned within the interplay between community engagement and knowledge and planning tools, by building on and moving forward the existing tradition of the Italian Conservation Handbooks (Giovanetti 1992). Digital technologies, and in particular BIM (Building Information Modelling), are instrumental to update the traditional approach pursued by the Conservation Handbooks and exploit the potential of digital technologies in heritage conservation. There is therefore a need of focus on the implementation of conservation policies, integrating management, conservation, development, and planning disciplines to practice. Indeed, implementing conservation policies is obviously challenging, since effective conservation requires alignment of policies and instruments at different level, adequate resources and availability of skills and competences (Ginzarly et al. 2019). The abovementioned tradition of "Conservation Handbook" stems from the pioneering experience developed in 1977 in the city of Pesaro (Panella 1992). In this city, local government was seeking to implement the local plan for the historic centre, and was struggling to implement effective conservation of the urban fabric. Resulting in a dedicated city laboratory, supported by experts and conservationists. The experience let to the creation of a handbook, offering technical support to architects and conservations, which at the same time acting as vehicle for raising awareness across residents about the value of heritage assets.

Based on this pioneering experience, the City of Rome replicated the methodology, between 1982 and 1984 thanks to the support given from the University La Sapienza and experts of the caliber of Paolo Marconi. At that time, the famous architect Carlo Aymonino was councilor for the historic centre and enabled synergies with the university course on reuse of historic buildings directed by Giovannetti (Panella 1992). A final case of reference which fully developed this methodology is the handbook prepared for the city of Citta' di Castello, which spans between 1980s and early 1990s (Giovanetti 1992). These cases supported the development and testing of a now consolidated methodology for the conservation of historic urban fabric, based on the three specific goals: (1) encourage and steer the conservation of historic urban fabric, through appreciation of the materiality of historic buildings; (2) offer technical insights to conservations and architects; (3) engage with the communities on the conservation of traditional heritage. In fact, once exemplar cases become "models" to look at, following the publication of the handbooks, residents acknowledged the value of those buildings and a virtuous process of value recognition and historic buildings appreciation emerged. Eventually, conservation handbooks became indirectly instrumental to raising awareness and proud with locals.

Over the years, this methodology has been replicated and led to the production of a robust body of knowledge on the traditional characters of historic architectures in different regions of Italy. The rationale beyond the conservation handbooks lies at the interplay between micro, meso and macro scale. Conservation of the character of the urban fabric is enabled by the effective conservation of the buildings, which are made of different elements, such as roofs, windows, floors, walls. The articulation of some selected exemplar buildings through their own components, allows depiction of the key-elements for the thorough understanding and appreciation of the materiality of the historic fabric. Each handbook offers therefore a selection of case studies, extracted from some selected exemplar buildings and showing the material details of the city by means of its components. While creating technical knowledge, the handbook also works in the interplay between society (community recognizing values) and economic fabric (workers capable to perpetuate the technique), perpetuating the concept that historic urban fabric and landscape are outcomes of the socio- economic place- based fabric (Turri 2001).

Nowadays digital technologies offer a unique opportunity for uplifting the power of the rationale beyond conservation handbooks. In facts, they offer the possibility to integrate multiple layers of information and to link across industry, community and higher education with a flexibility and timeliness that traditional techniques such as paper-based drawings did not allow at such an extent (Udeaja et al. 2019). In particular, Building Information Modelling (BIM) offers the opportunity to link a variety of information concerning heritage assets and convey them across multi-disciplinary professionals (Pocobelli et al. 2018). This is a process also known as Heritage Building Information Modelling (HBIM). Therefore, the researchers developed a project hypothesis rethinking conservation handbook in the context of digital technologies. It is based on the idea that contemporary conservation handbook should take the form of BIM models, embedding key features of historic buildings whilst enabling designers to gather and reassemble information easily (Volk et al. 2014). This facilitates the conservation of historic centres, both through an enhanced body of knowledge made available to the local professionals' community, and through community engagement.

2 Research Methodology

This study aims at showing the potential of an application of digital technologies to the conservation of historic centre, by channelling BIM into the tradition of the conservation handbook. Digital handbooks based on BIM objects will facilitate the preparation and delivery of conservation projects in historic centres, and at the same time will contribute to raise awareness across the local community about the importance of such heritage. At this goal, this study discusses the application of this methodology through a demonstrator project, i.e. the BIM Conservation Handbook for the City of As-Salt, in Jordan. Thanks to a Royal Academy for Engineering British grant, a team of UK and Jordan based architects and academics are developing a BIM based Handbook for the conservation of the historic architecture of the city of As-Salt, Jordan. This city has been chosen because it holds great importance as heritage and traditional architecture, whose conservation is currently threatened because of abandonment and decay. The planning office showed interest in collaborating with the team of academics and demonstrating the viability of the hypothesis, hence the team decided to pursue this collaboration since engagement with local stakeholders was necessary for developing the demonstrator.

An action research approach was adopted for this study. Action research involves an iterative process approach in which the action researcher and a client collaborate in the diagnosis of the problem and in the development of a solution based on the diagnosis (Bryman 2012; Bryman and Bell 2011). This type of research is facilitated by participation and collaboration of number of individuals with a common purpose. In this case, the researchers are collaborating with the office "Project Development Unit" (in charge of delivering the UNESCO application for inscription) of the city of As-Salt to re-adapt the traditional handbook for heritage conservation by implementing digital technologies. Action research is chosen in order to introduce improvements in urban heritage conservation practices in As-Salt. This paper sets up the preliminary studies for undertaking the demonstrator, which will be developed in a second phase of this research. Establishing the context for the selection of the exemplar buildings and clarifying the steps for the development of the demonstrator are the preliminary steps covered by this study. Further investigation and empirical data collection will conclude this study.

3 As-Salt: Supporting Historic Urban Landscape Conservation Through Digital Technologies

The City of Al-Salt is situated in Jordan as shown in Fig. 1. It was the Jordan capital city in 1922 and it is located West of Amman, along the way connecting Amman to Jerusalem (ASCOP 2016). The unique atmosphere of Al-Salt heritage city is mainly due to its late XIX century residential buildings. Historic houses were built two or three floors, elegantly decorated with columns, balconies and vaults. These houses are very peculiar because they were built in a local yellow stone, extracted from caves close to the city. This stone is extremely tough and resistant, however, negligence and lack of care from residents and local authorities let them perish to the point that the heritage centre is now in decay. The population is growing but locals prefer to invest in modern buildings rather than caring about the historic ones, thus, nowadays many buildings are in a bad state and need repair. Moreover, attempts to exploit the potential of tourism development by city beautification proved to be fragmented and superficial (Khirfan 2013).

In the 1990s, an in-depth analysis of the urban fabric was conducted by initiative of the Salt Development Corporation, such studies were brought forward leading to a systematic understanding of the level of integrity and protection of the historic centre. However, despite efforts made to document and steer the conservation of the historic fabric, still Fakhoury and Haddad (2017) found that severe and rapid urban change is noticeable and planning policies do not properly address heritage values. Thus, leading to the destruction of image and authenticity of significant areas in the historic core. On the other hand, traditional architecture included in the historic fabric holds the potential to hit sustainability targets (ASCOP 2016; Almatarneh 2013). Amongst the various examples of historic buildings, in As-Salt, the team focused on chosen sub-case studies based on the following criteria: (1) availability of data survey and (2) being the building exemplar of a recurrent constructional and typological tradition, rather than unique.

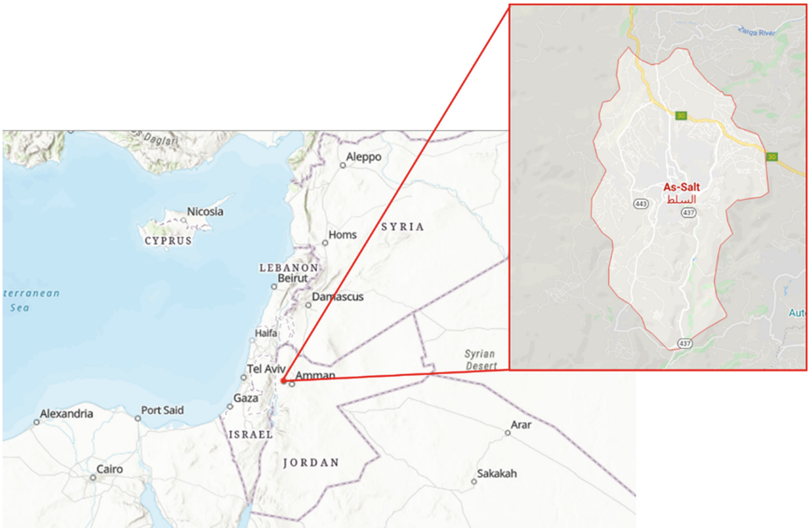

Fig. 1. As-Salt, Jordan (Source: ArcGIS modified by authors)

4 Case Study Preliminary Development: Qaqish House

The Qaqish house is one of the oldest notable residences in Al-Salt which currently serves as the office of As-Salt's City Development Project (ASCOP 2016). Restoration of the Qaqish house was conducted in two phases: 1989 to 1993 and in 2000 by the owner Basem Eid Qaqish. The Qaqish house is characterized as an extended family home transformed into a merchant house, with numerous traditional features such as a cross-vaulted entrance, stone walls and arched windows (Fig. 2). The project team conducted on field observation and direct survey on the Qaqish house and is producing

BIM objects, by identifying relevant architectural elements inside and outside the house, including doors, windows, arches, stairs, façade decorative features. The team has selected sample BIM objects that are repetitive in the traditional architecture of As-Salt (cross- vault, stone wall, arched windows). A new library of BIM objects derived by the Qaqish house will be developed for future conservation works. BIM objects will include details of materials used such as stone, mortar, wood.

As a result, documentation of the house is necessary to start working on BIM objects. This can be achieved through several software such as AutoCAD and Autodesk Revit. The project used Autodesk Revit for documentation and the researchers obtained laser scan drawings for the house with collaboration with As-Salt municipality as shown in Fig. 3. The use of 3D Laser scanning for heritage assets is an ideal technology for BIM due to its effectiveness, accuracy, and high level of detail (Barazzetti et al. 2015; Beraldin 2004). 3D Laser scanning accurately documents as built settings and real environment and can also be used for reality capture and augmented reality in many aspects of architecture and engineering. The previous drawings of 3D laser scan will be inserted into Revit, and all details of the house will be listed as library inside Revit. In this regards, the role of BIM is to link all information relating to the Qaqish house and combining it to produce a comprehensive a 3D model and as BIM has to rely on different software to collect this information for a project and compile it together (Sztwiertnia et al. 2019; Garagnani and Manferdini 2013). Revit is one of the BIM software to create BIM model. It combines the architectural design, structural engineering for coordination. Also, it helps in making a data-rich (library) model based on the contributions. Such a model of the house will be a rich based of information about each detail inside and outside the house for any circumstances and as first step of combining tradition, heritage and technology.

Fig. 2. Interior features of Qaqish House (Source: Authors)

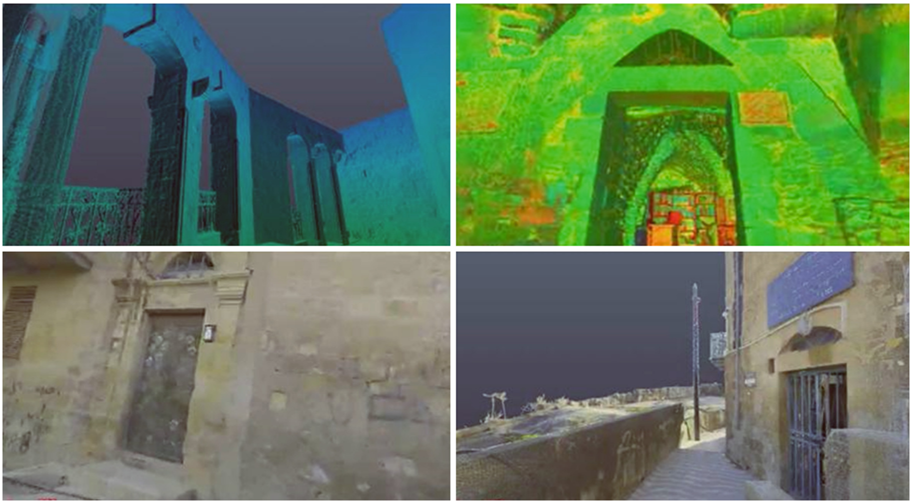

Fig. 3. 3D laser scanning for Qaqish house (Interior & exterior features) (Source: Authors)

5 Conclusions

This paper presented the preliminary studies undertaken by UK and Jordanian team of academics, seeking to build and move forward the tradition of Conservation Handbook by implementing digital technologies and turning traditional paper-based Conservation Handbooks in digital toolkits for designers and conservationists. This will be achieved by developing a proof of concept in Jordan, made possible by a grant awarded to the team by the Royal Academy of Engineering. The proof of concept will consist of a sample chapter for a Digital Conservation Handbook for the city of As-Salt. Moreover, the proof of concept will allow development that will be used to test the impact of such an innovative and digitally based Conservation Handbook on local communities. Furthermore, the implementation of this project will be used to raise awareness across residents on the value of traditional historic buildings in As-Salt. BIM is a well-established process to optimize the building process with many benefits such as avoiding issues of conflict, reworking and duplication whether in offices or on a construction site. However, using BIM in heritage conservation is a still a novel opportunity of using BIM in terms of documentation, urban reservation and socio-cultural criteria. Another opportunity is creating concrete connection between components of building design, environment, construction site, social elements, and economical issues. In order to achieve accuracy, data is captured and inserted about the morphology of the house and the surrounding and the contexts have to be surveyed using high definition technologies (point clouds) which are state of art for preservation of elements, complemented by fieldwork and direct observation. Digital technologies are used to check on structural preservation and for studies about technological building systems over architecture history period. In conclusion, the BIM process allows data to be collected, combined and inserted from engineering perspectives into other tools to make it available for researchers, experts and generic actors involved in heritage means. The use of BIM that will be tested in this case study is innovative, because it will be related to the aim of creating a digital conservation handbook on traditional historic buildings in As-Salt. It is expected that as a result of such a study, engagement with local planners and residents will raise awareness on the importance of valuing the conservation of the historic centre of As-Salt. Furthermore, the testing will allow for the development of a proof of concept for a BIM based conservation handbook. Thus, perpetuating this tradition through the instruments of digital technologies.

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Facility Management Services in Smart Cities: Trends and Perspectives

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Abstract. A Smart City can be defined as a complex socio-technical system in which services are optimized by the use of digital telecommunication technologies for the benefit of its inhabitants and business activities. The Smart City topic is today at the centre of many debates at European and international levels, also for the potential impact of the innovation of urban services within the overall performance of cities. Literature and virtuous cases of Smart Cities at the European level envisage optimization and innovation scenarios for traditional Urban Facility Management (UFM) services, based on the application of Information and Communication Technologies (ICTs), in particular Internet of Things (IoT) and Big Data management. Although the interest in the transition of the cities towards Smart Cities by administrations is growing, this transformation process appears to be still experimental and not much supported by shared knowledge references and tools. In light of this premise, the contribution - that is part of the PRIN research "Metropolitan cities: economic-territorial strategies, financial constraints and circular regeneration" - introduces the main results of the study conducted on a sample of 21 cities at the European scale with the aim of deepening and analyzing: (i) current innovation scenarios of UFM services enabled by ICTs that allow information sharing (Big Data flows) and a continuous monitoring of infrastructures and physical assets at the urban scale; (ii) characteristics and main trends in the implementation by public administrations of information platforms for the provision of smart UFM services and, more in general, for the smart management of cities; (iii) the potentialities of Milan, investigating the evolution of the offered smart urban services and of the adopted cognitive tools to manage city information, highlighting main trends, strengths and possible scenarios of improvement.

