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# Business Intelligence, Project Management, and System Dynamics to support a socio-economic and ecological sustainable transition

*Coupling Governance Tools for Localizing the UN 2030 Agenda*

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*Declaration*

I, Francesco Gennusa, solemnly declare that I am the sole author of this doctoral dissertation. This thesis is the original work and was submitted to the University of Palermo in 2025.

*Dedication*

I dedicate this doctoral thesis to my parents, Francesca and Salvatore, for always being by my side, for supporting with pride every choice I have made, and for sharing with me this extraordinary three-year journey. It is to you that I dedicate everything: thanks to your sacrifices, I am able today to reach this important milestone in my personal and professional growth.

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BUSINESS INTELLIGENCE, PROJECT MANAGEMENT, AND SYSTEM DYNAMICS TO SUPPORT A SOCIO-ECONOMIC AND ECOLOGICAL SUSTAINABLE TRANSITION

*Coupling Governance Tools for Localizing the UN 2030 Agenda*


## ABSTRACT

The localization of the United Nations 2030 Agenda has emerged as one of the most pressing governance challenges of our time. While global frameworks establish common goals, their translation into place-based strategies is fragmented. This dissertation investigates how the localization of the United Nations 2030 Agenda can be operationalized through an integrated governance architecture in which Business Intelligence provides the evidentiary basis for decision-making, while System Dynamics, further elaborated through the Dynamic Performance Governance (DPG) framework, renders visible the feedback structures, trade-offs, and outcome pathways that shape policy trajectories. Rather than merging these elements into a single comprehensive tool, the study employs them as complementary modules within collaborative platforms, where project management routines, particularly those adopted in the context of European funding programs, translate analytical insights into structured work plans, milestones, and deliverables. The combination of these approaches, applied across multiple case studies, enables a cross-case analysis that reveals recurrent mechanisms through which global objectives are transformed into context-sensitive strategies, and clarifies the institutional conditions under which stakeholder interaction, coordination, and learning can be sustained over time.

The research is structured around four case studies that represent distinct domains of stakeholder engagement in the localization of the Sustainable Development Goals (SDGs). The CiD alliance illustrates how transnational projects scaffold local partnerships; the Knowledge Graph prototype shows how data infrastructures can facilitate the coordination of policies and stakeholders; and two territorial applications in Sicily (Italy) demonstrate how DPG reframes debates around outcomes and systemic drivers. Empirical evidence is collected through semi-structured interviews, document

analysis, and the development of analytical and managerial models, including Causal Loop Diagrams, DPG charts, and Knowledge Graphs.

Findings indicate that SDG localization advances when evidence, causal reasoning, and delivery routines are jointly embedded in collaborative platforms: data provide the empirical basis for deliberation, causal models structured around outcomes make explicit the interdependencies that allow stakeholders to coordinate their perspectives and actions, and project-management routines convert these pathways into accountable plans and recurrent monitoring cycles. In this configuration, project management operates as a meso-level infrastructure that institutionalizes learning beyond project cycles.

The dissertation clarifies SDG localization as an iterative process that relies on boundary infrastructures, orchestration roles, and multidisciplinary integration. It develops protocols that connect stakeholder knowledge, causal maps, project routines, and indicator systems into place-sensitive architectures. Across the case studies, this approach shows how data infrastructures and analytical models can be combined with project management routines to align global goals with local realities, while taking into account the constraints of funding programs and administrative cycles. The results provide concrete insights into the conditions that sustain coordination among diverse actors, facilitate institutional learning, and support the long-term implementation of the SDGs.

Across the four case studies, the research specifies the institutional conditions under which local actors can align global goals with place-based initiatives despite administrative and funding constraints. The findings emphasize that sustainable transitions require interoperable infrastructures in which data platforms, analytical models, and managerial routines operate in concert, enabling collaborative pathways that transform global objectives into context-sensitive strategies.

**Keywords:** SDG Localization; Project Management; Business Intelligence; System Dynamics; Dynamic Performance Governance; Place-Based Governance.

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List of Acronyms

BI – Business Intelligence

CiD – Circular Design For Bio-Based Innovation Towards Climate-Neutral Cities

CLD – Casual Loop Diagram

DPG – Dynamic Performance Governance

DPM – Dynamic Performance Management

EACEA – European Education and Culture Executive Agency

EPM – European Project Management

ERDF – European Regional Development Fund

ESF+ - European Social Fund Plus

EU – European Union

KG – Knowledge Graph

LIFE - Programme for the Environment and Climate Action

LPG – Labeled Property Graph

MDGs – Millennium Development Goals

ML – Machine Learning

NGOs – Non-Governmental Organizations

NLP – Natural Language Processing

OECD – Organization for Economic Cooperation and Development

PSOs – Public Sector Organizations

SD – System Dynamics

SDGs – Sustainable Development Goals

SDSN – Sustainable Development Solutions Network

SME – Small and Medium-Sized Enterprises

UN – United Nations

UNCED – United Nations Conference on Environment and Development

UNDP – United Nations Development Programme

WCED – World Commission on Environment and Development

WSSD – World Summit on Sustainable Development

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# CHAPTER 1

# INTRODUCTION

Over the last decade, the 2030 Agenda has offered a universal framework for aligning social, economic, and environmental goals. However, its strategic promise has only been partially fulfilled at the subnational level. Global monitoring indicates that numerous targets are deviating or regressing, underscoring a persistent implementation gap between global objectives and localized effective measures (Sachs et al., 2024; Biermann et al., 2022). This gap is not a coincidence; it is built into the system.

Such issues embedded in the SDG, defined as "wicked" and "super-wicked" problems, are cross-sectoral and marked by nonlinear feedbacks, time delays, and contested problem framings (Rittel & Webber, 1973; Ackoff, 1974; Levin et al., 2012). In such conditions, linear planning and short political cycles routinely clash with the dynamic and place-based nature of sustainability challenges (Christensen & Fimreite, 2006).

The main goal of this thesis is to address the mismatch between *problem structure* and *governance practice*. Evidence suggests that although the SDGs have transformed the sustainability debate, they have not uniformly prompted substantial policy integration or resource reallocation at the local level (Biermann et al., 2022). The outcome is a persistent pattern: activities are initiated within SDG frameworks, yet trade-offs are unanticipated, learning occurs occasionally, and stakeholder participation is intermittent rather than integrated.

Another important aspect is related to the European policy and funding context. EU tools and frameworks (e.g, ESF+, Cohesion Fund, Horizon Europe, LIFE, Erasmus+, etc.) explicitly enhance multilevel and multi-actor collaborations increasingly linked to SDG outcomes (European Commission, 2021; 2023; 2024). These programs can catalyze place-based innovation, however, they also impose demanding requirements on planning, indicators, procurement, and monitoring that often exceed the administrative capacity of local actors (OECD, 2020). Co-financing rules and reimbursement mechanisms further strain beneficiaries, and cross-border consortia coordination raises additional governance complexity (Interact, 2024). This highlights the need for dynamic, multidisciplinary, and

integrative methods, as EU-funded projects may be carried out in a manner that is overly focused on compliance and has a limited impact on the system as a whole.

A further issue is represented by the operationalization of collaborative governance. The literature highlights that wicked problems necessitate inclusive, multi-stakeholder arenas to mobilize dispersed knowledge, build legitimacy, and share responsibility (Roberts, 2000; Fischer, 1993; Feldman et al., 2006; Ansell & Gash, 2008; Daviter, 2017). Yet the "how" of coupling collaborative processes with rigorous, outcome-oriented methods is under-specified and poorly documented in terms of routine practice. In particular, there is a need to connect System Dynamis (SD) - a modelling and simulation methodology designed to represent feedback structures, accumulations and time delays in complex socio-ecological systems, and to test policies ex-ante (Sterman, 2000) - with Business Intelligence (BI) to ground deliberation in timely evidence and support iterative learning in real-time (Galluzzo & Gennusa, 2023).

In this dissertation, SD is adopted because it is explicitly built to capture feedback-rich behaviour over time and to explore the dynamic consequences of alternative policy scenarios before implementation. This is crucial in the context of sustainability transitions, where delayed side-effects and cross-sectoral interactions can easily undermine well-intentioned interventions. Alternative approaches, such as static indicator frameworks or one-off multi-criteria assessments, can support prioritization, but they are less suitable to investigate how policies interact dynamically and how unintended consequences accumulate over time. SD is therefore used as the core dynamic modelling and sense-making methodology. At the same time, BI tools are employed as a complementary pillar to transform heterogeneous territorial data into timely, reusable evidence that can inform SD-based reasoning and collaborative deliberation. Finally, Dynamic Performance Governance & Management frameworks are mobilized to translate these insights into outcome-oriented architectures of projects, indicators, and routines, rather than remaining at the level of isolated models or dashboards

One of the main motivations at the basis of the research presented here is to provide a contribution for overcoming the knowledge-to-practice gap. Systems thinking, data-informed decision-making, and collaborative governance are frequently promoted in isolation; nevertheless, integrated implementations across the whole policy cycle in

authentic territorial contexts and under genuine administrative constraints are very uncommon. There is not yet enough empirical work on the conditions that make integration possible, such as capabilities, data infrastructures, orchestration roles, and trust, which speed up the localization of the SDGs (Perry et al., 2021; UN-Habitat, 2015; Guarini et al., 2022; Hambleton, 2020; Jönsson & Bexell, 2021; Ciambra et al., 2023). A significant proportion of SDG targets relies on local and regional authorities, underscoring the importance of subnational governance in any viable implementation strategy (OECD & SDSN, 2020).

Such circumstances call for a systemic governance architecture (causal and anticipatory), dynamic (learning-oriented and adaptive), and intelligent (data-enabled), while capable of orchestrating contributions across public bodies, firms, civil society, and academia (Rhodes, 1996; Sørensen & Torfing, 2009; Bryson et al., 2015).

To summarize, this thesis proposes an integrated approach that combines System Dynamics (SD), Dynamic Performance Governance (DPG), and Business Intelligence (BI). The objective is to: (i) render causal structures and trade-offs visible; (ii) align actors on outcome pathways and performance drivers; (iii) embed evidence into routine decisions; and (iv) institutionalize iterative learning. By examining multiple case studies and governance settings, the research investigates the conditions under which this integration strengthens SDG localization, enhances resilience to wicked and super-wicked problems, and converts European policy opportunities into sustained local value (European Commission, 2021; 2024; OECD, 2020; Interact, 2024; Bianchi, 2016; 2021; 2022; Sterman, 2000; Ansell & Gash, 2008).

In the following of this introduction first the main research objectives and questions are explained; then the contribution and obtained findings are described, and finally the thesis organization is provided.

### 1.1 Research Objectives and Questions

This dissertation aims to develop a place-based governance architecture that weaves together SD, DPG, and BI within collaborative platforms. The overarching purpose is to accelerate the localization of the SDGs while strengthening resilience to wicked and super-wicked problems in real territorial settings.

Guided by these aims, the dissertation addresses the following research questions:

RQ1. What are the salient mechanisms that produce the local implementation gap of the SDGs in the studied contexts, and how do time delays, feedback, and organizational boundaries shape those mechanisms?

RQ2. How can the integration of System Dynamics, DPG, and place-based BI be made operational in real governance settings to improve policy design, coordination, and adaptation?

RQ3. In what ways do collaborative platforms align heterogeneous stakeholders around shared outcomes, and which practices institutionalize learning across the policy cycle?

RQ4. How do EU funding requirements and multilevel governance arrangements influence the design and delivery of SDG-related initiatives in the cases examined, and which project-management choices mitigate the resulting frictions?

RQ5. Which cross-case design principles (e.g., orchestration roles, data and indicator architectures, and monitoring routines) consistently convert participation and evidence into durable, place-based outcomes?

To address the research questions and meet the above objectives, the study employs semi-structured interviews with key stakeholders (public and private organizations, non-profit entities, community representatives, residents, and academic actors) to elicit place-specific mechanisms influencing SDG localization, collaboration, and resilience. The interview guide is designed to elicit perceptions of drivers, barriers, and trade-offs. The answers are then compared to find similarities and differences between contexts.

Simultaneously, secondary sources such as academic journals, policy papers, legal and regulatory texts, programmatic materials from EU initiatives, and institutional websites are employed for triangulation and contextualization. The inquiry applies a DPG perspective to synchronize outcomes with performance drivers across organizational boundaries, incorporates SD to elucidate feedback loops and time delays while examining policy levers ex-ante, and utilizes BI to anchor deliberation on disaggregated evidence. These parts work together to support adaptive governance and iterative learning throughout the policy cycle.

This dissertation is primarily addressed to scholars and researchers in the fields of sustainability governance, public management and system dynamics, who are interested in how dynamic modelling, performance governance and business intelligence can be combined to support sustainability transitions at the local level. A second intended readership are policy-makers and practitioners working in regional and municipal administrations, EU project units and territorial observatories, who are confronted with the practical challenges of localizing the SDGs and coordinating place-based initiatives. Finally, the work may also be of interest to data and BI professionals involved in the design of territorial information systems that aim to manage outcome-oriented decision-making and collaborative platforms.

### 1.2. Contribution of Thesis

This dissertation advances both scholarship and practice on sustainable development governance by articulating a pragmatic architecture for SDG localization that tightly couples SD, DPG, EPM, and BI within collaborative platforms. Rather than treating these elements as parallel streams, the thesis demonstrates how causal reasoning, outcome-oriented steering, EU-coherent project routines, and evidence use can be integrated into a governance frame capable of addressing wicked and super-wicked problems in territorial settings.

Conceptually, the work bridges domains that are frequently siloed. It connects systems thinking, making explicit feedback, delays, and cross-sector trade-offs, to an outcome-based performance management that links shared strategic resources, intermediate performance drivers, and outcomes. In doing so, it refines the notion of the *collaborative platform*, transforming it from a consultative forum into an institutional device for collective problem-solving, where deliberation is grounded in causal structure, aligned with performance logic, and continuously informed by disaggregated evidence. The contribution is the transition from adopting the SDGs as static commitments to operationalizing them, specifying how global goals become local trajectories with explicit assumptions, risks, and learning loops. At the same time, it specifies how EPM transforms those pathways into intervention logics, work plans, milestones, and deliverables, as well as reporting schedules aligned with EU requirements.

Methodologically, the thesis contributes a replicable toolkit. Qualitative Casual Loop Diagrams (CLDs) based on SD modeling surface interdependencies and enable ex-ante stress-testing of policy levers; DPG charts align outcomes, drivers, and strategic resources across organizational boundaries; BI models collect territorial indicators and dashboards that help with daily decisions. The innovation lies in treating SD, DPG, EPM, and BI as interoperable modules rather than a single tool. They are tightly coupled through practical hand-offs so that insights flow from stakeholder evidence to causal maps (SD), to outcome/performance pathways (DPG), to intervention logic and work packages (EPM), and to indicators and dashboards (BI), with each component activated when its distinctive affordances are required. The research also elucidates the roles of orchestration and boundary-spanning facilitation as essential competencies for transitioning from diagnosis to coordinated action and iterative adaptation.

Empirically, across the examined cases, the thesis identifies recurrent enabling mechanisms, such as the presence of a recognized orchestrator, explicit outcome pathways, and shared indicator architectures. By comparing contexts and governance arrangements, the study explains why initiatives that appear similar in theory diverge in practice, thereby providing grounded insights that extend beyond anecdotal descriptions.

For practitioners and policy makers, the thesis offers a usable playbook. It specifies how to convene stakeholders around a concise set of shared outcomes; how to translate those outcomes into performance pathways and testable policies; how to design lean BI routines that embed evidence into routine meetings and decisions; and how to institutionalize learning cycles that survive staff turnover and program phases. In EU-relevant settings, it demonstrates how to convert burdens (co-financing, procurement, indicator and reporting requirements, and cross-partner coordination) into opportunities for capability building by aligning them with the integrated governance and evidence practices proposed here.

Finally, the thesis clarifies boundary conditions and transferability. It identifies the minimum capabilities and data infrastructures required for adoption, the governance arrangements that are most conducive to uptake, and the risks that can derail implementation. It also outlines how the integrated toolkit can be adapted to territories with varying institutional capacities, providing criteria for scaling while maintaining contextual relevance.

Taken together, these contributions provide a coherent conceptual framework, a practical methodology, empirical insights, and actionable guidance for institutions seeking to localize the SDGs and build holistic resilience through collaborative, dynamic, and data-driven governance.

### 1.3. Synthesis of Findings

Across the examined cases, evidence suggests that SDG localization does not emerge as a byproduct of projects or policies, but rather depends on scaffolding infrastructures that connect actors, resources, and knowledge in various ways. Three complementary infrastructures recur: European Project Management (EPM) as a meso-level scaffold that couples instrumental resources with organizational learning and creates boundary arrangements (e.g., observatories, intervention logics, work packages) through which transnational outputs can take root locally; data infrastructures (e.g., knowledge graphs) that render otherwise hidden relations legible and actionable for orchestration; and outcome-based performance management as a cognitive scaffold that reframes local debates around outcomes, drivers, feedbacks and delays.

These infrastructures operate as boundary objects and roles that make collaboration durable and outcome-oriented; yet, their effects are highly sensitive to time, as project cycles, data refresh, and governance routines rarely align with the slower processes of institutionalization. Durability thus depends on ongoing systems, regular monitoring, and the integration of collaborative activities within administrative capability.

Divergences across settings underline the situated nature of localization: alliances mobilize resources but need local intermediaries to anchor them; graphs reveal opportunities but require coverage and validation; charts, models, and loops shift culture only if integrated into regular decision-making. Taken together, the findings show localization as a scaffolded process where international alliances give frameworks and resources, data graphs aid in identifying and connecting partners, and DPG facilitates discourse around systemic drivers and outcomes. None is sufficient on its own, but when combined, they may provide the tools and places for players to identify interdependencies, test collaborations, and adapt strategies over time.

### 1.4. Thesis Structure

The remaining part of this thesis is organized as follows.

Chapter 2 (Research Background) develops the conceptual ground for the study. It reviews the evolution of sustainability and the 2030 Agenda, with a focus on the localization of the SDGs and the governance challenges posed by wicked and super-wicked problems. The chapter examines collaborative and multi-stakeholder governance, situating the European policy landscape—Cohesion Policy, research, and environmental programs—as an enabling context. It introduces the integrated perspective that links SD, DPG, and BI.

Chapter 3 (Research Methodology and Data) presents the methodological approach and data strategy. It describes the system-thinking paradigm adopted, the construction and use of a qualitative SD approach, the DPG lens for an outcome-oriented approach across organizational boundaries, and the BI components that support evidence-informed deliberation. The chapter details the semi-structured interviews with stakeholders, the use of secondary sources, the protocols for validity and reliability, and the ethical safeguards applied throughout the inquiry.

Chapter 4 (Findings) reports the empirical results across the selected cases. For each case, the analysis reconstructs problem structuring, outcome pathways and performance drivers, stakeholder configurations, and the BI platform used in collaborative platforms; it also documents the EPM value in localizing the SDG and mapping the stakeholder ambitions embedded in project governance. A cross-case synthesis then identifies recurrent enabling mechanisms and persistent constraints,

Chapter 5 (Conclusions) answers the research questions by synthesizing the evidence and articulating the theoretical, methodological, and practical contributions of the thesis. It discusses limitations, outlines directions for future research and practice, and reflects on the implications for SDG localization and place-based resilience through collaborative, dynamic, and data-enabled governance.

References and appendices complete the work, providing the bibliographic corpus and supplementary materials to support transparency and replication.

# CHAPTER 2

# RESEARCH BACKGROUND

## 2.1. Problem definition

The United Nations General Assembly adopted the Sustainable Development Goals (SDGs) in 2015 as part of the 2030 Agenda for Sustainable Development. The 17 SDGs and their 169 targets aim, among other things, to end poverty, protect the planet, and ensure prosperity for all by the year 2030. These goals span across various interconnected domains, including health, education, social justice, and sustainable energy. Many of the challenges they address are commonly described as "wicked problems" (Rittel & Webber, 1973). These complex and interconnected issues cannot be tackled in isolation due to their systemic nature and the multitude of actors and interests involved.

These interdependencies necessitate a holistic approach to policy integration, one that considers the diverse range of stakeholders involved and the various layers of governance implicated. However, there are no universal models that work for all contexts. Each community, context, or reality faces unique challenges, objectives, and aspirations, necessitating tailored solutions for achieving the SDGs. Despite being a decade into the 2030 Agenda, progress is still insufficient: approximately 16% of global targets are expected to be met by 2030, while 84% face delays or obstacles to growth (Sachs et al., 2024). The disparity between global ambitions and local outcomes highlights the challenge of translating global goals into tangible, local improvements. Thus far, the socio-political influence of the SDGs has primarily been stressed in communication, modulating the dialogue surrounding sustainable development, rather than resulting in meaningful policy reforms or significant resource reallocations (Biermann et al., 2022). The formal adoption of the SDGs by cities and states has not yet led to a significant transformation in public policy, highlighting the core issue that this thesis addresses: how to bridge the gap between global agendas and local action.

The issue at hand is multifaceted and highly complex. The challenges outlined in the 2030 Agenda, spanning from social justice to environmental protection, from inclusive growth to institutional innovation, are interconnected and defined by non-linear

interdependencies. The systemic character of these issues suggests that actions in one area (e.g., energy policy) will impact others (e.g., poverty alleviation, health, ecosystems), creating an interconnected framework that renders conventional, isolated strategies insufficient. Lah (2025) observes that systemic disconnections among sectors and stakeholders lead to fragmented development, redundancy, and inefficiencies, even in the presence of political solutions and financial resources, necessitating more integrated and collaborative strategies to "break the silos." Localizing SDG is not only a collection of discrete sectoral difficulties, but it is a transversal wicked problem itself that necessitates the resolution of policy fragmentation and the acknowledgment of local complexity.

Case studies from different countries demonstrate that localizing the SDGs is often challenging due to issues such as poor vertical and horizontal coordination, unclear task assignments, high staff turnover, and a lack of resources (Hambleton, 2020; Jönsson & Bexell, 2021; Ciambra et al., 2023). To put the 2030 Agenda into action at the local level, Public Sector Organizations should invest in ongoing facilitation and negotiation between all levels of government (local, regional, national, and supranational) as well as across different sectors and groups in society (state, market, and civil society). This multilevel integration remains weak in practice due to rigid administrative procedures and an institutional culture that lacks the capacity to work together across sectors or governments. The result is that public policy is fragmented, making it harder to implement the SDGs at the local level.

To address today's challenges, it is essential to shift from linear thinking to systems thinking, embracing more adaptive and holistic approaches. In this thesis, systems thinking refers to a way of framing problems that focuses on feedback structures, accumulations (stocks) and time delays, and on how these elements interact across interconnected policy domains to generate patterns of behaviour over time (Sterman, 2000). In this regard, frameworks such as SD and DPM/DPG, which operate through comprehensive modeling, are applicable methodologies to address sustainability issues by integrating environmental, social, and economic variables. Decision-makers need to engage in continuous learning processes, revising their strategies and mental models as new challenges emerge. In parallel, decision-support tools are used in combination where SD clarifies causal mechanisms, DPG structures outcomes and performance pathways, and BI provides timely and operational evidence. When operating in combination, these

tools become mutually reinforcing and support local governments in navigating trade-offs and uncertainties. However, adoption of such tools remains embryonic in public institutions. Many local authorities continue to tackle wicked problems with traditional tools, lacking the systems thinking needed to design long-term and cross-sector interventions. The absence of methodologies that integrate environmental, social, and economic dimensions, as well as inadequate analytical capacity, hinders the ability to craft effective strategies to achieve the SDGs at the local level.

In light of these challenges, there is a growing need for innovative tools and approaches that support adaptive, collaborative, and place-based governance for sustainable development. The unpredictable and interconnected nature of SDG-related issues demands institutions that are capable of continuous learning and flexibility. At the same time, collaborative governance becomes indispensable (Ansell & Gash, 2008). Systematic cooperation is required among local administrations, regions, the central government, private actors, researchers, and civil society. The literature has long emphasized that participatory and co-design processes help overcome institutional barriers and foster coalitions around shared goals (Ansell & Gash, 2008). In this regard, approaches such as Living Labs, public–community partnerships, and collaborative platforms (Bianchi, 2022) promote knowledge-sharing and co-created solutions, laying the groundwork for more resilient and inclusive implementation.

The inherently interconnected nature of sustainability challenges, many of which qualify as wicked problems (e.g., climate change, demographic decline, equal opportunities, etc.), requires interdisciplinary frameworks that integrate knowledge from diverse domains, including public policy, system dynamics, and data science. Equipping local territories with multidisciplinary, holistic, and integrated governance tools, such as SD, DPG, and BI, enables place-based value creation and sustainable resilience, thereby bridging the gap between global SDG agendas and tangible, localized implementation.

As the cases discussed in this thesis will demonstrate, both data-driven platforms and a holistic approach to outcome-based performance management offer valuable, complementary contributions to this evolving field. Promoting interdisciplinary collaboration is therefore not merely a theoretical aspiration but a practical necessity for designing effective and place-based sustainability interventions.

### 2.1.1 The 2030 Agenda for Sustainable Development

Initially linked to ecological integrity in the World Charter for Nature (UN, 1982), the concept of Sustainable Development has progressively come to encompass a broader range of social, economic, and environmental issues. Throughout the following decades, world summits and international documents allowed to institutionalise the aforementioned concept; these included *Our Common Future* (WCED, 1987), which provided a programmatic and intergenerational definition of sustainability; the 40 chapters of *Agenda 21*, ratified at the 1992 Rio Earth Summit (UN, 1992); and the *Millennium Declaration* (UN, 2000), which resulted in the establishment of the Millenium Development Goals (MDGs). Notwithstanding the criticism for their restricted environmental scope, their narrow focus on developing countries, and the lack of integrative strategies for overarching global challenges (Waage et al., 2010; Fehling et al., 2013); the latter established a time-sensitive and quantitative framework for international development cooperation.

In 2015, through the adoption of the resolution entitled "Transforming Our World: the 2030 Agenda for Sustainable Development" (UN, 2015), the United Nations General Assembly officially created a new global roadmap structured around 17 SDGs, 169 targets, and 232 indicators. The 2030 Agenda delineates a conceptual and strategic progression beyond the MDGs, encompassing a comprehensive approach to sustainability across environmental, social, and economic domains thanks to its universal and integrated framework. It prominently highlights systemic barriers to development, including increasing disparities, environmental degradation, unsustainable consumption patterns, and the vulnerability of institutions and governance structures.

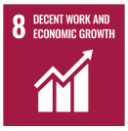
Notably, a significant shift marked by the 2030 Agenda was the increased emphasis on context-based approaches. The SDGs present a global vision and recognize that sustainable pathways must differ by region, as they must take into consideration the various geographic, cultural, economic, and institutional contexts (Hickmann et al., 2024). This is particularly evident in SDG 11, which emphasizes the need to "make cities and human settlements inclusive, safe, resilient and sustainable." SDG 11 acknowledges that environments in urban areas, where more than half of the world's population resides, are essential domains for tackling climate change, infrastructure development, public

health, housing, and mobility, intricately linked to local contexts. Several other SDGs share similar contextual awareness; therefore, a call for tailored strategies has become imperative, particularly in areas such as agriculture, water management, disaster risk reduction, and energy access (See Table 1).

*Table 1. Sustainable Development Goals short description (UN, 2015).*

| Icons | Goal | Description |
|---|---|---|
|  | **Goal 1**<br>End Poverty in all its forms everywhere | The goal is to eradicate extreme poverty and mitigate relative poverty. Despite ongoing poverty reduction efforts, high poverty rates persist in various regions worldwide, indicating insufficiently effective measures to address the underlying structural issues, including economic and social inequalities. |
|  | **Goal 2**<br>Zero Hunger | Addressing hunger and malnutrition. Despite some progress in addressing extreme hunger, food crises persist in various regions globally. Moreover, the issues of excessive food production and unequal food distribution persist as significant challenges. |
|  | **Goal 3**<br>Ensure healthy lives and promote well-being for all at all ages | The topic of good health and well-being is of great importance. Enhancing individuals' health and well-being. Despite advancements in healthcare, the COVID-19 pandemic has exposed the vulnerability of numerous nations' healthcare systems. Furthermore, a significant portion of the population lacks access to high-quality medical care and sufficient health services. |

| | | |
|---|---|---|
|  | **Goal 4**<br>Quality Education | Ensuring universal access to high-quality education. While education access has seen improvements globally, the issue of education quality persists as a significant concern. Furthermore, individuals facing poverty, armed conflict, and other challenging circumstances often lack access to education. |
|  | **Goal 5**<br>Achieve gender equality and empower all women and girls | Promoting gender equality to empower women and girls. Gender inequality remains prevalent globally despite ongoing efforts to address it. Gender discrimination and violence continue to be prevalent issues affecting women and girls. |
|  | **Goal 6**<br>Ensure access to water and sanitation for all | Ensure universal access to clean drinking water and adequate sanitation facilities. While there have been improvements in the availability of clean water and sanitation in various regions, a significant portion of the global population continues to lack access to these essential services. Moreover, the provision of drinking water and sanitation frequently exhibits substandard quality. |
|  | **Goal 7**<br>Ensure access to affordable, reliable, sustainable, and modern energy | Advocate for the adoption of renewable and readily available energy sources. Despite attempts to promote clean and affordable energy, the majority of global energy production still relies on non-renewable sources, namely oil and coal. Furthermore, there remains a significant |

| | | |
|---|---|---|
| | | lack of electricity access, particularly in certain regions. |
|  | **Goal 8**<br>Promote inclusive and sustainable economic growth, employment, and decent work for all | Promoting the attainment of decent employment opportunities and fostering sustainable economic growth. Unemployment and precarious work remain prevalent in various regions worldwide, despite the presence of global economic growth. Persistent economic inequalities and the concentration of wealth among a small segment of the population continue to be significant issues. |
|  | **Goal 9**<br>Build resilient infrastructure, promote sustainable industrialization, and foster innovation | The objective is to create sustainable infrastructure and encourage innovation and industrialization. Despite advancements in infrastructure and innovation, numerous regions worldwide continue to face deficiencies in infrastructure, while innovation tends to be concentrated in specific areas. Furthermore, the process of industrial development frequently has adverse impacts on both the environment and human health. |
|  | **Goal 10**<br>Reduce inequality within and among countries | Addressing economic, social, and territorial disparities. Efforts to address inequalities, including economic, social, and territorial disparities, continue to be significant challenges in various regions globally. Furthermore, the COVID-19 |

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| | | pandemic has further exacerbated pre-existing inequalities. |
|  | **Goal 11**<br>Make cities inclusive, safe, resilient, and sustainable | The topic of focus is the development of sustainable cities and communities. Despite efforts to create sustainable cities and communities, the majority of cities worldwide still lack environmental, social, and economic sustainability. Furthermore, the process of rapid urbanization frequently gives rise to challenges such as traffic congestion, air pollution, and environmental degradation. |
|  | **Goal 12**<br>Ensure sustainable consumption and production patterns | Advocating for sustainable production and consumption. The current consumption and production model is unsustainable and gives rise to environmental and social issues, including pollution, natural resource exploitation, and waste generation, despite efforts to promote sustainable production and consumption. |
|  | **Goal 13**<br>Take urgent action to combat climate change and its impact | Examining climate change and its impacts. Despite efforts to address climate change, greenhouse gas emissions are still rising, and the impacts of climate change are becoming more apparent globally. Furthermore, climate action frequently prioritizes technical solutions rather than effectively addressing the underlying issues of climate change. |

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|  | **Goal 14**<br>Conserve and sustainably use the oceans, seas, and marine resources | The objective is to safeguard and rehabilitate marine and coastal ecosystems. Despite conservation efforts, marine and coastal ecosystems remain threatened by overfishing, pollution, ocean acidification, and climate change, which pose risks to their biodiversity. |
|  | **Goal 15**<br>Sustainable management forests, combat desertification, halt, and reverse land degradation, halt biodiversity loss | The focus is on safeguarding and rejuvenating land-based ecosystems. Despite conservation efforts, terrestrial ecosystems are still at risk due to deforestation, desertification, habitat loss, and excessive hunting, which pose threats to terrestrial biodiversity. |
|  | **Goal 16**<br>Promote just, peaceful, and inclusive societies | Advocating for peace, justice, and the establishment of efficient and transparent public institutions. Corruption, violence, political instability, and conflict persistently undermine global peace, justice, and the functioning of transparent public institutions, despite efforts to promote these ideals. |
|  | **Goal 17**<br>Revitalize the global partnership for sustainable development | Enhancing international collaborations to accomplish the goals outlined in the 2030 Agenda. Despite efforts to strengthen global partnerships, international cooperation often remains fragmented and limited. The poorest and most vulnerable countries encounter significant challenges in their pursuit of the objectives outlined in the 2030 Agenda. Furthermore, affluent and |

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| | | influential nations frequently prioritize their interests, disregarding the well-being of the least privileged and most susceptible countries. |

The 2030 Agenda thus reflects a shift from prescriptive development models toward a flexible, place-aware governance paradigm, capable of aligning global objectives with the diversity of national and subnational contexts. It asserts that no singular approach to sustainability can be universally applied; instead, development should be guided by local expertise, institutional capabilities, and specificities of the social and environmental contexts (Oosterhof, 2018). The 2030 Agenda does not provide a comprehensive explanation of how this contextualization should be implemented, deferring that discussion to national policy instruments and implementation frameworks, although it establishes the normative basis for it.

The SDGs introduce a significant novelty by explicitly recognizing inequality as a structural issue that must be addressed. Although equality was identified as a fundamental principle in the *Millennium Declaration*, the SDGs concretize it as Goal 10, which focuses on diminishing inequalities both between and within nations (Grippi, 2023).

Moreover, the SDGs advocate for a networked governance model that encompasses public institutions, private actors, civil society, and local authorities, thereby addressing the quadruple helix model. This strategy facilitates the collaborative development of transformative policies and utilizes instruments such as continuous monitoring, digital innovation, and the sharing of best practices. It underscores the implementation of ethical governance principles, including transparency, inclusiveness, and accountability, which are deemed crucial for securing legitimacy and societal buy-in (Swain, 2018).

Crucially, the Agenda acknowledges the principle of national ownership: each nation is accountable for executing the SDGs in accordance with its unique situation, capabilities, and objectives. Furthermore, the Agenda encourages all nations to collaborate under a unified global vision, coordinating initiatives while honouring national differences.

The 2030 Agenda is predominantly executed at the national level; nevertheless, it is noted that increasing emphasis is being placed on the significance of local initiatives. Indeed, a significant number of the SDGs can be achieved solely through subnational involvement and localized strategies. A comprehensive examination of this topic will be addressed in subsequent chapters; however, it is important to highlight that the localization of the SDGs is now broadly recognized as essential for their global efficacy. As Perry et al. (2021) argue, top-down and sectoral approaches often overlook the interconnections and complexities of sustainable development. Consequently, fostering effective multi-level governance is becoming a pivotal frontier for actualizing the revolutionary transformative potential of the 2030 Agenda.

### 2.1.2 The Localization of Sustainable Development Goals (SDGs)

The successful execution of the 2030 Agenda for Sustainable Development increasingly relies on the ability to convert global aspirations into meaningful local actions. Although the SDGs were designed as a universal framework, able to be applied to all nations and circumstances, their achievement fundamentally depends on their interpretation, integration, and execution at subnational levels. This imperative represents a notable shift from conventional top-down development models, situating the concept of localization as a core operational pillar within contemporary sustainability governance.

In the emerging literature, localization is understood not merely as a territorial breakdown of global goals but as the active contextualization of SDG targets through alignment with institutional capacities, policy priorities, socio-economic conditions, and ecological peculiarities (Perry et al., 2021; Guarini et al., 2022). It involves the formulation, execution, and oversight of locally tailored plans that simultaneously aim to pursue global, national, and subnational objectives (UN-Habitat, 2015). This technique facilitates a more precise policy analysis and strategic diagnosis by calibrating interventions to the underlying cultural, economic, and environmental systems that define each distinct geographical area. Moreover, it enhances global governance by demonstrating how various territorial forces might activate a common global framework in locally differentiated ways (Perry et al., 2021).

Therefore, localization becomes a pragmatic necessity rather than a simple rhetorical ideal. The SDGs, akin to the overarching sustainable development agenda, do not

particularly target municipal authorities or urban stakeholders. Nevertheless, these stakeholders are essential for the successful implementation. It is estimated that approximately two-thirds of the SDG targets will require urban-level engagement, highlighting the pivotal role of municipal institutions, local communities, and city networks in implementation processes (Perry et al., 2021; Bilsky et al., 2022). The actual efficacy of local governments in delivering on the SDGs is significantly influenced by multilevel governance structures within their respective national contexts, encompassing fiscal, legal, and institutional frameworks that either facilitate or hinder local agency.

It implies a relational process through which national strategies are reshaped by the opportunities and constraints of subnational governance, and in which cities, regions, and local communities serve not merely as passive implementers but as active co-producers of sustainable development pathways.

This conceptual shift is grounded in an empirical fact: a significant percentage of the SDG targets, estimated to exceed 65%, cannot be realized without the active involvement of local and regional authorities (OECD & SDSN, 2020). Critical challenges, including clean water and sanitation, sustainable urbanization, resilient infrastructure, public health systems, climate adaptation, and inclusive education, are intricately linked to local systems and necessitate context-sensitive interventions. SDG 11, which explicitly addresses sustainable cities and communities, exemplifies this logic most distinctly; yet it should be noted that the notion permeates nearly the whole agenda.

Researchers and professionals have increasingly emphasized the place-based dimension of sustainability challenges, contending that effective solutions rely on regional attributes and governance dynamics (Hickmann et al., 2024). According to Williams and Blasberg (2023), the SDGs serve as a "strategic innovation platform," allowing cities and local stakeholders to test policy instruments and institutional frameworks that address local priorities while remaining aligned to global standards. This method requires a delicate equilibrium that is fundamentally political, managerial, and institutional.

Furthermore, localization is not merely an administrative procedure; it entails the development of localized indicators, monitoring systems, and policy instruments that can effectively track progress at the subnational level (Zambrano-Monserrate et al., 2023).

In addition to what was stated above, the literature emphasizes that localization extends beyond administrative competence and encompasses collaborative capacity. It necessitates collaboration with a wide range of stakeholders, including civil society, academia, private sector actors, and marginalized communities, in the co-design, implementation, and evaluation of sustainability initiatives. A comprehensive discussion of this stakeholder dimension will be presented in subsequent sections; however, it is crucial to recognize that effective localization relies on mechanisms of distributed governance and horizontal collaboration, especially in contexts where state capacity is constrained or fragmented (Nonet et al., 2022; Valdecañas et al., 2023).

Nevertheless, despite the increasing consensus on the importance of localization, considerable obstacles persist. These include inequalities in financial and technological capabilities among local governments, fragmentation of planning procedures, data restrictions at subnational levels, and inconsistencies in national policy frameworks. Moreover, localization efforts are frequently hindered by vertical coordination failures and the enduring existence of sectoral silos, which compromise the integrative principles of the SDGs (Fox & Macleod, 2023).

The local shift in SDG governance signifies not a weakening of global aspirations, but rather their operational maturation. Instead of diminishing the universality of the Agenda, localization actually provides it with practical traction, integrating its principles into the actual experiences of places and communities. It facilitates the activation of site-specific knowledge, institutional innovation, and community involvement, all of which are crucial for addressing the complex, multi-scalar challenges that characterize sustainability in the twenty-first century.

The localization of the SDGs is not only an administrative adjustment of global objectives to local jurisdictions, but a transformative governance mechanism that initiates context-sensitive pathways to sustainable development. It redefines global governance by emphasizing proximity and relevance, enabling local institutions to shape trajectories that are globally coherent and grounded in local contexts (Perry et al., 2021). The efficacy of this localization process is not exclusively dependent on institutional capability or strategy alignment. Indeed, its success increasingly relies on the capacity to engage a diverse array of public, private, civic, and academic stakeholders whose expertise,

legitimacy, and influence are essential for transforming collective goals into meaningful outcomes. In this growing governance ecosystem, the role of European programs in enhancing collaborative approaches and multi-stakeholder engagement emerges as a crucial facilitator of effective and inclusive SDG localization. The forthcoming section will examine this dimension in depth.

### 2.1.3 The Role of EU Policies in Supporting SDG Localization Through Collaboration

Localizing the SDGs necessitates coordinated efforts across all levels of governance. The EU has committed to incorporating the SDGs into its policy framework comprehensively and formally recognizes and acknowledges the concept of multilevel governance in the design and execution of EU policies (European Commission, 2020). Such commitment reflects an acknowledgment that achieving the 2030 Agenda requires collaboration among EU institutions, national governments, regional and local authorities, civil society, and the private sector. The EU's multi-level governance structure promotes collaboration, ensuring that local and regional perspectives shape national and European sustainable development initiatives. The European Commission established a Multi-Stakeholder Platform on the SDGs, consisting of approximately 30 members from civil society, businesses, and local authorities, to guide SDG implementation. This suggests a more inclusive governance strategy that leverages the contributions of all stakeholders (European Commission, 2017). By utilizing these and other collaborative platforms, the EU is aligning its top-level policies with the SDGs while also empowering stakeholders at multiple levels to engage in and shape the sustainability agenda.

In this context, EU policies and funding instruments are crucial for translating global goals into tangible, local initiatives. The EU's internal funding programs (e.g., Cohesion Policy grants, Horizon Europe, and LIFE), along with its external cooperation instruments, are designed to promote sustainable development outcomes. These tools are specifically designed to promote partnerships and enhance capacity-building, allowing local authorities and stakeholders to implement SDG-related programs effectively. The following subsections provide an overview of the major European funding programs for sustainable development (Section 2.1.4) and examine the challenges encountered and best practices recognized in the administration of EU grants (Section 2.1.5).

### 2.1.4 Overview of European Funding Programs for Sustainable Development

Within the EU, a collection of funding programs supports sustainable development initiatives by providing financial resources, policy frameworks, and incentives for cooperation. The EU's Cohesion Policy is paramount, directing substantial investments into regions and cities to foster equitable socio-economic growth. The Cohesion Policy, primarily executed via the European Regional Development Fund (ERDF), the European Social Fund Plus (ESF+), and the Cohesion Fund, is specifically associated with the SDGs. In the 2021–2027 programming period, almost 94% of Cohesion Policy resources are directly contributing to 12 of the 17 SDGs (European Commission, 2024). This marks an expansion in scope compared to the prior era and emphasizes that virtually all Cohesion-funded projects (from infrastructure to social inclusion initiatives), advance SDGs. Investments under Cohesion Policy, for example, aim to achieve goals such as Industry, Innovation and Infrastructure (SDG 9) by promoting innovation and digital connectivity; Sustainable Cities and Communities (SDG 11) through urban development and transportation initiatives; Climate Action (SDG 13) by financing energy efficiency and resilience; and Reduced Inequalities (SDG 10) by prioritizing less-developed regions and vulnerable communities (European Commission, 2024).

The ERDF is crucial in this regard because it provides funding for projects that promote innovation, enhance infrastructure, and protect the environment. This helps the EU achieve its primary objectives of innovative, sustainable, and inclusive growth (Bădîrcea et al., 2025). The ERDF also supports important goals in many SDGs, such as SDG 7 on clean energy, SDG 8 on decent work and economic growth, SDG 9 on industry, innovation, and infrastructure, and SDG 11 on sustainable communities. It achieves this by funding projects such as clean urban transport, renewable energy infrastructure, research and development for small and medium-sized enterprises (SMEs), and digital connectivity in areas that lack it. Recent research indicates that ERDF funding has contributed to progress on the SDGs in all EU regions, particularly in lower-income Member States. These investments help reduce regional inequalities while also addressing global issues, such as climate change (Bădîrcea et al., 2025). In addition to the ERDF's emphasis on infrastructure and competitiveness, the ESF+ serves as the EU's primary mechanism for investing in human capital. With a budget of approximately €142.7 billion for 2021-2027, the ESF+ provides substantial support to EU employment,

social inclusion, education, and skills policies (European Commission, 2021). The ESF+ directly supports SDGs pertaining to poverty alleviation, quality education, gender equality, and decent employment (specifically SDGs 1, 4, 5, 8, and 10) by co-financing numerous projects at both national and local levels. For instance, ESF+ supported specific initiatives aimed at integrating vulnerable populations into the labor market, addressing long-term unemployment, enhancing educational and training systems, and strengthening social services. The ESF+ helps disadvantaged populations gain economic opportunities by funding vocational training, upskilling programs, and community-based social inclusion initiatives; thereby lowering poverty rates and inequality. These initiatives promote Partnerships for the Goals (SDG 17) by creating collaborations among local governments, NGOs, and employers. Research demonstrates that in underdeveloped areas, ESF funding strongly fosters cooperation among various stakeholders and fortifies local development partnerships (Bădîrcea et al., 2025). This collaborative ethos inherent in the ESF+ highlights the multilevel governance approach of the EU's sustainable development initiatives.

Alongside Cohesion Policy funds, the EU administers many thematic initiatives that facilitate SDG-related achievements through collaborative projects. A notable example is Horizon Europe, the European Union's flagship research and innovation program (2021–2027), with an indicative budget of €95 billion. Horizon Europe expressly seeks to address climate change and facilitate the attainment of the UN SDGs while enhancing EU competitiveness (European Commission, 2021). It does so by fostering worldwide research collaborations and innovation networks that address global concerns, including health, renewable energy, sustainable urban development, food security, and digital transformation, all of which align with the SDGs. The program’s mission-oriented approach (e.g., Missions on Climate Adaptation, Climate-Neutral Cities, Ocean protection, etc.) and its support for European Partnerships (bringing together public and private stakeholders to co-invest in R&I) exemplify how EU policies leverage collaboration to drive sustainable solutions. Furthermore, Horizon's commitment to multi-country consortia guarantees capacity-building and knowledge transfer to regions with lower research intensity, in accordance with the EU's cohesion and sustainability goals (Segal et al., 2025).

The LIFE Programme is another of the EU's main funds for protecting the environment and fighting climate change. With a budget of €5.4 billion for 2021–2027, LIFE, established in 1992, remains the only EU program that focuses solely on environmental, climate, and energy goals. By co-funding pilot initiatives and best practices, its goal is to catalyse the shift towards a more sustainable, circular, energy-efficient, and climate-neutral economy (European Commission, 2021). LIFE has funded over 5,000 projects in EU member states over the past 30 years, primarily at the local or regional level. These projects have dealt with issues like protecting nature (biodiversity protection aligns with SDG 15 “Life on Land”), reducing pollution and managing waste (SDG 12 “Responsible Consumption and Production”), transitioning to “clean energy” (SDG 7), and “adapting to climate change” (SDG 13). The LIFE Programme not only provides grants but also focuses on better governance and capacity at all levels. Indeed, one of its goals is to develop and disseminate innovative techniques while also improving environmental governance, including enforcement of EU environmental legislation by local authorities (European Commission, 2021). By sponsoring local pilot projects and advocating the use of successful solutions, LIFE serves as a laboratory for sustainable projects that can be scaled up with additional funding or policies. It also commonly involves partnerships between cities, NGOs, and private actors; this helps build networks for sustainability.

#### 2.1.4.1 The Erasmus+ Program

The Erasmus+ Programme, another key project traditionally linked to education and youth mobility, is increasingly becoming a strategic tool for supporting sustainable development and SDG localization. With a budget of over €26 billion for the 2021–2027 period, Erasmus+ supports education, training, youth, and sport initiatives across the EU and beyond. It is crucial for SDG localization not only because it supports SDG 4 (Quality Education), but also because it helps SDGs 10, 11, and 17, primarily through collaborations and capacity-building at the local and regional levels (Nogueiro et al., 2022).

Following its redefinition in 2021, Erasmus+ has more firmly integrated with the European Education Area, the European Green Deal, and the United Nations 2030 Agenda. The Programme integrates inclusivity, digitalization, and environmental sustainability as overarching priorities across all project categories. These

interdisciplinary themes guarantee that local Erasmus+ initiatives can serve as gateways for extensive interaction with the SDGs (Saraiva et al., 2022). Local governments and civil society organizations frequently engage in Key Action 2 (Cooperation Partnerships) and Key Action 3 (Support to Policy Development) projects to enhance skills, stimulate social innovation, and encourage civic involvement about sustainability topics. Therefore, Erasmus+ serves as a tool for both education and training, as well as participatory governance, embodying the collaborative ethos inherent in the SDG framework.

Additionally, Erasmus+ initiatives actively facilitate the localization of the SDGs by promoting peer learning, knowledge transfer, and transnational collaboration. Municipalities, schools, NGOs, and other entities are introduced to innovative practices in sustainability, urban development, digital inclusion, and social cohesion through mobility programs and strategic collaborations. Numerous partnerships yield localized adaptations of models linked with the SDGs. For instance, projects that focus on climate education in schools or civic participation in marginalized neighbourhoods enhance institutional and community capacity, which is a cornerstone of effective localization (De Benedictis & Leoni, 2021).

The youth dimension of Erasmus+ is particularly significant in the context of implementing the SDGs at the local level. The program empowers youth to take on leadership roles in sustainability initiatives and local governance, aligning closely with SDG 16 (Peace, Justice, and Strong Institutions) and SDG 17 (Partnerships). The European Solidarity Corps, operating under Erasmus+, assists young people in volunteering and community-based projects that often tackle local environmental and social issues. These interactions cultivate social capital and promote a culture of active citizenship, hence enhancing the inclusivity and resilience of communities (Johanesova, 2024).

Erasmus+ strengthens the EU's multilevel and multi-actor cooperation approach from a governance standpoint. Local and regional authorities qualify as applicants or partners in numerous Erasmus+ initiatives, and the program progressively promotes synergies with other EU funds, including ESF+ and ERDF. This enhances policy coherence and enables local stakeholders to diversify their financing sources while implementing integrated development initiatives.

The EU implements a comprehensive range of policies and financial mechanisms to facilitate the localization of SDGs, both within its Member States and internationally. These encompass territorially-oriented investment funds (ERDF, ESF+, Cohesion Fund) as well as thematic and research initiatives (LIFE, Horizon Europe). A common characteristic of these instruments is their focus on multilevel collaboration and partnership. This collaborative approach guarantees that projects align with local needs, strengthen local capabilities, and foster widespread ownership of development results. Through its funding and facilitation role, the EU catalyzes the localization of the SDGs by offering financial assistance and a platform for collaborative learning, innovation, and inclusive governance towards sustainability.

### 2.1.5 Challenges and Best Practices in Managing European Grants

Executing EU-funded projects for sustainable development at local and regional levels presents considerable managerial and administrative difficulties. Local authorities and companies often face steep learning curves in mastering EU grant procedures, which are characterized by their stringent regulations and complexity. Prevalent challenges encompass administrative burdens, capability limitations, co-financing requirements, and the necessity for efficient cooperation among partners. Understanding these obstacles is crucial for recognizing optimal approaches that might improve the efficacy of SDG-related projects funded by European resources.

A significant challenge is the huge administrative and compliance obligations associated with EU financing. EU grant programs provide comprehensive directives on project design, budgeting, procurement, monitoring, and reporting (European Commission, 2023). The application process itself can be intimidating; developing a high-quality project proposal that aligns with EU criteria typically involves considerable time (many months of preparation) and expertise in areas such as logical framework planning and indicator setting. Beneficiaries must maintain comprehensive documentation of activities and expenditures throughout the implementation period to comply with EU auditing criteria. Especially smaller governments or civil society organizations may encounter difficulties in meeting these needs if they lack specialized project management units or experienced personnel. The restricted administrative capability at the local level is often identified as an obstacle to the efficient utilization of EU funds. An OECD study revealed

that insufficient skills and institutional capacity among smaller beneficiaries, such as small municipalities or NGOs, can hinder their ability to navigate the complexities of EU-funded investments (OECD, 2020). This includes challenges in comprehending and implementing intricate regulations, managing procurement procedures, and executing monitoring and evaluation in accordance with EU standards. Insufficient capacity poses a risk of errors or delays in project implementation, which can lead to disallowed costs or even the withdrawal of funding in worst-case scenarios.

A further problem concerns the financial dimensions of EU grants, particularly the co-financing requirement. Most EU programs do not cover 100% of project expenses; beneficiaries are required to provide a contribution, which may vary from 20% to 50% or more of the entire budget, contingent upon the fund and the region's status. Local governments with constrained finances or NGOs dependent on donations may find it challenging to obtain this matching contribution. If co-financing is not readily available, promising projects may fail to initiate or may be curtailed. Furthermore, managing cash flow is essential. EU funds are typically reimbursed only post-expenditure, necessitating that beneficiaries must front the costs and then claim them, thus straining their resources. In some cases, stakeholders have contended that EU co-funding rates ought to be elevated to reduce the burden on local partners; specifically, in the context of cross-border cooperation programs, local authorities considered the standard 80% EU co-financing rate to be “insufficient” and advocated for an increase in the EU contribution to enhance project viability (Interact, 2024). Co-financing is intended to ensure local ownership and commitment; yet, it is a delicate endeavor to establish a rate at a level that is both ambitious and accessible for underdeveloped regions.

Coordination and partnership management pose further challenges. EU projects often involve multiple partners (different municipalities, agencies, NGOs, or private firms), perhaps from diverse nations. Effective management of a consortium necessitates well-defined governance frameworks, robust communication, and confidence among members. Challenges may emerge from cultural disparities, divergent expectations, or the inherent logistical complexity of organizing activities among partners. Moreover, synchronizing local goals with EU priorities necessitates meticulous planning; projects must satisfy EU objectives (as specified in program calls or Operational Programs) while concurrently addressing authentic local needs. Local actors have occasionally

encountered difficulties when project themes are dictated by EU agendas that may not align with their specific contexts. Indeed, although programs such as Interreg have become more flexible, there are demands for greater responsiveness to local particularities (Interact, 2024). Facilitating substantial stakeholder engagement throughout the project cycle is another hurdle: it is essential to involve community stakeholders (citizens, local enterprises, civil society) to secure public support and ensure enduring impact; however, this necessitates considerable time and expertise in facilitation and participatory planning.

#### 2.1.5.1 Best practices from managing European funds

In response to these issues, some best practices have emerged to enhance the administration of European funding for sustainable development initiatives. Primarily, strengthening the skills and expertise of those executing EU programs is essential. The European Commission and several other organizations have developed extensive guidance materials, workshops, and online platforms to support local project managers in understanding EU regulations and enhancing their competencies. Investing in internal capacity, for example, by establishing a specialized EU project office within a municipality, yields benefits by improving grant application success rates and facilitating smoother implementation. The OECD emphasizes that reinforcing the proficiency of beneficiaries is essential for effectively managing the complexities of EU subsidies (OECD, 2020). Secondly, adopting the EU's partnership principle becomes a best practice in itself. Involving pertinent stakeholders early and consistently enhances projects through diverse knowledge and increased support. Local authorities have determined that partnering with universities or specialized NGOs can strengthen the design and execution of projects (for instance, a city working with a technical university on an innovation project funded by Horizon Europe, or a social NGO helping implement an ESF+-funded inclusion program). Furthermore, horizontal collaboration among cities and regions accelerates the pace of knowledge sharing and learning. Involving stakeholders can significantly improve project outcomes; for instance, local communities' engagement in an SDG initiative, such as a climate adaptation plan, enhances the plan's relevance and fosters community buy-in, resulting in more sustainable outcomes (Marín-González et al., 2022). Ultimately, the effective implementation of EU funding requires the adoption of a results-oriented project management approach and the coordination of competencies.

Implementing EU-funded initiatives that meet the SDGs requires not only technical and administrative skills but also an adaptive governance function that is adept at managing complexity across various institutional levels and stakeholder domains. In this context, a burgeoning corpus of public management literature highlights the necessity for orchestrators, entities that not only coordinate operations but also actively direct networks of participants towards common goals in the absence of hierarchical authority (Rhodes, 1996; Sørensen & Torfing, 2009). In multistakeholder EU projects, where public authorities engage with civil society, academia, and private entities, the function of the orchestrator is crucial for maintaining direction, accountability, and coherence over time.

From a systems thinking perspective, such orchestration corresponds with the principles of system dynamics: the implementation of SDG-related initiatives entails interacting subsystems (social, economic, political, ecological) where unintended consequences, feedback loops, and time delays must be anticipated and managed (Sterman, 2000). Orchestrators function not only as conveners but also as learning agents who oversee interdependencies, modify tactics in response to emerging input, and guarantee adaptive capability throughout the project lifecycle (Bryson et al., 2015).

This necessity is particularly evident in EU-funded SDG initiatives that encompass co-creation, participatory evaluation, and cross-sectoral innovation. In the absence of orchestrators fulfilling this integrative function, whether institutionalized (e.g., specialized project management units) or emergent (e.g., individuals with boundary-spanning abilities), such initiatives are susceptible to fragmentation, duplication, or stagnation.

These approaches not only mitigate risks but also enhance the substantive impact of projects, ensuring that the resources mobilized by the EU yield measurable advancements toward the SDGs at the local level.

It is clear that effectively leveraging EU policies for SDG localization involves not only securing funds but also ensuring effective implementation. By adopting best practices in project management and embracing the EU's collaborative frameworks, local governments and stakeholders may overcome administrative hurdles and convert EU support into significant on-the-ground activity. The multi-level governance framework of the European Union, characterized by a combination of financing opportunities,

regulations, and support mechanisms, equips local actors with both resources and the impetus to enhance their capabilities. Consequently, EU-funded projects often serve as models of how meticulous planning, extensive stakeholder involvement, and rigorous financial oversight can lead to sustainable outcomes. By implementing these methods, European regions and cities are better positioned to achieve global objectives by 2030, demonstrating the crucial role of EU policies in promoting and sustaining SDG localization through collaboration.

### 2.1.6 Statement of the problem

Although nearly all UN member states have formally adopted the SDGs and there is a global agreement on the 2030 Agenda for Sustainable Development, it remains challenging to translate these goals into coherent, effective, and place-based local action. The SDGs have established a framework to facilitate sustainable development across social, economic, and environmental dimensions. However, it remains challenging to implement them at the local level (Nilsson & Weitz, 2019; Stephens et al., 2018). Empirical research and global progress reports indicate that most targets are either off track or moving backward, and that national and subnational policies frequently overlook the complexity and interconnectedness inherent in the SDGs (Sachs et al., 2024).

Most institutional frameworks still rely on sectoral logic, top-down planning, and short-term policy cycles, which are poorly suited to cope with the multifaceted, long-term, and place-specific nature of the SDGs. Additionally, there is often a gap between national-level goals and the capacity of local actors to act meaningfully within their own contexts. This results in situations where local authorities are formally tasked with implementing SDG-related actions but lack the appropriate knowledge systems, decision-support tools, or collaborative mechanisms to do so effectively (Perry et al., 2021).

In such a setting, it becomes crucial to question how the localization of the SDGs can be supported not just through normative alignment, but through operational innovation. Localization, as a process, does not simply imply the territorial disaggregation of global targets. It involves the active re-contextualization of goals, the co-production of policy instruments, and the adaptation of governance models to reflect local specificities, capacities, and constraints (UN-Habitat, 2015). This requires tools capable of integrating

multiple sources of knowledge, capturing non-linear relationships between policy domains, and facilitating real-time learning and adaptation. It also requires institutional arrangements that enable multi-actor participation and iterative decision-making across various levels of governance (Galluzzo & Gennusa, 2023).

Although these needs are well-recognized in the literature, a significant gap in both theory and practice remains, particularly regarding how such integrated, dynamic, and collaborative approaches can be concretely applied to the localization of the SDGs. While concepts such as systems thinking, data-informed decision-making, and stakeholder co-creation and co-governance are increasingly referenced in policy making, the actual operationalization of these ideas remains limited and poorly documented in real-world contexts. In particular, there is a lack of empirical evidence on how specific methodological frameworks, such as System Dynamics, DPG, and BI, can be employed to enable adaptive, participatory, and territorially grounded strategies for sustainable development.

This thesis is situated within that gap. By analyzing multiple case studies in which these methodologies are being applied in different governance settings, it aims to understand under what conditions and to what extent such tools can support more effective localization of the SDGs. The research seeks to explore not only the technical functionality of these instruments but also their institutional embedment, their relationship with stakeholder dynamics, and their potential to foster long-term place-based value and sustainable resilience. In doing so, the work contributes to the broader academic and policy debate on how to move beyond the rhetorical alignment with global goals and toward their substantive and transformative realization at the local level.

### 2.2 Related Literature

The following sections present a critical literature review of the scientific literature relevant to the frameworks and methodologies employed in this doctoral research. Given the complexity and interconnected nature of the 2030 Agenda, the review adopts an interdisciplinary theoretical perspective, governance frameworks, and digital tools. In particular, it addresses how to approach wicked and super-wicked problems, how collaborative and systemic governance paradigms have evolved over time, and how platform-based and data-driven infrastructures, such as System Dynamics, Dynamic

Performance Governance, and Business Intelligence, can help with SDG localization. The goal is to outline the theoretical and empirical bases on which the thesis's analytical and methodological framework is based.