Keywords: Urban Facility Management (UFM) · Smart City · Urban services · Internet of Things · Big Data Management · Information platforms

1 Smart Cities and Scenarios of Innovation of Traditional Urban Services

The adoption of Information and Communication Technologies (ICTs) is redefining the scenario of traditional Urban Facility Management (UFM), understood as the integrated management of support services for the operation, use and enhancement of urban goods [1]. These services are today affected by important changes, especially in metropolitan areas, due to the evolution of ICT solutions and the application of Internet of Things

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(IoT) and Big Data paradigms, which concern aspects such as: methods of data detection, analysis and management; methods of communication/interaction with users; monitoring of performance; methods of response of systems, network interactions, etc. The digitalization of urban management processes is not simply bringing services towards ICT-based solutions, but it is redefining in a disruptive way the meanings of the concept of the city itself (digital, eco, green, intelligent, sustainable, etc.) [2, 3], multiplying the interpretive keys of its cognitive methods [4], dynamically expanding its boundaries (from the smart city to the smart region) in relation to the growth of networks based on smart specialization strategies [5, 6]. It is a scenario characterized by a heterogeneity of interpretations and experiments [7–10] in which the evolution of the new ICT technological offer plays an important role in placing the importance of services as enablers of transformations of the behaviors of the different categories of stakeholders [11] as well as in the management of tangible and intangible assets and related parameters for urban performance assessment [8]. Thus, it arises the need to acquire interpretation tools, capable of relating the consolidated methods of analysis and forecasting of the dynamics of development of urban systems with phenomena linked to the evolution of services, considered in a smart perspective [12]. Therefore, the paper aims to highlight trends and propose new classification schemes useful for describing new/renewed UFM services affected by digital evolution, new service management models, enabling technologies and information sources. To this end, it has been developed a European-scale analysis of smart urban services, here offered in a sample of significant Smart City experiences. The sample was defined by selecting cities that: (i) have been involved in projects concerning ICT applications in urban service management under the EU's 7th Framework Program or Horizon2020; (ii) are developing/have developed initiatives, policies, guidelines and/or strategies relating to the integration of ICTs in the management of urban FM services. The sample consists of 21 cities[1]. The analysis of smart urban services assumes and relates the following three levels:

- Domains of the Smart City. They are widely shared in literature [13, 14] and they represent the different sectors of urban development, classified as follows: People, Economy, Governance, Mobility, Environment, Living [15, 16];
- Domains of UFM. By comparing the traditional UFM services with the Smart City domains, it arises the need to propose a new set of urban FM domains [1, 17, 18]. The urban FM domains thus identified are: Building, Energy, Education, Governance, Environment, Business, Mobility, Health, Waste, Safety & Security, Water;
- Smart services in relation to different application fields. According to Rapaccini and Gaiardelli (2015) it is possible to "*define the service as intelligent or smart when this is provided in order to anticipate problems/needs of the customer, thanks to ICTs that favor the acquisition and processing of contextual information. The objective is to provide proposals for intervention in less time and with less effort*

[1] Antwerp (Belgium), Barcelona (Spain), Berlin (Germany), Bristol (UK), Copenhagen (Denmark), Eindhoven (The Netherlands), Espoo (Finland), Geneva (Switzerland), Genoa (Italy), Lisbon (Portugal), London (UK), Lyon (France), Milan (Italy), Munich (Germany), Nice (France), Padova (Italy), Santander (Spain), Stavanger (Norway), Stockholm (Sweden), Vienna (Austria), Warsaw (Poland).

and costs" [19]. Examples of smart UFM services are: Smart Street Lighting Mgmt; Energy Grid Mgmt; Smart Bins Monitoring & Dynamic Scheduling; Smart Water Mgmt & Real-time Leakage Detection; etc. Parallel to these innovative services, there are also sharing and delivery services - such as bike/car sharing, co-working, food delivery, etc. - which represent another important emerging ICT-based service category [20].

In relation to this classification structure, a qualitative comparative analysis was conducted to identify the smart city and UFM domains most affected by the adoption of advanced ICT solutions and to identify the main characteristics of smart services. Table 1 shows a summary of the sample review.

Table 1. Summary of the survey on 21 European Smart Cities: smart UFM services, trends by domain and innovative strategies for the planning and delivery of services. Adapted from [2]

SC domain	Service Strategy Innovation	Smart Cities
Energy	• Continuous monitoring of energy consumption and data analyses provide insights on energy demand at urban/district scale for the identification and location (GIS) of peak hours and for the identification of areas with energy surplus able to support any neighbouring areas in energy deficit • Smart lighting systems (motion and presence sensors and actuators for switching street lighting on/off) to improve citizens' perception of safety	Eindhoven, Milan, Padova, Stockholm, Espoo, Nice
Waste	• Wireless ultrasonic sensors that detect the filling level of waste containers • Planning and optimization of waste collection routes: geo-location data of the containers together with data from the sensors about their filling level allow to identify real-time the most efficient routes for waste collection • Municipal waste management platform: drivers of collection vehicles can use mobile apps to scan, confirm and generate report on any event (e.g. automatic billing for the collection of waste on request)	Berlin, Vienna, Barcelona, Lisbon, Stockholm
Building	• Real-time monitoring of energy consumption (e.g. identification of peaks) • Real-time adjustment of the energy distribution • Scheduling maintenance and cleaning interventions based on actual use (no longer periodic interventions with frequencies defined on a statistical basis but real-time monitoring of the operating conditions of the elements and interventions according to real conditions) • Real-time monitoring of user behaviour (use of as-sets, fixed furnishings, preferences, etc.) to improve the management of spaces and internal layout	Stavanger, Warsaw, Antwerp, Lyon, Geneva, Lisbon, Genoa

(*continued*)

Table 1. (*continued*)

SC domain	Service Strategy Innovation	Smart Cities
Environment	• Network of wireless sensors for monitoring environmental parameters (e.g. CO2, noise, temperature, etc.) to improve the city environmental quality Air quality monitoring through wireless sensor networks and mobile device networks for the detection and monitoring of air pollution (e.g. sensors on smartphones) that allow people to keep track of pollution levels in real time and feed a central database	Berlin, Munich, Genoa, Milan, Nice, Stavanger, Eindhoven, Antwerp, Bristol, Santander
Mobility	• Real-time monitoring and communication for: (i) public transport (e.g. real-time updates of waiting times, etc.); (ii) parking management (e.g. real-time updates of available parking spaces, etc.); (iii) traffic management (e.g. real-time updates of traffic conditions, notification of the best routes, etc.)	Berlin, Munich, Santander, Copenhagen, Barcelona, London
Governance	• Municipality Open Platforms provide digital services (e-government): Public services provided by PAs are managed electronically, promoting communication with PAs and engaging citizens into public affairs • Collection and use of citizens' online feedback to support decision making and to inform the policy development process	Eindhoven, Berlin, Munich, Santander, Barcelona, Copenhagen, Stockholm
Safety & Security	• Platforms with call management, intelligent mapping, field communications, data reporting and analysis to obtain an updated common operational framework to increase the city response capabilities • Sharing and combining real-time CCTV video surveillance networks of municipal agencies with other public and private security systems for problem detection and cooperation of agencies and related staff	Eindhoven, Bristol, Lisbon
Water	• Smart water meters together with sensors on electric motors, pumps, valves, etc. and water management software applications allow: (i) real-time detection of leaks, reducing non-revenue water; (ii) optimized pressure management, reducing energy consumption and losses; (iii) better accuracy in cost calculation and automatic billing • Smart Water platform for: end-users participation in improving water distribution systems; cooperation between water suppliers and end users	Santander, Barcelona, Bristol, Lyon, Milan

From the investigation and comparison of the observed cases, it is possible to highlight some recurring aspects of interests and trends linked with the key role of the technological component such as: (i) use of digital ICT infrastructures and IoT solutions to improve the ability of public administrations to collect, manage and analyze data; (ii) activation of virtuous circular and integrated information flows on urban scale, together with standardized communication processes for the exchange of information in real time between the city administration and citizens; (iii) overcoming of the "physical place" as an unavoidable dimension of the activities, guaranteeing, for example, multimodal accessibility to useful data and digital services. Focusing on smart UFM services, several common trends emerge from the analysis of case studies:

1. Bottom-up approach to the planning and delivery of urban services and the rise of a new social entrepreneurship. Unlike traditional UFM services, that essentially follow a top-down approach in design [21, 22], in the case of smart services it is possible to observe a bottom-up approach. These services are created mainly through "bottom-up" processes, enabled by ICTs, with the involvement of various actors (developers, users, etc.), who have an active role in the recognition of problems and needs and, in some cases, in the definition of application proposals, such as: reporting of accidents and roadblocks (London), the case of voluntary citizens' organizations to carry out cleaning and maintenance of local common goods (Barcelona), or the more structured cases of car pooling applications or short-term hosting proposed directly by citizens. This new concept of services derives from the integration of public administrations (in an open government logic, thanks to databases, web applications and open information platforms for data sharing made available to all by PAs) and the "privates", no longer intended only as traditional private players (e.g. private service provider companies), but as an aggregation of small players, such as developers, interested citizens, researchers, technology suppliers, etc., which generates novel forms of social entrepreneurship;

2. Services based on real-time data and data-driven decision-making processes. Smart services involve increasingly dynamic data flows available in real time. This makes possible a continuous monitoring (as in the cases of the Real Time Networks in Vienna and the London Datastore in London) and the application of different forms of "sensing and responding" [23];

3. Existence of two main approaches in acquiring both static (from statistical sources) and dynamic data from smart devices (sensors, tags, GPS, GIS, smart-phones, etc.), confirming the two approaches described by the British Standard Institute in the City data survey report [24]. A first approach which consists in the targeted collection of data, following the identification of one or more urban issues (as in the case of London which focuses on optimizing the provision of public transport in less central areas of the city). The limit of this approach is an excessive siloed vision focused on single services within the same domain, which if - on one hand - has the benefit of optimizing a certain service - on the other - presents the risk of precluding the possibility of integrating large amounts of data coming from other domains or other services. The second approach consists in the massive collection of large amounts of real-time data concerning several aspects of the city useful for several services (cross-domain), with a view to Big Data Analytics systems (as in the case of SmartSantander project which envisaged the implementation of 20,000 sensors in Belgrade, Guildford, Lübeck and Santander - which alone has 12,000 sensors - to test and exploit the potential of data analysis technologies and techniques). The risk of this approach is an overabundance of data, from which it may be difficult to derive effective value in absence of clear aims;

4. Integrated approach to the management of urban services. The pursuit of integrated approaches to city management supported by ICT-oriented services can be extensively observed (e.g. Vienna, London, Eindhoven, Santander, Berlin, etc.). This marks a trend towards the shift from a siloed approach to integrated approaches in the organizational models of municipalities. It means the transition from organizations based on independent decision-making and operational centres referring to individual vertical domains, with problems of communication and information sharing [25], to functions of "integrated holistic governance" [26, 27], relying on shared knowledge bases thanks to the use of information platforms and organizational models based on integrated and collaborative decision-making centres [7, 28].

The case studies highlight how the achievement of this systemic and holistic vision of urban management depends on the implementation of a Smart City Platform which, in this context, represents a key enabling factor.

2 Enabling Technologies and Tools for Information Management Within Smart Cities

The analysis of the sample reveals a particular attention paid by municipalities to implement information platforms. Although this implementation process appears to be still at an experimental stage and little supported by shared references and support tools, the investigated cities contribute to recognize the key role of the platforms in enabling the delivery of new digital services. The Smart City Platform has the potential to gather experiences, skills and knowledge and to set up a common development plan for all the sets of smart services offered within the various city domains. The cases of Barcelona, Berlin, London and Vienna highlight a further meaning of platform, on which it is worth paying attention, defined as *Open* Smart City Platform. This meaning refers to the fundamental concepts of:

- accessibility. Public administrations are increasingly aware that their data represent a heritage for the community. The accessibility and diffusion of city data play an important role for various stakeholders (investors, facility managers, urban planners, developers, service providers, citizens, etc.) to support decision-making processes at different levels (strategic, operational) [29];
- interoperability, i.e. the ability of the platform to work in a coordinated way with other systems (e.g. other databases, devices and sensors, Continuous Monitoring System, Energy Management System, Data Analysis System, etc.) by exchanging data in interoperable formats in order to exploit the benefits of data systemization and the potential of calculation and analysis of specialized software [30]. In this way it is possible to overcome the problem of integration of heterogeneous data (different languages, formats, etc.) coming from different systems;
- open and expandable platform structure. An open platform is based on the use of IoT technologies and exploits the capabilities of Big Data Management. The analysis of the platforms available on the market has highlighted a recurrence in the characteristics of their structure: modular, multi-layer, multi-tenant, scalable and expandable over time [31]. In particular, the performed analysis highlighted the

main technological layers of an information platform: Sensing Layer (data collection and device management); Network and Gateway Layer (connectivity and normalization); Platform Layer (central dynamic database); Data Analytics layer (data analysis and proactive responses); Application Layer (user interfaces and data visualization).

Despite the majority of the analyzed cities has developed platforms that share the general characteristics described above, they are following different implementation approaches that can be summarized into three main configurations with increasing level of complexity in terms of economic and organizational efforts necessary for the implementation, development and management of the platform:

- implementation of individual platform segments. These are open source and interoperable components, that over time can be assembled and combined with other platform components offered by the same supplier or by third parties. This reality represents an evidence of the interest of municipalities in adopting this technological infrastructure and it opens up possibilities for its diffusion at different levels of city size (for specific urban areas, for cities of size medium-small, etc.). This is the case, for example, of Copenhagen, which has implemented a single segment of the entire CISCO Kinetic for Cities platform, dedicated to environmental sustainability;
- implementation of existing platforms on the market. A review of the products on the market made it possible to verify the presence of predefined Open Smart City Platform solutions that have already been implemented by some cities, such as the CitySDK platform for managing Amsterdam Smart City;
- implementation of customized platforms (e.g. choice of functional modules, APIs, etc.) according to the needs and requirements defined by administrations starting from the models available on the market. For example, this is the case of Vienna, that implemented an adapted version of the FIWARE Platform (by Fiware Foundation EU), which expands the potential of real-time data visualization - including functions of interpolation of data coming from different projects (e.g. Smarter Together, eLogistik, etc.) through open source Real Time Networks [32].

3 The Case of Milan Smart City

The evolution of Milan in a Smart City began almost a decade ago and has recorded a continuous progress over time. Thanks to the interventions in the field of digitalization of the territory with the distribution of optical fibers, Wi-Fi hot spots and digital islands, the Milanese territory has been a place of development and diffusion of experimental smart practices in different sectors - such as social streets, e-tourism, co-working spaces, etc. - with relevant consequences for social inclusion. This evolution is confirmed, among others, by ForumPA ICity Rate 2019 that certifies the leadership of Milan, confirming it for the sixth year the 1st Smart City at national level, and by the Booklet Smart City 2019 of Assolombarda and EY (Ernest & Young) which demonstrates a good positioning of Milan also with respect to the European benchmarks.

Analyzing the city according to three macro-categories of observation of smartness - namely: services and applications; sensing technology; database and data analysis - it is possible to observe how Milan has already widely undertaken smart projects. These projects are now consolidated in some domains (e.g. mobility and energy) in terms of sensor installation and provision of smart services through various digital applications and interfaces available to citizens. In particular, among the services offered in Milan, sharing mobility services (e.g. car and bike sharing, etc.) and sustainable energy services (e.g. district heating networks, etc.) appear to be competitive with respect to the European benchmarks [11]. As regards the digitalization of infrastructures through sensors and smart devices, Milan presents a remarkable development of the application of sensors in the public transport and road networks (e.g. sensors for detecting availability of bike and car sharing vehicles, GPS sensors for local public transport vehicles, traffic detection sensors, occupancy sensors for public car parks), public lighting and energy network monitoring (e.g. smart metering for water and gas networks). The big data generated by these sensor systems should be processed through the information platform in order to improve the offered services. However, the city seems to be not yet fully able to exploit dynamic data for understanding frequencies and intensity of use of the different offered services, users behaviors, etc., useful for outlining possible future city service strategies. In particular, Milan owns an Open Database [33], accessible through the municipal website, but it has not yet developed solutions for integrating dynamic data from sensors and from smart services. Milan published on the Municipality portal about 420 open datasets, a substantially lower number of datasets compared to cities such as London, Berlin and Lyon (more than 1000 datasets). Furthermore, the majority of published Open Data are still of a "static" nature (e.g. km of road infrastructure, no. bus stops, no. subway lines and stops, etc.) or statistics (e.g. from censuses, reports, etc.) and not coming in real time from sensors/services. In this regard, it is important to underline that the number of datasets present within the open database is partially influenced by the willingness - expressed by the managers of smart services - to share dynamic data with the city administration. To sensitize public and private actors to the topic of Open Data, Milan has joined from 2015 the Digital Ecosystem E015, an initiative promoted by Lombardy Region, with Confindustria, CCIAA di Milano, Confcommercio, Assolombarda, Unione del Commercio and technical-scientific coordination by Cefriel. This initiative aims to encourage "*the creation of digital relationships between public and private subjects interested in enhancing their digital heritage by sharing it or in enriching the software solutions for their users with the features and information shared by the other participants*" [34]. Digital Ecosystem E015 aims to develop a platform for the collection and integration of heterogeneous and multi-thematic data useful for the development of new services in different sectors (e.g. tourism, transport, culture, etc.). The initiative involved the development and publication of various APIs (Application Programming Interfaces), written according to common guidelines, which allow the sharing of information and functionalities. Currently the E015 catalogue has more than a hundred APIs of which about one fifth related to Milan (e.g. Around Me, etc.). The apps developed for Milan from the data made available on the platform mainly relate to mobility, tourism and culture (e.g. ATM GiroMilano; Milan Airports; etc.). Following the example of London, Lyon and Amsterdam, Milan could update the geo-localized data coming in real time from sensors and services and use this database to feed third-party applications relating to various fields of interest for the city itself and its citizens. Milan open database could expand the range of thematic data categories becoming more attractive to app developers, as is already the case of London where the majority of applications and services are developed on the basis of the London Datastore, the open database of the municipality of London. In London, the open data and APIs of the London Datastore have supported thousands of developers working on the design of innovative applications, services and tools [35], facilitating the development of small and medium-sized technological enterprises. Concluding, this future prospective for Milan can be translated into the optimization of the platform into a digital ecosystem capable of involving public and private apps, in order to allow the integration and combination of multi-sectoral data, accessible for development of third party services in multiple sectors, such as transport, hospitality, energy, sustainability, culture, sport, tourism, waste, business, housing, employment, safety, health, etc.