### 2.2.1 Wicked and Super-Wicked Problems

Over the last forty years, a broader consensus has emerged across disciplines regarding the inadequacy of traditional, linear models of public policy in addressing the complex societal challenges of our time. Issues like climate change, terrorism, urban deterioration, and systematic inequality are not only insidious; they are intricately interconnected, dynamic, and fraught with conflicting ideals and interests. Ackoff (1974) noted that issues rarely exist in isolation; instead, they are components of larger, interrelated systems of dysfunction. He referred to this connection as a "mess," contending that efforts to address isolated components of urban systems (e.g., transportation, health, education, crime, etc.) frequently exacerbate the overall situation (Ackoff, 1974: 21, as cited in Head & Alford, 2013: 713). This understanding established the foundation for the notion of wicked problems, introduced shortly thereafter by Rittel and Webber (1973).

Wicked problems cannot be "solved" in the conventional manner. They elude exact definition, lack a clear endpoint, and resist categorization as either "true" or "false" answers. On the contrary, solutions are evaluated in terms of "better" or "worse", and often only retrospectively. Wicked problems are essentially distinctive; although they may exhibit superficial similarities, each case is influenced by a particular combination of historical, institutional, and social factors. In most cases, a wicked problem often reflects more extensive structural conditions, which might be called "problems of the second order". Furthermore, any effort to address such issues produces mostly unpredictable outcomes, many of which are irreversible or cumulative (Turner & Baker, 2019). These characteristics collectively render standard policy instruments and decision-making frameworks insufficient, frequently reinforcing the complexity they intend to resolve. Generally, new manifestations of wicked problems arise when attempting to comprehend and treat one of them (Ritchey, 2013).

"The classical systems approach … is based on the assumption that a planning project can be organized into distinct phases: 'understand the problems', 'gather information ', 'synthesize information and wait for the creative leap', 'work out solutions', and the like.

For wicked problems, however, this type of scheme is ineffective. One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve" (Rittel & Webber, 1973, p. 161).

The literature has further refined the concept of wicked problems by identifying a distinct category known as super wicked problems, which exhibit even more severe and intractable characteristics (Levin et al., 2012).

These challenges are characterized by several distinctive features: time is limited for effective action; there is no central authority with the power or legitimacy to implement a solution; those endeavoring to address the issue frequently exacerbate it; and most importantly, future repercussions are often undervalued or disregarded in present decision-making.

Indeed, climate change exemplifies the full spectrum of wickedness, elevated to an existential scale. Their drivers, including fossil fuel combustion, deforestation, and unsustainable industrial and agricultural practices, are embedded in the core of contemporary economies. These actions are not peripheral but systemic, and those attempting to manage climate change (governments, corporations, and civil society) are simultaneously contributors to the issue. This paradox makes climate governance distinctly intricate (Levin et al., 2012).

In policy making, addressing wicked problems involves enhancing the global condition rather than uncovering absolute truths. From this perspective, policymakers are accountable for the outcomes of the solutions they implement; thus, planners have no justification for errors. They must contemplate unconventional approaches to address these complex difficulties. Rittel and Webber (1973) acknowledged the imperative to address these concerns for a comprehensive approach to problem comprehension and resolution, emphasizing that interpretations cannot be strictly categorized as true or incorrect. The interpretation and validity of potential solutions depend on the assessments of the stakeholders affected, which are influenced by their value systems and ideological predispositions. Any potential solution for wicked situations produces limitless implications over time, which cannot be fully comprehended until they have entirely unfolded. Furthermore, the solutions are frequently irreversible (Turner & Baker, 2019),

invariably leaving traces, and any effort to amend or rectify unintended consequences may generate additional wicked problems or intensify existing ones, often intersecting various policy domains (Christensen & Fimreite, 2006).

The current literature offers various strategies for tackling wicked and super-wicked challenges. To address the intrinsic dynamic complexity and multifaceted governance structures associated with these issues, a proposed strategy involves engaging multiple stakeholders, including entities from the public, private, and non-profit sectors, within a collaborative framework (Roberts, 2000; Ansell & Gash, 2008). The literature suggests that effectively addressing wicked problems requires the active involvement of public authorities in engaging diverse societal groups and non-governmental entities. This inclusive strategy aims to integrate diverse perspectives and ideals relevant to the issue at hand. Collaborative arrangements are acknowledged as vital mechanisms for accessing fragmented and localized knowledge, mobilizing both tangible and intangible resources, and establishing legitimacy through a shared sense of purpose and collective responsibility in addressing common issues. The notion of knowledge is frequently defined as both shared and produced within collaborative settings (Feldman et al., 2006), hence greatly enhancing the capacity to address complex issues.

Different scholars emphasize the importance of adopting a more discursive and inclusive approach in policy discourse for addressing complex and challenging situations. Fischer (1993) describes the “paradox of wicked problems,” indicating that broadening the participatory basis of policy making is not detrimental, but rather a resolution (Daviter, 2017). Collaborative governance is a consensus-driven method of governance characterized by self-coordination and voluntary engagement, which enhances trust and facilitates consensus-building. Improper management of collaborative public administration initiatives may result in diminished efficiency and effectiveness. This corresponds with Huxham's (2003) notion of “collaborative inertia.”

These characteristics, especially regarding climate change, demonstrate that numerous difficulties faced by modern societies are not only multidimensional and interlinked but also entrenched in systems where time, authority, and accountability are profoundly misaligned. In this context, the inadequacies of traditional policy instruments become

increasingly apparent, as linear, sectoral, and short-term strategies fail to meet the scale and urgency of the challenges presented (Levin et al., 2012).

The rise of super wicked problems has compelled institutions and communities to reevaluate both their goals, and the frameworks used to convey and accomplish those objectives. This reconsideration is fundamentally driven by a critical necessity: the establishment of a comprehensive vision that surpasses disciplinary confines and temporal limitations, integrating ecological constraints, human welfare, and global equity into a cohesive and progressive agenda (Incropera, 2015).

### 2.2.2 Genesis and Evolution of the Concepts of Sustainability and Sustainable Development

The notion of sustainable development, as presently articulated in academic, political, and institutional discussions, did not arise from a unified definitional agreement. Instead, it has developed over a decades-long period influenced by geopolitical transformations, environmental crises, intellectual reconfigurations, and an increasing recognition of planetary constraints. This evolution signifies a profound enhancement in environmental awareness and a reconfiguration of the relationship between nature, society, and development. Sustainable development has evolved from its initial formulations on ecological preservation to a multidimensional framework for global governance, serving as the primary perspective through which modern societies seek to balance economic prosperity, social justice, and environmental responsibility.

The first significant milestone in this progression was the *United Nations Conference on the Human Environment*, held in Stockholm in 1972. This occasion marked the first global recognition that environmental deterioration jeopardizes both ecosystems and human welfare, as well as economic progress. Although the conference did not include contemporary sustainability terminology, the Stockholm Declaration stated principles that would subsequently provide the foundation for the notion that environmental conservation and development must be handled concurrently. Principle 13 of the Stockholm Declaration expressly advocated for comprehensive economic planning that considered environmental impacts:

“In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their

development planning to ensure that development is compatible with the need to protect and improve the environment for the benefit of their population."

Principle 6, instead, recognized the responsibility of states to protect the environment in the context of human development (UNEP, 1972):

"The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill countries against pollution should be supported."

This acknowledgment arose against the backdrop of intensifying industrialization, population expansion, and scientific warnings over resource exhaustion, exemplified by the *Limits to Growth* report published that same year by the Club of Rome.

The concept of "sustainable development" was defined and popularized with the publication of the Brundtland Report, titled "Our Common Future" (1987). The World Commission on Environment and Development (WCED), led by former Norwegian Prime Minister Gro Harlem Brundtland, articulated sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). This definition incorporated a temporal and ethical dimension into development planning, highlighting intergenerational justice as a fundamental principle. The research contended that environmental protection could not be achieved independently of economic and social policies, asserting that poverty and inequality are significant contributors to environmental degradation. Furthermore, it highlighted the uneven allocation of environmental risks and the global nature of ecological interdependence, hence necessitating a cohesive international response.

The impact of the Brundtland Report was most prominently observed at the 1992 United Nations Conference on Environment and Development (UNCED), also known as the Rio Earth Summit. The summit, held in Rio de Janeiro, was unparalleled in its scope and ambition, convening more than 170 heads of state and thousands of delegates from governments, NGOs, and civil society. More than a mere diplomatic meeting, it

represented a global recognition that environmental degradation, poverty, and inequality are interconnected issues that require cohesive solutions. This significant conference produced two essential documents: the Rio Declaration on Environment and Development and Agenda 21. The former delineated 27 principles to guide national and international policy, emphasizing human-centeredness (Principle 1), intergenerational and intragenerational justice (Principles 3 and 5), and the essential incorporation of environmental protection within development initiatives (Principle 4). Principle 7 was particularly significant as it established the notion of common but differentiated responsibilities, acknowledging the unequal contributions to global environmental issues and the differing capabilities of nations to address them (UN, 1992a; IAU, 1992). Meanwhile, Agenda 21 (UN, 1992b) provided a comprehensive and pragmatic framework for implementing sustainable development across multiple sectors and levels. The 40 chapters encompassed topics ranging from climate and biodiversity to health, consumption patterns, and land exploitation. Significantly, it emphasized the necessity of coordinated action among states, local authorities, private enterprises, and civil society organizations. Chapter 28 specifically introduced the concept of *Local Agenda 21*, encouraging communities to formulate localized initiatives that match global goals. Furthermore, Chapter 30 emphasized the responsibility of businesses and industries, particularly transnational corporations, to implement sustainable practices and engage in self-regulation. Therefore, Rio marked a paradigmatic shift: sustainability evolved from a normative aspiration to a multi-level policy framework based on collective yet varied responsibilities, aimed at converting principles into operational programs across several governance levels.

#### 2.2.2.1 The World Summit for Social Development

The concept received further institutional structure at the 1995 World Summit for Social Development in Copenhagen, where the international community ratified a declaration that officially acknowledged the three pillars of sustainable development (economic, social, and environmental) as "interdependent and mutually reinforcing" (UN, 1995). This recognition solidified sustainable development as a systemic approach, transcending limited environmentalism to address broader issues of inequality, employment, education, and social cohesion. It also emphasized governance and ethical responsibility,

underscoring the importance of inclusive institutions, transparency, and robust legal frameworks.

At the beginning of the 21st century, the focus shifted to goal-oriented governance with the implementation of the *Millennium Development Goals* (MDGs) in 2000. The MDGs, eight worldwide targets to be accomplished by 2015, embodied a more technocratic and measurable approach to development. Although sustainability was not the primary framework, Goal 7 explicitly focused on environmental sustainability, and the architecture of the MDGs established a foundation for integrating targets and indicators as essential components of global policy coordination (UN, 2000). Notwithstanding their accomplishments in poverty reduction and educational access, the MDGs faced criticism for their narrow scope, inadequate focus on ecological limits, and lack of attention to systemic disparities and governance challenges.

In 2002, the *World Summit on Sustainable Development*, held in Johannesburg, was attended to revitalize the political momentum established in Rio. The Johannesburg Declaration reaffirmed the commitments outlined in Agenda 21. It underscored the importance of multilateral cooperation, emphasizing the need for all sectors (public, private, and civil) to collaborate towards sustainable development (UN, 2002). It also emphasized the role of corporate social responsibility and reinforced the imperative of foreign direct investment in fostering sustainable growth, particularly in the Global South.

A significant conceptual and strategic advancement occurred during the Rio+20 Conference in 2012, where the conclusion document, *The Future We Want*, delineated the post-2015 vision for sustainable development. It clearly advocated for the establishment of the SDGs, which would enhance the MDGs while being more universal, integrated, and ambitious. The above-mentioned manifesto reaffirmed the tripartite paradigm of sustainability and incorporated new focuses on resilience, green economy, and inclusive growth. The *High-Level Political Forum on Sustainable Development* was formalized as the principal UN entity for overseeing and evaluating implementation (UN, 2012).

Over the past four decades, the concept of sustainability has evolved from a primarily environmental issue into an extensive framework for global governance, intricately integrated with international institutions, corporate practices, national policies, and civil society discussions. Its trajectory illustrates not merely the aggregation of declarations

and strategies, but a profound intellectual shift towards perceiving the Earth as a collective system, ecologically vulnerable, socially unequal, economically interconnected, and politically fragmented. Sustainable development embodies both a normative goal and a pragmatic roadmap, being simultaneously visionary and operational. Section 2.2.1 will demonstrate that this conceptual architecture is most formally and systematically represented in the 2030 Agenda for Sustainable Development, which delineates 17 universally accepted goals aimed at tackling the critical challenges of our era.

### 2.2.3 The Need to Include Environmental Variables in Socio-Economic and Cultural Models

Throughout the majority of the twentieth century, dominant economic theories and policy frameworks treated the environment as an unlimited source of resources. In neoclassical economics, natural capital was often excluded from fundamental growth models, and environmental deterioration was viewed as a manageable consequence of industrialization. As a result, mainstream development policies have predominantly emphasized GDP growth, technological progress, and market liberalization, while neglecting the ecological limits of resource extraction and the social implications of environmental degradation (Butera, 2023).

This omission became progressively unacceptable as the cumulative consequences of global industrial activity became apparent. Starting in the 1970s, a wave of ecological discourse, rooted in the Limits to Growth report of the Club of Rome (1972), began to question the sustainability of limitless economic expansion on a finite planet.

The publication of the Brundtland Report in 1987 further legitimized this paradigm shift by framing sustainability as a development issue and underlining the necessity for systemic integration of environmental issues and socio-economic planning (WCED, 1987). In the following decades, many frameworks were developed to capture environmental dynamics in macroeconomic models. The concept of natural capital gained prominence, with alternative indicators such as the Human Development Index (HDI), the Genuine Progress Indicator (GPI), and the Ecological Footprint, all designed to address the limitations of GDP-centric models.

Empirical evidence reinforced the theoretical critiques. Phenomena including climate change, deforestation, and biodiversity loss have exposed intricate feedback loops between ecological degradation and socioeconomic vulnerability, especially in low-income and marginalized groups. Hariram et al. (2023) contend that socio-economic models should transition to a paradigm of "sustainalism," prioritizing quality of life and ecological resilience as primary developmental goals rather than secondary concerns. Similarly, Davoodi et al. (2021) emphasize the need to incorporate environmental risks and ecological thresholds into evaluations of macroeconomic stability, particularly in environments characterized by systemic uncertainty and institutional vulnerability.

The incorporation of environmental variables into socio-economic and cultural models reflects the growing recognition of the interconnection between human and natural systems. Fields such as ecological economics, political ecology, and sustainability science have demonstrated that phenomena such as pollution, resource depletion, and climate variability are not merely "environmental" issues but systemic challenges with extensive cultural, political, and economic implications.

The escalating urgency of the climate catastrophe has prompted initiatives to integrate environmental factors into global policy frameworks. The Paris Agreement (2015) and the IPCC's Sixth Assessment Report (2021) emphasize that future economic resilience is fundamentally linked to ecological stability. The separation of economic growth from carbon emissions, the promotion of circular economies, and the allocation of resources towards green infrastructure are now seen not just as environmental necessities but also as prerequisites for long-term socio-economic viability.

### 2.2.4 The Interconnection Between the Three Pillars of Sustainability: Economy, Society, and Environment

The modern concept of sustainable development is based on the recognition that economic prosperity, social equity, and environmental integrity are interconnected systems rather than isolated entities. The triadic model, comprising economy, society, and environment, was officially defined in international governance frameworks starting in the early 1990s and has since emerged as the dominant heuristic for policy integration.

The conceptual maturation of this paradigm can be traced back to the 1992 Rio Earth Summit, which emphasized the necessity to reconcile economic growth, environmental

conservation, and social progress as articulated in the Rio Declaration and Agenda 21. The 1995 Copenhagen Declaration on Social Development codified these three dimensions as "interdependent and mutually reinforcing" (United Nations, 1995), a concept further emphasized in the Johannesburg Plan of Implementation (2002), which highlighted the indivisibility of the pillars of sustainable development (United Nations, 2002).

This interconnection demonstrates a systematic understanding of the mechanisms that underlie current global challenges. Economic policies that overlook social inequities can lead to instability and opposition, ultimately undermining long-term development goals. Likewise, social development initiatives that overlook ecological limitations are likely to be unsustainable or perhaps counterproductive. Environmental preservation initiatives that neglect economic viability may result in marginalization or worsen poverty, especially in situations where livelihoods rely on the exploitation of natural resources. Consequently, policy consistency among these pillars corresponds to a structural necessity.

The interconnection of these factors has been examined from an analytical perspective across other fields. Researchers such as Sachs (2015) and Stiglitz, Sen, and Fitoussi (2009) have argued that there should be a shift away from limited economic measures, like GDP, and toward the use of multifaceted indicators that encompass social welfare and environmental well-being. The inadequacy of GDP in representing inequality, environmental degradation, or non-market contributions, such as unpaid care work, has led to the creation of alternative frameworks, including the Human Development Index (HDI), the Better Life Index, and the Inclusive Wealth Index. These models aim to capture the qualitative aspects of development, encompassing access to education, healthcare, environmental quality, and democratic participation.

The three-pillar approach was further refined with the introduction of systems thinking and the integration of ecological economics into policy discussions. Instead of perceiving the three pillars as equal and distinct, several theorists, particularly Kate Raworth (2017) in her “doughnut economics” model, have advocated for a nested systems approach, wherein the economy is situated within society, which subsequently functions within the limits of the biosphere. This perspective corresponds with the “strong sustainability”

paradigm, which asserts that natural capital is irreplaceable by human-made capital and that environmental limits must be respected to maintain system viability (Neumayer, 2003). This aligns with the planetary limits paradigm presented by Rockström et al. (2009), which delineates nine essential ecological thresholds that, if crossed, may initiate irreversible environmental change.

This theoretical evolution has enhanced the conceptual coherence of sustainability; however, its practical application remains inconsistent. Trade-offs between pillars represent a persistent difficulty in policy-making. Large-scale infrastructure projects can catalyze economic growth and enhance service accessibility, although they may also lead to displacement, cultural disruption, and environmental degradation. Conversely, rigorous environmental regulations may impose expenses for industries and result in job losses, unless specific social and economic policies accompany them. Effective management of these trade-offs requires planning instruments, collaborative governance, and institutional alignment across all sectors and levels.

This transformation in sustainability thought has progressively transformed international development priorities. The recognition that economic, social, and environmental issues must be addressed concurrently and through continuous dialogue established the basis for future global frameworks. This vision will find its most organized and ambitious expression in the 2030 Agenda for Sustainable Development, which integrates and solidifies the triadic model into a cohesive global framework.

### 2.2.5 The importance of multi-stakeholder engagement for the localization of SDGs

Localizing the SDGs is universally recognized as essential for the achievement of the 2030 Agenda. Increasing research highlights that success in achieving the SDGs is largely contingent upon the implementation of the agenda by local and regional governments, as well as the involvement of various stakeholders, including civil society, academia, and the corporate sector (Valdecañas et al., 2023). Engaging these stakeholders is not just a normative ideal but a practical imperative, since it links global aims with local needs and knowledge, fosters ownership of programs, and mobilizes resources and expertise beyond governmental capabilities. Incorporating diverse viewpoints and interests, stakeholder involvement ensures that SDG initiatives are relevant and locally embraced, thereby increasing the likelihood of successful implementation and impact.

The importance of stakeholder participation in the localization of SDGs can be understood through several theoretical perspectives. Firstly, the stakeholder theory asserts that optimal sustainable outcomes are best achieved when the needs and contributions of all stakeholders are acknowledged (Freeman et al., 2010). Within the framework of the SDGs, this implies that development programs acquire legitimacy and efficacy by considering the interests of communities, businesses, and other interest groups in conjunction with governmental goals.

Simultaneously, collaborative governance frameworks contend that wicked problems, such as climate change, are beyond the capabilities of individual entities, requiring "governance structures that bring public and private stakeholders together in collective forums of decision-making" (Ansell & Gash, 2008). This partnership has, in fact, "played an important role in nations' progress towards achieving the SDGs" by facilitating collective problem-solving and mutual accountability across sectors. Co-production presents a complementary perspective: instead of a top-down approach to policy delivery, it entails collaboration between stakeholders and officials working *together* to design and implement solutions. Studies have shown that co-productive approaches in SDG localization, such as participatory systems mapping at the city level, can convey local knowledge to decision-makers and build stakeholders' capacity to address systemic complexities, frequently resulting in new insights and a redefinition of challenges in the process.

Engaging stakeholders through collaborative and co-creative methods leverages the comprehensive range of society's knowledge and resources, which is essential for addressing the complex and multifaceted nature of sustainability issues. When stakeholder participation is treated as a mere formality, unstructured, lacking clear goals or genuine inclusion, it typically produces minimal practical outcomes (Dentoni et al., 2018). Consequently, significant stakeholder engagement serves as a critical driver of effective SDG localization, connecting global objectives to local implementation through dialogue, collaboration, and mutual commitment.

In the following subsection, the roles of public sector actors, private sector actors, civil society actors, and academic institution actors will be thoroughly analyzed to emphasize their importance in the localization of the SDGs.

#### 2.2.5.1 Roles of Public Sector Actors in SDG Localization

Public sector entities, particularly local governments, function as primary coordinators in the localization of SDGs. Local authorities, as the level of government closest to citizens, frequently bear the responsibility of incorporating SDG targets into urban and regional planning, public services, and regulatory frameworks. Their complex role, establishing local development priorities, linking them with national SDG commitments, and creating conducive settings for stakeholder contributions, requires strong political leadership. A 2023 OECD/SDSN survey indicated that 76% of cities and regions considered committed political leadership as the most important component in promoting the SDGs locally. For instance, the province of Bataan in the Philippines benefited from "visionary leadership" that acknowledged the significance of the SDG framework; under this leadership, the provincial government actively brought together businesses, civil society, and academia to address all 17 Goals in an integrated manner (Valdecañas et al., 2023). Likewise, in Bristol (UK), mayoral backing was pivotal when the city council officially adopted the SDGs. This occurred after community stakeholders had been promoting the agenda, and the mayor's support indicated a significant commitment, facilitating the integration of the goals into municipal policy (Hambleton, 2020).

Specifically, the process of SDG localization does not necessarily originate within governmental institutions. Indeed, an effective public sector job requires a reciprocal dynamic of participation. This encompasses co-planning, co-designing, co-producing, and co-evaluating integrated policy solutions in partnership with societal stakeholders (Bovaird, 2007; Crosby et al., 2017; Torfing & Ansell, 2017), as well as collaboratively managing public assets and service delivery systems (Ansell & Gash, 2008, p. 2).

To guarantee that local initiatives receive national-level support, whether in the form of funding, enabling legislation, or integration into national SDG reporting processes, coherent multi-level governance is crucial. The effectiveness of subnational sustainability initiatives is significantly increased, according to the OECD, by encouraging vertical coordination "across national, regional, and local levels of government to align priorities, incentives, objectives, and resources" (OECD, 2020). Several “SDG Model Cities” empirically support this dynamic, according to a UN-Habitat report: municipalities specifically designated and funded by national governments exhibit better

implementation results and greater stakeholder engagement than those not affiliated (UN-Habitat, 2023).

On the other hand, local authorities may be seriously weakened by inadequate vertical coordination or an unstable policy environment. The UNDP cautions that abrupt changes in national priorities following elections often cause disruptions to SDG initiatives, emphasizing that "regular communication and coordination between local and national governments are crucial in establishing clear roles and responsibilities" (UNDP, 2023). Indeed, a recent UNDP study found that abrupt political changes were the primary obstacle to ensuring the sustainability of their SDG programs in more than half of the regions examined (UNDP, 2023).

#### 2.2.5.2 Roles of Private Sector Actors in SDG Localization

The private sector plays a unique and increasingly recognized role in the localization of the SDGs. Enterprises may catalyse innovation, investment, and efficiency in sustainable development initiatives. They frequently possess resources, technologies, and managerial expertise that, if aligned with SDG targets, can accelerate advancements in areas such as clean energy, infrastructure, and job creation (Menghwar & Daood, 2021). The motivations for private actors to participate in SDG localization are diverse. On one hand, companies may react to external demands or corporate social responsibility standards; on the other hand, many may perceive strategic opportunities in sustainability challenges. Research suggests that firms establish cross-sector SDG collaborations because they “witness a stagnation in the capacity of individual organizations to innovate” around sustainability and perceive that collaboration can produce more rapid and scalable solutions (Kolk, 2016). The SDGs provide a unified framework that transforms abstract societal goals into tangible business opportunities, compelling companies to create new products, services, and markets that meet local needs while also generating profit. Thus, stakeholder collaborations make global objectives tangible and actionable, and businesses anticipate that generating social and environmental value through such innovation will ultimately unlock new opportunities for financial value as well (Alshukri et al., 2024).

In practice, private sector actors facilitate the localization of the SDGs through investments in local projects, the adoption of sustainable practices, and participation in multi-stakeholder initiatives. Public–private partnerships are common in sectors such as

infrastructure (SDG 9) and sustainable cities (SDG 11), when local governments depend on business collaborators for technical expertise and financial resources. In addition to formal collaborations, companies can participate in local business networks or chambers of commerce that align their members with the SDGs (UN Global Compact, 2024).

Nonetheless, the private sector's involvement is fraught with difficulties; companies may hesitate to engage if they do not perceive clear incentives or if the participation channels are inadequate. Stakeholder theory provides that companies derive long-term advantages from addressing broader societal interests, and those that "engage with their stakeholders more meaningfully" generally exhibit superior performance in sustainability and financial metrics (Freeman et al., 2010). In the realm of SDG localization, forward-looking enterprises recognize that investing in community welfare, whether through public health initiatives or educational programs, fosters stable markets and cultivates a healthy workforce for the future. Local governments and civic society can encourage private engagement by acknowledging and rewarding their contributions, as well as by establishing platforms where businesses can co-design solutions alongside other stakeholders.

#### 2.2.5.3 Roles of Civil Society and Community Actors in SDG Localization

Civil society actors (e.g., non-governmental organizations, community-based organizations, grassroots movements, informal citizen groups, etc.) are essential stakeholders in the localization of the SDGs. They incorporate public opinions into the process and facilitate inclusive and accountable development (Local2030 Coalition, 2018). A fundamental function of civil society is to represent and advocate for communities, notably excluded or marginalized groups, in the design and implementation of the SDGs (Sanz Corella et al., 2020). Civil society can localize global objectives by advocating and raising awareness in ways that align with local values and interests, so fostering popular support for the 2030 Agenda (Sanz Corella et al., 2020).

Civil society organizations frequently assume implementation roles in programs connected to the SDGs, in addition to their advocacy efforts. They may provide services (e.g., an NGO executing a health or education initiative that promotes SDG 3 or 4), act as facilitators between the government and citizens, or assess and evaluate local progress. They may possess profound trust relationships inside communities and can involve

residents more efficiently than governmental institutions, particularly among vulnerable groups. Civil society is positioned as a crucial agent for the "Leave No One Behind" principle of the SDGs.

This principle requires that progress towards sustainable development expressly targets the most vulnerable and disadvantaged groups, including those experiencing systemic discrimination, poverty, geographic isolation, or restricted access to essential services (UN, 2016). The "Leave No One Behind" principle entails disaggregating data, addressing structural disparities, and ensuring that every SDG target is achieved for all societal segments (Stuart & Samman, 2017). Civil society actors, due to their integration within local communities, are uniquely positioned to identify concealed exclusions, amplify the voices of marginalized groups, and ensure institutional accountability for equitable implementation (Mansuri & Rao, 2012). The participation of civil society functions not merely as intermediaries but as co-creators in the effort to guarantee that development inclusively benefits all individuals, not just in theory, but in quantifiable practice.

By involving community members in the discourse, civil society ensures that local insights and preferences inform SDG strategies. Moreover, civil society actors significantly enhance the efficacy and fairness of SDG implementation by promoting public participation and facilitating communication between authorities and citizens.

#### 2.2.5.4 Roles of Academic and Knowledge Institutions in SDG Localization

Academic institutions and research organizations play a crucial role in stakeholder participation in the localization of the SDGs. Universities, think tanks, and expert networks function as knowledge producers within the multi-stakeholder environment. Their responsibilities include data gathering and analysis, policy consultation, capacity building, and innovation (Hege & Demailly, 2018).

A significant contribution is the adaptation of global SDG indicators to suit local contexts, frequently in partnership with municipalities and statistical agencies (Klopp & Petretta, 2017). This includes the technical design of place-based indicators and the institutional frameworks for monitoring success, efforts that are crucial for transforming abstract objectives into tangible and quantifiable tactics. For instance, systems thinking

methodologies have demonstrated efficacy in constructing conceptual models that clarify causal relationships among local development issues, thereby enhancing local capacity to prioritize actions and assess unintended consequences (OECD, 2017). Academic entities facilitate participatory processes by providing impartial forums for various stakeholders, including local governments, private sector actors, and civil society, to engage in collaborative problem-solving. Academic institutions not only supply data and technical expertise but also promote stakeholder engagement by offering impartial platforms and fostering, through modular expansion, the establishment of a coherent, sustainable, and balanced set of interconnected "theme-focused" ecosystems for widespread "place-based" value creation (Bianchi & Grippi, 2025).

In addition to research and facilitation, academic institutions play a crucial role in capacity building. Universities provide local stakeholders with the skills necessary to interact with the SDG framework through formal education, training programs, and extension initiatives. Co-production projects, such as participatory action research, enable communities to create and utilize local knowledge in partnership with academics, thereby reinforcing local agency and innovation (Ostrom, 1996; Burford et al., 2013).

National and international funding schemes progressively bolster capacity-building initiatives. As previously analyzed, the EU has funded (and continues to fund) various projects, such as Erasmus+ and Horizon Europe, that directly facilitate local SDG implementation and stakeholder involvement. These programs often encompass information exchange platforms, training modules, and technical assistance designed to enhance municipal planning capabilities and promote interdisciplinary collaboration.

It is noted that the efficacy of academic participation depends on significant integration. The symbolic or undefined involvement of universities may weaken their contributions. Research indicates that academic engagement is most effective when grounded in organized governance frameworks and tailored to local needs (Hege & Demailly, 2018).

### 2.2.6 Collaborative Platforms for Sustainable Development

SDG localization represents a paradigmatic wicked problem, where the complex interactions of environmental, social, economic, and institutional factors render straightforward or linear governance strategies ineffectual. These difficulties are

intricately rooted in complex and dynamic systems that encompass several scales and jurisdictions. The ramifications of this complexity extend beyond specific policy sectors, permeating interrelated realms of contemporary life, necessitating governance methods that are adaptable, integrative, and collaborative (Ungar, 2011; Bianchi, 2021; 2022).

The 2030 Agenda provides a universally accepted framework for sustainable development; yet, translating its macro-level objectives into specific, implementable policies at the local level remains one of its most challenging aspects (Perry et al., 2021). Hierarchical and rigid planning frameworks frequently fail to account for the variability of local circumstances, institutional capabilities, and stakeholder priorities. The interconnected nature of sustainability concerns requires governance systems that can manage complexity, facilitate cooperation across all levels, and develop solutions from bottom-up initiatives.

Collaborative platforms have recently been recognized in literature and practice as essential governance infrastructures to address these requirements. They are organized frameworks that convene various stakeholders, governments, civil society, academic institutions, and private entities into specialized forums for discussion, problem-solving, policy co-design, implementation, and collaborative evaluation. These platforms function both horizontally (across sectors and stakeholders) and vertically (among different governmental levels), thus promoting multilevel integration and accountability (Ansell & Gash, 2018; Emerson & Nabatchi, 2015).

In contrast to ephemeral partnerships or isolated initiatives, collaborative platforms are recognized as institutionalized and strategically crafted governance frameworks. Their operational logic is based on the acknowledgment of mutual interdependence (Pfeffer & Salancik, 2003) and the necessity to manage resources, responsibilities, and risks collaboratively. This relational aspect is codified via procedural frameworks, collective norms, and adaptive coordinating mechanisms (Thomson, Perry & Miller, 2009). Collaborative platforms enable stakeholders to establish roles, responsibilities, and regulatory standards through both formal and informal interactions, thereby fostering procedural legitimacy and shared ownership of the results.

A fundamental architectural characteristic of these platforms is their modularity, that is to say, the ability to arrange functions into distinct, interoperable units that can operate semi-

independently while being integrated within a cohesive governance framework. Modularity facilitates the expansion or evolution of collaborative platforms by incorporating new participants or creating spin-offs while maintaining systemic integrity (Ansell, 2019). For instance, subgroups or thematic clusters within a platform may concentrate on distinct SDGs or territorial levels, functioning independently but contributing to common goals and metrics. This distinctive structure facilitates both scale and specialization, enabling collaborative governance to adapt to emerging difficulties and contextual diversity.

Such a strategy not only bolsters democratic legitimacy and transparency but also functions as a catalyst for innovation, policy alignment, and continuous learning. The strategic significance of collaborative platforms in the localization of the SDGs is in their ability to perform three essential functions: 1) They ensure coherence among global, national, and local policy frameworks, assisting stakeholders in converting normative SDG commitments into geographically specific action plans; 2) By consolidating technical expertise, experiential knowledge, and institutional resources, platforms facilitate stakeholders in co-producing viable, adaptive plans and developing the competences essential for implementation; 3) They provide institutional frameworks for performance assessment, knowledge acquisition, and iterative policy refinement via shared metrics, immediate feedback, and transparent decision-making procedures.

The efficacy of collaborative platforms depends on many facilitating conditions. The essential components include a distinct and collective mandate, institutional legitimacy, inclusive and equitable stakeholder representation, adequate and continuous funding, and strong leadership adept at convening diverse interests and mediating potential conflicts (Emerson & Nabatchi, 2015; Sørensen & Torfing, 2019). Without their presence, platforms may devolve into technocratic facades or superficial endeavours, unable to foster authentic cooperation or realize transformative results.

In conclusion, collaborative platforms are not merely auxiliary technical tools but essential infrastructures for the localization of sustainable development. Their design and implementation indicate a transition towards governance that is deliberative, interconnected, and place-based. Consequently, they serve as both a methodology and a framework for addressing the intricate issues of sustainable development, providing a

practical yet profoundly strategic approach to harmonizing local initiatives with global ambition.

#### 2.2.6.1 Enabling Conditions and Challenges for Effective Stakeholder Engagement

Stakeholder participation is significantly enhanced by a favorable social and cultural environment, particularly through intangible components such as mutual trust, a culture of cooperation, and shared values that foster sustainable development. Cultural characteristics, such as high levels of trust and cooperation, are strongly correlated with local communities' successful participation in sustainability initiatives, according to empirical research. For instance, according to Zheng et al. (2021), "cultural traits are linked to the achievement of all 17 SDGs and 79% of SDG targets," according to a panel-data study conducted across several countries. This suggests that communities with higher levels of trust and shared values have more engaged stakeholders (Zheng et al., 2021). These results underscore the importance of promoting social norms and shared values to sustain engagement in long-term and systemic initiatives.

When stakeholders possess mutual trust and confidence in the integrity of the process, they are more inclined to engage in open collaboration and provide resources. Scholars of collaborative governance assert that cultivating trust and mutual understanding serves as both an outcome and a prerequisite for effective collaboration. Implementing neutral facilitators, defining clear objectives from the outset, and celebrating interim achievements can enhance the relational dynamics of group outcomes by making joint efforts more coherent, sustained, and effective (Ansell & Gash, 2008).

The advantages of stakeholder engagement in SDG localization are evident, although several problems and obstacles may compromise these efforts. Understanding these obstacles is crucial for devising effective strategies to overcome them. A commonly mentioned barrier is the insufficiency of both financial and human resources allocated to joint endeavors (OECD, SDSN & CoR, 2024). Meaningful stakeholder engagement necessitates funding for meetings, communications, and frequently for executing established activities collaboratively. Numerous local governments, particularly in developing or financially restricted contexts, struggle to allocate adequate budgets for SDG activities. In 2023, 64% of local and regional authorities identified inadequate financial resources as a significant barrier to the implementation of the SDGs (OECD,

SDSN & CoR, 2024). Without adequate resources, even well-intentioned engagement strategies may falter or remain superficial. Likewise, if agencies are inadequately staffed, they may lack individuals to facilitate partnerships or address stakeholder feedback. This resource deficiency is often intensified by disjointed or isolated administrative structures. When governmental actors at various levels fail to communicate or coordinate, stakeholders receive mixed signals, resulting in unfocused engagement attempts (Smith & Rossi, 2024).

Another substantial challenge is political discontinuity or misalignment. Changes in political leadership or priorities might undermine local SDG initiatives. Elections might bring power to officials who do not share their predecessors' commitment to the SDG agenda, potentially causing the breakup of stakeholder forums or the abandonment of action plans. More than half (52%) of the local governments surveyed by OECD & SDSN (2024) indicated that changing political priorities following local elections presented a challenge to the continuity of SDG initiatives. Furthermore, if there exists antagonism or low trust between political leaders and specific stakeholder groups (such as an administration perceiving NGOs as adversaries), authentic collaboration will be challenging.

A pertinent difficulty is the lack of vertical integration. When national governments neglect to establish a supportive framework or actively engage local actors in national SDG planning, local stakeholders may perceive their efforts as unsupported or unacknowledged. The lack of multi-level governance systems was identified as an obstacle in SDG localization assessments, with "insufficient vertical coordination" noted alongside resource limitations and political fluctuations as a principal governance difficulty (Smith & Rossi, 2024).

Stakeholders who perceive their involvement as a mere formality are unlikely to sustain their engagement. Without capacity-building (as mentioned above), participation may be predominantly influenced by more powerful or skilled players, such as government officials or large corporations, thereby undermining the purpose of inclusion. Addressing these imbalances is a delicate task; neglecting this responsibility may marginalize specific voices and erode the partnership's legitimacy in the eyes of weaker stakeholders.

### 2.2.7 Collaborative Platforms and Data-Driven Tools for SDG Localization

Recent research indicates that the localization of the SDGs requires new ideas and methodologies that bring together people from diverse scientific sectors to utilize innovative tools in decision-making. In such a setting, collaborative platforms that can combine different types of data and help with coordination across regions are increasing in popularity, yet in the process. Knowledge Graphs are, for example, one of these promising infrastructures that can structure and visualize the complex web of relationships between stakeholders, goals, and resources. Technologies like Neo4j enable policymakers to combine disparate data sources into a unified relational map. This makes it easier to identify hidden connections between stakeholders and make more coherent and systemic decisions. This feature is particularly useful for addressing sustainability issues, which are labeled as wicked problems in this research project, as they are highly interconnected and involve multiple sectors. To address these challenges, public, private, and civil society organizations must collaborate.

In this context, Galluzzo and Gennusa (2023) propose an interesting framework that utilizes collaborative platforms and data science to facilitate SDG localization. The research is based on the idea that challenges related to Sustainable Development involve interdependent variables. Such platforms may help System Dynamics experts find new and valuable partnerships and develop local solutions that align with the SDGs. A Knowledge Graph is at the heart of the platform. It illustrates the connections between various local stakeholders, including public agencies, research institutions, NGOs, and private actors, and provides relevant metadata on their roles, resources, and areas of activity. This graph-based infrastructure serves as both a repository for information about territories and a tool to aid in decision-making. It illustrates how existing collaborations are established and enables individuals to ask questions about the actors involved in sustainability governance (Galluzzo & Gennusa, 2023).

This can be achieved by analyzing cause-and-effect connections related to both proposed policies and the phenomena that have led to past outcomes and current conditions that key actors aim to address. Therefore, System Dynamics provides fundamental support for the holistic representation of sustainability performance, considering the policies adopted and the issues at hand. By understanding the interactions between the specific socio-

economic, environmental, and institutional factors, policymakers and stakeholders can develop targeted strategies that address the unique challenges facing their communities.

From a methodological perspective, Galluzzo and Gennusa's (2023) work is particularly useful for creating place-based participatory governance platforms. Indeed, the framework demonstrates how to integrate Business Intelligence and System Thinking into collaborative technologies for a sustainable transition. The Knowledge Graph collects and analyzes data from stakeholders and projects, employing a Business Intelligence approach that transforms raw, fragmented data into actionable insights, enabling individuals to make informed decisions within their own communities. However, the entire concept is grounded in System Dynamics principles, which means that the focus is not on individual projects, but on how different components of a system interact with one another, such as actors, resources, and feedback loops. The authors make it clear that such a platform is intended to help people understand one another and learn together. It achieves this by presenting the SDG-related ecosystem in a manner that enables people to identify points of leverage for systemic change (Galluzzo & Gennusa, 2023). In line with the focus of Agenda 2030 on collaboration across sectors and levels of government, the tool enhances both horizontal integration (across sectors and local stakeholders) and vertical coherence (across governance levels).

This literature-based overview will serve as the theoretical foundation for the in-depth analysis of the Galluzzo & Gennusa platform that will be developed in the following chapters. The case will be explored from both a methodological and empirical perspective, in order to assess its actual contribution to stakeholder engagement and SDG localization in multilevel governance settings.

# CHAPTER 3

# RESEARCH METHODOLOGY

This chapter defines the methodologies utilized in the study, encompassing the research paradigm, Dynamic Performance Management and Governance (DPM/DPG) approach, application of Business Intelligence (BI) tools for sustainable development, research design, instrument validity and reliability, data sources, collection methods, procedure, management and ethics, sampling techniques, size, and selection.

## 3.1 Research Paradigm

Scholarly inquiry employs methodical approaches to investigate phenomena and address complex problems that emerge in social contexts. These approaches enhance the understanding of human behavior and current social dynamics. The development of a cogent theoretical and philosophical stance that guides the research is a crucial step in this process. To comprehend the topic of study, researchers must express their worldview, which in turn influences the methodological decisions they make throughout the research (Khatri, 2020). Establishing a distinct philosophical position in this situation is crucial, and this is accomplished by conforming to a research paradigm as defined by Kuhn (1962). The fundamental presumptions, whether philosophical or theoretical, that guide the execution of a research project are embodied in a research paradigm. According to Mackenzie and Knipe (2006), the term “paradigm” describes the researcher’s overall worldview or interpretive lens. This worldview is a philosophical and cognitive framework composed of common assumptions that shape the creation and interpretation of knowledge.

According to Lincoln and Guba (1985), the four main components of any paradigm are methodology, axiology, ontology, and epistemology. The nature of knowledge and the researcher’s relationship to what is known are the subjects of epistemology. The fundamental nature of reality is the subject of ontology. Axiology pertains to the principles and ethics that guide research practice, whereas methodology refers to the tactics and procedures employed to produce knowledge (Mertens, 2010; Khatri, 2020). Together, these factors shape the researcher’s philosophical stance, which impacts every stage of the research process, from establishing reality and identifying reliable sources of

information to choosing suitable techniques and maintaining moral principles (Hughes, 2010; Khatri, 2020).

The development of human reasoning and the variety of interpretive frameworks used to examine global phenomena are reflected in the rise of several philosophical paradigms in the contemporary academic environment. Numerous complex philosophical stances have emerged as a result of classical paradigms, such as positivism and interpretivism (Adom et al., 2016).

This thesis is situated within an interpretivist paradigm (Guba & Lincoln, 1989; Adom et al., 2016). From this point of view, social reality is understood as being shaped by the meanings that individuals and groups attach to their experiences. Knowledge is therefore actively constructed through interaction with the surrounding context and reflection on those interactions, rather than passively received (Guba & Lincoln, 1989; Cashman et al., 2008; Hein, 1991; Kalender, 2007). This paradigm is commonly associated with qualitative, context-sensitive approaches that seek to capture participants' perspectives in their natural settings (Adom et al., 2016).

Within this paradigm, qualitative approaches employ flexible and context-sensitive data collection techniques to capture the essence of human experience from the participants' viewpoints. The subjective experiences of both participants and researcher provide the main basis for interpreting the findings.

To gain a deeper understanding of the topic under study, the researcher interacts with participants in their natural environments, observing and sometimes participating in their lived experiences (Adom et al., 2016). Interpretivist research acknowledges the plurality of realities shaped by personal and institutional viewpoints, which leads to a range of possible interpretations. Social and cultural interaction are therefore seen as the primary processes through which knowledge is co-created, and meaning emerges from ongoing dialogue with others.

Instead of starting with predetermined hypotheses, research guided by the interpretivist paradigm usually begins with broad, exploratory questions. Depending on the breadth and coherence of the findings, the analysis of the data results in conclusions that may be more definitive or more tentative (Adom et al., 2016).

### 3.2. Core Principles of System Dynamics: Stock-and-Flow Mechanisms and Feedback Loops

System Dynamics (SD) is an effective method to study how complex systems behave, particularly since it can model adaptive processes and interactions that are based on feedback. The primary objective of this approach is to build a hypothesis based on feedback that explains the system's patterns over time. The overarching aim is to support the development of organizational policies that can lead to enhanced systemic performance (Wolstenholme, 1985). In such a framework, methodology pertains to the complete and ongoing process by which ideas, conceptual frameworks, and theoretical constructs are expressed, regardless of the specific field or problem under investigation (Grippi, 2023). It is essential to distinguish this broader meaning from the narrower one, in which methodology refers to a prescribed set of operational techniques required to implement a specific analytical strategy, such as linear programming (Wolstenholme, 1985).

As a field, SD draws upon many different disciplines to understand the intricate dynamics characterizing complex and interconnected systems. Its foundations lie in the principles of nonlinear behavior and feedback regulation, which originate from research traditions in physics, mathematics, and control engineering (Grippi, 2023). By applying these theoretical concepts, SD facilitates the analysis of dynamic phenomena in a more nuanced and multifaceted manner. Additionally, it draws on concepts from cognitive and behavioral sciences, economics, anthropology, and other social science disciplines to enhance its analysis (Sterman, 2000). SD is a method for examining systemic complexity and evaluating policy changes aimed at achieving genuine transformation through the creation and application of simulation models.

#### 3.2.1. Stock-and-flow modelling

Stock-and-flow representations are central to the analysis of system behavior, as they enable the modeling of how quantities accumulate over time, how delays influence outcomes, and how relationships within systems may exhibit non-linear behavior. Engaging with complex or ill-structured problems requires familiarity with these structural elements, as they often govern the dynamics of such systems. Accumulation, in this context, refers to a progressive increase or decrease in a specific component of the

system across a defined temporal interval. Time delays describe the lag between an action and its observable impact, often complicating efforts to assess causality or intervene effectively. Within SD, stocks represent the system's state at a given time, providing a foundation for interpreting behavior and supporting the development of informed decisions (Sterman, 2000).

In diagrams, stock elements are typically illustrated as rectangular symbols that function conceptually as containers. The content of these stocks changes through inflows and outflows - each governed by decision rules expressed in mathematical terms, which reflect responses to available information (Forrester, 1961 pp. 81–82). Figure 1 displays a standard example of this configuration. In some models, the inflow and outflow are merged into a single net rate of change, capturing the overall dynamic of the stock (Sterman, 2000 pp. 191–197).

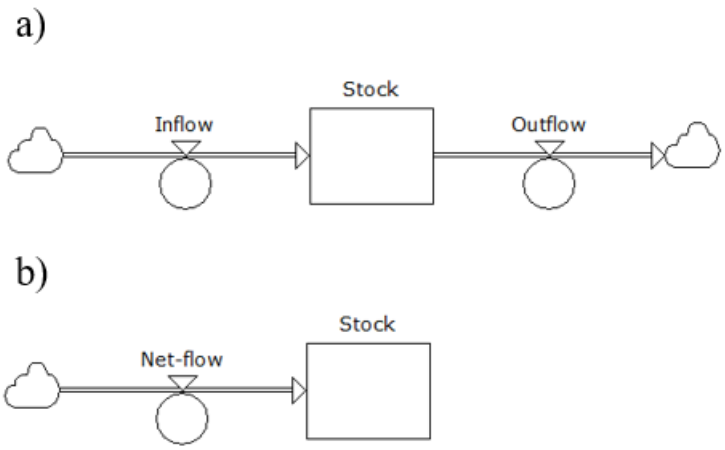


*Figure 1. Illustrative representations of stock-and-flow structures (adapted by the author from Sterman, 2000; modeled using Powersim Studio).*

The behavior of complex systems is primarily governed by the interplay between stock-and-flow structures, feedback mechanisms, temporal delays, and nonlinear relationships. In most cases, stocks are subject to processes that manage the rates at which inputs enter and outputs exit the system. These regulatory mechanisms are commonly referred to as feedback loops, as they involve cyclical interactions that influence the system's evolution over time.

### 3.2.2 Structural Feedback Analysis: Reinforcing and Balancing Loops

Feedback loops help keep a system in check by keeping a given amount of stock. Stock-and-flow models demonstrate that complex behaviors in systems typically arise from the interactions between parts through feedback loops, rather than from the inherent complexity of the parts themselves. Two primary types of feedback loops combine to create system dynamics: positive (reinforcing) loops and negative (balancing) loops (Salmon et al., 2020). Positive feedback loops amplify trends within a system, which can lead to either growth or decline. Negative feedback loops, on the other hand, work against changes and encourage stability and balance. There are mechanisms called balancing loops that automatically limit behavior and move the system toward a steady state (Sterman, 2000). In System Dynamics, the links between variables represent hypothesised causal relationships rather than mere statistical associations, and feedback loops are formed by closed chains of such causal links (Sterman, 2000).

Determining whether a causal feedback loop is reinforcing or balancing involves examining the polarity of its causal relationships. In this application, polarity describes how one variable affects another. More specifically, it describes whether a change in one variable causes a change in the other variable that is either positive (positive polarity) or negative (negative polarity). One way to sort the loop is to multiply the polarities of all the causal links. A positive result means that the loop is reinforcing, indicating that it tends to amplify changes over time. A negative result indicates that the loop is balancing, suggesting it tends to maintain system stability. The number of negative links can also be counted. If the count is uneven, it means that the links are balancing each other out; if the number is even, it means that the links are strengthening each other. These methods offer a structured approach to understanding how feedback systems function.

When one variable increases (or decreases), the other also does. This is called positive polarity. A negative polarity is the opposite: when one variable goes up, the other goes down, and vice versa (Sterman, 2000, p. 139). Causal loop diagrams (CLDs) are widely used to show these kinds of relationships. Figure 2 shows an example of a reinforcing loop (a) and a balancing loop (b).

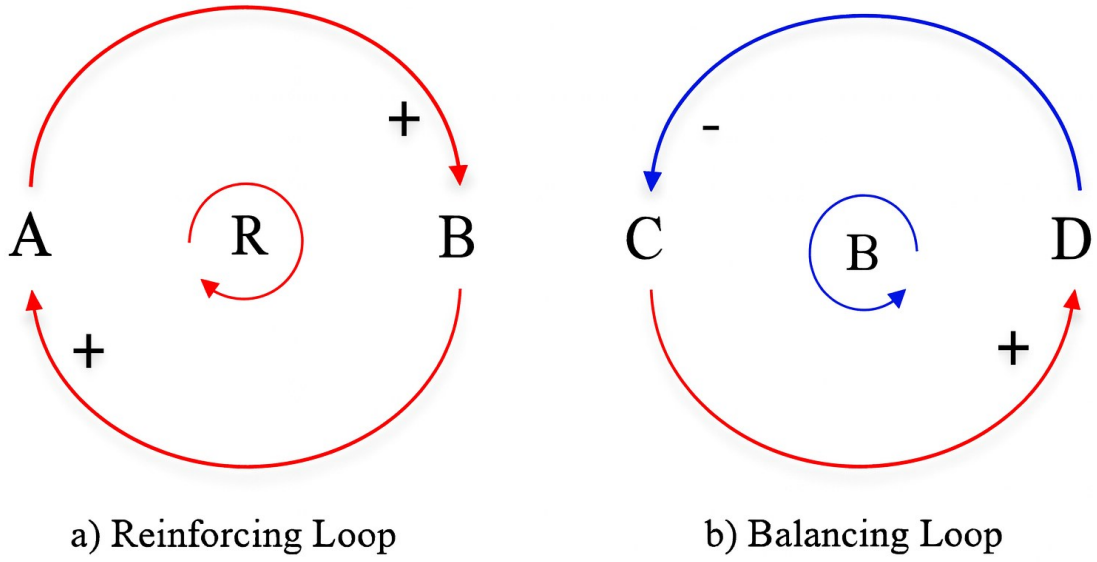


*Figure 2. Illustrative examples of (a) reinforcing and (b) balancing feedback loops (adapted from Sterman, 2000; created by the author using Microsoft PowerPoint).*

### 3.2.3 Prevailing behavioral modes in System Dynamics

A system's behavior is fundamentally shaped by its underlying structure, which consists of interacting feedback mechanisms, stock-and-flow configurations, and nonlinear dynamics. These structural elements arise from the interplay between tangible and institutional components, as well as the decisions and actions taken by individuals and organizations within the system. As stated by Forrester (1969, p. 107), complex systems, like all systems, are composed of interconnected feedback loops that permeate all forms of decision-making, whether public or private, deliberate or instinctive. This feedback-based architecture spans multiple domains, encompassing human behavior and natural processes, as well as disciplines such as psychology, physics, medicine, and engineering. Dynamic systems exhibit a range of behaviors, each of which is associated with a specific feedback mechanism. These common patterns are: a) exponential development, b) behavior that seeks goals, and c) oscillations (see Figure 3). Growth occurs when there are reinforcing loops, where an increase in quantity leads to a faster rate of change, which

in turn leads to an even larger quantity, and so on. This creates fast, self-reinforcing growth.

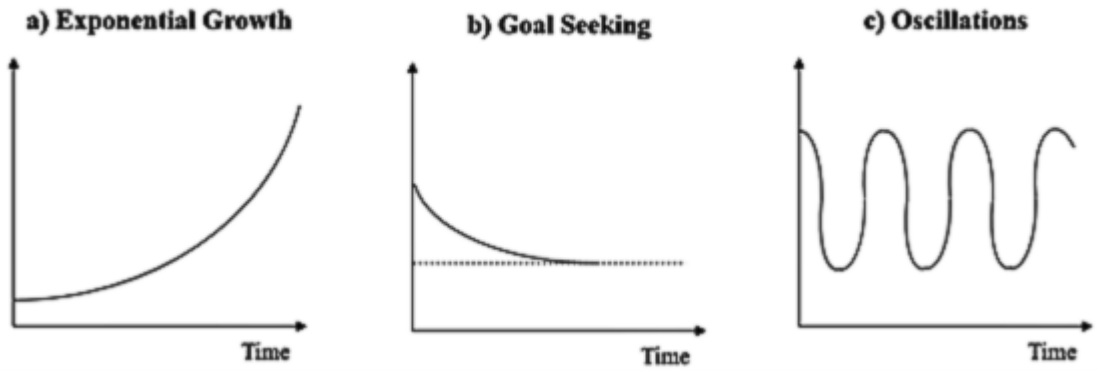


*Figure 3. Basic behavior patterns in dynamic systems (adapted from Sterman, 2000, p. 108).*

The goal-seeking behavior is characterized by the dominance of the balancing loop, which adjusts the system's state to achieve equilibrium in accordance with a specified objective (Grippi, 2023). The negative loop mitigates potential disruptions that could significantly adjust the system's condition from the objective. When a disparity exists between the current and the desired condition, corrective measures are implemented to reestablish the condition to the desired level. Finally, oscillations are produced by negative feedback loops that seek to adjust the deviation between the actual and desired states. The system's objective is consistently characterized by overshooting and undershooting, attributable to inherent temporal delays that compel excessive adjustments, subsequently initiating corrective measures in opposing directions. Delays may arise from discrepancies in the perception of the system's condition, attributable to the time required for measurement and reporting (Sterman, 2000, pp. 108-114). As shown in Figure 4, complex behavioral patterns arise from the nonlinear interactions among these structures, specifically: a) s-shaped growth, b) s-shaped growth with overshoot, and c) overshoot and collapse.

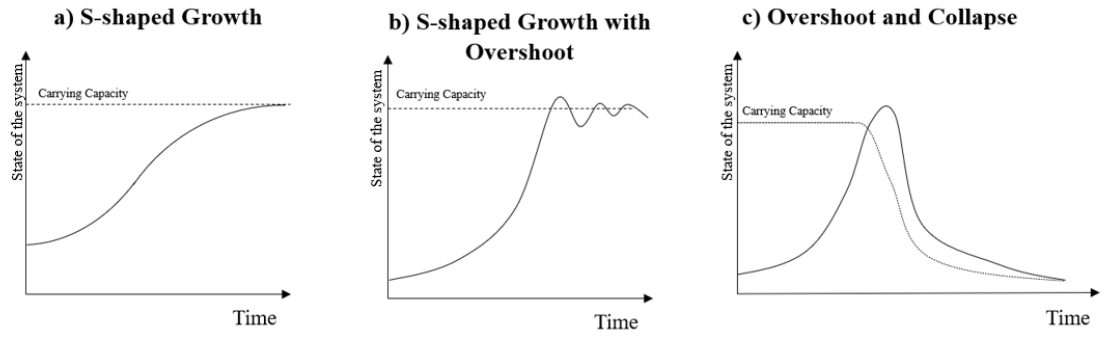


*Figure 4. Other modes of behavior: a) S-shaped Growth, b) S-shaped Growth with Overshoot, and c) Overshoot and Collapse (Adapted from Sterman, 2000: 118-123). In all three graphs, the vertical axis represents the state of the system, while the horizontal axis represents time.*

S-shaped growth is a commonly observed behavioral pattern, as it reflects the fundamental limitations to growth that all systems inevitably encounter. A reinforcing feedback loop typically initiates a phase of rapid, exponential growth. Eventually, a balancing feedback loop prevails, decelerating growth as the system nears its objective or limit, guiding it towards equilibrium (Sterman, 2000, p. 118).
The second behavioral pattern can arise from the first one. Despite the initial similarity in growth patterns, temporal delays in the balancing feedback loops cause the system to exceed its carrying capacity, resulting in oscillations around that limit (Sterman, 2000: 121).

The third pattern, overshoot and collapse, is distinguished by the premise that carrying capacity is not static but subject to change over time. As growth approaches the system's threshold, the carrying capacity deteriorates, resulting in a significant drop in both capacity and the system's condition. The predator-prey dynamic exemplifies how, as prey populations near their ecological limits, predator populations tend to rise in response. Nevertheless, as prey becomes limited, predators start to perish. Notwithstanding the decrease in predator populations, the surviving predators continue to deplete the prey population, thereby further reducing the carrying capacity. In the absence of recovery mechanisms, this cycle results in total collapse, possibly culminating in extinction (Sterman, 2000, p. 123).

### 3.2.4 Structural and Behavioral Analysis in the Context of Urban Systems for the Localization of the SDGs

The theory that connects system structure and behavior can be used in numerous domains, including the governance of urban neighborhoods towards sustainable development. When applied in this context, it enables policymakers to compare outcomes with long-term development paths. From an SD perspective, urban environments are viewed as intricate systems exhibiting four main behavioral patterns, each indicative of a unique mode of system performance: crisis prevention, stability, restructuring, and revitalization. As illustrated in Figure 5, these four behavioral states represent alternative performance trajectories that urban areas may follow (Bianchi, 2016: 41). Additionally, each pattern corresponds to one of two primary strategic orientations: maintenance or redesign. The first goal is to maintain current performance levels, while the second is to alter the systemic paradigm that underpins the performance of urban areas (Bianchi, 2016).

The crisis prevention phase involves identifying early indicators of unsustainable growth and taking action on performance drivers to promote more sustainable trajectories. At this stage, a balancing feedback loop can be activated to support the system in behaving in a manner closer to the equilibrium. Stabilization, on the other hand, is characterized by the continuation of current performance levels, supported by multiple balancing loops that collectively sustain the system with minimal intervention. Nevertheless, when decision-makers make changes of varying shapes and sizes, oscillatory patterns may emerge, causing the system to behave in different ways.

After stability, the reorganization phase is guided by the principles of system dynamics and aims to prevent possible crises that could slow down urban growth. To start or maintain growth, a reinforcing feedback loop is employed here. However, maintaining control over this process requires targeted interventions through associated balancing loops, which act to stabilize the system and enable reinforcing dynamics to operate more effectively.