4 Conclusions

The ICTs application to UFM field allows to optimize existing services and develop new digital ones, based on the key concepts of IoT, Big Data and information sharing. New capabilities characterize UFM services (e.g. real-time data collection, continuous performance monitoring, proactive system response, interaction with users through digital interfaces, etc.) which represent a key enabling factor for the realization of the Smart City concept. Despite the diversity of approaches in the adoption of ICTs, the analyzed Smart City case studies and the recent studies on Smart City management converge in proposing a change of approach from siloed vertical management to integrated holistic governance. The transfer of this integrated systemic approach to UFM management practices can be realized through the implementation of Open Smart City Platforms able to organize real-time data coming from heterogeneous sources (e.g. sensors, tags, smart meters, etc.) and to optimize decision-making at operational and strategic levels. In this highly dynamic context, which still appears to lack in shared consolidated references, the clear definition of cognitive tools and interpretive categories - useful for reading the evolution of UFM services - appears necessary, also in order to allow city administrations, investors and city managers to understand the contribution of UFM smart services in ensuring the city efficiency and smartness, so that policies and strategies can be properly calibrated. In light of this, the contribution proposes reading keys for understanding the features and the role of the UFM smart services in the context of a smart city, useful to support administrations and stakeholders in managing UFM smart services in a smart ICT-based perspective. In particular, the paper proposes: (i) a definition of UFM domains; (ii) a mapping of the UFM services offered by a sample of 21 Smart Cities on a European scale and related trends in implementation approaches; (iii) an analysis of existing enabling technologies and information platforms; (iv) the definition of trends in the approach to city governance. Lastly, with respect to these tools, the city of Milan has been described and analyzed, highlighting strengths and weaknesses, opening up perspectives for future improvements and innovations that take into consideration new organizational models, deriving from the adoption of digital technologies.

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Evolution and Transformation of Real Estate Dynamics in the City of Milan

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Abstract. With the foundation of metropolitan cities, we have witnessed a transition that has implemented the drivers of change and innovation in large cities, towards the production of knowledge and all the resources necessary to face international competition and overcome possible structural crises on a territorial basis.

This article shows some results of a study on Italian metropolitan cities, to investigate the extent to which the values of the real estate market and land revenues are linked to the performance of the cities and the territory.

Through a series of parameters and the grouping of investments by the main real estate players, this study seeks to answer the following research question: following the development activities in the Italian metropolitan cities, did real estate properties increase their value and their revenues?

The phenomenon of urbanization of metropolitan cities is analyzed by proposing a framework for the analysis of the real estate profile on a metropolitan-tan scale, in order to understand the role of this entity in relation to aspects of social cohesion and economic-environmental sustainability.

Keywords: Real estate development · Investment · Metropolitan cities

1 Introduction

With the establishment of “metropolitan cities”, approved by the Italian government in 2014 (L. 7 April 2014, n. 56 on “Provisions on metropolitan cities, provinces, unions and mergers of municipalities”), we have witnessed a significant transition. The establishment of metropolitan cities requires overcoming the critical issues and links that these contexts face on different scales and dimensions - mainly economic, environmental and social - including aspects relating to the variation of settlement/functional trends and the complexities of urban transformation/regeneration processes and building restoration.

In this scenario, which reveals an increasing competitiveness between territory, cities, geographical areas and territorial systems, public institutions are involved in the relaunching and requalification activities. They are aware of the fact that in the competition between urban areas the most dynamic “systems” able to combine the protection of their territory with the development hypotheses will be awarded [1].

Metropolitan cities have been entitled to become drivers of change and innovation, privileged centers of knowledge production, powerful competitors in international

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markets, and enablers to overcome crises [2]. Metropolitan cities are expected to demonstrate "the capacity to recover quickly from difficulties" [3], hence to tow territories toward resilience, as for the Oxford dictionary's definition.

The paper analyzes the metropolitan dynamics an focus on Milanese experience as an example of urban resilience, by exploring the real estate strategies that supported the recovery from the crisis.

2 Methodology of Investigation

In the last ten years, extensive researches have sought to assess the dynamics involved in the metropolitan cities by comparing them with one another. Most of these studies have defined synthetic indicators to measure urban smartness [4] and also its dimensions and productivity [5].

Some observers note that although indicators are a powerful means of describing complex phenomena and supporting decision-making processes to define effective strategies and urban actions, they may sometimes be ineffective for measuring elements such as social, demographic, and cultural differences between cities [6, 7].

The Research Project of Relevant National Interest - PRIN "Metropolitan cities: territorial economic strategies, financial constraints and circular regeneration" his aimed to improve the knowledge system regarding the functions, structure and performance of Metropolitan Cities, as well as the role to be assigned to second and third order cities, "territorial order centers", in a context of reduced functionality and tendential disappearance of the Provinces.

The analysis of the real estate profile implies data processing, after gathering information from the principal official sources reporting the national real estate market behavior.

We analyzed official data provided by the main real estate operators and also focus on data from the Real Estate Market Observatory (Italian OMI – Osservatorio del Mercato Immobiliare), and large database, provided to Politecnico by "Il Quotidiano Immobiliare" – QI (https://www.ilqi.it/post/quotidiano-immobiliare), the first Italian online magazine and search engine about real estate issues.

The results of these multiple-method examination will be presented in the following sections of this paper.

3 Metropolitan Cities and Real Estate Investments in Italy

In Italy, the law of April 7, 2014 no. 56 the establishment, redefining the provincial system. The measure identified ten metropolitan cities. According to the geographical areas defined by the Italian National Institute of Statistics (ISTAT), the 10 cities approved by the law 2014 no. 56, were structured into three classes [8]:

- Northern metropolitan cities: Turin, Milan, Genoa and Bologna;
- Central metropolitan cities: Florence and Rome;
- Southern metropolitan cities: Bari, Naples, Reggio Calabria.

Later, four other metropolitan cities have been identified by the special statute regions Cagliari (Sardinia); Catania (Sicily); Messina (Sicily); Palermo (Sicily).

3.1 Metropolitan Cities

As acquired by the main institutional sources [9–11], the Italian metropolitan cities are very heterogeneous in terms of both population size and area, as well as levels of wellbeing and socio-economic development and, more generally, the extent of urban infrastructure.

By referring just to demographic for example, ISTAT data show that in 2017 the population of the 10 capital cities was about 8,000,000 (16% of the Italian population), while that of the metropolitan areas was about 18,5 million (33% of the Italian population).

Table 1. Population, area and density of the metropolitan cities (Source: Polytechnic elaboration on data from "ISTAT 2017").

Capital city	Dimension (kmq)	Population (Istat 2017)	Capital City density (inhab./kmq)	Metropolitan area n° municipalities	Dimension (kmq)	Population (Istat 2017)	Metropolitan area density (inhab./kmq)
Roma	1.287,36	2.873.494,00	2.232,08	121,00	5.363,28	4.353.738,00	811,77
Milano	181,67	1.351.562,00	7.439,65	134,00	1.575,65	3.218.201,00	2.042,46
Napoli	119,02	970.185,00	8.151,45	92,00	1.178,93	3.107.006,00	2.635,45
Torino	130,01	886.837,00	6.821,30	316,00	6.817,28	2.277.857,00	334,13
Bari	117,39	324.198,00	2.761,72	41,00	3.862,88	1.260.142,00	326,22
Firenze	102,32	382.258,00	3.735,91	42,00	3.513,69	1.014.423,00	288,71
Bologna	140,86	388.367,00	2.757,11	55,00	3.702,32	1.009.210,00	272,59
Genova	240,29	583.601,00	2.428,74	67,00	1.833,79	850.071,00	463,56
Venezia	415,90	261.905,00	629,73	44,00	2.472,91	854.275,00	345,45
Reggio Calabria	239,04	182.551,00	763,68	97,00	3.210,37	553.861,00	172,52
	2.973,86	**8.204.958,00**	**2.759,03**	**1.009,00**	**33.531,10**	**18.498.784,00**	**551,69**

The cities vary greatly as regards population and density: Rome, for example, has over 2,800,000 inhabitants while Reggio Calabria has about 240,000. The population share of the capital city compared to the metropolitan area (see Table 1) varies between the maximum value of Genoa, where about 70% of the population is concentrated in the capital, and Bari (26%).

The lack of homogeneity is also highlighted by a series of critical issues including:

– the lack of a true integration between the city center and the metropolitan hinterland, beyond a historical structure that sees the hinterland hosting mainly industrial activities [12];

– the difficulty for the metropolitan belts to find true new economic vocations capable of compensating for the tendential reduction of industrial jobs;
– the fiscal-financial crisis of the new CMs, lacking - as is the case in the French case - of their own taxation and of adequate resources for the important tasks assigned to them [13];
– the absence in our country of a tradition of strategic planning on a vast, metropolitan scale;
– the collapse, which occurred in the last decade and not only since the crisis, of public, national and local investments, as a result of the overall fiscal crisis in the country, with the major cities leading the decline [14].

3.2 Real Estate Transaction by Building Type in Italy

Focusing on real estate transactions (deals) recorded in Italy by QI with a minimum amount of 5 million euros, from 2012 to 2017. These account for over 500 records. From the analysis of this database, we can formulate a few considerations regarding the building types and the most active cities in the Italian real estate market, in relation with the general investments.

Real estate operations concentrate mainly in the tertiary sector (see Fig. 1).

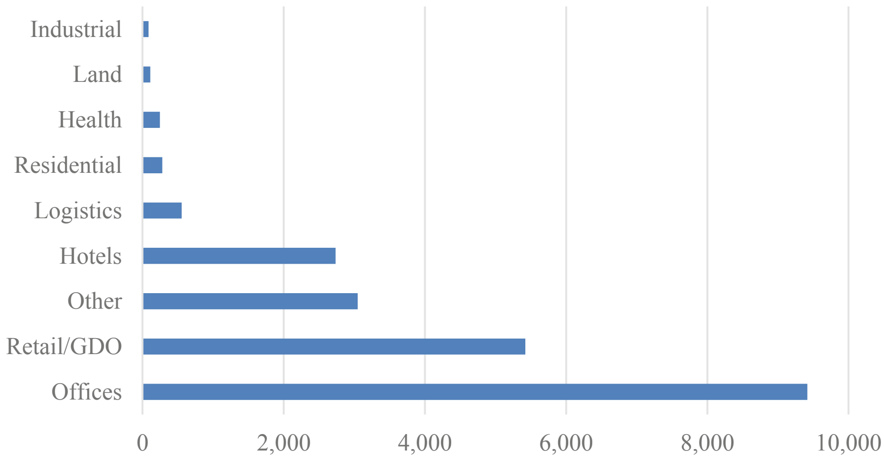

Fig. 1. Large real estate investments in Italy from 2012 to 2017 by building type (value in mln €) – (Source: Polytechnic Elaboration on data from QI).

Most of the transactions in terms of value concern the purchase of buildings intended for office use, which takes up to about 43% of the total investment volume (with over 9 billion invested). The retail sector follows with 25% (over 5 billions) and hospitality with 12% (almost 3 billions). These three types alone represent more than 80% of the total volume of real estate investments. Only marginal investments are directed to other building types. Especially surprising is the limited amount of money devoted to housing. The census showed that investment in the residential sector represents only 1% of the total volume of investments in the Italian real estate sector.

Recent data from the Bank of Italy confirm these already explicit trends and show that the market of non-residential real estate investments in 2018 reached a record value with about 11.1 billion Euro and a growth rate of about 25% compared to 2016 [15]. The average value of single asset transactions closed in 2017 in all sectors was 37 million Euro, in line with long-term data.

3.3 Real Estate Transactions by City

By analyzing the location of investments (see Fig. 2), the metropolitan city preferred by investors is Milan (with over 11 billion euros in the period 2012–2017). The metropolitan city of Rome attracts only one third of the volume produced by Milan.

Milan sees more than 150 transactions above 5 million each. Rome reaches barely one third of the Milan's number and value of transactions. All other Italian metropolitan cities run far behind these records. Other provinces with relatively high performance are: Sassari (thanks to the 600 million Euros spent by a Holding of Quatar in the hotel sector), Bologna (with around 500 million invested in the commercial/retail and logistics sectors), and Turin with almost 500 million Euros distributed mainly in the tertiary and commercial/retail sectors.

Milan is confirmed as the most active city in the Italian real estate market, based on both the number of real estate transactions and their value between 2012 and 2017.

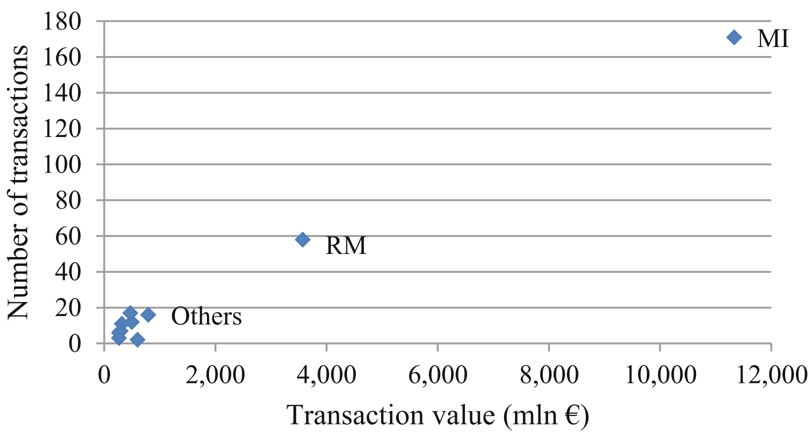

Fig. 2. Number and value of real estate deals in Italy. – Elaboration on data from QI.

3.4 Real Estate Performance in Milan

Taking into consideration the trends in the decade under consideration of the real estate prices (all intended uses) of the Municipality of Milan, in each OMI range (B, C, D, E zones), the trend in the individual areas seems to follow an average trend constant while the price difference between the individual zones is evident (see Fig. 3).

Figure 3 in fact highlights a substantial difference between the average value of the prices recorded in zone B (central) which is approximately double compared to zone C (semi-central). Value that goes further towards the peripheral areas.

Between 2013 and 2014 there was a marked variation in the prices due to the previously illustrated process of ten-year revision of the territorial areas ended in 2014.

The updating of the articulation of the municipal territory by homogeneous areas has incorporated the structural changes of the urban fabric and the local market, found through detailed territorial analyzes.

According to our elaborations on data from QI, the real estate deals in Milan distribute among the following building types: 62% offices; 9% retail; 2% hotels and 27% all the others.

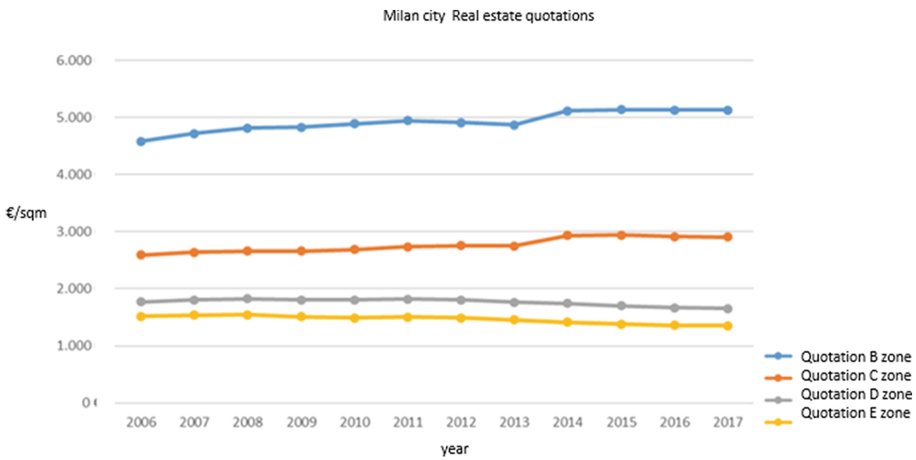

Fig. 3. Milan real estate quotations. – (Source: Polytechni Elaboration on data from OMI).

In 2016, the office building market in the metropolitan city of Milan recorded an overall growth in the volume of transactions of 67% [16]. Surprisingly, these transactions are mainly concentrated within the Milan municipality. Deals do not concern much all the surrounding territories that compose the administrative borders of the metropolitan area. The office market of the Milan municipality registered a conspicuous increase in the area exchanged, which equals to 320,000 square meters in 2017, compared to 280,000 in 2016 [17]. Not less important is the absorption rate, which rose from 55% in 2016 to 64% in 2017 [17], indicating a gradual reduction in the gap between supply and demand.

4 Conclusion

Milan has demonstrated the ability to recover from the 2008 economic-financial crisis relatively fast and to turn the difficulties into chances for redevelopment. In the last five years, the commercial real estate market has become increasingly active.

We found out that these operations tend to concentrate in a few poles, as they have been encouraged by public initiatives that were directed to regenerate entire areas of the city, such as the Porta Nuova District. Many companies have invested in a number of initiatives, directed both to building development and enhancement, which have concurred to reactivate the local market and economy. Our paper examined the most recent commercial real estate initiatives, in order to explain how they helped the Milan metropolitan area to develop a resilient attitude.

The investments seem mostly interested in moving to these new areas, in first-hand premises, suitable to boost the company's image by being aesthetically impactful and environmentally sustainable.

Real estate initiatives can regenerate urban areas while boosting economic, environmental and social activities. Our research endorses that urban resilience goes hand-in-hand with this kind of initiatives. Companies produce knowledge, compete in international markets, and contribute to overcoming the crises. Public authorities should prioritize the attraction of investors and organizations that are interested in real estate initiatives, as they can increase urban resilience.

The case of Milan confirms the attractiveness of metropolitan cities that become the privileged contexts for multiple businesses to settle.

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"Il Quotidiano Immobiliare" – QI (https://www.ilqi.it/post/quotidiano-immobiliare), the first Italian online magazine and search engine about real estate issues,

Real Estate Market Observatory (Italian OMI – Osservatorio del Mercato Immobiliare) is the principal official sources reporting the national real estate market behaviour and, on the basis of a partnership deal between Italian IRS "Agenzia delle Entrate" and Politecnico di Milano ABC Department, collaborated to this project by providing us with a database occurring in Italy from 2012 to 2017. The analysis proposed in this paper are largely based on this information.

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Proactive Maintenance Strategy Based on Resilience Empowerment for Complex Buildings

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Abstract. Resilience of the built environment, particularly in complex buildings, is strictly related to the effectiveness of systems and sub-systems that provide the expected features to manage risk scenarios in routine and non-routine conditions. In this perspective, maintenance is therefore a key factor to assure building resilience by keeping systems and equipment in the required operational state. Risk management can be empowered if system resilience and disruptive events are monitored in real-time, and, to this aim, proactive maintenance can nowadays monitor systems resilience with innovative digital tools.

More specifically, proactive maintenance, through Industry 4.0 (I4.0) tools, can enact control strategies for mitigating both endogenous risks – such as equipment failure, aging and obsolesce not always deeply investigated in building sector – and exogenous risks.

Anticipation of disruptive events of systems and control of endogenous risks is possible thanks the introduction of IoT and machine learning tools which may allow to modify the traditional corrective maintenance in the direction of a proactive maintenance approach.

Aim of this paper is to highlight how proactive maintenance approach, if fully implemented, and supported by I4.0 tools, can empower resilience of systems in the building sector.

Keywords: Complex building resilience · Condition-based maintenance · Proactive maintenance · Information management · I4.0 · Risk management

1 Introduction

1.1 Proactive Maintenance Approaches in Support of Infrastructure Resilience

Maintenance, in its general exception, ensures system performances over time. Introducing the exception of proactivity, through real-time data management, maintenance can dynamically support in advance the actions taken in order to:

- prevent the occurrence of a disruptive event;
- monitor the system status, alerting if performances are reaching a critical threshold.

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Actual proactive maintenance application needs:

- a real-time data flow management;
- systems able to process real-time data and learn in order to obtain dynamically system predictions and select responding actions.

These conditions can be supported by enabling technologies proposed by Industry 4.0 (I4.0). Through them, by processing a huge amount of data over a limited time frame, proactive maintenance can:

- describe the assets status/performance in a relative short period;
- contribute to highlight the risks of the disruptive events deriving from internal & external hazards.

In this way, proactive maintenance, seen as strategy which describes in advance assets current and possible future status, can empower systems resilience in complex buildings, by dealing with actions - such as anticipate, resist, adapt, react and adjust (ARARA) [1], which withstand the possible changes due to the progressive degradation and the abrupt failures of systems.

Innovation, in the traditional maintenance strategies of complex buildings, consists in the application of IoT, machine learnings and big data - already used in industrial sector – in the management of systems to empower complex buildings resilience.

This paper shows an application of a methodology, tested for the proactive maintenance of equipment, which support the operations of hospital buildings.

2 Complex Systems Resilience Management in the Building Sector

2.1 Current Complex Systems Resilience Approaches in Building Sector

In management of complex buildings, especially where criticalities of systems must be carefully considered, a risk management framework (based on: context analysis, risk assessment, taking control measures, monitoring and review, communication and training) is highly recommended in order to increase their resilience.

Currently, the major attention of risk management seems to focus on natural hazards related to earthquakes, fire, climate change, rather than to the effects of technical events, apparently less dangerous, such as service equipment faults, aging of the systems, cyber-attacks of ICT system or infrastructure incorrect use and so on.

However, these effects are very often those that constitute the principal and most frequent highly-impacting causes in the loss of performance for the systems, so, even on these factors should be necessary to develop a resilience strategy.

By analysing the current literature (Table 1), resilience in complex building management starts to be a hot-topic, investigated from different points of view, in particular those related to some strategic actions (such as anticipate, resist, adapt, react, adjust) and managed with the support of some dynamic tools.

Table 1. Comparison table of resilience references in the building sector.

Authors	Field	Risk	Resilience features	Resilience quantification tool	Levels		
					SOC	ECON	ENV
Hashemi et al. (2019) [8]	Building materials	Collapses	Resist, Recovery, Adapt	Multi-axis hybrid simulation	✓	✓	✓
Khanmohammadi et al. (2018) [11]	Hospital buildings	Earthquakes	React, Adapt	Dynamic simulation for post-recovery	✓		
Yu et al. (2019) [17]	Hospital buildings	Earthquakes	React	Fault tree analysis	✓	✓	
Cimellaro et al. (2018a) [6]	Hospital buildings	General events	React	Questionnaires, Factor analysis	✓		
Kurth et al. (2019) [12]	Building industry	General events	React, adapt	Resilience metrics	✓	✓	
Cimellaro et al. (2018b) [5]	Building and Transportation System	Earthquakes	Resist, react	Performance function, Analytical model	✓		
Hossain et al. (2019) [9]	Power grid	Extreme weather events	Resist, absorb, react	Bayesian Network	✓	✓	
Cho et al. (2019) [4]	Nuclear power plant	Earthquakes	Resist, absorb	Dynamic response analysis	✓		
Rehak et al. (2019) [15]	Energy infrastructure	Cyber-attacks	Resist	Robustness, Adaptability and Recoverability index	✓	✓	
Pantelic et al. (2019) [13]	Buildings	Air pollutant	Anticipate, react	I/O ratio, E-index. IoT technology	✓		

The investigated references highlight some issues:

- The 5 resilience actions (ARARA) are never considered all together at the same time;
- Resilience is mainly assessed through qualitative tools rather than quantitative methods;
- Resilience can benefit through real-time data collection and elaboration system;
- Resilience is mainly considered in relation to risks depending on external high-impact events, rather than to those depending on the outage of equipment;
- Maintenance is normally not considered as a strategy to improve system resilience.

2.2 Proactive Maintenance for Resilience Empowerment

The literature analysis highlights how proactive maintenance strategy may be one of the possible measures for the improvement of the resilience of complex buildings, by the management of:

- the effectiveness of the systems considered as control measures for external hazards
- the hazards related to aging, degrading patterns and disruptive faults of the systems themselves.

In this regard, proactiveness can innovate the traditional resilience approach (Fig. 1 – part A) by anticipating the prediction of the time of failures through the dynamic analysis of real time data enabled by technologies, such as big data, IoT and machine learnings.

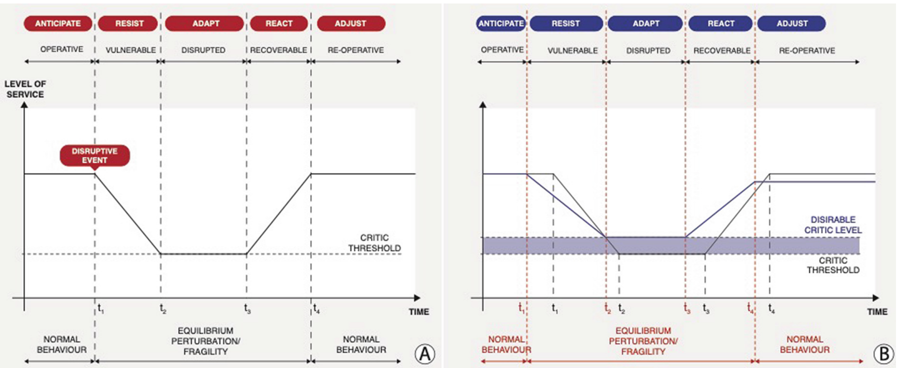

Fig. 1. Resilience approach in traditional (A) and innovative (B) approach

Figure 1 shows the representation of the resilience of a system highlighting the ARARA actions in relation to a disruptive event. The resilience curve can be represented through many control functions related to reliability, availability, resistance and others [1]. The critic threshold represents the minimum level of the service that the complex buildings can stand. This critic threshold doesn't necessarily coincide with the default state in which the complex building doesn't comply with its intended purpose. After the disruptive event, the fragile phases of complex buildings are represented by the vulnerable, disrupted and recoverable phases.

By applying proactive maintenance, supported by I4.0 tools, the typical resilience actions can be empowered:

- *Anticipate* can be activated through an effective management of information flows, supported by IoT and sensors deployment;
- *Resist* can be supported by monitoring tools, such as automated feedback;
- *Adapt* and *React* can be favored by a support from machine learnings – data-driven model, physical based model and hybrid model – that can help the decision making process. Furthermore, also operational activities may be supported for instance in providing spare parts with 3d printers which can be used for the production of components suddenly necessary;
- *Adjust* can be reached through digital twin [7], platforms and database deployment;

The analysis of the wide current literature (Table 2) highlights the central role of IoT and machine learning in the practice of proactivity. In particular, from the perspective of IoT (Table 2):

- considering the IoT levels (sensors level, communication level and service level), some approaches can be useful for system performance analysis. The big data flow passes through the three different levels, facilitating system prediction analysis and/or performance assessment;
- in the service level data are elaborated and stored. These applications are currently already available also in cloud solutions: PaaS, SaaS and PMaaS, through which proactiveness can be offered as a service;
- services provided through IoT are offered, at present, through data storage form – SaaS, DbaaS – and data analytics form too – BiaaS, BfaaS and FaaS.

Table 2. Comparison table of IoT components is service layer offered as proactive tools.

Authors	Maintenance purpose	IoT components
Evaluation of Predictive-Maintenance-as-a-Service Business Models in the Internet of Things. **Zoll et al. (2018)**	**PmaaS**	Cloud analytics
Software as a Service. **Buxmann et al. (2008)**	**PmaaS**	Cloud analytics
Tradeoffs between performance and security of cryptographic primitives used in storage as a service for cloud computing. **Patel et al. (2012)**	**SaaS**	Cloud storage
Bridging data-capacity gap in big data storage. **Bhat et al. (2017)**	**DbaaS**	Cloud storage and database
Cloud and IoT-based emerging services systems. **Sharma et al. (2018)**	**BiaaS, Bfaas, DaaS**	Cloud analytics

(*continued*)

Table 2. (*continued*)

Authors	Maintenance purpose	IoT components
Cloud-enabled prognosis for manufacturing. **Gao et al. (2015)**	**MaaS**	Cloud analytics
Failure as a service (faas): A cloud service for large-scale, online failure drills. **Gunawi et al. (2011)**	**FaaS**	Cloud analytics and storage
Machine learning for predictive maintenance: A multiple classifier approach. **Susto et al. (2015)**	**FaaS**	Cloud analytics
Smart technologies with wireless sensor networks. **Dener and Bostancıo˘glu (2015)**	**PmaaS**	Cloud analytics
Timed verification of machine-to-machine communications. **Gharbi et al. (2014)**	**PmaaS**	Cloud analytics
Emerging trends, issues and challenges in Internet of Things, Big Data and cloud computing. **Kobusińska et al. (2018)**	**PmaaS**	Multi-Cloud
Deadline-constrained coevolutionary genetic algorithm for scientific workflow scheduling in cloud computing. **Liu et al. (2017)**	**PmaaS**	Multi-Cloud
Networking protocols and standards for internet of things. **Salman and Baset (2012)**	**PmaaS**	Multi-Cloud
Development of an earth observation cloud platform in support to water resources monitoring. **Bucur et al. (2018)**	**PmaaS**	Cloud analytics and storage

Business Integration/Intelligent-as-a-Service: **BiiaS**, Business framework-as-a-Service: **BfaaS**, Database-as-a-service: **DbaaS**, Failure-as-a-Service: **FaaS**, Predictive-Maintenance-as-a-Service: **PmaaS**, Software-as-a-Service: **SaaS**.

From the point of view of machine learnings (Table 3):

– transferred data in an IoT architecture are elaborated in a machine learning tool, which can be deployed in a service layer, which provides a system performance prediction.
– different kinds of machine learning (ML) tools can be used, but those which are referred as data-driven model [10] are the most promising, as they use big data originated from the specific components of complex building operations, resulting in more accurate predictions.

The success of an efficient resilience assessment for complex buildings is dependent on an architecture for information management flow, which focuses its strategy on innovative *anticipating* actions (Fig. 1 – part B). In the traditional approach, collected

Table 3. Comparison table of machine learning tools for a data-driven model.

Authors	Information sources	Goal	ML
Multiple fault separation and detection by joint subspace learning for the health assessment of wind turbine gearboxes. **Du et al. (2017)**	Expert knowledge, Sensor data	Identify fault patterns	**JSL**
A novel approach for data-driven process and condition monitoring systems on the example of mill-turn centers. **Kißkalt et al. (2017)**	Sensor data	Degradation pattern recognition	**HMM**
Prognostics and health management: A review of vibration based bearing and gear health indicators. **Wang et al. (2018)**	Sensor data	Life prediction of system	**HMM**
A data-driven method for estimating the remaining useful life of a composite drill pipe. **Lahmadi et al. (2018)**	Sensor data	RULs prediction of system	**RNN**
Intelligent health monitoring of machine bearings based on feature extraction. **Chalouli et al. (2017)**	Sensor data	Fault diagnosis	**KM**, **KM**
Equipment Sub-system Extraction and its Application in Predictive Maintenance. **Zhao et al. (2018)**	Sensor data	Fault detection	**HC**
An Industrial Case Study Using Vibration Data and Machine Learning to Predict Asset Health. **Amihai et al. (2018)**	Sensor data	Prediction of asset health	**RF**
(WIP) Correlation-Driven Service Event Routing for Predictive Industrial Maintenance. **Zhu et al. (2018)**	Sensor data	Prediction of system fault	**ECA**
Tool wear condition monitoring based on continuous wavelet transform and blind source separation. **Benkedjouh et al. (2018)**	Sensor data	Prediction of wear in milling operations	**CWT**
Data-driven prognostic method based on Bayesian approaches for direct remaining useful life prediction. **Mosallam et al. (2014)**	Nasa prognostic center dataset	RULs prediction of critical components	**KM**
Prognostics of multiple failure modes in rotating machinery using a pattern-based classifier and cumulative incidence functions. **Ragab et al. (2019)**	Sensor data	RULs prediction of critical components	**ANN**, **SVM**
Remaining useful life prediction using prognostic methodology based on logical analysis of data and Kaplan–Meier estimation. **Ragab et al. (2016)**	Sensor data	Survival analysis	**KME**

(*continued*)

Table 3. (*continued*)

Authors	Information sources	Goal	ML
Vehicle remote health monitoring and prognostic maintenance system. **Shafi et al. (2018)**	Sensor data	Fault prediction for subsystems	**DT**, **SVM**, **KNN**, **RF**
A Simple State-Based Prognostic Model for Filter Clogging. **Skaf et al. (2015)**	Sensor data	Detect filter clogging	**HMM**
Machine learning for predictive maintenance of industrial machines using IoT sensor data. **Kanawaday et Sane (2017)**	Sensor data	Prediction of failures and quality defects	**ARIMA**
Machine Learning approach for Predictive Maintenance in Industry 4.0. **Paolanti et al. (2018)**	Sensor data, Maintenance logs	Fault prediction	**RF**
Predicting tool wear with multi-sensor data using deep belief networks. **Chen et al. (2018)**	Sensor data	Prediction of wear system	**DBN**, **ANN**, **SVM**
Early fault detection of machine tools based on deep learning and dynamic identification. **Luo et al. (2019)**	Sensor data	Fault detection	**DL**
A research study on unsupervised machine learning algorithms for early fault detection in predictive maintenance. **Amruthnath et Gupta (2018)**	Historical data, Sensor data	Fault detection	**PCA**, **HC**, **KF**, **FA**
On the use of machine learning methods to predict component reliability from data-driven industrial case studies. **Alsina et al. (2018)**	Sensor data, Equations	Reliability estimation	**RF**, **LR**, **SVM**, **ANN**
Thermal power generation fault diagnosis and prediction model based on deep learning and multimedia systems. **Chen et al. (2018)**	Historical dataset	Fault diagnosis	**DL, FA**
Towards online data-driven prognostics system. **Elattar et al. (2018)**	Sensor data	Online prognostics system	**DL, KF**
Machine prognostics based on sparse representation model. **Ren et al. (2018)**	Sensor data	Estimation of machines life	**SR, HC**

Artificial neural network: **ANN**, Auto Regressive Integrated Moving Average: **ARIMA**, Blind source separation: **BSS**, Continuous wavelet transform: **CWT**, Deep Belief Network: **DBN**, Decision trees: **DT**, Deep Learning: **DL**, Event correlation algorithm: **ECA**,, Fuzzy Algorithm: **FA**, Health Indicator: **HI**, Hidden Markov Model: **HMM**, Hierarchy clustering: **HC**, Kalman filter: **KF**, K-Means: **KM**, Kaplan-Meier estimation: **KME**, Nearest neighbour: **KNN**, Joint subspace learning: **JSL**, Linear regression: **LR**, Principal Component Analysis: **PCA**, Recurrent Neural Network: **RNN**, Random forest: **RF**, Sparse representation: **SR**, Support vector Machine: **SVM**.

data are used to propose a description of the system. However, the system may be changed during the observation period, causing an outdated description, so a new data acquisition may be necessary. This requires new data collection. In the real time approach, the continuous collection of data, offered by big data, can optimize the time between asset monitoring and performance description ($x \rightarrow \tilde{y}_1$) and behavior predictions over a long period ($x \rightarrow \tilde{y}_2$) within a certain accuracy and uncertainty (Fig. 2).