Revitalization involves strategically modifying urban development policies to prioritize achievable and sustainable outcomes. This phase also necessitates the identification of predominant balancing loops that exacerbate urban decline, particularly those that result in the exhaustion of critical shared strategic resources. To counteract these trends and

promote renewal, decision-makers must engage the suitable reinforcing feedback mechanisms linked to growth (Bianchi, 2016). Madanipour (2012) emphasizes the significance of SD in improving strategic decision-making, particularly by providing a framework for analyzing long-term urban growth trends. Consequently, policymakers are tasked not just with formulating transformation policies but also with providing essential public and social services that impact long-term urban outcomes. In this context, urban regeneration projects are essential tools for facilitating systemic transformation, in accordance with the long-term objectives outlined in the system dynamics paradigm (Omong, 2021).

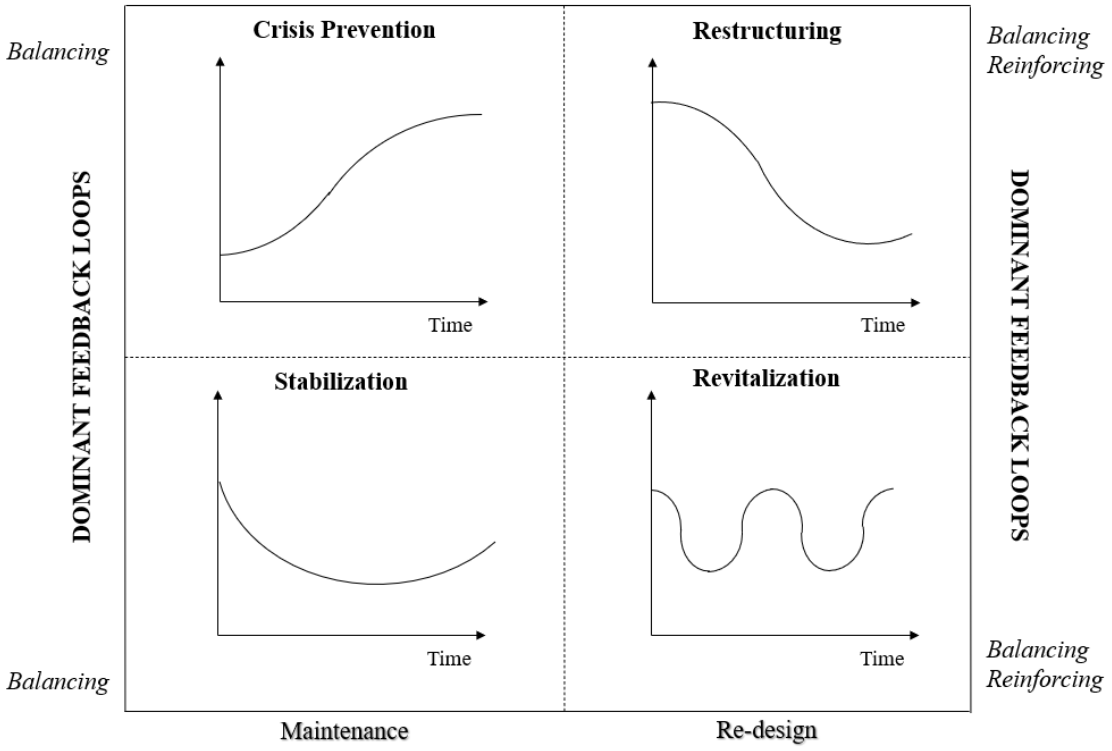


*Figure 5. System dynamics framework for assessing local area performance (adapted from Bianchi, 2016, p. 43).*

### 3.3. Adopting Dynamic Performance Management and Governance Approach for Systemic Resilience

The Dynamic Performance Governance (DPG) framework represents an evolution of the Dynamic Performance Management (DPM) approach. For this reason, DPG can be described as an application of DPM principles within the domain of governance. Both

DPM and DPG are intended to assist policymakers and practitioners in the development and implementation of effective and resilient policy interventions.

DPM enables decision-makers to examine the causal dynamics that influence system performance over time. The DPM method combines SD with Performance Management to analyze dynamic complexity, identify causal relationships between outputs and outcomes, acknowledge time delays, and establish appropriate boundaries for strategic planning.

Through this lens, DPM functions as a tool for understanding the feedback mechanisms that influence performance and for designing alternative, innovative strategies aimed at improving organizational effectiveness (Bianchi, 2016). Furthermore, DPM contributes to the advancement of performance management systems by incorporating not only tangible resources but also intangible assets such as trust in institutions, leadership capabilities, organizational image, and overall governance capacity (Xavier & Bianchi, 2020).

### 3.4. Enhancing Policy Processes Through Dynamic Performance Management

By adopting the SD structures previously outlined, the DPM approach enables the monitoring not only of key output indicators and both intermediate and final policy outcomes, but also of the critical success factors, referred to as performance drivers, that influence these results. These drivers are quantified as ratios, comparing the current levels of strategic resources to predefined benchmarks or desired targets.

Monitoring these key drivers enhances the system's capacity to anticipate unexpected side effects and unintended outcomes, thereby providing decision-makers with the insights necessary to implement corrective measures and improve overall performance. The continuous measurement of performance drivers facilitates the attainment of sustainable outputs, defined as volume-based indicators (Ammons, 2001), and outcomes that reflect the system's ability to provide targeted service levels or to effect changes in the accessibility of strategic resources among various organizations.

These outputs and outcomes then contribute to the stock of strategic resources, generating another cycle of performance (Bianchi, 2016; Bianchi et al., 2017; Bianchi, 2021; Grippi, 2023). The final outcomes and performance drivers are crucial for precisely delineating

causal links within the system. Notably, although performance drivers may be modified in the short term, the consequent alterations in outputs and outcomes generally become evident over medium to long-term spans. Output indicators are linked to a more confined system boundary and shorter time frame, while outcome indicators often represent broader system dynamics and extended temporal scopes (Bianchi, 2016). The cyclical process is illustrated in Figure 6.

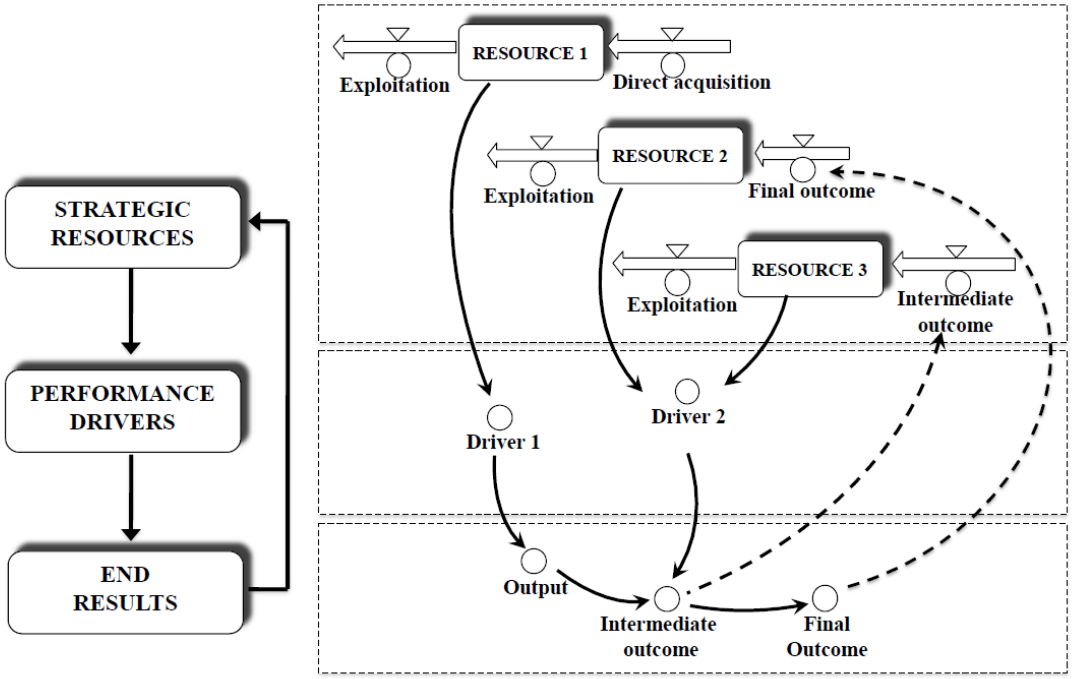


*Figure 6. DPM chart structure (Source: Bianchi, 2022, p.338. Adapted from Bianchi, 2016, p. 73)*

The DPM approach integrates fundamental principles from systems dynamics, specifically feedback mechanisms and stock-and-flow structures, into qualitative modeling frameworks, thus fostering a dynamic and systemic understanding of performance management. This stands out with traditional static approaches, where decision-makers might overlook the vital connection between resource indicators and performance measurements, a relationship that embodies a means-to-ends logic. In static models, this misalignment can lead to strategic plans that are fragmented or filled with targets that are neither measurable nor closely tied to performance outcomes. DPM provides a method to address this problem by enabling the identification of strategic performance drivers, hence diminishing uncertainty in policy design (Bianchi, 2016).

A fundamental aspect of DPM is its ability to capture the scope and degree of collaboration as a strategic asset. This includes inter-organizational coordination in service provision and frameworks for community engagement and consultation (Xavier & Bianchi, 2020). Furthermore, DPM provides a platform for stakeholders to bring together their conceptual frameworks, particularly when tackling intricate, interrelated wicked problems, such as climate change adaptation, biodiversity loss, urban air and water pollution, deforestation, and the transition to sustainable energy systems. The behavior of complex social systems evolves due to their intrinsic nonlinear feedback structures. These processes are influenced by both structural characteristics and the cognitive frameworks and judgments of policymakers concerning outputs and outcomes (Sterman, 1994). Identifying changes in structural configurations and performance trajectories enables policymakers to anticipate failures and unexpected consequences of policy implementation, particularly when such outcomes are obscured by static, segmented perspectives of governance (Xavier & Bianchi, 2020).
The combination of formerly isolated disciplines, specifically performance management, governance, and system dynamics, improves the communicative and analytical capabilities of policymakers, hence improving the design and implementation of public policy. This interdisciplinary integration enables a progressive shift towards outcome-focused performance management and governance frameworks.
DPM utilizes SD methods to facilitate the conceptualization of both tangible and intangible strategic resources vital to policy implementation. While some assets may be directly acquired, others are endogenous and result from the implementation of the policy itself. In the DPM model, strategic resources are depicted as stocks, adjusted by inflows and outflows, allowing policymakers to exert influence on assets that cannot be externally acquired. These flow variables are generally quantified as ratios of the stock level to time. Strategic resources function as levers that influence performance drivers and final outcomes (Bianchi, 2016).

Furthermore, DPM provides a causal framework for policy formulation, which may underpin quantitative modeling. Although this modeling necessitates substantial data, time, and technical proficiency in system dynamics simulation, qualitative modeling also provides significant value. It facilitates comprehensive conceptual analysis and allows for the depiction of system behaviors that may otherwise be overshadowed by data

constraints (Wolstenholme, 1999; Bianchi, 2016; Bianchi, 2021). The DPM framework effectively captures the interrelations among essential subsystems, socio-economic, political, institutional, and organizational, thereby supporting a holistic approach to governance and performance improvement.

### 3.4.1 A holistic perspective on Performance

The notion of performance sustainability can be articulated through several profiles within the DPM framework. Figure 7 demonstrates that performance evaluation can be examined from three complementary perspectives: internal, external, and temporal. From an internal perspective, sustainable performance is expected to present as a cohesive and balanced profile, demonstrating alignment among the various subsystems, sectors, and organizational units or functional domains.

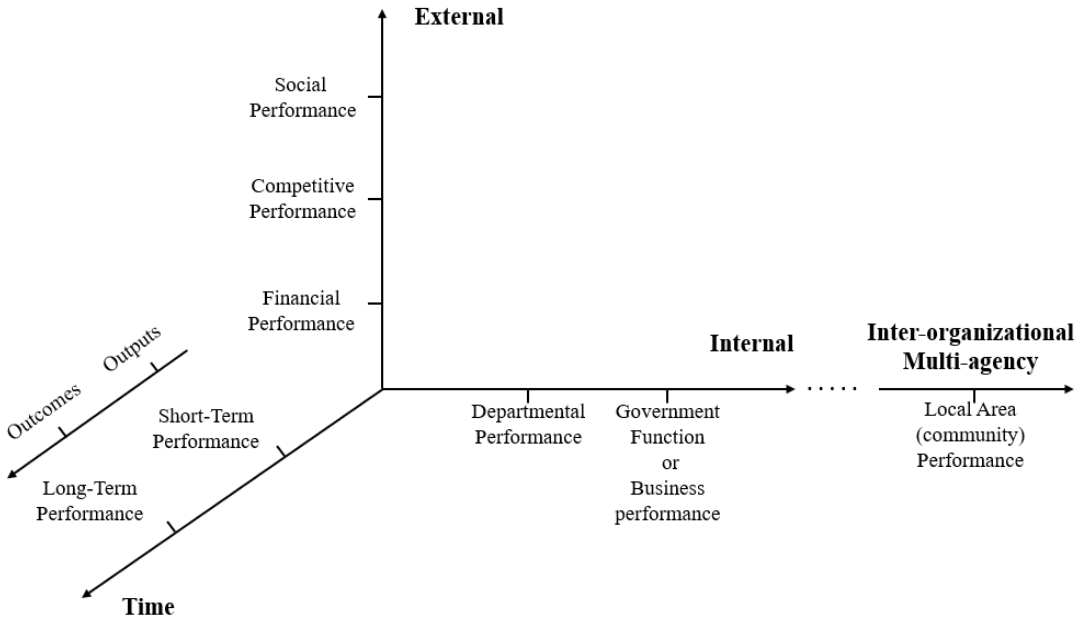


*Figure 7. A holistic perspective on Performance (Adapted from Bianchi 2016, p. 53)*

Coda (2010) emphasizes the necessity of consistency in the design of social and competitive performance elements for ensuring robust financial performance from an external perspective. Meanwhile, the temporal perspective emphasizes the importance of evaluating sustainability in a way that considers potential trade-offs between short- and long-term goals. Performance must be assessed with an understanding of the way present

decisions may impact future system dynamics and the availability of resources. Bianchi (2016) posits that the three perspectives collectively form a triadic model, shedding light on the interconnection between an organization (or public institution) and its external context. Expanding on the internal dimension, an extra layer, inter-organizational performance, may be integrated into the DPM framework. This expanded dimension emphasizes the performance of a specific territorial area, highlighting the ability of local stakeholders to participate in the co-creation of shared strategic resources. This collaboration aims to create public value, thereby improving local institutions' capacity for long-term, sustainable development.

The public value generated by these collaborative processes may impact both the social and competitive performance of different companies, thereby enhancing the overall financial success and appeal of the specific context. Policy evaluation in such a setting requires looking at both short-term and long-term outcomes over time, acknowledging the dynamic interplay between policy implementation and improvements in the common good.

Embracing an external performance perspective through inter-organizational collaboration enables local agencies and stakeholders to tackle multiple facets of sustainability cooperatively. Each agency's function encompasses evaluating its consistency in supporting and contributing to overarching community policies. This comprehensive strategy can be executed through the adoption of DPG, which integrates DPM principles to governance and strategic policy evaluation (Bianchi et al., 2019).

### 3.5 Dynamic Performance Governance Approach

By encompassing diverse aspects of sustainability-related performance, organizations operating within a specific territorial context can adopt an “outside-in” perspective of performance management, working in synergy with other institutional and non-institutional stakeholders (Bianchi et al., 2019). In a subsequent stage of analysis, each organization is expected to evaluate the consistency of its contribution to the implementation of community-level policies. This orientation can be operationalized through the DPG framework, which extends the DPM approach to the governance domain (Bianchi et al., 2019).

The DPG model is built upon the foundations of DPM and extends its scope by integrating a variety of actors and systems, including the socio-economic, political, institutional, and environmental components. It shifts the conventional "inside-out" view of outcome-based performance management, typically founded in the different goals of individual organizations, toward a "outside-in" view, which prioritizes the territorial context in the policy formulation process (Bianchi, 2022). This approach enables stakeholders to collaboratively develop policies that can generate shared strategic resources, thereby enhancing collective public value and improving the performance capabilities of specific agencies and the local community as a whole.

Nonetheless, the actual implementation of this shift remains challenging due to embedded mental models among all the stakeholders that may be involved in the process. These players may view community-oriented goals as potentially undermining their organizational performance, or even as catalysts for crises of effectiveness or legitimacy (Bianchi & Vignieri, 2020). In urban settings, municipalities often implement policies aimed at improving the efficiency and effectiveness of service delivery. Although these initiatives may enhance organizational outputs and outcomes, their impact on broader societal outcomes, such as well-being, inclusivity, or environmental sustainability, is often indirect or inadequately considered.

Urban settings encompass a variety of stakeholders whose collaborative efforts, or absence thereof, profoundly influence the appeal and quality of life in the neighborhood. This fact underscores the necessity of an "outside-in" approach for policy design, implementation, and evaluation, ultimately aimed at fostering a cohesive and engaged community whose ambitions extend beyond mere compliance with legal and regulatory requirements. In this context, the concept of community transcends legal definitions of citizenship, encompassing a collective sense of belonging and accountability among individuals (Bianchi, 2021, 2022). This collective identity is based not only on geographical proximity or formal duties but also on shared ideals, cultural standards, and enduring commitments to civic participation. This cultural and ethical foundation aligns with the initial interpretations of civic duty and commitment, as outlined by Cooper and Gulick (1984) and Cooper et al. (2006).

The implementation of an "outside-in" approach in performance governance indicates that fostering active citizenship should be regarded as a key objective of public policy. Active civic engagement is crucial for maintaining collaborative initiatives among official institutions, business organizations, civil society individuals, and volunteer groups. In the absence of such a foundation, collaborative governance models may ultimately become unsustainable. Ansell and Gash (2008) argue that the engagement of various societal actors in policymaking is crucial for achieving sustainable community outcomes, as it leverages a range of skills, perspectives, and resources essential for addressing complex social issues, enhancing territorial attractiveness, and improving quality of life (Bianchi, 2021).

This “outside-in” framework facilitates the assessment of sustainable performance across three analytical dimensions: time horizon (short-term vs. long-term), focus area (social, competitive, financial), and performance object (individual organizations vs. the broader local area) (Bianchi, 2016; Bianchi et al., 2019; Xavier & Bianchi, 2019; Bianchi, 2021; 2022; Grippi, 2023). Consequently, policies targeting sustainable outcomes must reconcile social and competitive objectives while ensuring financial viability.

The DPG framework allows policymakers to identify and manage the intricate interdependencies that characterize local performance from a systemic perspective. It facilitates the formulation of collaborative governance solutions that promote the co-creation of public value and common resources. The resulting community-level strategies serve as the foundation for implementing organizational policies, which must align with the overarching community goals. This necessitates a coherent process for translating corporate strategies into departmental actions and continuous monitoring of their execution through the tracking of performance indicators, outputs, and outcomes (Bianchi, 2021, 2022).

In tackling wicked problems, governance systems should not rely exclusively on reactive feedback mechanisms. They must integrate a feedforward logic (Otley, 1999), facilitating adaptive learning processes that enable swift policy adjustments at both institutional and local levels in response to emerging challenges or opportunities identified during the implementation phase (Bianchi, 2021). The “outside-in” view enhances the capacity

of outcome-based performance management to address the intricate nature of social concerns and produce more inclusive, resilient, and sustainable policy solutions.

Figure 8 illustrates how integrating DPG and DPM using an outside-in approach can lay the groundwork for achieving sustainable performance that is both efficient and effective, at the organizational and societal levels.

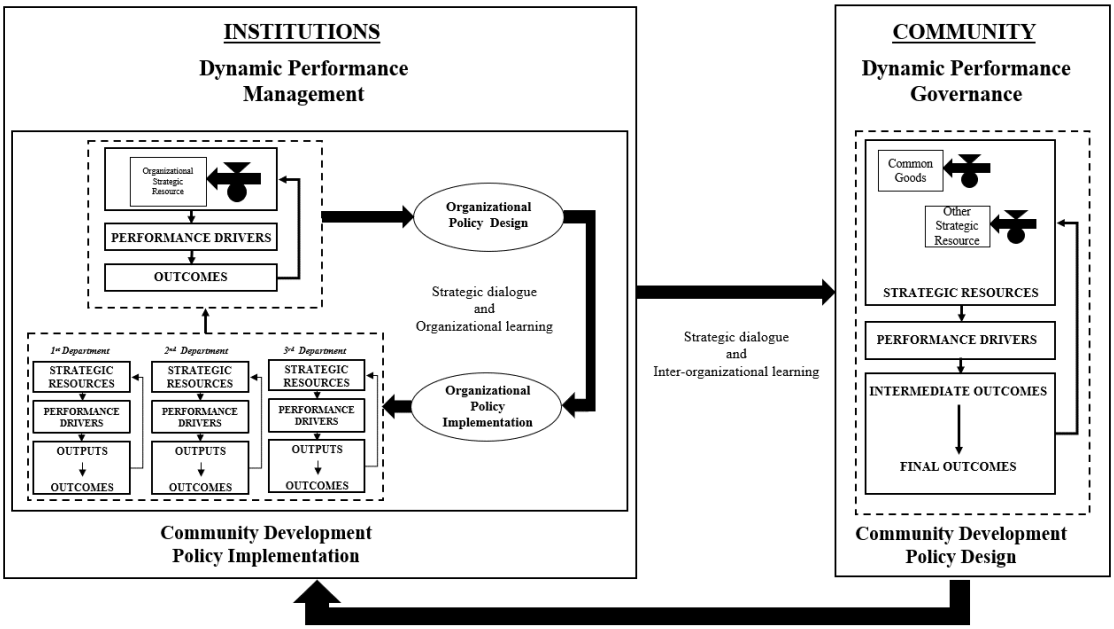


*Figure 8. Advancing sustainable community outcomes through an "outside-in" lens by supporting policy design and implementation via DPM/DPG (Adapted from Bianchi, 2021, p. 342)*

## 3.6 Business Intelligence for Sustainable Development

Business Intelligence (BI) provides a conceptual and methodological infrastructure for organizing, combining, and analyzing complex datasets that to enhance the pursuit of sustainable development. In this research, BI is understood both as a technical toolkit, and as a strategic framework for transforming fragmented sustainability-related data into useful information that can help with decision-making and stakeholder engagement. This is especially important for SDG localization, which requires coordination between different sectors and data ecosystems tailored to each specific situation. As Petrini and Pozzebon (2009) argue, BI systems can contribute to sustainability by enabling organizations to structure huge information volumes and link them to broader planning and performance frameworks, including non-financial and socio-environmental indicators.

The data integration concept is at the core of BI. This concept represents the process of integrating structured and unstructured data from various institutional and geographic sources into a single analytical environment (Baars & Kemper, 2008).

This often means building data warehouses or data marts, which are specialized data stores designed for specific areas or stakeholder groups with a vested interest in them. Data marts can be designed to support strategic planning for specific SDGs (e.g., clean energy, social equity, climate resilience) or for specific governance levels (e.g., municipalities, regional agencies, national or international governments). By organizing data around stakeholder needs and objectives, BI systems facilitate targeted knowledge production, enhance transparency, and allow for customized feedback loops between data users and policy designers (Dibsi & Cho, 2023).

The construction of stakeholder-oriented data marts supports a relational view of governance, wherein data serves not only as a control mechanism but as a shared resource that enables negotiation, alignment, and co-creation of value. In this sense, BI is the backbone of multi-actor learning environments, where diverse actors (governments, businesses, civil society organizations) access tailored dashboards, indicators, and spatial visualizations. As Muntean (2018) demonstrates, dashboards that visualize sustainability progress in real-time can enhance institutional agility, while also promoting internal collaboration across departments. When these visual environments are extended to external stakeholders, they provide an interface for participatory decision-making and increase accountability through open reporting.

In the methodological design of this thesis, BI is strategically positioned as a component of a larger ecosystem that includes SD and DPG. These systems-based approaches require robust data infrastructures to model feedback loops, simulate scenarios, and support anticipatory governance. BI supports these goals by ensuring the quality, traceability, and accessibility of the underlying data. Importantly, BI systems enable the operationalization of place-based strategies by adapting global sustainability frameworks (such as the SDGs) to the specific characteristics, actors, and trajectories of a local territory.

The relevance of BI for sustainable development lies in its capacity to overcome traditional silos of policy and data management. By creating integrated, stakeholder-sensitive data environments, BI systems provide the methodological foundation for

building knowledge-based governance models that are participatory, adaptive, and aligned with the long-term principles of the 2030 Agenda (Salvador & Sancho, 2021). In this light, BI is not only a support tool but a transversal enabler of strategic coherence and local empowerment in sustainable development planning.

An illustrative methodological contribution to the application of BI for sustainable development is offered by Galluzzo and Gennusa (2023), who developed a platform that combines semantic data processing, stakeholder mapping, and predictive analytics to support the localization of the SDGs. Such a framework is structured around a KG architecture that integrates diverse datasets, ranging from institutional actors and funding calls (e.g., Horizon Europe) to local sustainability objectives, into a unified analytical environment. Through the use of natural language processing (NLP) techniques, policy documents are parsed to extract SDG-relevant keywords, which are then embedded using FastText word vectors. These vectors are used to position actors and initiatives within a semantic space, enabling the analysis of thematic proximity and alignment.

A key methodological innovation lies in the application of link prediction algorithms to the KG. By training classifiers such as Random Forests, Logistic Regression, and Multi-Layer Perceptrons on the graph embeddings, the platform can identify potential but unrealized connections between actors. This predictive functionality aligns with the principles of anticipatory governance, offering a decision-support tool that helps local authorities or project designers identify meaningful new collaborations. The approach effectively transforms passive data into active intelligence, enabling a proactive stance in stakeholder engagement and project design.

In BI terms, the platform functions as a dynamic, stakeholder-oriented data mart, a specialized analytical layer that supports scenario analysis and strategic alignment among territorial actors. By storing relationships, thematic classifications, and metadata in Neo4j, the system allows for advanced querying, customized visualizations, and real-time updates, supporting both internal institutional planning and multi-actor coordination. As such, the framework exemplifies how BI can move beyond retrospective reporting to actively guide sustainability transitions by embedding intelligence within data infrastructure.

This approach is particularly valuable in the context of this research, which emphasizes the integration of BI with SD and DPG. The platform in question (Galluzzo & Gennusa, 2023) operationalizes several key dimensions of BI theory, data integration, stakeholder relevance, prediction, and value creation, while demonstrating how these can be technically implemented within a place-based strategy for SDG localization.

### 3.7 Validity and Reliability of Instruments

The validity of the research instruments was confirmed by multiple sources, including existing reports, literature studies, consultations with the research supervisor, and discussions with subject-matter experts (Taherdoost, 2016). A pilot study was conducted to validate the instruments, in particular the semi-structured interview questionnaire used with key informants (see Appendix – Interview Guide). This initial phase concentrated on assessing the clarity, length, and suitability of the questions, utilizing feedback from interviews. Interviews were conducted with non-sampled individuals to assess whether the questions adequately framed the research problem and were interpreted by respondents as intended (Hilton, 2017). Additionally, the pilot study provided insights into the average time required to complete the interview, contributing to practical refinements.

The results of this phase were crucial when developing the final versions of both the questionnaire and the interview guide. The process was grounded in the assumption that participants provided truthful responses, thereby supporting the reliability of the data collected. This stage was essential to ensure that the phenomenon being studied and its related variables were accurate and valid (Taherdoost, 2016). The pilot study also demonstrated that the questionnaire items were effective in measuring the constructs of interest in the particular context, while also indicating potential overlaps with related constructs.

Notably, the interview guide was adaptable in a multitude of circumstances, thereby enhancing the potential for generating comparable results (Bastos et al., 2014; Grippi, 2023). In this context, ensuring reliability was essential to the data-collecting procedure, as it facilitated consistency in the deployment of instruments throughout the study (Zohrabi, 2013; Taherdoost, 2016; Omong, 2021).

### 3.8 Data Sources and Collection: Procedures, Management, and Ethics

This study incorporates both primary data collected from key informants and secondary data obtained from institutional documents, research papers, and official websites. A primary risk of utilizing secondary data is its tendency to be obsolete or inadequately suited to the specific context of the investigation. To address this, pertinent insights were gathered by collecting primary data. In parallel, secondary data played a very important role. By carefully combining both sets of data, the study compensated for the weaknesses of each and enhanced the reliability and utility of its results (Saunders et al., 2012).

Primary data for this study were collected from a wide range of interviewees, encompassing individuals associated with social enterprises, NGOs and non-profit organizations, community-based groups, citizens, and university professors. The interview guide for these key informants was carefully crafted to fit the study's specific goals. On the other hand, secondary data were sourced from a wide array of sources, including institutional databases, official reports, research papers, and websites. A cross-sectional survey approach was employed, as it was most suitable for capturing context-based dynamics within the temporal constraints of the research (Saunders et al., 2012; Omong, 2021; Grippi, 2023).

The study started with the transcription of interview recordings, followed by rigorous anonymization protocols to preserve participant identities. Special attention was given to ensuring confidentiality, particularly in cases where the information disclosed was sensitive.

After being transcribed and stripped of any identifiable information, the text data were examined and organized into thematic groups that fit the research goals. This phase encompassed both content and theme analysis, enabling an initial coding process that helped in the structure and interpretation of the data. Simultaneously, the original data were analyzed, combined with secondary sources to detect discrepancies, rectify apparent gaps, and facilitate comparisons with other urban contexts displaying similar trends (Omong, 2021; Grippi, 2023). The integrated data facilitated the creation of DPG diagrams and causal loop diagrams (CLDs) for the case examined.

During the interviews, participants were assured that their privacy would be protected and that any information they supplied would be kept private. Participation was entirely optional, and all informants were made aware, both verbally and in writing, that they could refuse or withdraw from the study at any time without repercussions. During the research process, strict ethical guidelines were followed to ensure that the rights and dignity of the participants were fully respected (Turcotte-Tremblay & McSween-Cadieux).

Ethical research principles were carefully adopted to maintain equality, dignity, and mutual respect for all participants throughout the data collection process and beyond (Ryen, 2004; Grippi, 2023). No personal or intrusive questions were asked throughout the interviews, as the interview guide was carefully aligned with the primary study objectives. Before each interview, participants were fully informed about the study's aims to ensure their comprehensive understanding and voluntary participation. They were expressly informed of their right to refuse participation or withdraw from the study at any point without risking any adverse consequences.

Establishing a polite and trustworthy interaction was crucial, embodying basic ethical criteria in respondent attendance. A flexible methodology was employed throughout data collection, involving shifting of interviews to contexts that ensured privacy and anonymity. The researcher paid attention to non-verbal signals, such as physical distance, quietness and reserve, or disengagement, that could signify discomfort or reluctance to continue, in order to avoid any coercion or undue pressure (Omong, 2021).