By adopting such tools, complex buildings management can display proactiveness, by improving the accuracy of these predictions.

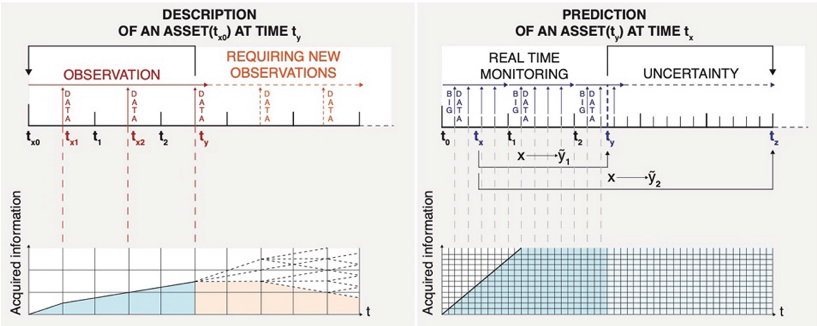

Fig. 2. Acquired information from an asset with traditional and innovative approach.

3 Proposal of a Proactive Maintenance Framework for Dynamic Information Management of Complex Building Resilience

On the basis of the above described innovative scenario, this paper presents a research aiming to develop a proactive maintenance procedure for complex building. Innovation is offered by the opportunity of taking advantage of data-driven model in the building sector, to develop a proactive approach, mainly used in the industrial sector.

Proactive maintenance in complex buildings - such as hospitals, airports, stations and office buildings – supported by IoT and machine learnings, can have an appropriate application especially in critical systems (such as Heating, ventilation, air conditioning & refrigeration – HVACR, electrical, ICT, conveying, plumbing and fire protection). In addition, the inclusion of I4.0 tools can integrate the existing supervisory systems, such as Supervisory Control and Data Acquisition, Building Management System (BMS), Enterprise Resource Planning, Computerized Maintenance Management System and Information System (SI). When big data are stored, in a physical database or in a cloud storage, they can be analyzed through a machine learning tool aiming to build a data-driven model.

Among the current data-drive models, the Recurrent Neural Network (RNN) seems to be the most promising one for its capacity to: store useful data; remember the history related to normal behavior of assets; ignore the irrelevant information.

The conditions for the use of RNN is to have a labelled benchmark dataset, in which:

- failures of assets are registered (typically performed in a SI);
- failures are abundant over a period, so that a failure pattern can be recognized;
- different variables, for normal and abnormal behavior, in the form of big data, are continuously and massively acquired in time laps of 1-15 min;
- at least a reasonable amount of data is available (typically 1 year or more of stored data to be split in 70–80% of trainset and 30–20% of testset).

RNN architecture is composed of a multi-structure of neurons which elaborate, according several loops, the acquired information (such as monitored temperature and electrical values, typically tracked by control systems). Vibration, electric and temperature sensors can be used to collect data and transfer it in a preprocessing phase.

Acquired data are then transformed - according to Root Mean Square and Kurtosis value or Fourier Transform - and stored in relational tables in the form of numeric values. The process of prediction with a RNN is composed of some steps: (i) preprocessing phase to transform input big data into output vectors to further feed RNN; (ii) a data normalization phase through a MinMax Scaling technique to have more uniformed dataset. The normalization is needed, in the learning process, especially if several series of different amplitude are recorded through sensors; (iii) train phase; (iv) test phase.

If RNN needs to be used to model for long-term dependencies, it can be structured as a Long Short-Term Memory RNN network (LSTM) in Fig. 3.

LSTM have the form of a chain of consequential modules (Unit State) of neural network, with the main difference of LSTM consisting in Units of 4 neural network layers, interacting according special gates.

In each LSTM Unit there is a horizontal information flow, like a conveyor belt where data are processed in the entire chain. Each LSTM Unit State has three gates where an input gate controls if the unit memory is updated, a forget gate monitors if the unit memory is reset to zero and an output gate verifies if the information of the current unit state is made visible. All the three gates use a sigmoid activation function to describe how much of each component should be transmitted. A value of 0 refers to not letting through any value, while a value of 1 means letting through the value, in order to make the model differentiable.

The desired output of LSTM is to know the time-to-failure of a HVAC system, according to the change of input variable over the time, according its operative performance.

The knowledge of this variable allows to further implement strategies for improving system resilience and reducing risks.

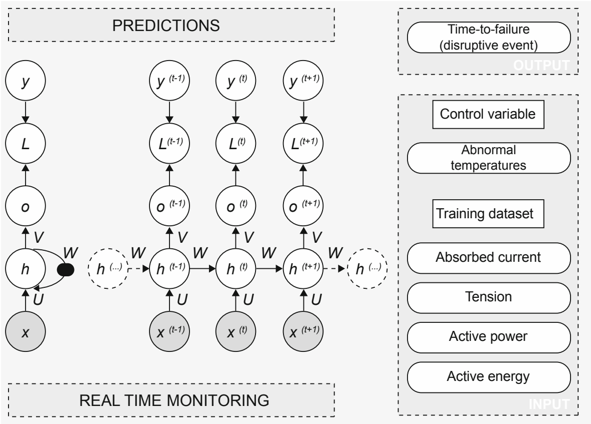

Fig. 3. Structure of a LSTM-RNN with input data coming from a typical HVAC system.

4 Conclusion

Resilience in complex buildings represents a hot topic in the correct management of the critical systems. Innovation in building resilience can nowadays be leveraged through IoT and machine learning by enabling proactive maintenance.

Proactive maintenance, seen as an innovative approach in the construction sector, can introduce in the management of complex buildings the opportunity to anticipate failures and possible consequent changes in the hazard framework or in the effectiveness of the control measures, which could jeopardize systems resilience.

Applications of proactive maintenance approach to increase building resilience can be performed in the management strategies of different complex buildings (such as hospitals, airports, stations, warehouse, etc.…) especially where equipment are intensively used in daily operations and play a key role in resilience performances.

Current IoT and machine learnings tools, which exploit data extracted directly from the systems, can help to build a proactive strategy, which pursues anticipation (knowledge, decision, actions), that can effectively improve the robustness of resilience plans empowered through enabling technologies that support resist, absorb, react and adapt actions.

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An Integrated Decision Support System to Define the Best Scenario for the Adaptive Sustainable Re-Use of Cultural Heritage in Southern Italy

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Abstract. The objective of this document is to propose an integrated evaluation model to support the choice of an alternative of an historic industrial archeology building located in Southern Italy, in order to define a strategy shared based on a "bottom-up approach". The methodological path, in consideration of the needs of the local community and of the historic and cultural values of the historic building, is able to verify the feasibility and economic sustainability of the hypothesis in relation to different management models that involve different forms of public-private partnership. The positive results obtained show that the proposed model can be a useful decision support tool in contexts characterized by high complexity, where the goal is to build shared development strategies.

Keywords: Strategic evaluation · Circular economy · Sustainable re-use of cultural heritage · Multi-Criteria decision aid · Economic evaluation · Financial sustainability

1 Introduction

In the last few decades, researches and debates at an international level have seen the attribution of an increasingly significant role to cultural heritage within the framework of development models based on local peculiarities and on the enhancement of the endogenous resources of the territories. In particular, cultural identities have taken on new values and specificities also thanks to the implications of an intangible nature - such as those related to traditions, knowledge and creativity - that have enriched the notion of heritage. It has been recognized that the process of preservation and enhancement of cultural heritage - addressed to all the other resources which characterized and represented the distinctive signs that history has sedimented in a territory - if supported by "system" strategies can play an important function both in preserving the resources that promote and support the economic development of local communities. The involvement of local communities, also implemented through the networking of the main stakeholders in the area, raises awareness of cultural heritage, understood as the ability of citizens to recognize their identity in that heritage, to recognize it as their own and, consequently, to cooperate for its conservation.

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To guarantee the collective interest in the processes of enhancing the cultural heritage, it is necessary to define sustainable strategies that must take conservation as a priority and, at the same time, be able to trigger virtuous circles of territorial and local development. These purposes can only be achieved by a public administration capable of governing the entire decision-making process that leads to a programming of the sustainable management of these assets, by equipping itself with tools to support decisions (Fusco Girard and Nijkamp 1997; Della Spina 2019a, b; Della Spina 2020; Nesticò et al. 2018).

As part of the broader theme of cultural heritage and building and urban recovery in particular, the reuse of public buildings with cultural value offers significant opportunities to start sustainable development processes. In this case, it is essential to verify the impacts that the new activities/functions established can produce and the positive effects in terms of widespread recovery processes.

In accordance with the principle of sustainable protection of public real estate, the preventive evaluation of re-use choices has the aim of ensuring the safeguarding of cultural values in the actions to enhance existing building resources. In particular, the new functions must be able not only to protect the identity of the asset, guarantee significant growth in economic and social values, but also be feasible and sustainable in the long term from an economic point of view (Fusco Girard and Nijkamp 1997; Calabrò and Della Spina 2019; Dolores et al. 2020). In this regard, the expectations of the community are decisive in the definition of the re-use strategies and can contribute to the improvement of the quality of life, increasing functional endowments, infrastructures and services, with positive implications on the socio-economic context. On the contrary, public policies and reuse choices are often implemented in the absence of large-scale strategies, capable of achieving integration between the physical, economic and social values expressed by the artifacts to be recovered and the contexts in which they are inserted.

In this document, a multi-group and multi-criteria decision support method (Ishizaka and Nemery 2013) has been applied to support the decision-making process related to the strategies of re-use of disused and abandoned cultural heritage, in a perspective of circular economy (Fusco Girard and Gravagnuolo 2017; Della Spina et al. 2019).

The methodological path incorporates the needs of the local community but does not neglect the historic and cultural values of the heritage, as well as the economic and financial ones.

The methodology follows the general approach to decision (Simon 1972), adapted to the case study analyzed to support the public administration - the owner of the area - to choose the best alternative re-use functions from a sustainable perspective and to build shared development strategies (Della Spina and Calabrò 2018; Nestico and Maselli 2020).

In this context, the document proposes an integrated evaluation model, which combines multi-criteria methodologies and economic-financial analysis, in order to classify the alternatives and define the most suitable scenario according to the expectations of the interested parties (Della Spina 2019; Pinto et al. 2017).

Finally, in order to evaluate the hypothesis of alternative reuse of the public asset under study, was verified the level of profitability and economic sustainability in the management phase, in relation to the choice of a management model in public-private partnership.

The paper is organized as follows. In Sect. 2, the case study is illustrated. Section 3 describes the methodology adopted. In Sect. 4, discussion of results and future research is presented.

2 Case Study

The case study in question concerns the reuse of the Gasometer, a plant that represents a rare Italian example of industrial archeology, of historic value, whose original structure dates back to 1878. The industrial building is located in the historic center of the municipality of Catanzaro, a city located in the south of Italy. The city which is the regional capital is an important administrative, commercial and cultural center, with considerable administrative functions at a regional level. The development strategy of the municipal administration is mainly oriented towards the redevelopment and regeneration of degraded urban spaces in the historic city center.

The Gasometer is located inside the “Valletta Park” a “central” area, it represents a possibility of valorisation and requalification of an abandoned and disqualified marginal area adjacent to the surface metro station of Catanzaro Sala. Today only the iron frame of the old Gasometer, the factory, the warehouses and the building remain of the original structure. The architectural style is the classic one of the French, English and Belgian industries. The exposed masonry is obtained with living stone from the Catanzaro area, the local building material, and constitutes its most valuable element.

3 Methodology

3.1 The Integrated Decision Support System

The methodological approach used for the case study is based on deliberative evaluation methods and Multi-Stakeholder Decision Analysis (M-SDA) capable of creating an interaction between the different actors involved towards a shared vision, taking into account the strategic role that cultural heritage can play in a circular economy perspective (Fusco Girard and Gravagnuolo 2017; Della Spina 2019; Geissdoerfer 2017).

The proposed methodology aims to include multiple dimensions in the evaluation process to support the identification of re-use and sustainable development strategies, including knowledge of experts and the community. The choice of a participatory methodology is aimed at supporting the co-learning and co-planning process towards a proposal for a new shared action plan for the historic center of Catanzaro.

The result is a hybrid methodological approach for the design of complex urban regeneration processes, capable of assessing which new uses/functions and scenarios could be more suitable for implementing a circular development model (Kirchherr et al. 2017; Mao et al. 2018; Potting et al. 2017). The approach combines, in the various stages of the decision-making process, multi-criteria methodologies and a feasibility/sustainability analysis of the intervention, in order to develop a tool to improve the quality and reliability of the internal decision-making process which also concerns the management phase of the historic asset.

Based on a survey of the existing literature, the methodology follows a workflow (Fig. 1) in which the first step concerned the involvement of the interested parties, in which participation techniques were used, capable of creating an interactive relationship between "expert knowledge" and "common knowledge" (Yang 2014; Bourne 2005; Dente et al. 2014). This was useful to understand the role played by the parties involved and their power to influence decision makers in identifying potential actions capable of triggering the multidimensional productivity processes of the city.

In this first phase of the decision-making process, the Decision Maker (DM) identifies the problems, opportunities and objectives related to the project of re-use of the cultural heritage in disuse and to be redeveloped. To achieve this, a list of criteria has been identified. The list of criteria was structured on the basis of when it emerged also in a focus group with the public administration and technicians (Dyson et al. 2015).

The next step is to define five alternatives/scenarios, defined during a focus group organized by the public administration with experts (architect, economist and sociologists) and political representatives. The idea is to evaluate which are the best performing scenarios/alternatives for most stakeholders (Della Spina 2019).

A multi-criteria and multi-group evaluation was developed through the application of the Novel Approach to Imprecise Assessment and Decision Environments (NAIADE) and Analytic Network Process (ANP) (Saaty 1996; 2005; 2006) to evaluate the alternative urban regeneration scenarios that are emerged as significant, incorporating internal and external dependencies between the sets of criteria identified (Munda 2004; Gamboa and Munda 2007) and the interrelationships between the various dimensions: economic, social, environmental and cultural, into the evaluation process. The choice of criteria (cluster) derives directly from the alternatives (Munda 2004) and represents the technical translation of the objectives and needs of the actors, resulting from the institutional analysis and elaborated by the research group.

The final result of the multi-criterion assessment is the identification of the perceived preferable scenario and a preference ranking among the alternatives/scenarios of the participatory process.

The objective of the chosen reuse project is to restore the former Gasometer's use value to make it a "creativity hub", an integrated place of production, consumption and cultural innovation, in which to experience the promotion of culture, the aggregation of young people and creativity as useful elements to amplify and improve the effects of innovation organizational (Della Spina et al. 2016). The reuse project, closely linked to the various interventions envisaged within the municipal structural plan, aims to optimize artistic production, improve the usability of cultural heritage and aims to create an integrated and innovative management system between cultural actors, as an element able to multiply, qualify and diversify the cultural offer and improve its use (Della Spina et al. 2019; Della Spina 2019; Della Spina 2020).

Finally, on the scenario perceived as preferable, the profitability and sustainability of the re-use project in the management phase is verified.

In this document, the application to the case study will focus in particular on this last phase, postponing the study of the methodology used for selecting the best performing scenario to studies and publications edited by the authors themselves (Della Spina et al. 2019; Della Spina 2019; Della Spina 2020; Della Spina et al. 2016; Della Spina and Calabrò 2018; Calabrò and Della Spina 2015).

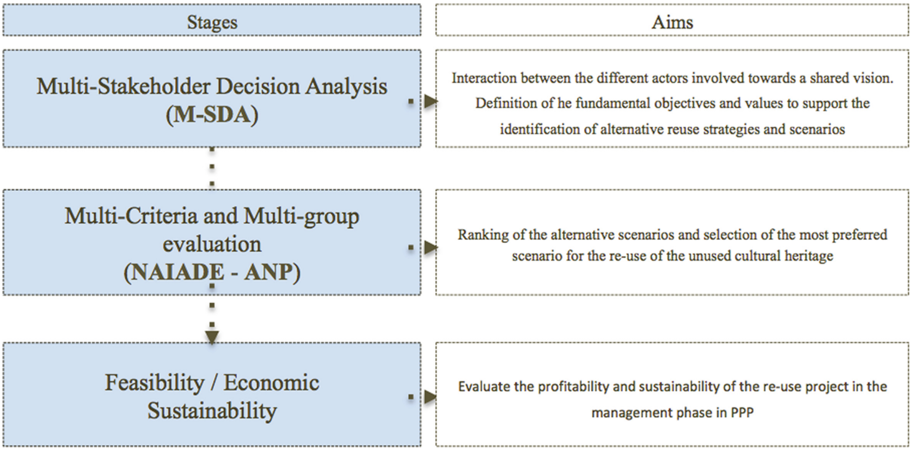


Fig. 1. Multi-methodological evaluation process

3.2 Choice of the Management Model: Feasibility/Economic Sustainability

Today, more than in the past, the scarce availability of public money pushes technicians and public administrators to evaluate possible investments in a preventive way (Roscelli 2014; Forte and De Rossi 1992; Prizzon 1995; Realfonzo 1994).

Unfortunately, is frequent the construction of works not strictly necessary, which offer services on an occasional and non-continuous basis and which weigh on public budgets in terms of management costs (Calabrò and Della Spina 2018; Calabrò 2019).

Evaluating investments at this moment means verifying on the one hand verifying the convenience for the community and on the other also the convenience of private subjects, with a view to identifying for which works and to what extent the involvement of private capital in the realization can be foreseen and management of the intervention (Della Spina and Calabrò 2018; Calabrò et al. 2018).

The theme of the Public-Private Partnership (PPP) therefore becomes closely connected to economic-social and economic-financial convenience, because only in conditions of "balance" can a collaboration be established between two subjects that have different purposes (social utility and financial profit).

In assessing the opportunity of a given public investment, one of the fundamental moments is represented by the analysis of alternatives, with the consequent choice of the best solution.

In the case study in question, on the best re-use scenario, selected through the multi-methodological evaluation process, briefly described in the previous section (Della Spina et al. 2019), was verified the feasibility and economic sustainability

(Dolores et al. 2020) of the intervention in the management phase to regime, in order to verify the management balance and the ability to ensure economic sustainability over a period of time equal to the life cycle of the project (Calabrò 2019; Calabrò and Della Spina, 2018; Calabrò et al. 2018).

The choice of the management model is the preliminary phase to the definition of the total investment costs and management revenues generated by the project (Roscelli 2014; Forte and De Rossi 1992; Prizzon 1995; Realfonzo 1994; Della Spina and Calabrò 2015; Calabrò and Della Spina 2018).

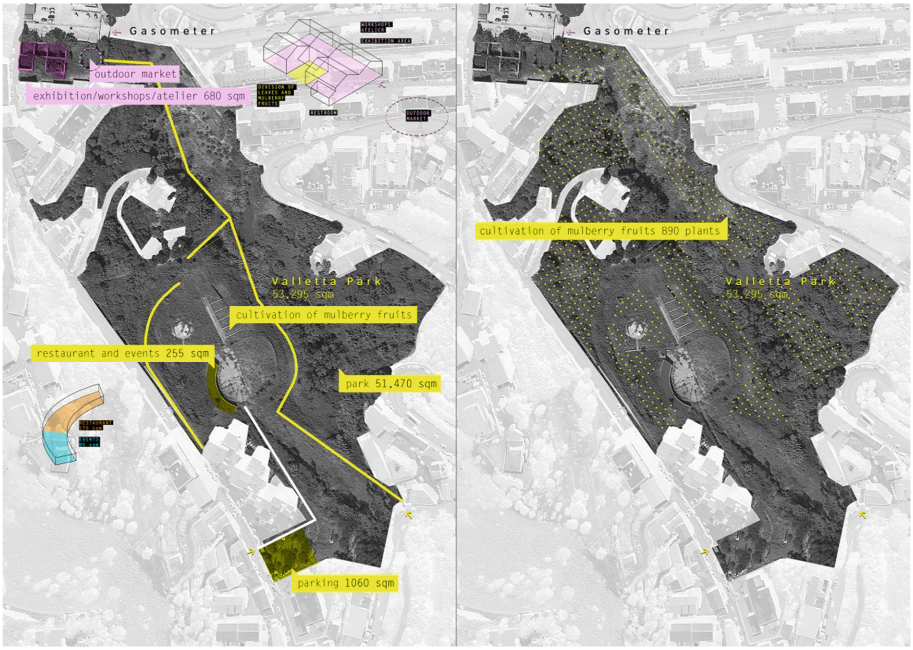


Fig. 2. Re-use project

Once the reuse project has been defined (see Fig. 2), it is possible to evaluate:

- Investment costs (Investments for the recovery and reuse of buildings, Investments for the usability of real estate, Investments for communication and marketing) (see Appendix A).
- Management costs (Identification of the management model and of the manager; evaluation of the human resources plan, evaluation of the management costs, consumables, services, human resources, etc.) (see Appendix B).
- Estimated Revenue (Identification of the products to be produced or services to be supplied; Estimate of their unit sales price; Identification of the reference target; Estimate of the demand to be satisfied based on the reference objective; Evaluation of revenues) (see Appendix C).

– Feasibility and economic sustainability of the project in the management phase to regime. (see Appendix D).

The costs and revenues for each function were assessed through a market analysis and by referring to the official list prices. The evaluation used a direct approach, through comparison with historical data, when available, and an indirect approach, when it was not possible to find historical data (Roscelli 2014; Forte and De Rossi 1992; Prizzon 1995; Realfonzo 1994; Della Spina and Calabrò 2015).

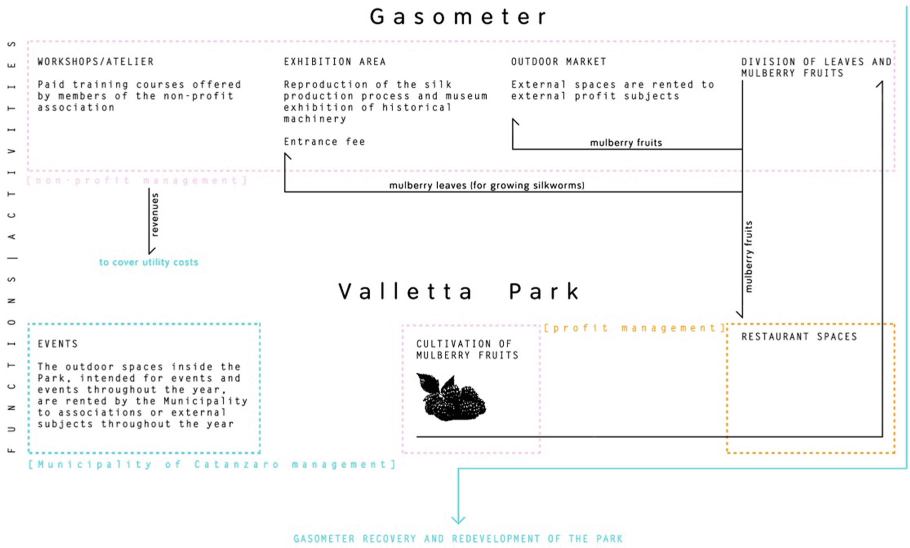


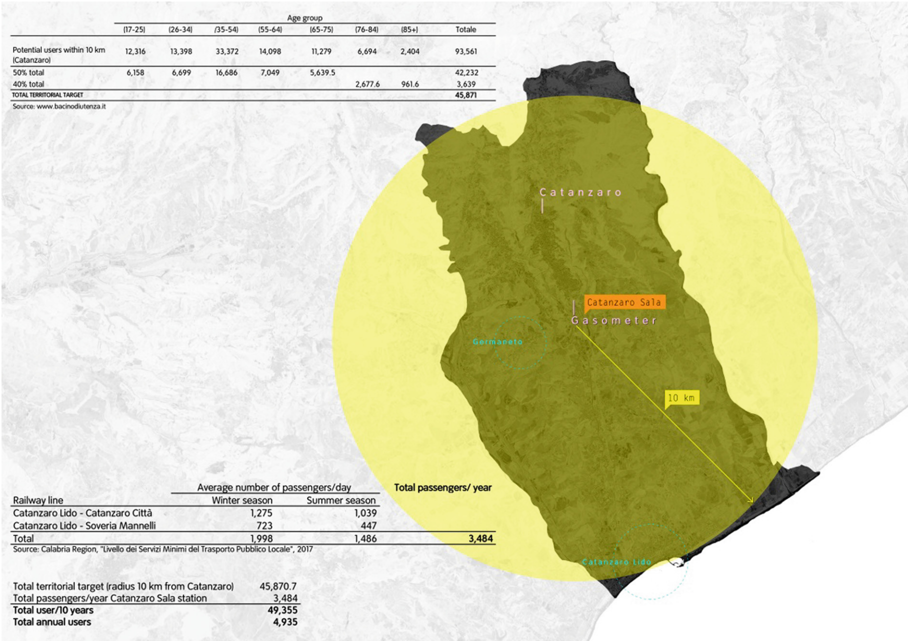
Fig. 3. The management model

In the hypothesized management model (Fig. 3), the Municipality of Catanzaro will bear the costs of the investment for the recovery of the Ex Gasometer and for the redevelopment of the related area of the Valletta Park (Appendix A).

The estimate of operating revenues is a crucial point of the analysis, whether it is a public work or whether it is carried out and/or managed by private entities (Appendix C).

Operationally, it is necessary to calculate the catchment area and make a balance between potential demand and existing supply, to check if there is an unfulfilled demand share that "reasons" in some way the realization of the work. The difference between potential demand and satisfied demand determines the possible residual demand, which can highlight a space in the market or, on the contrary, an already saturated situation. This is obviously a simplification, since if the service offered is better you can think that it will subtract from the competition. Conversely, even in the presence of a residual demand share, in the face of a service of lower quality than what already exists, it may not be able to capture a sufficient number of users for optimal operation (Roscelli 2014; Calabrò and Della Spina 2018).

The new uses/functions envisaged for the Gasometer area have as reference the target the population of the municipality of Catanzaro. It was considered a territorial water catchment area within a radius of 10 km and the potential flows of travelers of the Catanzaro Sala railway station, which will be reactivated in the short term (Fig. 4).



	Age group							
	(17-25)	(26-34)	/35-54)	(55-64)	(65-75)	(76-84)	(85+)	Totale
Potential users within 10 km (Catanzaro)	12,316	13,398	33,372	14,098	11,279	6,694	2,404	93,561
50% total	6,158	6,699	16,686	7,049	5,639.5			42,232
40% total						2,677.6	961.6	3,639
TOTAL TERRITORIAL TARGET								45,871

Source: www.bacinodiutenza.it

	Average number of passengers/day		Total passengers/ year
Railway line	Winter season	Summer season	
Catanzaro Lido - Catanzaro Città	1,275	1,039	
Catanzaro Lido - Soveria Mannelli	723	447	
Total	1,998	1,486	3,484

Source: Calabria Region, "Livello dei Servizi Minimi del Trasporto Pubblico Locale", 2017

Total territorial target (radius 10 km from Catanzaro)	45,870.7
Total passengers/year Catanzaro Sala station	3,484
Total user/10 years	**49,355**
Total annual users	**4,935**

Fig. 4. Analysis of the user base

In the hypothesized management model, the Municipality will entrust the management of the activities envisaged within the Gasometer and of the care of the park's greenery to non-profit associations.

In addition, the outdoor spaces will be rented for events and shows throughout the year. The revenues from the activities to be placed within the Gasometer (laboratories/ateliers/market) will cover the costs for utilities and human resources for the staff involved in the care of the mulberry trees and park greenery (Appendix B and C).

The semi-circular building located in the lower part of the park will instead be leased by the Municipality of Catanzaro to a private external profit subject (Figs. 2, 3 and 5).

Non-profit association	**1. Gasometer**		
	Revenues		105,800.00 €
	Management costs		105,213.58 €
		Net balance	**586.43 €**
Municipality of Catanzaro	**2. Valletta Park**		
	Incomes		39,000.00 €
	Management costs		0.00 €
		Net balance	**39,000.00 €**
Private for profit	**2.1 Restaurant spaces**		
	Revenues		196,560.00 €
	Management costs		151,490.00 €
		Net balance	**45,070.00 €**

Fig. 5. Sustainability of the intervention in the management phase to regime

The area of the Gasometer and the Valletta Park, thanks to an initial public investment, would be entrusted to two different managing bodies (Fig. 5), the spaces of the Gasometer and the care of the park to a non-profit association, while part of the semi building -circulate to the bottom of the valley to a profit external subject Appendix B).

In the management hypothesis taken into consideration, the non-profit association, thanks to the revenues from the proposed training courses, the exhibitions set up inside the Gasometer, the sale of mulberries and the rent of the area in front of the area market, would be able to fully cover the management costs borne by it and to have a profit that could be used by the same association to organize events or contact external people to hold lessons inside the fashion workshops (Appendix C).

The private profit, by renting the spaces of the Municipality within the park, would be able to support its restaurant business (Appendix C).

4 Discussion and Future Research

This document presents an integrated methodological approach for the choice of sustainable alternative functions for adaptive re-use in a circular economic perspective of the ex Gasometer, a historic industrial archeology building located in Southern Italy (Della Spina et al. 2019; Della Spina and Calabrò 2018).

The proposed methodology integrates different evaluation methods to support the whole decision-making process, characterized by numerous elements of complexity, from the problem definition phase to the assessment of the feasibility and economic-financial sustainability of the chosen re-use scenario, taking into account the opinions of the different experts involved in the problem (Simon 1972).

The evaluation process to support the identification of re-use and sustainable development strategies for disused cultural heritage aims to include multiple dimensions, including expert and community knowledge, in order to define a “solution of greater compromise”, feasible as well as sustainable in the long term from an economic point of view.

The results obtained show that the re-use scenario, chosen through a multi-group and multi-criteria decision-making process, and the chosen PPP management model is feasible and economically sustainable.

Many experiments show that the public administration, which is characterized by the availability of an invaluable cultural heritage, does not have the sufficient economic and managerial capacity necessary to keep this heritage efficient over time and, therefore, sees the private interlocutor (profit or non profit) the key actor with whom to collaborate and cooperate for enhancement projects, aimed at promoting and supporting entrepreneurship and employment, in particular youth, by supporting innovative forms of business capable to raise the quality of the cultural offer, both local and national. (Calabrò and Della Spina 2018; Calabrò et al. 2018; Della Spina and Calabrò 2018; Calabrò and Della Spina 2019).

The results obtained from the decision support process show that the re-use scenario, identified through a multi-group and multi-criteria decision process, and in particular the chosen PPP management model, is feasible as well as sustainable in the long term by a from an economic point of view, as operating revenues allow full coverage of operating costs, including ordinary and extraordinary maintenance, without additional charges and costs for the public sector (Della Spina and Calabrò 2015; Della Spina and Calabrò 2018; Calabrò and Della Spina 2019).

The overall consistency of the results obtained also highlights that the involvement of non-profit associations in the management model of the public good is relevant not only for the economic sustainability of the project, but also for the emancipation of the local communities and the re-appropriation of their identity, indispensable for triggering virtuous processes of local development (Della Spina 2020).

Today, the new challenge for local authorities is to regenerate abandoned and disused heritage buildings, in a process that must necessarily involve the various stakeholders and the local community in order to create new governance models that are capable of to guarantee economic sustainability and the conservation of historic heritage and cultural values, as in the case of the former Gasometer, which has always been a symbol for the local community (Della Spina et al. 2019).

From this perspective, the study could have interesting political implications in the challenge faced by decision-makers in rethinking the planning and design of a general plan aimed at relaunching and enhancing the immense historic heritage with a view to circular economy, economic development of the territory, which identifies the keys to a culture-led regeneration process in adaptive reuse and cultural and creative (Della Spina et al. 2019; Della Spina 2020; Vickery 2007).

Author Contributions. The contribution is the result of the joint effort of the authors. Despite the global responsibility for the work being equally shared between the three authors, Lucia Della Spina is responsible for Sects. 3 and 4, while Claudia Giorno e Ruggiero Galati Casmiro are responsible for Sects. 2 and Appendix. The abstract and introduction are the result of the joint work of the three authors.