The research design was suitable for fulfilling the study's aims, facilitating the acquisition of pertinent data for all research questions. The combination of insights from interviews, institutional reports, publications, and secondary sources provided an in-depth understanding of the matter. This data provided a basis for formulating evidence-based conclusions (Omong, 2021).

In operational terms, all participants provided informed consent before the interviews took place. For written interviews conducted via email or document exchange, informed consent was obtained in written form before the participant provided their responses. For oral interviews, consent was given verbally at the beginning of the meeting and

documented in the field notes. To ensure confidentiality, personal identifiers were removed during transcription, and all quotations used in the thesis were anonymized.

The study involved exclusively professional actors discussing non-sensitive topics, and therefore fell within the category of minimal-risk research. According to the procedures of the University of Palermo, this type of study does not require formal approval by an ethics committee. Nonetheless, the principles of transparency, confidentiality and responsible data management guided all phases of data collection, processing and reporting.

### 3.9 Sampling Technique, Size, and Selection

The research has focused on the exchange of knowledge, expertise, experiences, and skills across various fields, including sustainable development, public administration and governance, data management, system dynamics, and project management. Integrating several research fields enables a more accurate representation of the intrinsic complexity of the phenomenon under examination, particularly regarding sustainable development issues and the importance of integrated, multidisciplinary, and holistic approaches towards the ecological transition. Various stakeholders were consulted to capture all the perspectives on the examined issue comprehensively.

The sampling frame refers to the dataset or set of sources that includes the entire target population or relevant subgroups from which the sample will be drawn (Czaja & Blair, 2005). This frame pertains to the analyzed population. The population of interest comprises stakeholders from the areas under analysis. The sampling frame comprises key players from the EU, selected based on their contributions to the project in question and their personal experiences in that context. A diverse target population provides optimal settings for examining potential disparities in responses, perceptions, and behaviors. Diversity is crucial for a comprehensive evaluation of the region's characteristics. The importance of the responses gathered from the semi-structured interviews is twofold (Grippi, 2023). They are essential for assessing stakeholders' viewpoints on complex issues. Secondly, they aid in addressing the research issues through a comparison with the existing literature in the relevant field (Omong, 2021).

The target population denotes the group or collection of items being examined, to whom the study's conclusions will be generalized. Analyzing individual viewpoints would provide advantages by facilitating the generation of analytical findings concerning the study issues. Individuals may perceive specific issues differently depending on various factors, including but not limited to race, gender, socioeconomic background, education level, and geographic context. To account for this diversity of perspectives, a non-probability sampling strategy was employed, combining purposive and snowball techniques (Vehovar et al., 2016). In the purposive phase, participants were deliberately chosen based on specific attributes considered relevant to the research objectives. This selection relied on the researcher's informed judgment in identifying key respondents who possessed particular insights or experiences central to the study. The primary distinguishing characteristic among the key participants was their role within their firms, which granted them enhanced knowledge and allowed them to deliver thorough solutions to the interview questions. Snowball sampling (Grippi, 2023) was employed as a strategy due to the limited population size and the challenges in identifying specific and important respondents. The snowball sampling method was employed by initially selecting a principal respondent from the target group for interviews. Thereafter, the appointed first responder would offer recommendations or locate further primary respondents who satisfied the study's requirements until the requisite sample size was achieved (Omong, 2021).

Although snowball sampling was necessary to reach relevant stakeholders who were not easily identifiable through formal lists or public registers, this technique also presents well-known limitations. In particular, it may reinforce existing relational clusters, over-represent well-connected actors, and introduce homogeneity biases linked to pre-existing social and professional networks. To mitigate these risks, the initial entry points were deliberately selected across different organizational types and territorial contexts, ensuring exposure to diverse viewpoints from the outset. During data collection, attention was paid to maintaining heterogeneity in the emerging sample and avoiding early closure around a narrow group of informants. Despite these precautions, reliance on snowball sampling remains a limitation of the study design and may have favored more central stakeholders over more peripheral or less institutionally visible ones.

# CHAPTER 4

# EMPIRICAL APPLICATIONS AND RESULTS

## 4. Introduction

This chapter presents a set of four empirical applications aimed at exploring how systemic and collaborative methodologies, namely Business Intelligence (BI), System Dynamics (SD), and Dynamic Performance Governance (DPG), can be employed to support the localization of the Sustainable Development Goals (SDG). These cases reflect diverse territorial settings, policy objectives, and stakeholder configurations, yet are united by a shared emphasis on generating place-based public value and enhancing institutional learning through data-informed, participatory approaches.

Both theoretical and practical criteria guided the selection of the case studies. From a theoretical standpoint, the cases operationalize key concepts introduced in Chapters 2 and 3: the relevance of multi-actor governance in sustainability transitions, the strategic use of BI as an integrative infrastructure, and the role of dynamic modelling in navigating complexity. Practically, the cases were chosen based on the researcher's direct involvement in interdisciplinary projects and co-authored initiatives, ensuring access to internal data, process documentation, and post-hoc evaluation. Each case captures a different facet of the SDG localization challenge, ranging from technological innovation to territorial resilience, thus offering a basis for comparison across scales, instruments, and governance dynamics.

Three of the four case studies derive from peer-reviewed publications that have either been accepted or are submitted for academic dissemination. While the original studies are preserved in their core structure and findings, they have been reframed here to ensure coherence with the theoretical and methodological framing of this dissertation. Each is preceded by a contextual explanation and followed by a brief critical reflection. The other case study, developed specifically for this thesis, investigates an original experience of collaborative innovation design in a local context and will be discussed in detail as a standalone contribution.

The structure of the chapter is as follows: Section 4.1 introduces each case study, providing background and methodological framing; Section 4.2 presents the empirical results of each case, including qualitative insights, data analysis, and visual representations; Section 4.3 offers a cross-case discussion highlighting patterns, divergences, and strategic implications for SDG localization through systemic tools.

## 4.1 Case Studies

This section presents the case studies analyzed in this research. Each case study is introduced separately, highlighting its context, objectives, and methodological relevance.

The case studies have been selected for their relevance in illustrating different dimensions of SDG localization through different frameworks: European Project Management (EPM), BI, SD and DPG. The section is structured as follows:

- Section 4.1.1 examines the case "European Project Management and SDG Localization: Evidence from the CiD project," examining how EPM facilitates the localization of the SDG, focusing on the Erasmus+ CiD project;
- Section 4.1.2 presents the case "Knowledge Graphs Embeddings for Link Prediction in the Context of Sustainability," which proposes a methodological framework for a collaborative platform supporting SD experts in identifying partnerships and policy innovations, through a Knowledge Graph that maps stakeholder relationships and metadata;
- Section 4.1.3 discusses the case "Enhancing Value Creation in Inner Areas through Dynamic Performance Governance," investigating how local public administrations can enhance public value creation through strategic stakeholder engagement, system thinking, and planning;
- Section 4.1.4 presents the case "Enhancing Policy Innovation to tackle Rural Depopulation and foster Public Value Creation through Dynamic Performance Governance," addressing the "Houses for 1€" policy adopted by the municipality of Sambuca di Sicilia (Italy), exploring how DPG can support innovative policy design to counteract rural depopulation and enhance public value creation.

### 4.1.1 Case study 1: European Project Management and SDG Localization: Evidence from the CiD project

This case study examines the role of European Project Management (EPM) in facilitating the localization of the SDG. Focusing on the Erasmus+ project *Circular Design for Bio-Based Innovation towards Climate-Neutral Cities (CiD)*, the research investigates how transnational alliances contribute to translating the SDGs into locally relevant practices.

The increasing emphasis on the localization of the SDG has underscored the need for governance models that are not only cross-sectoral and participatory but also adaptable to the unique characteristics of local contexts. In this evolving paradigm, European Project Management (EPM) has demonstrated its role as a crucial facilitator of place-based innovation strategies. European financing mechanisms facilitate international partnerships that enable the adaptation of global initiatives, such as the 2030 Agenda, into localized actions that correspond with regional needs, values, and institutional capabilities.

Within this framework, this case study examines the *CiD – Circular Design for Bio-Based Innovation Towards Climate-Neutral Cities* project, an Erasmus+ initiative co-funded by the European Union through the European Education and Culture Executive Agency (EACEA).

The project seeks to bridge gaps in education, training, and entrepreneurship in the creative design sectors, with a specific focus on circularity, sustainability, and bio-based innovation for urban transformation. In doing so, it aligns directly with the broader priorities of the European Green Deal, the New European Bauhaus, and the pursuit of climate-neutral, inclusive cities, as reflected in SDG 11 *(Sustainable Cities and Communities)*. At the same time, the structure and implementation of the project exemplify key dimensions of SDG 17 *(Partnerships for the Goals),* offering insight into how multi-stakeholder cooperation, networked governance, and shared learning platforms can generate sustainable and long-lasting impacts at the local level.

The analysis will focus on the relationship between two foundational constructs: on the one side the Community of Interest (Newman, 1980; Fischer, 2001) concept, that is to say a distributed network of actors united by shared values, goals, or thematic priorities, often transcending geographic boundaries; on the other side the Place-Based Innovation

Ecosystem (Oksanen & Hautamäki, 2014; Rissola et al., 2019) approach, a territorially anchored system of interaction among institutions, stakeholders, and resources that collectively shape context-specific pathways for innovation.

Through the lens of the CiD project, the case study aims to explore how European project frameworks can activate and connect these two logics, and whether the collaborative dynamics fostered within the project are evolving toward a territorially embedded innovation ecosystem, or remain primarily instrumental and project-based in nature.

The case study draws on qualitative data gathered through semi-structured interviews conducted with key project partners across Europe. The interview protocol was specifically designed to investigate partners' motivations, patterns of collaboration, perceived territorial impacts, and future projections for sustainability.

By focusing on a real-world initiative situated at the intersection of design, circular economy, and territorial development, this case study contributes to a deeper understanding of how EU-funded innovation alliances can play a catalytic role in the localization of the SDG, particularly by mediating between abstract global goals and concrete local action through structured, transnational, and multi-level cooperation.

#### 4.1.1.1 Theoretical Framework: European Project Management as a means for the Localization of the SDG

Contemporary sustainability challenges, such as climate change, resource depletion, and social injustice, are widely recognized as wicked problems (Rittel & Webber, 1973): issues that are complex, interconnected, and resistant to linear or technical solutions. Their distinguishing feature is systemic entanglement: each resolution effort uncovers additional dimensions, trade-offs, or conflicts. As outlined in Chapter 2, such challenges defy singular solutions and necessitate adaptive, inclusive, and multi-stakeholder approaches.

The SDGs embody an attempt to establish a global consensus regarding this complexity. Nevertheless, despite their thoroughness, the SDGs are strategically ambiguous. They provide a shared vision rather than a definitive plan. The execution relies fundamentally on their interpretation, negotiation, and application within specific contexts. Consequently, the notion of localization has become pivotal in the discussions

surrounding the 2030 Agenda (Perry et al., 2021). Localization refers to the process of translating global SDG frameworks into local strategies, capacities, and actions (UN-Habitat, 2015). Addressing wicked problems is both a political and operational need, as they arise locally and require localized responses. The localization of the SDG is essential, as it involves adapting the 2030 Agenda to local contexts by identifying and implementing local actions that support global goals. The Joint Research Centre (2025) notes that activities necessary to meet global targets "must be executed locally," necessitating engagement and cooperation across all governmental tiers.

At the European level, this challenge is embedded within the logic of multi-level governance, a feature that has long been a hallmark of EU policy design. The European Commission (2019) has emphasized the need to fully integrate the SDG across EU strategies, while enabling coordination between supranational, national, regional, and local levels.

In this context, EPM arises not merely as an administrative instrument but as a strategic framework for facilitating localized initiatives. EU-funded projects, such as Horizon, Erasmus+, and Interreg, form transnational consortia focused on specific sustainability concerns (Bădîrcea et al., 2025), among other fields of activity. EU-funded initiatives frequently operate as intermediaries between overarching objectives and practical implementation. These programs, often enhancing a quadruple helix approach, intentionally connect consortia of partners, including municipalities, universities, NGOs, and enterprises, under a common objective associated with a specific SDG. Such structured consortia act as intermediary infrastructures that link global and local dimensions (Bădîrcea et al., 2025). They are generally financed and directed by European initiatives (ensuring coherence with overarching objectives), but executed through local pilot projects, case studies, or capacity-building efforts in diverse regions.

Such a framework promotes organized and multi-stakeholder collaboration by connecting the strategic vision of supranational entities with the contextual expertise of local stakeholders. The rationale is that "actions essential for attaining the SDG globally can be expedited through formal networks" (JRC, 2025), wherein each governance level plays a role: the EU supplies resources and a collaborative framework, national and regional

entities coordinate enabling conditions, and local actors implement specific initiatives towards SDG localization.

#### 4.1.1.2 Communities of Interest vs Place-Based Innovation Ecosystems

A different perspective to understand how these projects may function is the interplay between two complementary concepts: the communities of interest and the place-based innovation ecosystem.

Communities of interest are groups of actors connected by shared goals or concerns, rather than by geographic location (Newman, 1980). As Dale (2007) notes, a community may be defined by place (a geographic community) or by interest (a network of people with a common purpose). However, either form implies ongoing communication, collective identity, and joint activities. In the context of European projects, the community of interest typically manifests as a trans-local network of stakeholders who rally around a thematic goal (for example, circular design for climate neutrality) irrespective of where they are physically located (Melin et al., 2022). Such a community is bound by shared vision and expertise, and it might include city officials, researchers, designers, entrepreneurs, and civil society leaders from different regions, all committed to a common innovation agenda (Roman, 2020). Crucially, this interest-based community facilitates horizontal knowledge exchange, where members share best practices, co-develop methodologies, and learn from each other's experiences, thereby creating a distributed pool of knowledge that benefits everyone in the network.

By contrast, a place-based innovation ecosystem refers to a territorially embedded constellation of actors, including public and private organizations, research institutions, and civil society, whose collaborative interactions foster locally grounded innovation. Unlike generalized models, these ecosystems emphasize regional specificities such as institutional arrangements, socio-economic structures, and historical trajectories (Sotarauta & Mustikkamäki, 2015). By leveraging place-specific assets (e.g., industrial clusters, research capacity, or natural resources), they generate innovations that are not only technologically viable but also socially and culturally appropriate (Balland et al., 2019). The quadruple helix model is central to this approach, highlighting the co-production of innovation by academia, industry, government, and civil society (Balland et al., 2019; Rissola & Haberleithner, 2020). Boundary-spanning actors such as

universities or local governments often coordinate these ecosystems, aligning stakeholder interests and facilitating knowledge flows (Rissola & Haberleithner, 2020). Their effectiveness depends not only on available resources but also on dense relational networks and the ability to navigate institutional complexity across various scales (Sotarauta & Mustikkamäki, 2015; Balland et al., 2019). As Rust and Rust (2024) underscore, such innovation is socially constructed, emerging from iterative, trust-based, and participatory processes embedded in local life-worlds. By privileging local agency and contextual knowledge, place-based ecosystems provide an alternative to top-down innovation, enabling the development of sustainable and responsive solutions (Balland et al., 2019; Rust & Rust, 2024).

While communities of interest and place-based innovation ecosystems are often presented as distinct, this paper suggests that they can be viewed along a continuum, particularly in the field of EPM. Over time, actors may move across this spectrum, depending on strategic aims, learning processes, and relationships. What starts as instrumental involvement, driven by funding or visibility, can evolve into something more embedded as collaboration deepens, practices align, and trust develops. In such cases, stronger ties to place may emerge, supporting local strategies and longer-term capacity. However, such a shift is not automatic. It may depend on conditions such as governance quality, shared priorities, active intermediaries, and the perceived relevance of local anchoring. Some collaborations remain loosely structured; others grow into more rooted ecosystems with lasting impact. Tracking these paths helps assess whether SDG localization survives beyond the life of specific projects. Communities of interest and place-based innovation ecosystems follow different logics, but their interplay can be productive, especially when project design encourages both peer learning and policy integration. This continuum offers a way to understand how actors position themselves and what shapes their movement toward deeper territorial engagement.

Table 2 outlines how actors' motivations and roles can shift over time, moving from participation in topic-based communities toward a more grounded engagement within local innovation ecosystems.

| Level | Prevalent Motivation | Type of Engagement | Project Implication |
|---|---|---|---|
| 1. Opportunistic | Access to funding, visibility | Functional, minimal participation | Formal involvement, low autonomy |
| 2. Instrumental | Capacity building, networking | Thematic collaboration | Partial adaptation to local context |
| 3. Strategic | Territorial positioning, policy influence | Co-Design and alignment with local stakeholders | Integration with local ecosystems |
| 4. Transformative | Shared territorial development | Embedded, long-term collaboration | Continuity beyond the project cycle |

*Table 2 – Motivational Trajectory from Community of Interest to Place-Based Ecosystem. Author's elaboration, 2025.*

The framework identifies four general stages, beginning with opportunistic involvement (often driven by the pursuit of funding or visibility) and progressing to more transformative forms, where a long-term commitment to a territory and shared solution-building takes root. While many collaborations start with practical or instrumental aims, these can gradually deepen as trust develops, interests converge, and governance conditions support ongoing exchange. The model suggests that place-based alignment is not automatic, but instead can emerge when the right conditions are present.

In this context, collaboration plays a crucial role in shaping how actors shift along the continuum and engage with place-based transformation. EU project consortia are built to bring together institutions from different sectors and levels of governance under common themes. However, these setups reflect a particular form of collaborative governance grounded in shared learning, distributed roles, and joint action across both institutional and territorial boundaries (Ansell & Gash, 2008; Emerson et al., 2012).

From this perspective, collaboration may evolve the space where thematic goals can take on local meaning, and where broader agendas become part of actors' priorities.

As the case analysis will show, collaboration within EU-funded projects does not take a single path. Its nature and depth vary depending on the context. However, when supported by strong governance, shared aims, and time-tested trust, it can provide the groundwork for more stable, locally anchored forms of collaboration, moving away from loosely connected networks and toward more integrated ecosystems.

#### 4.1.1.3 Methodology

This research employs a qualitative and exploratory case study approach to investigate how EPM practices facilitate the localization of the SDGs. The case study design effectively captures the intricacies of multi-level and multi-actor processes occurring within particular institutional and territorial contexts. As Yin (2018) notes, case studies are particularly suitable when the boundaries between the phenomenon and its context are blurred, as is the case in transnational sustainability partnerships.

The selected case is the ongoing project *Circular Design for Bio-Based Innovation towards Climate-Neutral Cities* (CiD), funded under the Erasmus+ program by the European Union through the European Education and Culture Executive Agency (EACEA). CiD operates at the intersection of a transnational community of interest and several place-based innovation ecosystems. By engaging actors from academia, local governments, civil society, and industry across multiple European regions, the project provides a rich empirical setting to examine how shared thematic commitments, in this case circular design and climate-neutrality, translate into territorially grounded innovation practices.

The central analytical focus lies on collaboration. For this research, collaboration is not seen only as a condition for project delivery, but as a generative process through which actors negotiate meaning, align strategies, and potentially reconfigure their roles within local innovation ecosystems (Sultana & Turkina, 2023). Collaboration is treated both as an object of inquiry and as a mechanism through which global goals are made locally relevant. In this regard, the study aims to comprehend the dynamics of collaboration across various governance levels and its role in facilitating the transition from interest-based engagement to territorial embedding.

Empirical data were collected through two primary methods: document analysis and semi-structured interviews. Project documents (e.g., descriptive materials, public reports, deliverables, etc.) provided contextual information on the structure, goals, and governance of the consortium. These were complemented by a series of semi-structured interviews with representatives of the 11 project's partner institutions. Adopting a quadruple helix approach, respondents included actors from higher education institutions, public administrations, private sector organizations, and civil society organizations. This

diversity reflects the multi-actor composition of the ecosystems in question, and was essential for capturing a range of perspectives on both project-level and place-based dynamics.

The interview protocol was designed to collect reflective narratives regarding participation, encompassing initial motivations, evolving roles, modalities of collaboration, and perceived contributions to local transformation. Special care was taken to determine if and how actors transitioned along the spectrum from a community of interest to a place-based innovation ecosystem. The interview blocks were organized around four main analytical themes: strategic motivations, network governance, territorial anchoring, and expected outcomes.

The data were examined through a qualitative thematic analysis, employing iterative coding of transcripts to identify recurring patterns, divergences, and context-specific dynamics. The conceptual framework, which focused on strategic alignment, institutional embedding, and ecosystem development, guided the process while still allowing for the emergence of new categories. Such an approach combined theoretical orientation with openness to actor narratives and underlying structures. Rather than seeking generalization, the study offers a theoretically informed interpretation of collaboration as a driver of SDG localization within a European project setting.

As the project was still ongoing during the data collection phase, findings capture a specific moment within an unfolding process. Although the respondents represented varied partners, they do not cover the full range of views in the consortium. Despite these limitations, the combination of multiple data sources, a robust analytical framework, and a focus on collaboration as a dynamic practice provides a solid foundation for understanding how European projects operate as infrastructures for localizing global goals for sustainable development.

### 4.1.2 Case study 2: Knowledge Graphs Embeddings for Link Prediction in the Context of Sustainability

This case study is based on a peer-reviewed article co-authored with Dr. Y. Galluzzo, titled “Knowledge Graph Embeddings for Link Prediction in the Context of Sustainability”, published in the proceedings of the *European Conference on Advances in*

*Databases and Information Systems* (2023). The content has been methodologically reframed to align with the structure of this dissertation.

The use of a large amount of heterogeneous, interconnected, and high-quality data has become essential to address challenges related to the development of solutions for complex systems. This case presents a methodological framework for the development of a collaborative platform intended to support the SD experts in identifying potential partnerships and innovative policy solutions. To this end, a Knowledge Graph (KG) approach is adopted to map relationships among stakeholders and store their metadata. The system leverages Machine Learning (ML) methodologies and models for data analysis as well as the prediction of connections among stakeholders and potential work tables to facilitate the achievement of the SDGs in specific contexts.

For the sake of clarity, the 17 SDGs are briefly recalled here in an abridged form, as a reminder, while a more detailed presentation has been provided above in Section 2.1.1. The United Nations (UN) has established the 17 SDGs as part of the 2030 Agenda for Sustainable Development, intending to address interconnected environmental, social, and economic challenges on a global scale. However, implementing these goals can be challenging due to differences in political, social, economic, and cultural contexts worldwide. To address such challenges, the localization of the SDGs is critical to ensure their practical relevance and feasibility. Wicked problems (Ansell & Torfing, 2014), such as climate change, poverty, biodiversity imbalances, population dynamics, and access to renewable energy sources, provide tangible examples of how interdependence can limit the effectiveness of policy responses targeting isolated issues. This interdependence implies the need to consider this set of problems holistically and to adopt a dynamic approach to policy analysis and stakeholder collaboration in pursuit of sustainable outcomes (Bianchi et al., 2021). Given that the 2030 Agenda is universal, integrative, and transformative, it is crucial to ensure horizontal integration among public, private, and civil society actors. Equally important is the need to establish vertical alignment between local, regional, and national institutions, to synchronize efforts and foster coherent governance structures.

| SDGs | SDGs Title |
|---|---|
| SDG 1 | No Poverty |
| SDG 2 | Zero Hunger |
| SDG 3 | Good Health and Well-Being |
| SDG 4 | Quality Education |
| SDG 5 | Gender Equality |
| SDG 6 | Clean Water and Sanitation |
| SDG 7 | Affordable and Clean energy |
| SDG 8 | Decent Work and Economic Growth |
| SDG 9 | Industry, Innovation and Infrastructure |
| SDG 10 | Reduced inequalities |
| SDG 11 | Systainable cities and communities |
| SDG 12 | Responsible consumption and production |
| SDG 13 | Climate action |
| SDG 14 | Life below water |
| SDG 15 | Life on land |
| SDG 16 | Peace, Justice and Strong Institution |
| SDG 17 | Partnership for the goals |

*Table 3. Table of the 17 Sustainable Development Goals (SDG).*

The integration and alignment of mandates, resources, and capabilities among diverse institutional and social stakeholders across multiple governance levels and sectors are crucial drivers for sustainable development. The localization of SDG is crucial, encompassing the identification, implementation, and management of plans at the community level to achieve global, national, and regional SDG (Perry et al., 2021). Recently, KGs have garnered increasing attention across diverse application domains, including precision medicine (Chandak et al., 2023), biomedical fields (Galluzzo, 2022), natural language processing (NLP) tasks (Schneider et al., 2022; Al-Moslmi et al., 2020), and recommendation systems (Shao et al., 2021; Guo et al., 2020), due to their capability to consolidate and correlate data from multiple sources within a singular database (e.g., Neo4j). KG has recently been utilized in the domain of sustainability (Fotopoulou et al., 2022; Kalaycı et al., 2021). This study aims to advance the scientific literature in a relatively underexplored field and investigate the dynamics between stakeholders and working groups, promoting effective collaborations to support the objectives outlined by the various SDGs. The proposed approach focuses on enhancing SDG localization by

establishing collaborative platforms, as outlined by Ansell and Gash (2018), underpinned by KG that facilitate a shared understanding, accommodate diverse perspectives, and promote a unified system view. The application will be designed to assist the specialist in SD. This methodology will be utilized to enhance learning processes in the formulation and execution of policies among various stakeholders.

#### 4.1.2.1 Proposed Approach

In light of the universal, integrated, and transformative nature of the 2030 Agenda, the effective implementation of SDG requires coordinated actions across multiple policy domains and governance levels. This, in turn, requires the establishment of collaborative networks that involve a diverse range of stakeholders, including institutional actors and civil society organizations. Within this framework, SD is applied as a methodological backbone to support and facilitate the effective implementation of collaborative platforms. These platforms aim to combine the policy level of contextual governance with the management level, through the action and interaction of the different organizations involved.

Collaborative platforms are essential for engaging local actors in addressing targets of the SDG (see Table 3), as they offer a structure for capturing emergent events and systemic interdependencies that often fall outside the scope of conventional policy tools (Ansell & Gash, 2018). These platforms facilitate collaboration, create shared understanding, determine each stakeholder's role in localizing the SDG, and promote the development of strategic resources for implementing collaborative policies in socio-economic, cultural, and ecological transitions. However, they often face challenges in mobilizing resources and expertise to address sustainable development challenges (Oosterhof, 2018).

An inclusive and multi-stakeholder approach to implementing the SDGs can generate several benefits, including enhancing public participation in sustainability initiatives, strengthening political alignment, and reinforcing a long-term commitment to SDG-oriented policies. Moreover, by promoting the convergence of efforts by different development actors, it can ensure the inclusion of marginalized demographic groups and communities, allowing them to have a role in development processes. SDG localization requires accurate and comprehensive data in support of collaborative platforms (and their facilitators) to assess progress, identify gaps, and inform decision-making. Indeed, data

is essential in several ways to support the achievement of the SDGs. Firstly, it enables governments and other stakeholders to establish benchmarks, monitor progress, and assess the effectiveness of development programs. Secondly, data is essential for mobilizing resources for the SDGs by demonstrating the necessity for investment, identifying priorities, and assessing their impact. Finally, data might reveal new collaborations and novel strategies that facilitate the attainment of the SDG in particular circumstances.

#### 4.1.2.2 Application Context

Within the scope of this research, the application of the SD framework aims to enhance the understanding of the causal relationships between policies implemented and the results achieved in the short-, medium-, and long-term horizons. Specifically, this approach seeks to account for the tangible and intangible factors that influence the impact of specific policies (Bianchi et al., 2018).

By supporting planning processes within collaborative platforms, the guidance of SD experts enables the explicit and tacit knowledge of key actors to be capitalized and refined, as well as the information system that supports the planning processes. This is achieved by analyzing cause-and-effect linkages related to both proposed policies and the phenomena that have led to past outcomes and current conditions that key actors aim to address. Therefore, SD contributes to a holistic understanding of the sustainability-oriented performance, allowing policies to be evaluated in light of their interconnected effects on complex systems.

In the context of SDG localization, the integration of SD into collaborative platforms enables decision-makers to account for the multidimensional interactions among socio-economic, environmental, and institutional factors. This systemic insight supports the formulation of territorially grounded strategies that are more attuned to the specific challenges and opportunities of local communities.

In this regard, EU policy instruments such as the Horizon Europe program exemplify how multi-level and multi-actor collaborations can be institutionalized and funded. These initiatives create a favorable environment for transdisciplinary research, participatory

innovation, and data integration, conditions that are critical for supporting SDG localization efforts through collaborative platforms and SD-based learning environments.

### 4.1.3 Case study 3: Enhancing Value Creation in Inner Areas through Dynamic Performance Governance

This case study - adapted from a peer-reviewed book chapter co-authored with Dr. N. Grippi and forthcoming in *Sidrea Covales Young Scholars* (Springer, 2025), with minor editorial adjustments to fit the dissertation's analytical framework - examines the application of the Dynamic Performance Governance (DPG) framework in territories facing demographic decline and socio-economic stagnation. Drawing on the Monti Sicani area in Sicily as a pilot territory, the study investigates how local public administrations can enhance public value creation through strategic stakeholder engagement, system thinking, and anticipatory planning.

These inner areas are contexts with rich and diverse cultural heritage and environmental assets (e.g., high-quality agricultural products, natural landscapes, archeological & historical settlements, museums, etc.) but distinct from urban settings because of their low population density and distance from key welfare services like healthcare, education, and transportation (Ottomano Palmisano et al., 2022; Rossitti et al, 2021). Such contexts face numerous challenges (e.g., depopulation, urban decay, aging population, limited job opportunities, outmigration, etc.) that worsen the existing constraints and limitations in their respective environments. These problems exacerbate the economic dynamism of these areas, leading to a decrease in public service provisions, external investments, and the overall quality of life and attractiveness of the area (Almeida, 2018). Such problems, referred to as "wicked problems" by Rittel and Webber (1973), have a feedback loop that worsens the already declining conditions of the socioeconomic, cultural, and ecological systems. These exhibit a growing blurriness, stemming from the complex structure of the relationships across different governance levels, making the policy agenda difficult to plan. Addressing such problems requires, on the one hand, a long-term perspective that identifies the underlying causes and considers the broader systemic context to produce lasting change, and, on the other hand, adopting innovative modes of planning (Ansell & Torfing, 2014) to foster public value creation (Osborne, 2021). From this perspective, by

adopting effective policies, public sector organizations (PSOs) have the potential to shape society's path profoundly.

Based on this, the authors posit the following. To address the above-mentioned challenges, it is crucial to involve different stakeholders (PSOs, businesses, and civil society) in co-planning, co-designing, co-producing, and co-evaluating holistic policy solutions (Bovaird, 2007; Crosby et al., 2017; Torfing & Ansell, 2017) and to manage public programs or assets (Ansell & Gash, 2008, p. 2).

By collaborating - through formal and informal dialogue - stakeholders jointly create rules and structures guiding their interactions and deliberations, involving shared norms and mutually beneficial interrelationships (Madden, 2015; Thomson, Perry, and Miller, 2009, p. 25; Wood & Gray, 1991) to leverage and foster tangible and intangible shared strategic resources (e.g., time, skills, knowledge, values, contacts, etc.) (Bianchi, 2021; 2022).

Such collaboration also implies the need for performance management and governance systems able, on the one side, to capture the intrinsic dynamic complexity characterizing inner areas and the related wicked problems affecting such contexts, and on the other, to support stakeholders in collaborative initiatives to foster consistency across an organizational, interorganizational, and context perspective of sustainable value creation. This requires a suitable method able to cut across different and interconnected viewpoints, i.e., time horizon, accountability, and field (Bianchi & Grippi, 2024).

In this empirical research, it will be highlighted that such collaborative initiatives necessitate strong performance management and governance approaches for framing critical strategic resources, drivers, outputs, and outcomes. In line with this, the chapter aims to illustrate how the DPG approach (Bianchi, 2016, 2021, 2022; Bianchi & Vignieri, 2020; Vignieri, 2022) can effectively enhance collaboration through stakeholder learning, thereby facilitating the creation of public value in inner areas. It will be emphasized how, building on three bodies of knowledge i.e., SD, performance management, and collaborative governance, DPG can support the design of performance management and governance systems that help frame trade-offs in time and space (Bianchi & Williams, 2015; Bianchi et al., 2019), so to deal with the intrinsic dynamic complexity of wicked problems affecting inner areas.

In our view, stakeholders could benefit from systems modeling and cause-and-effect models as tools for capturing public value drivers, outputs, and both intermediate and final outcomes, therefore contributing to a discussion on public value creation in collaborative settings.

In line with this, this chapter addresses the following research questions: (1) How can DPG play a role in creating public value in inner areas? (2) Why can DPG be a methodological guidance to foster stakeholder collaboration? (3) What role could DPG play in fostering inner areas resilience?

The overall goal of the case study is to propose an approach that integrates performance management with collaboration through systems thinking to tackle the dynamic complexity of inner areas. In doing so, it aims to fill the gap by introducing the DPG approach as a novel contribution to the discourse on inner areas. It recognizes inner areas as complex ecosystems with interdependent actors whose interactions in co-experiencing and co-producing public services contribute to creating public value (Strokosch & Osborne, 2020). The originality of this chapter lies in proposing the DPG framework to operationalize these principles in the context of inner areas. By combining SD, collaborative governance, and performance management, the DPG approach provides a framework for coordinating stakeholder efforts to solve the dynamic complexity of wicked problems. It emphasizes how a place-based perspective can improve governance system design by facilitating stakeholder learning, framing trade-offs over time and space, and promoting long-term public value creation.

#### 4.1.3.1 Dealing with inner areas' dynamic complexity through collaboration

Inner areas can be identified as social systems where different actors interact with each other and pursue their own goals (Vignieri, 2022). The interplay among diverse stakeholders, encompassing PSOs, community-based organizations, businesses, and non-profit organizations, influences their respective values, actions, goals, and delays in perceived and reported information, as well as variations between the actual and desired conditions of stakeholders (Vignieri, 2022). Such changes prompt stakeholders to adjust their behavior in response to the actions taken by other stakeholders (Bianchi & Tomaselli, 2015; Noto & Noto, 2019; Vignieri, 2022). However, stakeholders' actions or

other changes in specific governance spheres may have ripple effects across the entire system, resulting in non-linear and frequently unforeseeable results due to the existing delays between the underlying cause-and-effect relationships shaping such systems (Vignieri, 2019; 2022). This can help elucidate the underlying reasons influencing the complexity of managing inner area performance governance, as well as address the wicked problems (e.g., demographic decline, lack of economic dynamism, limited public services, social and digital isolation, and unemployment) that challenge such contexts. Indeed, inner areas are susceptible to many changes and transformations that may impact their dynamics when viewed through socio-economic lenses. Economic globalization, for instance, has increased the interdependence of the local and global economies, making local communities more vulnerable to changes and competitiveness. The wickedness of such problems necessitates the horizontal involvement of various organizations (e.g., PSOs, private sector organizations, civil society, and other stakeholders) in designing and implementing collaborative initiatives that span multiple policy fields (Vignieri, 2019, 2022). The quality of institutions and the ability of local governments to formulate and implement effective policies can have a significant impact on the aptitude of local communities to overcome challenges, develop new opportunities, and enhance public value creation, thereby fostering place resilience (Vignieri & Grippi, 2024).

Inner areas' resilience is "intended as the capacity of social, economic, and environmental systems to cope with changes, both foreseeable trends and unexpected events or disturbances, by responding and reorganizing themselves in ways that maintain their essential function and identity" (Ottomano Palmisano et al., 2022, p. 2; Knickel et al., 2018).

Inner areas can be conceived as complex, dynamic, and self-organizing ecosystems where organic, natural, and human components both self-organize, adapt, and shape the physical components of such contexts as infrastructure. The non-linear interaction among living and non-living components, whether top-down or bottom-up, gives rise to complex and dynamic patterns that can manifest as networks (Chen et al., 2023, p. 2; Vignieri, 2022).

The interactions between a complex system's constituent parts determine its behavior, which can result in intricate and unexpected patterns of behavior. The extensive feedback loops, delays, and nonlinear connections make such systems difficult to understand and

describe using traditional methods when faced with such dynamic complexity (Morecroft, 2015; Morecroft & Sterman, 2000). Indeed, such methods may run the risk of a myopic view stemming from the sectoral, static, and input-focused approach to performance measurement. It has been proposed that such methods should be supported by comprehensive conceptual frameworks underlying an integrated and holistic perspective (Ferreira & Otley, 2009).

To address such challenges and needs, new modes of planning and policy innovation are required (Ansell & Torfing, 2014). Policymakers should consider the pluralistic nature of modern society when public values and private interests collide (Spicer, 2010). Hence, PSOs should balance diverse interests, seek democratic legitimacy, and reconcile value controversies (Cui & Osborne, 2018) by serving as catalysts, implementers, and orchestrators (Crosby, Hart, & Torfing, 2017; Rajala et al., 2018, 2020; Peters, 2010) of innovation. In this sense, PSOs can play a catalytic role due to their authority (Crosby & Bryson, 2005). They should act as "local entrepreneurs" (Rhodes, 2017, p. 84) to foster stakeholder consensus in the policy agenda. To carry out such a role, there is a need to foster boundary-spanning leadership (Igalla et al., 2021; Sateesh et al., 2022), i.e., "the mechanisms and processes by which policy actors in the public, private, and non-profit sectors transcend organizational and institutional silos in pursuit of public value co-creation" (Conteh & Harding, 2023, p. 107). This shifts the focus from an organizational perspective to an entrepreneurial spirit devoted to fostering public value creation (Bianchi & Grippi, 2024). Such an interorganizational perspective necessitates integrative public leadership, which brings together different groups and organizations across sector boundaries to tackle complex problems and achieve the common good (Crosby & Bryson, 2006).

It is essential for innovative performance governance to foster holistic and pervasive efforts in policymaking aimed at enhancing policy design and consistent implementation to affect an inner area's attractiveness and quality of life (Bouckaert & Halligan, 2007). Through the implementation of policy network governance mechanisms, a PSO can involve multiple community stakeholders in coordinating a strategic learning initiative. Developing "robust" policies based on an outcome-oriented perspective is made possible through the learning process (Bianchi, 2019). This could entail cooperative efforts

between various stakeholders that include co-design, co-production, and co-assessment of policies to build community resilience and promote sustainable socioeconomic growth (Bovaird, 2007; Torfing & Ansell, 2017). Involving all the stakeholders in this process enables a holistic understanding of wicked problems (Crosby et al., 2017). This collaboration may also lead to the creation of public value since "value is created by identifying and exploiting new ways of approaching or representing problems, of combining skills and resources in crafting new solutions, assessing and sharing risks, coordinating actions, or building joint ownership" (Ansell & Torfing, 2014, pp. 229–230).

In this perspective, the value creation concept should be considered as a collaborative and co-evolutionary process, rather than a linear function, that involves networking with partners, allies, suppliers, and customers to share knowledge, resources, and activities. In line with this, the value creation process "is supported or constrained within complex and dynamic ecosystems where multiple actors (e.g. policymakers, organizations from across sectors, activists, communities, and service users) plan, design, deliver and consume public service, and accrue value, through various, nested layers of interactions" (Strokosch & Osborne, 2020, p. 431). The collaboration among such actors forms "value constellations" that work together to co-produce value (Romero & Molina, 2011). This implies that all these actors, bound by common interests and geographical or social ties (Wenger et al., 2011), act as active value co-creators through the co-experience and the co-construction of public services (Strokosch & Osborne, 2020).

Hence, collaboration among stakeholders is essential for achieving shared goals and values, including social inclusion, quality of life, and local area attractiveness. Such collaborative settings need to be properly framed in terms of public value creation and performance factors to be effective over a longer time horizon.

However, even when collaborative initiatives are carefully planned and implemented, such initiatives may fail (Bianchi et al., 2019; Bianchi, 2021; Bianchi, 2022) due to several reasons, such as divergent goals, lack of resources, lack of leadership or coordination, resistance to change, lack of monitoring and evaluation, and environmental or external constraints. These are often associated with the variety of parties involved and the lack of appropriate models or techniques to handle disagreements, which can encourage a strategic learning process among the parties concerned, establish confidence

and consensus, and foster a standard shared view (Bianchi, 2022), ultimately creating community outcomes. The community level is a crucial aspect of the value creation process, as value creation should encompass the overall community and its surroundings. In this sense, as highlighted by Sancino (2016), the community level should be regarded as a macro-level of analysis since it includes personal outcomes (micro level) and single organization and network outcomes (meso level). This facilitates the identification of divergent interests and resistance at various levels, which undermines the potential to achieve community outcomes and, consequently, to create public value.

In this sense, to frame the inherent dynamic complexity and enable the identification of such outcome levels, there is a need for performance management methods that can "practice for understanding organizational reality […] and systems designed to account for that reality" (Roberts & Scapens, 1985, p. 444). This is the domain of DPG (Bianchi, 2021; 2022; Bianchi & Vignieri, 2020), as illustrated in the next section.

#### 4.1.3.2 Dynamic Performance Governance framework

DPG fosters a "shift of mind" from a static to a dynamic view by adopting stock-and-flow and feedback modeling (Sterman, 2000), used in SD, - portrayed in Figure 9 and Figure 10 respectively - and applying them to performance management and governance, thereby contributing to increasing the quality of performance reporting, accountability, governance, and policy development (Bianchi et al., 2019; Xavier & Bianchi, 2019). Such a qualitative and lean modeling approach (Bianchi, 2016; 2021; 2022; Bianchi et al., 2018; Vignieri, 2022) contributes to fostering a descriptive and causal perspective in policy analysis. Such causal analysis is based on reinforcing and balancing loops and is portrayed through causal loop diagrams that depict the investigated system structure and related behavior over time. Feedback loop diagrams have a polarity that is portrayed through a symbol located in their center and is detected by multiplying all the signs of the arrows linking the variables in a loop. More specifically, a positive polarity indicates a reinforcing loop ("R"). It defines a self-reinforcing process, whereas a negative one indicates a balancing loop ("B") and represents a goal-seeking behavior (Sterman, 2000, pp. 12-14; Peters & Bianchi, 2023). For ease of reference, the notation for reinforcing and balancing feedback loops is repeated here, as previously introduced in Figure 2.

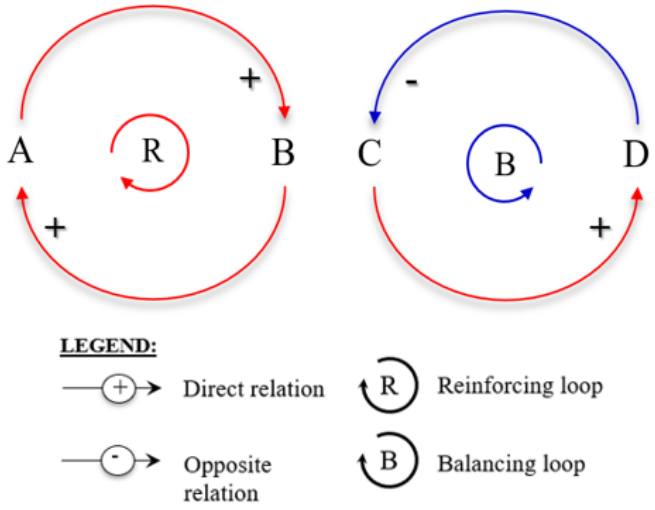


*Figure 9. Causal loop diagram showing the cause-and-effect relationships among different variables (Adapted from Sterman, 2000. Created by using Powersim Studio, repeated here from Figure 2 for ease of reference).*

Stock-and-flow modeling (shown in Figure 10) is a powerful technique used in SD to analyze the accumulation and deployment of tangible and intangible strategic resources within a system over time. Quantities or levels that accumulate over time (e.g., the population in a city) are referred to as “stocks”. "Flows" refer to the rates at which these quantities change, such as the birth and death rates of a given population. This technique is beneficial for analyzing complex systems, as it helps to uncover how different components of a system interact, leading to a deeper understanding of cause-and-effect relationships. Additionally, it is helpful in forecasting and scenario planning, enabling the simulation of temporal changes and forecasting future behavior in different circumstances. In policy design and evaluation, stock-and-flow modeling is frequently used to analyze the long-term effects of various interventions and to develop effective strategies (Sterman, 2000, pp. 191-193).

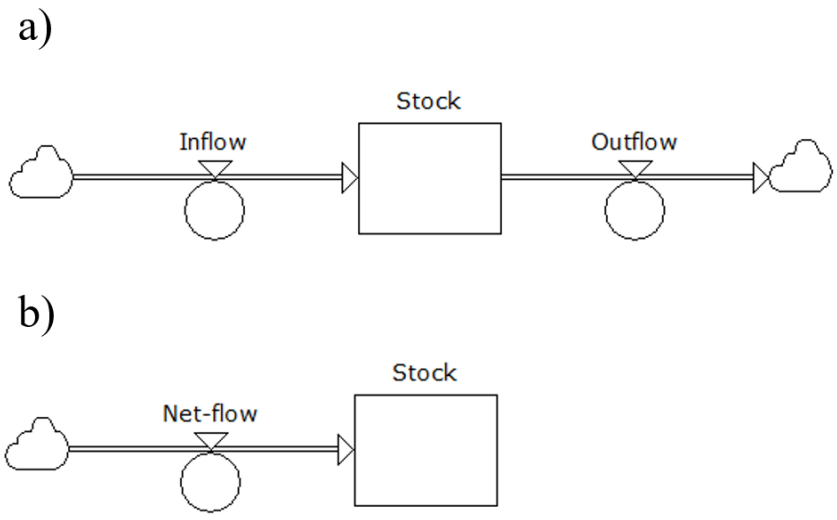


*Figure 10. Illustrations of stock-and-flow structure (Adapted from Sterman, 2000. Generated using Powersim Studio).*

The DPG approach, by combining the above-mentioned techniques, focuses on promoting stakeholder learning by demonstrating the sustainability of policies through three interconnected layers (Bianchi, 2021, 2022, 2023; Bianchi et al., 2019), namely strategic resources, performance drivers, and end results. The first layer shows the main shared strategic resources (i.e., resilient state measures), a range of tangible and intangible assets that are available to various stakeholders within a specific context and are represented as stocks. These assets can include natural resources, cultural heritage, reputation, expertise, leadership, trust, population, and quality of life (Bianchi, 2023). The level of these assets fluctuates over time due to several factors, including the implementation of network governance policies. Stakeholders play a crucial role in influencing community outcomes by effectively utilizing both organizational and shared strategic resources. Within the end-results layer, DPG detects different levels of intermediate outcomes that significantly impact the final outcomes (Bianchi, 2023). For example, the attractiveness of an inner area can be influenced by various factors that measure specific resources that contribute to its attractiveness. These resources may include a skilled workforce, infrastructure, parks, and services for residents and businesses. End results are gauged through the accumulation of flows into stocks of strategic resources. By deploying such resources, stakeholder policies may affect performance drivers over time. Performance drivers, or transition process measures, the other layer of the DPG chart, are critical success factors and "leading" indicators of future performance (Otley, 2012, p. 252) that contribute to achieving community outcomes. To

effectively address the impact of discontinuity on performance, policymakers must consistently monitor and identify early signs of change, and continuously adjust performance measures accordingly. Hence, recognizing and tracking performance drivers may indicate the necessity of implementing adjustments by expanding the examined system boundaries - which involves engaging additional stakeholders in policy analysis – to the originally implemented policies so as to mitigate the arising possible adverse effects. This forms the foundation of a feed-forward mechanism that would enhance strategic planning and control in interorganizational settings (Chen et al., 2023). Performance drivers are evaluated by comparing a strategic resource endowment to a benchmark using ratios (Bianchi, 2023). Figure 11 below shows the structure of a general DPG chart, which includes the three layers mentioned above (i.e., strategic resources, performance drivers, and end results) (Bianchi & Grippi, 2024).

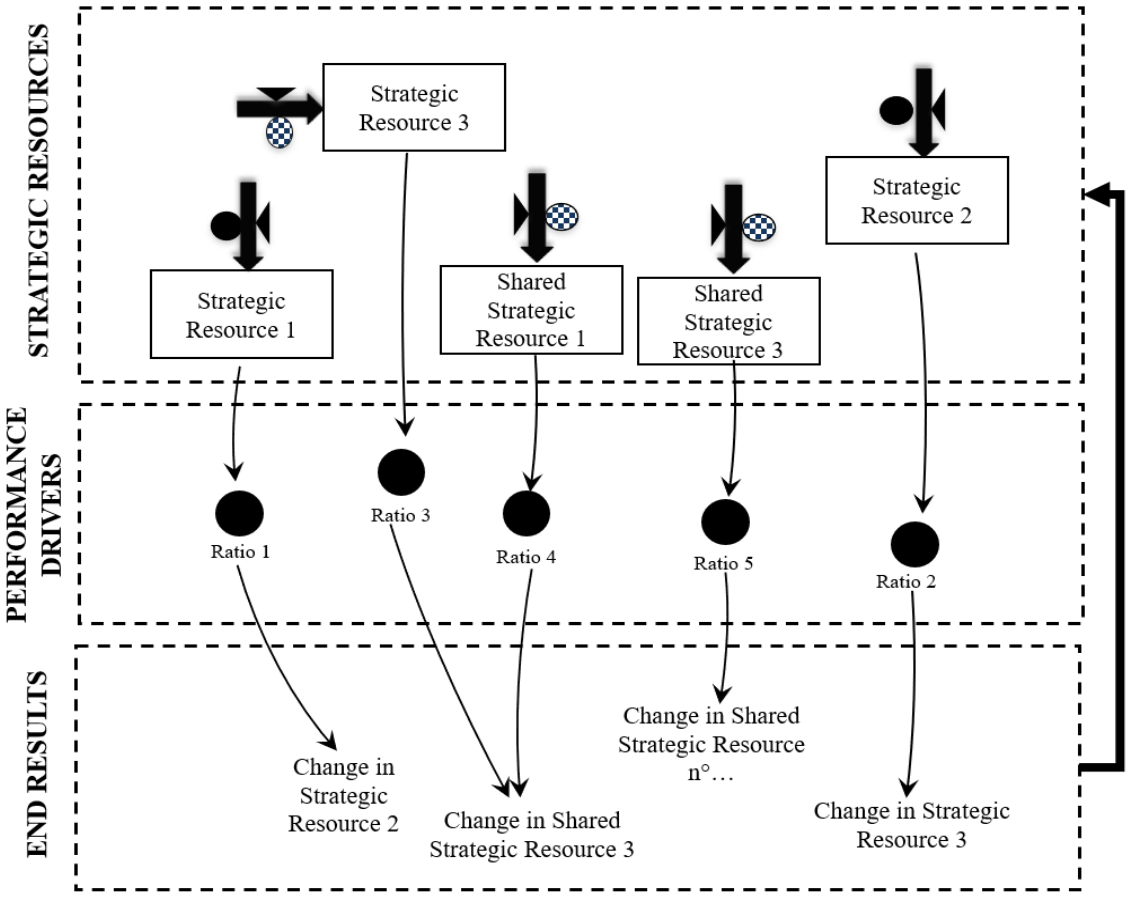


*Figure 11. Dynamic Performance Governance Chart Structure (Source: Bianchi, 2022, p. 338. Adapted from Bianchi, 2016, p. 73)*

The DPG framework adopts a distinctive approach to performance governance by shifting from the traditional "inside-out" perspective to an "outside-in" viewpoint (Bianchi, 2016, 2021, 2022, 2023; Bianchi & Vignieri, 2020). Instead of designing policies based on the individual organization's perspective, this methodology emphasizes the importance of considering the local area as a whole (Bianchi, 2022). This enables stakeholders to develop collaborative policies that generate collective strategic resources at the societal level, thereby enhancing organizational performance and promoting public value creation.

The insights derived from the application of the DPG approach in the Monti Sicani inner area, examined in greater depth in Section 4.2.3, provide the basis for the following case study, which focuses on the municipality of Sambuca di Sicilia. This final empirical application further explores how dynamic governance frameworks can be leveraged to support sustainable development and stakeholder engagement in small, depopulating territories undergoing complex socio-economic transitions.

### 4.1.4 Case Study 4: Enhancing Policy Innovation to tackle Rural Depopulation and foster Public Value Creation through Dynamic Performance Governance

This final case study is based on a co-authored article with Dr. N. Grippi and in publication in an international peer-reviewed journal. The study investigates the "Houses for 1€" policy adopted by the municipality of Sambuca di Sicilia (Italy), exploring how DPG can support innovative policy design to counteract rural depopulation and enhance public value creation. The content presented in this section has been analytically aligned with the structure of this dissertation, while maintaining the core methodological insights and empirical focus of the original research.

Rural depopulation is a growing phenomenon that has multiple domino effects on both rural areas and cities. The loss of human capital reduces the economic dynamism of these contexts, undermining, among other things, public service provisions, external investments, and local area attractiveness (Almeida, 2018). Such "wicked problems" (Rittel & Webber, 1973) can generate perverse, escalating effects, which accelerate an exponential decay in the socioeconomic, cultural, and ecological subsystems. The wickedness of such problems profiles an increase in the blurriness of dynamic and complex systems, which implies multilevel governance challenges and the unpredictability of performance levels (Bianchi, 2022).

We argue that to address rural depopulation, new modes of planning and policy innovation (Ansell & Torfing, 2014) are required to enhance public value, which, according to Crosby et al. (2017), is created when public policies address the problems of modern society. In this perspective, public sector organizations (PSOs) should balance the diversified interests of the different stakeholders involved in the area, seek democratic legitimacy, and reconcile value controversy (Cui & Osborne, 2018) by being catalysts, implementers, and orchestrators of innovations (Crosby, Hart, and Torfing, 2017). This requires proper performance management methods (Talbot, 2005; Fryer et al., 2009; Cepiku, 2017; Rajala et al., 2020; Bianchi, 2022;) that can frame the existing trade-offs in time and space originating from different stakeholders' goals and expectations, interconnected subsystems, and policymakers' short-term oriented mental models.

However, traditional performance management techniques might be inadequate in addressing complex local area problems as they adopt a calculative, static, and linear analysis (Vignieri, 2023; Vignieri & Grippi, 2024) that fails to capture the inherent dynamic complexity characterizing socio-economic, cultural, and ecological subsystems.

To overcome such problems, authors suggest bridging performance management with the SD methodology (Forrester, 1961; Sterman, 2000), as it frames the dynamic complexity underlying the above-mentioned subsystems by identifying the cause-and-effect relationships that shape a phenomenon (e.g., rural depopulation). The application of systems methods to outcome-based performance management increases the quality of performance reporting, accountability, governance, and policy development (Bianchi et al., 2019). This domain is characterized by Dynamic Performance Management (DPM) (Bianchi, 2016) and DPG (Bianchi, 2021, 2022, 2023). Such an approach enables the framing of the structural relationships between strategic resources, performance drivers, outputs, and outcomes (Bianchi & Rivenbark, 2014; Bianchi & Tomaselli, 2015; Cosenz & Noto, 2015; Noto, 2020; Vignieri, 2019; Vignieri & Grippi, 2024).

Building on this premise, this paper aims to contribute to both theory and practice by investigating how DPG can enhance policy innovation to tackle rural depopulation and foster public value creation, highlighting the causal relationships that shape the investigated phenomenon.

To this end, the case of an inner area located in Southern Italy, Sambuca di Sicilia, will be illustrated through DPG.

#### 4.1.4.1 Fostering policy innovation to tackle rural depopulation and create public value

Rural depopulation is a persistent phenomenon that affects various regions worldwide (Hospers & Reverda, 2014). The great industrialization process has contributed to the progressive improvement of urban areas' living standards, but has had minimal effects on agriculturally dominant regions (Rizzo, 2016). This has encouraged rural residents to move to urban areas in search of a better quality of life (Farazmand, 2023). Rural depopulation is both the result and the cause of various sectoral challenges, such as

declining job opportunities, lacking mobility infrastructures, poor public services (Baldwin & Dixon, 2008), urban decay, and demographic changes such as fertility, mortality, and migration (Johnson & Lichter, 2019; Almeida, 2018). Instead of focusing on sectoral short-term challenges, addressing wicked problems requires a holistic approach that combines a short-term perspective with a long-term one, identifying the cause-and-effect relationships shaping such phenomena. In this view, by adopting effective policies, PSOs have the potential to profoundly shape society's evolution path through policy innovation (Mintrom, 1997; Vaz-Canosa, 2021; Williamson, 2015).

This concept was defined "as a policy that is new to the state adopting it" (Mintrom, 1997, p. 741). However, this definition focuses solely on the resulting product (i.e., the policy itself), disregarding the overall process (Mintrom, 1997; Vaz-Canosa, 2021). There are different interpretations of what policy innovation is in the literature. For example, "policy innovation is about identifying the needs of constituents and shortening the time required to develop, test, implement, and diffuse a policy" (EY, 2017: 8). Here, the emphasis is on the importance of the time orientation under which the policy is provided to the public (Vaz-Canosa, 2021).

In this paper, policy innovation is regarded, from the one side, as the "novel processes, tools, and practices used for policy design and development that result in better problem solving of complex issues" (Brookfield Institute, 2018: 6). On the other side, it is related to the formulation and implementation of innovative policy solutions that respond to the changing citizens' needs and expectations while producing positive outcomes for the society as a whole (Head, 2022).

These definitions expand the scope of the policy agenda by highlighting the need to extend the traditional boundaries of the government framework. This requires an "out-of-the-box" thinking (Crosby, Hart, and Torfing, 2017: 656) through which public managers may overcome bureaucratic barriers and initiate valuable solutions by collaborating across sectoral and institutional boundaries to create new forms of value for the public (Crosby, Hart, and Torfing, 2017). From this perspective, policy innovation serves as a means to create public value.

The public value concept, widely used by practitioners and scholars, has been defined as what is valued by the public and suitable for the public (including the public sphere) (Moore, 1997; Cui & Osborne, 2018; Osborne, 2021; Bryson, Crosby, & Bloomberg, 2014). This type of value ought to be enjoyed collectively by the citizens as a whole and, therefore, meet their general aspirations (Bryson, Crosby, and Bloomberg, 2014; Moore, 2014). PSOs give actual expression to society's values by not simply delivering services (outputs), but also by producing an impact through their provision (outcomes) (Osborne, Nasi, and Powell, 2021). However, due to society's increasing complexity and its diverging interests, public values are often conflicting. This implies that policymakers, when designing and implementing innovative policies, should actively reconcile this value controversy by balancing diverse interests to seek democratic legitimacy (Cui & Osborne, 2018; Osborne, Nasi, & Powell, 2021). In this view, pursuing public value is a core paradigm for PSOs, driving public action and establishing the foundation for government legitimacy at all governance levels (Bryson, Crosby, & Bloomberg, 2014; Cordella & Bonina, 2012; Neumann et al., 2019).

Legitimacy is strongly related to trust since it plays a crucial role in shaping the relationship between the government and its citizens (Arif & Dutta, 2024; Moreno-Luzon et al., 2018). Indeed, even though by providing public services, outcome targets are met, a lack of trust will undermine public value creation. Hence, to be trustworthy, PSOs should design and implement effective policies and deliver services to the public (Kelly, Mulgan, and Muers, 2002). The practical and efficient use of public assets for public service provision adds value to society (Alford & O'Flynn, 2009). By focusing on these strategic assets, it is possible to develop policies that respond to society's needs, preferences, and expectations. Also, to design and implement effective policies, a strategic action could involve all the stakeholders in this process (PSOs, businesses, and civil society) as they can contribute to coming up with a holistic understanding of wicked problems (Crosby et al., 2016), and therefore, enhance trust and legitimacy. This collaboration may lead to the creation of public value since "value is created by identifying and exploiting new ways of approaching or representing problems, of combining skills and resources in crafting new solutions, assessing and sharing risks, coordinating actions, or building joint ownership" (Ansell & Torfing, 2014).

Therefore, it emerges that it is possible to design innovative policies considering all the peculiarities and structures of a context. Nevertheless, these interactions are neither straightforward nor spontaneous (Klijn & Koppenjan, 2000; Peters, 2015). Even well-designed collaborative initiatives may fail due to the lack of a shared standard view (Bianchi et al., 2019). This is frequently related to the diversity of involved stakeholders and the inadequacy of models or methods to manage conflicts, to foster a strategic learning process, and to build consensus and trust (Bianchi et al., 2019; Bianchi, 2021; Bianchi, Nasi, and Rivenbark, 2021; Bianchi, 2022). Hence, distinct steering and management techniques are needed to identify and evaluate outcomes (Klijn, 2008).