Appendix A - ESTIMATED INVESTMENT COSTS

PART I - INVESTMENT FOR THE RECOVERY AND RE-USE OF REAL ESTATE			
	Unit (sqm)	Construction Cost (euro/sqm)	Total (euro)
A - Estimated construction cost			
A.1. Gasometer			
Property recovery	965	680.00	656.200,00
A.2. Valletta Park			
External arrangement and planting of mulberries	51,470	6.00	308,820.00
Parking	1,060	38.00	40,280.00
Driveway	610	53.00	32,330.00
Amount of completion and redevelopment of “Valletta Park” project (2002–2010)			2,424,240.00
Photovoltaic system	255	2,000.00	5,000.00
A - Total costs for auction based works			3,466,870.00
of which: costs for the implementation of safety plans (not subject to auction reduction)			69,337.40
B - Estimate of the sums available to the promoter			
B.1 Economic jobs planned and excluded from the contract			0.00
B.2. Topographical survey, findings and geological surveys			0.00
B.3 Allacciamenti ai pubblici servizi (VAT included))			0.00
B.4 Unexpected costs			104,006.10
B.5 Acquisition of areas or assets			0.00
B.6 Provision for the adjustment of the prices (referred to art. 133, c. 3 del D. Lgs. 163/2006)			0.00
B.7 Incentive expenses (referred to art. 92, c. 5 del D.Lgs. 163/2006)			34,668.70
B.8 Technical expenses (planning, works management, daily assistance and works accounting)			208,012.20
B.9 Technical expenses (planning, works management, daily assistance and works accounting)			34,668.70
B.10 Expenses for consultancy and support activities			0.00
B.11 Possible expenses for selection boards			0.00
B.12 Expenses for advertising and, where applicable, for artistic works			0.00
B.13 Expenses for laboratory tests, technical checks and work tests			34,668.70
B.a - Total sums available to the Promoter excluding VAT			416,024.40
B 14. VAT (if not recoverable) and any other taxes			41,602.44
B.b - Total sums available to the Promoter including VAT			**457.626,84**

SUMMARY I - INVESTMENT FOR THE RECOVERY AND RE-USE OF BUILDINGS (PRODUCTION COST)	
A) Total costs auction based works	**3,466,870.00**
B) Sums available to the Promoter	**457,626.84**
I – Total investment for the recovery and re-use of real estate	**3,924,496.84**

PART II – INVESTMENT FOR REAL ESTATE USABILITY			
	Unit (n.)	Construction Cost (euro)	Total Cost (euro)
C.1 - Estimated cost of furniture			
Equipment for silkworm display area (cost per body)	1	–	200,000.00
Tables	20	120.00	2,400.00
Chairs	300	30.00	9,000.00
Cutlery and crockery	70	15.00	1,050.00
Linen	17	30.00	510.00
Workbench	1	4,800.00	4,800.00
Cut counter	1	5,000.00	5,000.00
Hob	1	1,200.00	1,200.00
Washbasin	1	1,300.00	1,300.00
Oven	1	5,700.00	5,700.00
Fridge	1	700.00	700.00
Dishwasher	1	640.00	640.00
Pots	1	580.00	580.00
Fryer	1	640.00	640.00
Kitchen Robot	1	410.00	410.00
Lighting System		3,000.00	3,000.00
C.1 - Costs Furniture excluding VAT			236,930.00
C.2 - Estimated cost of hardware and software equipment			
Computer	1	480.00	480.00
Printer	1	320.00	320.00
Sound system	8	200.00	1,600.00
Cash register	1	760.00	760.00
C.2 - Costs equipment excluding VAT			3,160.00
SUMMARY II – INVESTMENT FOR REAL ESTATE USABILITY			
C.1 - Costs furniture			236,930.00
C.2 - Costs equipment			3,160.00
II.a - Investment for real estate usability excluding VAT			240,090.00
VAT (if not recoverable)			52,819.80
II.b - Investment for real estate usability including VAT			**292,909.80**

PART III – INVESTMENT FOR COMMUNICATION AND MARKETING

Advertising communication	1	800,00	800.00
Website	1	12,00	12.00
Web designer	1	900,00	900.00
Flyers	500	0,05	25.00
Advertising posters	200	0,90	180.00
III.a - Investment total for communication and marketing excluding VAT			1.917.00
VAT (if not recoverable)			421.74421.74
III.b - Investment total for communication and marketing including VAT			**2,338.74**

SUMMARY INVESTMENT

I - Investment for the recovery and re-use of buildings	3,924,496.84
II - Investment for real estate usability	292,909.80
III - Investment for communication and marketing	2,338.74
TOTAL INVESTMENT	**4,219,745.38**

Appendix B - ESTIMATED MANAGEMENT COSTS

	Cost item		Annual cost
Non-Profit management	**Gasometer**		
	Ordinary maintenance (b)		€ 8,562.00
	Extraordinary maintenance (c)		€ 10,702.50
	Staff (human resources)		€ 18,200.00
	Consumables (a)		€ 1,060.00
		Total Gasometer	€ 38,524.50
	Valletta Park		
	Ordinary maintenance (b)		€ 28,750.70
	Extraordinary maintenance (c)		€ 35,938.38
	Costs for utilities (water)		€ 2,000.00
		Total Valletta Park	€ 66,689.08
		Total Non-Profit management costs	**€ 105,213.58**
Private Profit management	**Restaurant area**		
	Staff (human resources)		€ 70,800.00
	Raw materials, wines, drinks (Restaurant area) (a)		€ 53,000.00
	Consumables (a)		€ 1,590.00
	Industrial laundry (d)		€ 2,100.00
	Local rental		€ 24,000.00
		Total Profit management costs	**€ 151,490.00**

Sources: (a) University of Milan, "Feasibility study for the opening of a farmhouse in Franciacorta", 2015; (b) the value was calculated as 1% of the investment costs; (c) the value was calculated as 1,25% of the investment costs; (d) 17 tablecloths for 70 covers (1 tablecloth / 4 people) are considered for a cost of euro 0.50 / tablecloth.

Appendix C - ESTIMATED MANAGEMENT REVENUES

		Quantità		Prezzo unitario	Ricavo annuo
Non-Profit management	**Gasometer**				
	Entrance to the exhibition area	4,900	visitors/year	€ 2.00	€ 9,800.00
	Registration fee for training courses	50	members/year	€ 70.00	€ 3,500.00
	Sale of white mulberries (b)	8,900	kg/year (10 kg/tree)	€ 5.00	€ 44,500.00
	Market place rental (a)	5	stalls (5 days/week)	€ 800.00	€ 48,000.00
	Total Gasometer revenues				**€ 105,800.00**
Municipality of Catanzaro	**Valletta Park**				
	Rent event area	30	events/year	€ 500.00	€ 15,000.00
	Rent restaurant area	1	local	€ 2,000.00	€ 24,000.00
	Total Valletta Park revenues				**€ 39,000.00**
Private Profit management	**Restaurant area**				
	Revenue restaurant	13,104	56 meals a day / 234 days a year	€ 15.00	**€ 196,560.00**

Appendix D - FEASIBILITY AND ECONOMIC SUSTAINABILITY IN THE MANAGEMENT PHASE TO REGIME

Non-Profit management	**Gasometer**		
	Revenues		105,800.00 €
	Costs		105,213.58 €
		Net balance	**586.43 €**
Municipality of Catanzaro	**Valletta Park**		
	Income from rent		39,000.00 €
	Costs		0.00 €
		Net balance	**39,000.00 €**
Private Profit management	**Restaurant area**		
	Revenues		196,560.00 €
	Costs		151,490.00 €
		Net balance	**45,070.00 €**

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Middle Lands in Friuli Venezia Giulia. Research by Design and Towards Action

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Abstract. In the Italian Region Friuli Venezia Giulia, 71% of the Municipalities count less than 5,000 inhabitants, with a stop in population growth and an increase of aging trends. In the frame of the cohesion policies (*National Strategy for Inner Areas* – SNAI), three Project Areas were identified in the mountain sector. However, the presence of *middle lands* is even more pervasive. This term stands for marginalised contexts, outside those identified by the SNAI; they are dotted by natural and rural landscapes, small urban centres, and the peripheries of medium cities. Here the number of inhabitants and the functioning of services still hold on, economic crisis and abandonment have not reached their climax. Nonetheless, the risk to slip into more serious conditions of fragility is strong.

Since some years, at the University of Trieste, these areas have been the object of Urban Planning Courses. The methodology is that of research by design to support local planning and regional policies. Starting from the characters of marginalised contexts in Friuli Venezia Giulia, this paper presents the outputs of the activities developed in the middle lands along the river Cormor. Through the interaction with the Municipalities involved in the construction of a River Contract, the request to draw the extension of a horse/cycle path offered the opportunity to reflect on how to reconceive economies and services related to slow tourism within a larger planning perspective. Project investigations interpreted Cormor as the spine of a network of ecological services, and new functions were defined for existing collective facilities. The research is in progress, and more contexts will be studied within Friuli Venezia Giulia SNAI's areas. In view of the next season of EU cohesion policies, the closing paragraph questions the definition of place-based development strategies for marginalised territories, and the need to go beyond spatial perimeters centred on abstract statistical indicators and accessibility parameters.

Keywords: Friuli Venezia Giulia · Middle lands · Local development

1 Introduction

1.1 A Growing National Debate

In Italy, over the last years, there has been a rekindling of debate on territorial representations as a support to economic programs and cohesion policies [1, 2]. The start in 2014 of the *National Strategy for Inner Areas* (SNAI) was a turning point [3]. The classification of the Italian territory on the basis of the different degrees of accessibility

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to urban poles and services directed funding on some target areas in the most serious conditions of depopulation, economic crisis, hydrogeological and seismic risks[1]. This has opened up the possibility to start a new phase of development policies, and today SNAI's results offer inputs to further thought and action.

In the view of the next 2021–2027 EU programs, planning reflection is focusing on the variety of peripheral situations that characterise large parts of Italian urbanised contexts: in addition to the fragile and abandoned territories that are already included in the SNAI, the reflection also concentrates on the outskirts of large and medium urban centres, as well as on the variety of in-between landscapes made of disconnected aggregates of rural areas and small towns[2]. What emerges is a geography of different *marginalised areas*, punctuating the north and south of the Country, the mountains and the plains; they share problems of economic and/or demographic shrinkage, and the need to deeply reorganise the offer of basic equipment for social and health care, education and mobility.

However critical this representation of Italy may be, it also suggests a radical shift in development perspectives for both marginalised contexts and the whole Country. Extending and refining SNAI's approach, while putting aside policies based on a mere defence and homologation of 'slower' contexts to the (few) competitive urban areas, can be a way to give a voice and a future to many peripheral situations. The reference is to *place-based projects*, built together with local populations, and aimed at reactivating existing (and often hidden) resources and social-economic initiatives. However, *localism is not enough*. A new course of public-directed policies, addressing public and private investment, and referring to an *urban strategy built on national and regional scales*, is strongly needed [5–7].

1.2 Marginalised Areas in Friuli Venezia Giulia

Within a reflection on marginalised areas, the case of the Italian region Friuli Venezia Giulia is significant. Here 71% of the Municipalities count less than 5,000 inhabitants, with an overall standstill of population and a growth of aging trends; there is only one medium-sized city (Trieste, 204,338 inhabitants), and three small capital cities (Gorizia, 34,411; Pordenone 51,139; Udine, 99,518 inhabitants) [8]. Three SNAI's Project Areas have been recognised in the mountain sector: Dolomiti Friulane, Alta Carnia, Val Canale – Canal del Ferro (43 Municipalities and about 58,000 inhabitants in total, nearly 4.8% of the overall regional population) [9][3].

[1] On the basis of the travel time by car to the nearest urban/intermunicipal pole of services, SNAI classifies as "inner areas": "intermediate" (20–40 min), "peripheral" (40–75 min), "ultra-peripheral" (over 75 min) territories. They cover 51.7% of Italian Municipalities, 22.4% of national population and nearly 60% of the Country surface. By 2018, 72 target areas were selected; they cover 1,071 Municipalities (26% of territories classified as inner areas) [4].

[2] The building of atlases and debate on marginalised areas are currently at the core of research, seminars and conferences developed by the Italian Society of Planners (SIU; a technical group was established in 2019), the Italian Institute of Planning (INU), the National Research Council of Italy (CNR-IRISS), and many Italian Universities (among the others, Politecnico of Milano, Politecnico of Torino, IUAV of Venezia, Università Federico II of Napoli, Università di Camerino).

[3] By 2020, only one of the Strategies for the SNAI's areas (Alta Carnia) was approved by the National Committee for Inner Areas, shile the other two are still under signature by the Ministries.

If the coverage of SNAI's areas is quite relevant, the presence of *middle lands* is no less extensive. This term refers to contexts that, while pervasive, do not fall within the parameters and perimeters established for the SNAI's most marginal territories. In the middle lands, the number of inhabitants and the distribution of services still hold on (albeit with difficulty), the situations of economic crisis and abandonment are still limited, ecological, landscape and historical assets are often consistent, and entrepreneurial culture has not yet disappeared. Nonetheless, the increase of environmental and social and economic challenges, and the difficulties of small Municipalities to coordinate action and resources, put these contexts at the risk of slipping into more serious conditions of marginality. Today, the middle lands and the inner areas of Friuli Venezia Giulia jointly suffer from the lack of a regional vision, helping reactivate their development potentials. It is therefore no coincidence that in the SNAI's areas the expenditure of the available European, national and regional funds shows significant delays, nor that the access to specific funding remains highly uncertain for the middle lands of this region.

Since some years, at the University of Trieste, the strategic role that marginalised areas can play in spatial plans – both at the regional and the intermunicipal levels – has been the object of project investigations. The methodology is that of *research by design* to support policy and action. In the frame of the teaching activities of the Master Course in Architecture, regional contexts are chosen on the basis of the opportunity to work with local actors, in order to help them build development scenarios which are strongly embedded in local resources. This paper presents the outputs of the first investigations carried out in the middle lands along the river Cormor. The second paragraph describes the main features of the study area and the invitation to reflect on new interpretative approaches offered by the interaction with the Municipalities involved in the construction of a River Contract. The third section explains how the local stakeholders' request to draw the extension of a horse/cycle path was specifically translated into an opportunity to reframe economies and services related to slow tourism within a larger planning perspective. In this perspective, the Cormor was read as the spine of a network of ecological services, and new functions were defined for existing collective equipment. The research is in progress, and more contexts will be studied within Friuli Venezia Giulia SNAI's areas. In view of the next season of EU cohesion policies, the closing paragraph questions the definition of place-based development strategies for marginalised territories, and the need to go beyond spatial perimeters centred on abstract statistical indicators and accessibility parameters.

2 The Middle Lands Along the River Cormor

Working on the middle lands along the river Cormor provided insights into territorial conditions that recur in Friuli Venezia Giulia [10][4]. In this region, many urban centres stand nearby the system of rivers stretching from the mountains to the sea. The focus of

[4] The reference is to the Urban Planning and Design Studio (academic year 2018–2019), at the fourth year of Architecture, coordinated by Elena Marchigiani, with Paola Cigalotto and Andrea Peraz.

the University activities was on the sequence of urbanised spaces, including the small centres along the river Cormor, and the western peripheries of the middle-sized city of Udine[5]. These areas were selected in order to cover a significant sample of intertwined river and urban landscapes: from the northern foothill sector, where the Cormor runs in the middle of the reliefs topped by ancient villages; to the 'dry plain', where Udine conurbation lay, and the minor water network is mainly underground; to the southern 'wet plain', where the water comes again to the surface, and the urbanization becomes more scattered (Fig. 1).

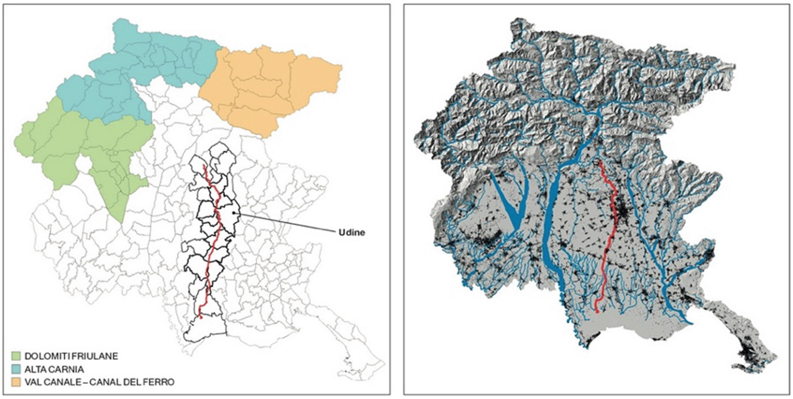

Fig. 1. Friuli Venezia Giulia. On the left, the SNAI's Project Areas and the Cormor middle lands; on the right, the settlements framework, the main watercourses, and the orography. In red, the river Cormor (SOURCE: L. Di Giusto)

2.1 Edge Territories Back at the Centre

Despite the presence of areas of environmental interest, over time, the weakening of relationship between the river landscapes and the neighbouring urban centres has contributed to relegate Cormor to a marginal position within the overall functioning and use of these middle lands. At a first glance, no exceptional landscapes, nor outstanding tourist and cultural attractors can be recognised. The minimal and ordinary elements of spatial identity and rural production suffer from the crisis of the social and economic conditions that, in the past, ensured their construction and management. Standing on the edge of the city and the countryside, of the water and the land, these counter-spaces of the contemporary urbanisation risk being reductively interpreted as *places that don't matter*, where abandonment and degradation are unavoidable [11].

However, these interpretative drifts can be eluded by taking a different approach. The first move is to *re-centralise the margin* [6]. By making our glance more attentive, we have to search for the local conditions where to graft trajectories of internal

[5] The investigation covered 11 Municipalities in the former province of Udine (from Tricesimo at the north, to Castions di Strada at the south), counting about 171,000 inhabitants.

metamorphosis. In this perspective, the relationship with the river can once again become an opportunity to answer the contemporary demands for a better *quality of life*, and for a 'slower', more sustainable and endogenous social and economic growth [12, 13].

2.2 The River Contract as an Opportunity

The opportunity to test this approach on the Cormor middle lands was given by the collaboration with local stakeholders[6]. Since the early 2000s, a number of Municipalities along the river have started to jointly reflect on the sustainable management of water resources and the settlement of new economic activities. Thanks to European cooperation funds, they succeeded in equipping the northern part of a horse and cycle track (*Ippovia del Cormor*). With the Valle del Cormor citizens' Association, the Municipalities are now engaged in the definition of a *River Contract*: a largescale and long-term strategic and planning tool, where environmental issues combine with those of local development.

The process towards the River Cormor Contract was fostered by the adhesion of the Friuli Venezia Giulia Region to these initiatives (in 2016), and by the perspective of future funds (that, however, have not yet been programmed)[7]. In 2017, the Valle del Cormor Association organised participatory activities with local communities. The definition of the *Document of Intents* for the River Contract started in May 2018. The actions developed with the University of Trieste strongly interacted with this process. In April 2019 the signature of the Document of Intents started, under the coordination of the Municipality of Tricesimo, with the involvement of the Friuli Venezia Giulia Region, the Reclamation of the Friuli Plain Consortium, and the Valle del Cormor Association. The objectives set by the Document cover different fields of action. They do not only consist in environmental protection, the prevention of hydrogeological risk, the reduction of water pollution due to urban and agricultural activities. They also deal with the tourist development of these territories, whose location in the proximity of important European cycle routes offers unprecedented opportunities (the reference is to the Alpe Adria cross-border itinerary)[8].

The stakeholders' request to design the extension to the Adriatic Sea of the horse and cycle track along the river gave the University a chance to reframe the issue of tourism in an *integrated planning perspective*, and to imagine the accessibility to the watercourse as a driver for new economies and services spreading their effects on larger territories.

[6] The teaching and research activities developed by the University of Trieste were organised in the frame of an agreement between the Department of Engineering and Architecture, the Municipality of Tricesimo, and the Valle del Cormor Association.

[7] The Regional Law no. 11/2015 defined and structured the process of negotiated planning for the River Contracts; with the resolution of the Regional Council no. 1448, 28.07.2016, Friuli Venezia Giulia formally adhered to the *National Charter of River Contracts*, launching activities aimed at promoting and supporting them on the regional territory [14].

[8] In the Regional Landscape Plan approved in 2018, the completion of the *Ippovia del Cormor* is part of the project for a regional slow mobility network [15].

3 Project-Oriented and Shared Representations

Teaching and research by design activities were addressed to draw representations and project inputs that could help local actors build deeper reflection on future policies and spatial interventions. The prompt was to read the river not as a trivial back of cities and rural sites, but as the spine of a new system of ecological services, able to put into play a rich estate of often underused public facilities and housing settlements, and to redefine cycle tourism in relation to the particular sensitivity and lifestyles of the Cormor middle lands.

During this process, professors and students were accompanied by representatives of the Valle del Cormor Association and of the Municipalities adhering to the River Contract. We started by combining the analysis of the current planning tools with visits to the study areas, where we talked to technicians and politicians, listened to inhabitants, observed and reflected in places. The discussion with our partners of intermediate results further prompted to synthesise ideas into new representations of existing resources and of their enhancement opportunities.

We were convinced that co-building explorations of *locally rooted potentials* for economic and social redevelopment had to be an essential ingredient of our contribution to the implementation of the River Contract. In this view, we started from recognising the functions and values of the waterway ecosystem, with the aim to take the places where they materialise as the main components of a new spatial system, in which the development of green and blue networks, of new tourist activities, and the reuse of existing equipment can find a synthesis and mutual interactions.

3.1 A Complex Ecosystem

All through the Urban Planning and Design Studio, students and local actors were invited to interpret the river contexts as a complex ecosystem.

In order to safeguard, restore, enhance and manage *river landscapes*, it is necessary to identify correlations among a multiplicity of material and immaterial processes and elements of the territory [16]. This viewpoint allows to recognise the primary value of the interconnections between the river and the urban settlements, the natural elements, and the evidence of local culture and production.

Building visions for the Cormor landscapes therefore meant focusing on the different functions (and values) that, today, waterways can recover in the fields of: *ecology* (rivers as excretory systems; natural corridors; areas where to govern hydrogeological fragility); *society* (rivers as spaces perceived and enjoyed by local communities; common goods; components of equipment addressed to stable and temporary, static and moving populations); *economy* (rivers as places for sustainable activities, different from intensive production and agricultural exploitation); *culture* (rivers as gates through which to rediscover and enhance the history and the identity of the territory, and as attractors of new tourist flows). In this way, the focus on the Cormor stream and trail was framed into a more complex spatial system.

3.2 Tourism and Well-Being

The issues of tourism and cycling added further inputs for drawing new representations of the Cormor ecosystem. Specifically, they invited to interpret the river as the component of a *network of greenways* [17]. Emphasis was put on the many potentials of slow mobility: from favouring the access and enjoyment of 'minor' landscapes; to offering the opportunity to activate circular economies. However, *cycling is not only a tourists' practice*. In our Country, the growth of seasonal and daily soft mobility is tracing new geographies, that tell how local administrations, stakeholders and enterprises have been able to conceive products and services of particular innovation and excellence, addressed both to tourists and residents [18].

According to these considerations, we invited the students to conceive the greenways as part of the *system of collective equipment* that already punctuates the Cormor middle lands. Our surveys had in fact shown how the fragility of the territories along the river and of the communities that inhabit them was also connected to a growing lack in the maintenance of public spaces and services; to their inadequacy to the needs of moving and changing populations; to their closure to the contexts and difficult accessibility. Integrated work on the banks of the river and on the edges of urban centres, on the rural spaces and on the leftovers of peri-urban agriculture, was therefore a stimulus to take the project of the cycle route as a prompt to rethink the uses of public facilities and their spatial connections; to regenerate the legacy of urban policies and planning standards that, over time, have built the *material quality of welfare and of everyday life* (green areas, spaces for mobility, social-assistance and educational-cultural services) [19].

3.3 Light Infrastructural Projects for Local Development

The search for places and materials where *light infrastructural and re-equipment projects* could be grounded forced us to continuously move across different scales. We started from a larger perspective, to draw a *master plan* holding together the many functions that the Cormor middle lands can play as a whole. In general terms, the horse and cycle itinerary was conceived not as a single path, but as a widespread infrastructure for the slow use of the territory. Design explorations showed the capacity of the cycle route to promote environmental protection and risk management, as well as to attract inhabitants and enterprises through the settlement of new facilities (accommodation and catering equipment, connected to the production, sale and consumption of typical goods; sports events and trails, offering the experience of regional landscapes). The parallel focus on a *site-specific scale* allowed to articulate the master plan according to different territorial situations. Specifically, three types of spatial 'transects' were recognised, on the basis of the features of the watercourse (channelled or not, above-ground or at a lower level, with natural or artificial banks), the proximity of the cycle way to the river, the combination of urban, rural or natural land uses. This, again, proved the internal variety of the middle lands, and the need to adjust visions and projects to their resources.

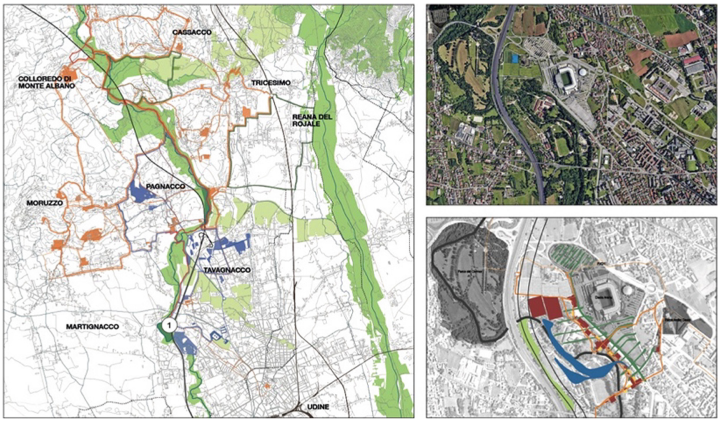

Fig. 2. The northern transect. On the left, the master plan; on the right, the Cormor and the citadel of sports in Udine (no. 1) (SOURCE: P. Barbiani, M. Caiffa, M. Collenz, S. Di Ferro, L. Lauricella, I. Morgera)

In the master plan for the northern transect, cycle itineraries link the main path along the river bank to the rural villages, historic villas and castles on the hills, and to the railway stations of small urban centres. Two main greenways articulate the picture, by overwriting the sequence of crops and areas of landscape interest that, across the plain, connects the rivers Cormor and Torre. When reaching the edges of Udine conurbation, this structure offers the opportunity to tackle the *functional and spatial segregation of existing large plots for territorial equipment*. Specifically, in the riverbed of the Cormor, new drainage basins, reed beds, and rows of trees are meant to reduce the impacts of the nearby highway. These green infiltrations further extend, to scratch the surface of the paved areas around the citadel of sports. Not far away, along a branch of the cycle path, shared vegetable gardens and areas for market and recreational activities draw a series of public spaces; their articulation helps bridge the gap between the huge scale of the sports complex and the fine grain of the surrounding settlements (Fig. 2).

In the central transect, the cycle route passes from one side to the other of the Cormor. By intercepting and supporting the reuse of 'vague lands', the soft mobility network contributes to the redesign of the fringes of Udine, Pasian di Prato and Campoformido. Like a comb, the *bicycle ring road* provides a fast connection for tourists and citizens, who can reach the leisure areas along the river by avoiding the busiest radial roads, and safely access the services in the city centre. When crossing the peripheries built by social housing districts and private neighbourhoods, this infrastructure becomes the backbone of a *necklace of parks*, adding porosity and permeability to urban land. Here, new woods and collective gardens spread transversally to the river, and trigger the regeneration of large urban sectors by connecting existing equipment to new types of services for education and open-air activities, light manufacture and urban agriculture (Fig. 3).

Fig. 3. The central transect. On the left, the master plan; on the right, the Cormor and the new urban woods in the residential peripheries of Udine (no. 1) (SOURCE: G. Bearzotti, G. De Conz, T. Linternone, T. Lippiello, M.T. Manzara, V. Novello, N. Pigat, G. Zei)

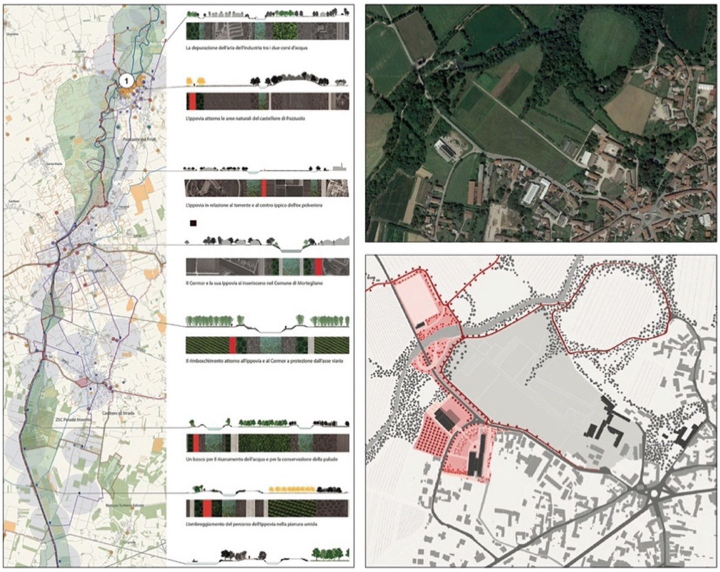

Fig. 4. The southern transect. On the left, the master plan; on the right, the river Cormor and the design inputs for the reuse of the beaches and the spinning mill in Pozzuolo del Friuli (no. 1) (SOURCE: D. Buccino, C. Furlani, S. Maiello, A. Romanzin, G. Tomasin, G. Vallone, F. Zotti, N. Zucchiatti)

Before reaching the lagoon and the sea, the Cormor relates again to the fine-grain of urbanised contexts and rural lands (Pozzuolo, Mortegliano and Castions di Strada). In this section of the watercourse, the extension of the bike path was a particularly complex design task. In order to identify resources to connect and upgrade, these *territories had to be read in braille*, through layers and careful examination. However, here more than in the other transects, the project of the cycle route offered the opportunity to demonstrate how slow mobility can help activate *circular economies*. In the master plan, the cycle itinerary follows the dirt roads next to the Cormor, searching for valuable landscapes and artefacts. New basins along the stream are meant not only to manage the waters and to treat pollution from rural activities, but also to design an extensive landscape project, linking the wetlands that characterise the southern section of the river. Arboriculture and reforestation give thickness and economic function to these environmental connections, that further and capillary radiate in the vegetal rows and hedges along the roads. The cycle itinerary also helps define themes for a selective reuse of abandoned spaces. Old beaches, mills, factories and warehouses, irrigation ditches tell the story of local life and production, by hosting new services and economic activities (from hostels and refreshment areas, to centres for education, research and/or enterprises' innovation) (Fig. 4).

4 Conclusions in Progress

The research is still on-going. In the academic year 2019–2020, thanks to interaction with local stakeholders[9], other study contexts will be chosen in the regional SNAI's areas (Alta Carnia, Val Canale – Canal del Ferro). Here, abandonment and depopulation trends ask for deeper investigation into the topics of economic regeneration (agricultural and manufacturing chains have to be radically rebuilt), environment and landscape protection (hydrogeological problems are strong, and so are the traces of a dramatic 'border history'), actions addressed to attract new and/or returning inhabitants. The work on the Cormor middle lands and the preparatory surveys on the mountain SNAI's contexts therefore trigger further reflection. However, some fundamental issues on planning and development in marginalised areas can already be recognised.

A first issue refers to *prosperity*, whereas the stimulus is to take a distance from mere economic growth paradigms [20]. Prosperous is a path that takes root in the places (their biographies and delicate metabolisms), and allows inclusive access to territorial resources. The immersion in the Cormor middle lands showed the need to *turn to new forms of environmental determinism*. This means negotiating the landing on Earth of our policies, by taking the *Terrestrial* (with its material features and human-non-human processes) as an essential and plural actor of future strategies and projects [21]. Only by putting aside the prevailing of economic determinants and by adopting a more responsible perspective, can we recover the ability to imagine a future of resilience and care for the places we live in.

9 Our next partner, Cramars NGO, is active in the fields of professional education, social innovation and local development; thanks to EU projects, Cramars is promoting the construction of an Atlas of Friuli mountain areas, and a Pact for local development among institutions, profit and nonprofit organizations, citizens (https://www.coopcramars.it).

A second issue refers to *territorial equipment*, as a means to enhance liveability conditions, to adapt to growing environmental and climatic changes, and to help reverse economic and demographic trends. In this sense, working in marginalised areas forces to rethink the *location and performance of public facilities and planning standards* [22, 23]. In the visions for the Cormor territories, green and blue infrastructures do not only offer the structuring principles of a new ecological project; they also provide a spatial support to the creation of new services and economies, for tourists and inhabitants. Furthermore, these projects invite to question the territorial perimeters that still guide the allocation of cohesion funds, and are mainly based on statistical indicators and quantitative accessibility parameters. These perimeters tend to overwrite the margins of marginalised areas, preventing possible synergies among existing resources, actors and geographies, as well as their capitalisation by regional and local policies.

The *ways of making spatialised policies and planning strategies* constitutes a third relevant issue. This is precisely the field where it is urgent to start, on a regional scale, *territorial laboratories* and *pilot projects and alliances* across levels, actors and sectors of public government/governance. A careful knowledge and working together with local administrations, economic/third sector stakeholders and communities are in fact necessary to ensure that next EU funds and public spending reach higher effectiveness. Instead of projects calls designed on the basis of general and abstract parameters, what the small Municipalities of the marginalised areas ask for are opportunities to aggregate places and subjects around targeted and synergic actions, aimed at feeding medium and long-term visions for sustainable development. These actions necessarily refer to a variety of policies (environment, economy and professional training, welfare and mobility, etc.), whose integration needs a strong public direction, and a profound change in institutional routines (from the national to the regional and local levels).

Finally, the investigation into the Cormor middle lands stimulates reflection on how far a vision for sustainable development can be implemented even without extraordinary financing channels. Due to their often minimal and incremental character, the design inputs this paper describes are not detached from the themes of municipal (or inter-municipal) urban planning. Even though local plans are often meant as simplified frames for public works and private interventions, their task should be to foster the implementation of future scenarios, by setting a coherence among a variety of spatial issues, actions and actors. In this sense, the hope is that the work done with the University can help address the use of *local planning procedures and tools towards the anticipation of more complex, largescale and integrated projects*. While recurrently called into question by international Urban Agendas, the ordinary planning practice should in fact start referring to a renovated frame of topics and challenges. This certainly requires a strong commitment by the numerous public administrations that today, especially in the most fragile areas of the Country, are wearied by the lack of economic resources and personnel. Nonetheless, such a viewpoint strengthens the belief that reinforcing the collaboration between the energies and knowledge provided by the University on the one side, the questions and practices emerging from the territories on the other, can do more than a lot in stimulating collective social and technical innovation.

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