Traditional approaches to outcome-based performance management rooted in an inside-out perspective may be ineffective for tackling such issues since they focus on a single organization rather than on all involved stakeholders (McLaughlin, Osborne, and Ferlie, 2002; Bianchi et al., 2019; Bianchi, 2021; Bianchi, 2022). This inherent complexity implies adopting innovative performance governance methods (Bouckaert & Halligan, 2007) and continuous interactions between different organizations to foster consistency for stakeholder behaviors and increase the capability to control the strategic resources that affect intended outcomes (Bianchi, 2021; Bianchi, 2022). According to Bianchi et al. (2019), it would be appropriate to adopt also an "outside-in" approach since focusing on an entire area (e.g., a community, a neighbourhood, or a city), fosters legitimacy and consensus-building throughout the contest policy cycle (Vignieri, 2022).

DPM and DPG could provide a critical contribution to public value creation by providing methodological guidance to foster policy innovation so as to tackle wicked problems (e.g., rural depopulation).

#### 4.1.4.2 Dynamic Performance Management & Governance: frameworks to support policy design and implementation

Both DPM (Bianchi, 2016) and DPG (Bianchi, 2021; 2022; 2023) challenge the classical performance analysis based on a static, financial, and sectoral-oriented view and propose a dynamic and intersectoral approach (Vignieri, 2022). These frameworks better capture a trade-off analysis of policies in both time (short vs. long term) and space (system vs. another subsystem) (Bianchi, 2016; 2021; 2022; Vignieri, 2022). Such frameworks can

capture the dynamics of these types of trade-offs. They may contribute to reducing performance delays, policy resistance (Ghaffarzadegan et al., 2011), and counterintuitive behavior in the system (Bianchi & Rivenbark, 2014). Indeed, these approaches, by extending the time horizon, can assess short-, medium-, and long-term results (outputs and outcomes), while considering the critical success factors that impact those results. Such factors, labelled "performance drivers", are represented as ratios between the current and potential or expected levels of strategic resources. These drivers are fundamental for decision-makers because they detect weak effects on outputs and outcomes, thus contributing to promptly counteracting possible adverse effects. Due to their crucial role, such factors should be continuously monitored and updated to increase the possibility of reaching expected goals (Bianchi, 2016; Bianchi, 2022). Lastly, the end results will flow back into strategic resources to restart the performance cycle (Bianchi et al., 2017). Such tangible and intangible resources (e.g., human capital, knowledge, trust, skills, place attractiveness, and quality of life) are utilized by decision-makers to affect both, directly and indirectly, end results. In the DPM chart, they are portrayed as stocks controlled by both their inflows and outflows, respectively influencing resource acquisition and depletion, namely the end results portrayed in the lower part of the DPM chart in Figure 12 (Bianchi, 2016).

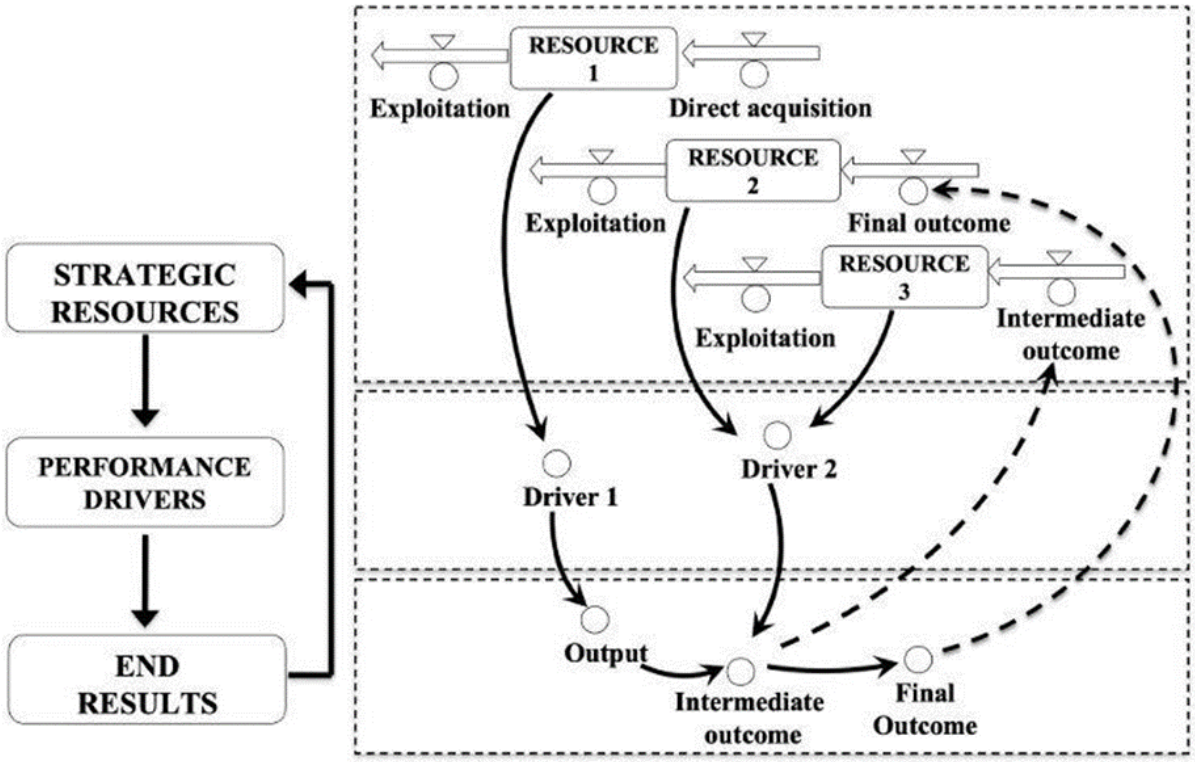


*Figure 12. The basic structure of a Dynamic Performance Management chart. Source: Bianchi (2022: 420) adapted from Bianchi (2016: 73).*

DPM adopts a systems approach by modeling the causal relationships between variables and their impact on results over time. It borrows both the principle of feedback analysis and the stock-and-flow concepts typical of SD (Sterman, 2000). Merging both system thinking and performance management allows for moving from a static and sectoral point of view to dynamic and outcome-based performance management (Bianchi, 2016; Bianchi, 2022). Such an approach is particularly suitable in dealing with complex social problems because of their inherent complexity, pluralism, uncertainty, and interconnectedness. Indeed, as stated by Sterman (2000), SD provides a set of conceptual tools that enable both researchers and practitioners to understand the intrinsic dynamics of complex systems. In detail, complex systems are difficult to investigate because they produce several counterintuitive behaviors, preventing decision-makers from designing and implementing corrective measures to minimize disruptive behaviors (Forrester, 1961; Bianchi & Noto, 2015). Hence, it is necessary to adopt an outside-in perspective of policy design and implementation in a local area context (Bianchi, 2021; Vignieri, 2022). Indeed,

an outside-in perspective allows for considering the inter-institutional and multi-agency setting, thus shifting the focus of attention to local area performance governance instead of a single organization (Luke Boyle et al., 2018). By focusing the attention on the governance level, we enter the domain of DPG as it allows stakeholders and PSOs to design and adopt policies that have an impact both on society and agency levels while dealing with wicked problems (Bianchi, 2022).

Figure 13 shows how DPM can be merged with DPG to enhance policy design and implementation through an outside-in perspective on performance (Bianchi, 2021).

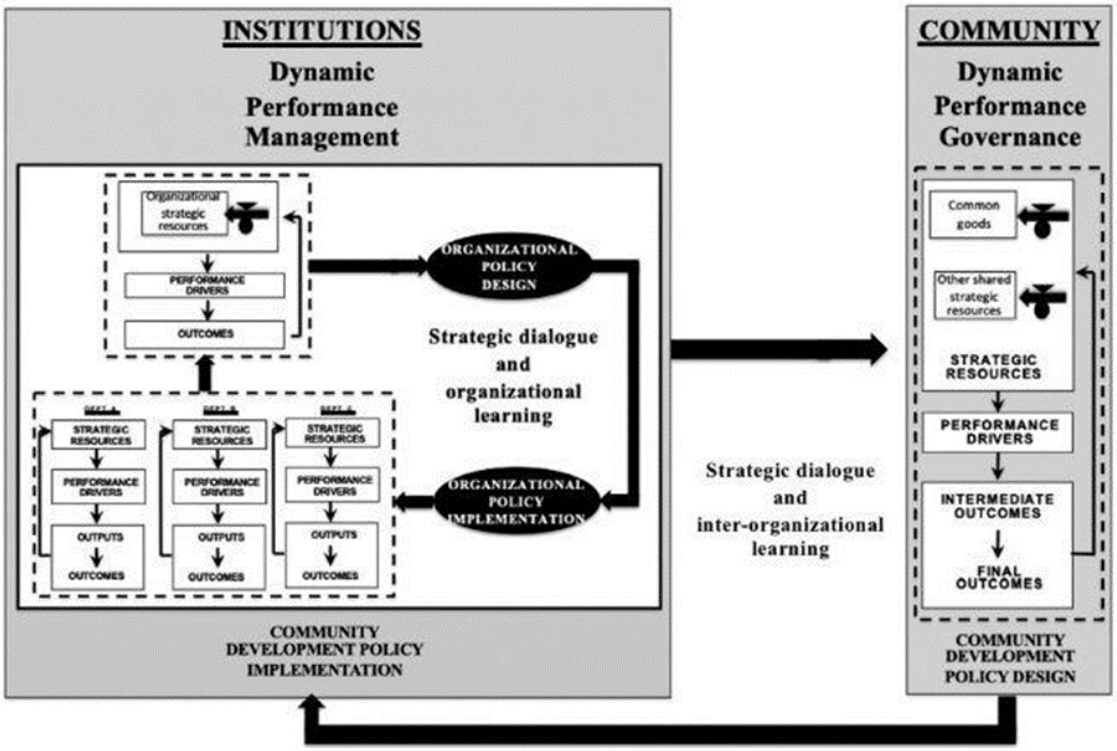


*Figure 13. DPM and DPG frameworks merged from an outside-in perspective—source: Bianchi (2021: 342).*

In such a setting, specific organizations are entrusted with fulfilling diverse activities that contribute to the achievement of shared goals, thus benefiting the overall local area. Understanding the relationship between management and governance is crucial during the policy cycle process. In the first planning and design phase, governance becomes dominant. As particular organizations execute specific policies, management from the perspective of a local region becomes crucial during the policy implementation process.

This means that the DPG supports the stakeholder policy network while the DPM supports the execution of the policies (Bianchi, 2021; Omong, 2021).

Through DPG, it is possible to foster collective awareness on the cause-and-effect relationships underlying the patterns of behaviour shaping a place, and, therefore, support stakeholders in developing a shared view of the wicked problems so as to boost public value creation. The DPG approach will be used to capture the existing interconnections and complexity characterizing the case of Sambuca di Sicilia.

#### 4.1.4.3 Dealing with rural depopulation: practical insights from Sambuca di Sicilia

Sambuca di Sicilia is a small town of 5,255 inhabitants (ISTAT, 2024) in the Belice Valley, southwestern Sicily (Italy). The foundation of the city is attributed to the Arabs in 827 A.D., when Emir Al-Zabut established the Saracen Castle. Subsequently, the village, situated overlooking the Sicani Mountains, experienced Norman, Swabian, Aragonese, and Jewish dominations (Ferreri, 2018). The division of the town into four districts and twelve neighbourhoods dates back to this period. Today, Sambuca still maintains its main Islamic character in the Arab neighbourhood and throughout the rest of the Mazzallakkar fortress on the shores of Lake Arancio (Ferreri, 2018).

Throughout the Republican period, which began in 1946, Sambuca faced four significant historical phases from socio-economic and cultural perspectives (Ferreri, 2021b).

The first phase started in 1968, when the Belice Valley experienced a seismic event of significant magnitude, which caused hundreds of deaths, the destruction of five municipalities, and the involvement of 16 others. This event, known as Belice's earthquake (Aprile, 2009), resulted in the abandonment and neglect of the urban areas and the destruction of Sambuca's historic city centre. Following this, processes of territorial transformation employing different construction methods shaped the urban physiognomy of the affected municipalities (Pellicano, 2020).

From 1968 to the 1990s (second phase), the economy was based on post-earthquake policies (regulation 18 March 1968, n. 241), which provided two different options for the evacuees: they could rebuild the house in situ, fully financed by the state; or, if sanitary or structural conditions were lacking, people could transfer their residence to a different

area. Due to the massive relocation, the newly created neighbourhood took the name of “trasferimento” (relocation). Despite the short- and medium-term positive economic outcomes and sectoral employment spillovers generated from the neighbourhoods’ reconstruction, specific labour policies and visionary projects able to reach long-term outcomes were still lacking (Ferreri, 2021b).

From the 1990s to 2015 (third phase), the initial economic dynamism petered out, and no permanent evolutionary process was triggered in the local financial system. At that time, the town’s economy was predominantly based on agriculture, with local farmers facing various challenges such as competition, globalization, imports, and reduced government subsidies, leading to a significant decrease in profitability (Ferreri, 2018). This further exacerbated several wicked problems that were also affecting other municipalities in the Belice Valley. Such problems included outmigration, a declining birth rate, limited job opportunities, and poor infrastructure and services (Badami, 2019). This resulted in continuous economic struggles and endangered a valuable socio-economic, environmental, and cultural heritage.

The last phase started in 2015, when Sambuca's local development path changed direction, mainly due to its admission to the "Most Beautiful Villages of Italy" Association (*Associazione Borghi più Belli d’Italia*) and the subsequent victory, in 2016, of the competition sponsored by the same association (Giordano, 2020). Sambuca’s local administration promoted this changing path, which represented a strong vehicle, from a symbolic point of view, to generate public value and to boost the development of sustainable tourism initiatives by enhancing identity assets such as cultural heritage, local traditions, and natural landscapes (Ferreri, 2021a).

#### 4.1.4.4 The “Houses for 1 €” project and its implementation

As mentioned above, the decision to relocate the inhabitants to the “trasferimento” neighbourhood contributed to the abandonment of the existing historic centre and its real estate assets. For decades, such assets have remained in the municipality’s housing heritage, and conditions to enhance diverse paths have not been integrated.

In 2019, the local government, with a strong focus on reversing depopulation and promoting tourism, made a crucial choice regarding its housing assets. Instead of disposing of properties in a haphazard way, they opted for an alternative approach known as the "Houses for 1€" project (Case a 1€). This strategy is today placed within the framework of the central strategic policies adopted in Italy to counteract depopulation, aging population, regressing local economies, and degradation of real estate assets (Barca et al., 2014).

The “Houses for 1€” project does not originate from Sambuca’s local administration. Indeed, in 1973, the Dollar House Program was launched in different American cities such as Wilmington, Baltimore, and Philadelphia (Delon et al., 2023) to counteract the post-industrial decline of North American inner cities. Also, in 2008, this initiative was implemented in Italy by another small Sicilian city, Salemi, in the province of Trapani, generating considerable media attention (Delon et al., 2023). However, bureaucratic mechanisms obstructed the effectiveness of the initiative.

In the case of Sambuca di Sicilia, the “Houses for 1€” project gained international media prominence thanks to important multinational news channels and journals such as CNN, The New York Times, and The Guardian. The local administration, which has already proposed three editions of the call, has sold the houses, owned by the Municipality, through a public auction with a base price of EUR 1 (Lino et al., 2022).

Having completed the recognition of each structure, in the first edition, 16 properties were put up for auction. A deposit of EUR 5000 has been requested to ensure their renovation and a commitment to fulfil the obligations within three years. The properties, all located in the blighted historic city centre, were attributed to the highest bidder. A total of 49 offers were received, and all the properties were sold, allowing the municipality to earn EUR 95.708 (Ferreri, 2021b; Lino et al., 2022).

The “Houses for 1€” project generated positive spillover effects also on the private real estate market, which potentially acted as a catalyst to attract tourist arrivals and foreign capital, creating job opportunities and finally reversing the negative demographic trend (Ferreri, 2021b).

The upcoming analysis will adopt a feedback-based perspective to examine the policies implemented in Sambuca di Sicilia aimed at counteracting rural depopulation by enhancing the area's attractiveness, quality of life, and economic vitality. Specifically, a DPG chart will be employed to illustrate the potential benefits of adopting a causal logic in the formulation and implementation of such policies. This perspective aims to highlight how a systemic understanding of strategic resources, performance drivers, and community outcomes can support more effective and innovative approaches to local development. Ultimately, this method contributes to fostering public value creation through the efficient and integrated use of both tangible and intangible assets.

## 4.2 Results

### 4.2.1 Results from case Study 1: Circular Design for Bio-Based Innovation towards Climate-Neutral Cities (CiD)

Following the general discussion of the findings in Section 4.1, this section presents the first case study. The *Circular Design for Bio-Based Innovation towards Climate-Neutral Cities* (CiD) project is funded under the *Erasmus+ 2021–2027* programme. Specifically, it was selected through the 2022 call for Partnerships for Innovation (Alliances), with a focus on education-enterprise alliances. This call, officially titled *"ERASMUS-EDU-2022-PI-ALL-INNO – Alliances for Education and Enterprises,"* supports transnational projects that foster innovation in higher education, vocational training, and industry collaboration. The CiD project thus operates as an Erasmus+ Innovation Alliance, aligning with European Commission priorities such as the European Green Deal and a Europe fit for the digital age (as evidenced by its emphasis on green and digital skills in the proposal). Co-funding is provided through the European Education and Culture Executive Agency (EACEA) under EU grant agreement No. 101111686.

The CiD project is a 36-month transnational partnership (2023–2026) that aims to support cities and regions in advancing circular and climate-neutral urban innovation, operating at the intersection of education in environmental sustainability, urban design, circular economy, and EU innovation policy.

Structured around a Quadruple Helix approach, the CiD consortium brings together eleven core partners from eight European countries (plus an associated partner), representing higher education and research institutions, civil society, business, and public authorities. The coordinating institution is Leibniz University Hannover (LUH) in Germany, which represent the Academic and research field together with other European partners like the University of Genoa (Italy), the Institute for Advanced Architecture of Catalonia (IAAC, Spain), the National Research Council of Italy (CNR), and ARCES Association (Italy), a higher education merit college and VET center.

Industry and innovation actors are also strongly represented. These include Materiom (United Kingdom), a platform dedicated to biomaterial research and open-source experimentation; Tallinn Business Incubators (Estonia), which supports entrepreneurial development and start-ups; Architektūros Fondas (Lithuania), active in architecture

education and cultural engagement; and the Architects' Council of Europe (ACE), based in Belgium, which ensures liaison with the profession and the broader building sector.

The civil society dimension is led by ALDA – European Association for Local Democracy (France), which contributes to the consortium with strong territorial outreach and governance know-how, and Fundació Ersília (Spain), specialized in evaluation and sustainability consultancy. Additionally, the Ellen MacArthur Foundation (UK) participates as an associated partner, bringing international expertise on circular economy models and policy.

While public authorities are not formal beneficiaries in the CiD consortium, they play a central role in the implementation phase, particularly through the Local Observatories and Urban Living Labs. City departments, planning agencies, and municipal actors from Hannover, Barcelona, and Genova are directly engaged in co-creation processes, ensuring that the project is embedded within real governance contexts and urban policy frameworks.

Each partner contributes complementary knowledge, enabling CiD to function as a transdisciplinary and multi-actor innovation alliance. This diversity ensures both high-level technical expertise and contextual sensitivity to local social and economic needs, where academic and research partners lead content development. In contrast, non-academic stakeholders ensure the project remains grounded in professional standards, market needs, and community contexts.

The project's strategic goal is to embed circular design principles into education and urban transformation processes. To achieve this, CiD develops and pilots three educational programs: a university curriculum for circular and bio-based urbanism, a business accelerator supporting entrepreneurial ventures, and a continuous education program for professionals and policymakers. These programs are designed collaboratively and implemented across multiple institutions in six European countries, combining academic depth with practical relevance.

From a collaborative perspective, a distinctive feature of CiD's architecture is the creation of six Circular Design Observatories, which operate as both internal coordination mechanisms and external engagement platforms. Three of them are geographically

anchored in the pilot regions of Hannover (Germany), Barcelona (Spain), and Genova (Italy). In parallel, three thematic Observatories operate at the European level, each led by a partner with relevant expertise: the Circular Economy Observatory (led by ARCES), the Bio-Based Innovation Observatory (led by CNR and Ersilia), and the Urban Transformation Observatory (led by ALDA). These thematic hubs bring together experts from across the continent to focus on resource efficiency, bio-material innovation, and sustainable planning. Together, the Observatories form a backbone of the project, providing ongoing intelligence, validating educational content, and linking CiD with external networks and policy agendas.

CiD self-describes as establishing an *"Innovation Ecosystem"*, which is embodied by the interplay of its partners and observatories. In practical terms, this means the consortium extends beyond the core 11 partners to include a wider circle of affiliated stakeholders. Indeed, by project design, up to 100 external stakeholders (companies, city departments, NGOs, etc.) are engaged through the Observatories as part of this ecosystem, co-creating, sharing knowledge, and validating outputs. Observatories act as internal bridges that connect these domains, enabling a feedback loop where practice informs theory and vice versa.

By aligning educational reform with urban innovation and circular economy strategies, the project contributes to the discussion on how transnational cooperation can generate localized and place-based solutions aligned with the SDGs.

#### 4.2.1.1 Operationalizing SDG Localization through the CiD Project

As outlined in the theoretical framework, the localization of the 2030 Agenda necessitates mechanisms that can bridge global goals and local realities, activating adaptive, collaborative, and multi-actor responses grounded in territorial dynamics (Perry et al., 2021). In this context, European-funded projects can be understood as strategic infrastructures for translating global ambitions into context-specific actions. The CiD project, as described in the previous section, exhibits many of the enabling features identified in the literature on SDG localization.

First, its consortium reflects a Quadruple Helix configuration, where universities, research centers, industry actors, civil society organizations, and local governments are

engaged not only in the project management phase, but particularly in the Observatories and Urban Living Labs. This diversity is not only functional for mobilizing interdisciplinary knowledge but is also key to ensuring that project activities remain relevant to specific territorial needs and governance contexts (Veeckman & Temmerman, 2021).

Second, CiD's architecture demonstrates the potential for interaction between local ecosystems and communities of interest by connecting transnational Observatories with place-based innovation structures in pilot cities. The pilot structures test and modify practices and knowledge locally, while the Observatories disseminate them throughout various contexts. Thus, the project provides a valuable context for observing how thematic collaboration can develop into innovation that is embedded in the territory.

Third, the project emphasizes collaboration not merely as a procedural requirement but as a core transformative mechanism. Through the Observatories, co-design workshops, public events, and continuous stakeholder engagement, CiD creates spaces for joint knowledge production and decision-making. Collaboration in this sense is not only horizontal but also vertical, linking project-level dynamics to institutional and community-level change (Berkes & Seixas, 2008). This aligns closely with the theoretical model introduced in Section 4.1.1.3, particularly the idea of a motivational trajectory from opportunistic engagement toward transformative territorial embeddedness.

However, to comprehend the practical unfolding of such dynamics (and the extent to which collaboration facilitates SDG localization), it is essential to examine not only project documentation but also the lived experiences of the individuals engaged in its execution.

For this reason, a qualitative analysis was conducted based on semi-structured interviews with key representatives from the CiD consortium. The aim was to explore their initial motivations, collaborative experiences, and perceptions of how the project engages with local ecosystems. These interviews allow us to view the project from the inside, shedding light on the evolving relationships, tensions, and enabling conditions that shape the localization of global goals in specific European contexts.

The following section presents the findings of this analysis, highlighting the key themes that emerged and situating them in relation to the theoretical concepts previously introduced.

#### 4.2.1.2 Results analysis: Motivations and Forms of Engagement

**Motivations and Participation**

Motivations across the interviewees appear to be different but ultimately similar: participants recognize instrumental drivers, such as international recognition and European funding, but they always present them as means to work toward transformative change. This entails updating curricula, creating interdisciplinary learning environments, and strengthening cross-sector and cross-border research partnerships. One participant described the project as “influencing our way of working far beyond producing additional publications,” noting shifts in staff routines and student experiences.

Numerous interviewees describe a well-balanced combination: funding and visibility enabled methodological experimentation, capacity building, and the initiation of collaborative programs, all of which aligned with the study's Motivational Trajectory between the strategic/transformative and instrumental stages, with little indication of opportunism. The inclusion of a vocational education partner further broadens the perspective. In this case, the focus is on developing technical and entrepreneurial skills, aligning training with the green transition, and participating in European discussions on sustainable urban transformation. This agenda reframes project resources as levers for long-term human capital development, rather than focusing on short-term outputs.

Other interviewees offer an additional justification: a partner in charge of the challenge-definition framework makes the case for a radical shift in the way circular design is taught and learned by connecting participation to the construction industry's disproportionate environmental impact. According to their account, funding and visibility are leveraged to drive long-lasting educational reform through the use of co-creation techniques and iterative, transdisciplinary monitoring. When considered collectively, the corpus suggests that European project management fosters institutional change by linking instrumental incentives with transformative practices within the ecosystems of training, research, and education.

### Collaboration and Networks

Respondents consistently portray collaboration as open, constructive, and trust-based. Concrete expressions include co-authored outputs, co-designed curricula, cross-teaching experiments (e.g., flipped and challenge-based formats), and continuing learning modules developed in collaboration with different stakeholders. Such exchanges reflect an emergent community of interest organized around circular design, bio-based innovation, and urban transformation, topics that bind actors regardless of geographic position.

Participants emphasize the importance of peer-to-peer learning that transcends institutional and disciplinary boundaries. Exposure to innovative tools and perspectives "broadened our perspectives and opened new mindsets," as one respondent put it, enabling reframing in research, teaching, and stakeholder engagement. The alliance's Observatories provide the scaffolding for this work, acting as boundary infrastructures that both coordinate content internally and convene non-academic actors externally, creating a feedback loop between professional practice and pedagogy.

Assessments of partnership quality are uniformly high, but views on sustainability diverge. Some respondents warn that continuation will hinge on resources and a motivated core once the grant ends; others voice confidence that trust, shared values, and joint outputs already in place can sustain collaboration beyond the project cycle. Finally, other interviewees reinforce the optimistic side of that ledger, citing enduring relationships rooted in a clearer understanding of partners' complementary capabilities and a pipeline of potential joint initiatives.

### Territorial Anchoring

On territorial value, the picture is positive. Respondents point to Local Observatories in Hannover, Barcelona, and Genoa, as well as training initiatives in Palermo, as channels that connect universities, businesses, NGOs, and public administrations in situated co-creation. Where prior networks or mandates exist in vocational and community-oriented education, interviewees describe a quicker translation from thematic collaboration to local coalitions around circular practices.

At the same time, several participants underline the structural limits of project temporality. A three-year window, they argue, rarely suffices to trigger stable institutional

change at the territorial scale; continuity rests less on formal architecture and more on intermediaries willing to carry the coalition between funding cycles, sometimes through lightweight structures such as associations or shared spaces outside university timelines. “Three years are not enough to ensure lasting local value,” one respondent noted.

Other interviewees add site-specific texture: curricular updates in a local educational institution are already visible, yet civil society participation remains limited, and policymakers are described as under-involved, in part because they are not accustomed to engaging with educational projects. This helps explain why anchoring is uneven across sites despite similar thematic commitments. Analytically, CiD sits at the intersection of trans-local community and place-based ecosystem, where embedding is contingent upon governance quality, stakeholder diversity, and the capacity of local actors to institutionalize emergent collaborations.

**Perceived Impacts and Future Outlooks**

Interviewees expect several legacies to outlast the project, including reusable curricula and teaching methodologies, open-access materials and digital tools that facilitate replication, and denser inter-organizational ties that can underpin future collaboration. Many also highlight the importance of relational assets built through the Observatories as a platform for continued convening.

To strengthen durability, respondents propose institutionalizing collaboration in forms that survive the grant: dedicated associations or physical spaces; deeper engagement of civil society to broaden inclusiveness and local ownership; and, from the most recent interview, the strategic use of visible demonstrators, pilot projects that show “what good looks like” and function as proof-of-concept for communities and prospective learners. They also flag risks (funding gaps; fluctuating student interest) and suggest diversifying revenue and building stronger institutional partnerships to mitigate them, including links to start-ups, professional networks, and community engagement channels.

In conclusion, respondents do not construe CiD as a short-term exercise in resource mobilization. They describe a catalyst that couples educational innovation with territorial engagement, advancing SDG 11 through locally relevant competencies and SDG 17 through multi-actor partnership, while recognizing that complete ecosystem

consolidation will depend on sustained governance, stakeholder mobilization, and institutionalization beyond the project cycle.

### 4.2.2 Results from case study 2: Knowledge Graphs Embeddings for Link Prediction in the Context of Sustainability

This sub-section reports the empirical results of the case study 2 , which investigates the use of KGs and link prediction techniques to support multi-stakeholder collaboration in the context of SDG. The goal of this experiment was to develop a collaborative data platform that reveals hidden connections among stakeholders, policy topics, and strategic objectives, thereby providing decision-makers and SD experts with a tool to navigate complex policy ecosystems and identify promising partnerships.

The analysis was conducted by extracting structured information from Horizon Europe funding documents and modeling it through a graph database that reflects the interconnections between actors, goals, and project themes. Link prediction was then applied to this graph to assess its capacity to infer future or missing relationships, with particular focus on two types of connections: collaboration ([CO WORK]) and thematic alignment ([WORK ON]).

The subsections that follow present the main results of this application. First, a brief overview of the experimental dataset and graph projections used in the model is provided. Next, the performance of the link prediction algorithm across different scenarios is analyzed, supported by quantitative metrics such as AUCPR and training time. Finally, the practical implications of these findings are discussed, emphasizing how this data-driven approach may enhance SDG localization and stakeholder coordination in future territorial strategies.

#### 4.2.2.1 General Use.

In this research, a KG data integration framework is proposed by experts in the field of SD. The goal of the framework is to enhance the productivity of domain experts by enabling more accurate identification of potential collaborations among stakeholders. More specifically, the framework is designed to improve the prediction of intrinsic connections, both among stakeholders and between stakeholders and thematic work tables.

The KG is implemented using a Neo4j graph database, which provides a transparent and unified view of data originating from heterogeneous sources, offering numerous

advantages in terms of flexibility and performance. Figure 14 illustrates the general structure of the proposed framework. Each component is described in detail in the following subsection.

A KG represents deep information of interconnected data enriched with metadata that can facilitate useful analyses for complex decision-making processes. In Neo4j, entities are typed and may include attributes (metadata), while relationships between entities are expressed as arcs, which can be weighted.

The first stage of the proposed framework involves the integration of data from the *Horizon Europe Program Guide 2021–2027"* (Apre, 2021).

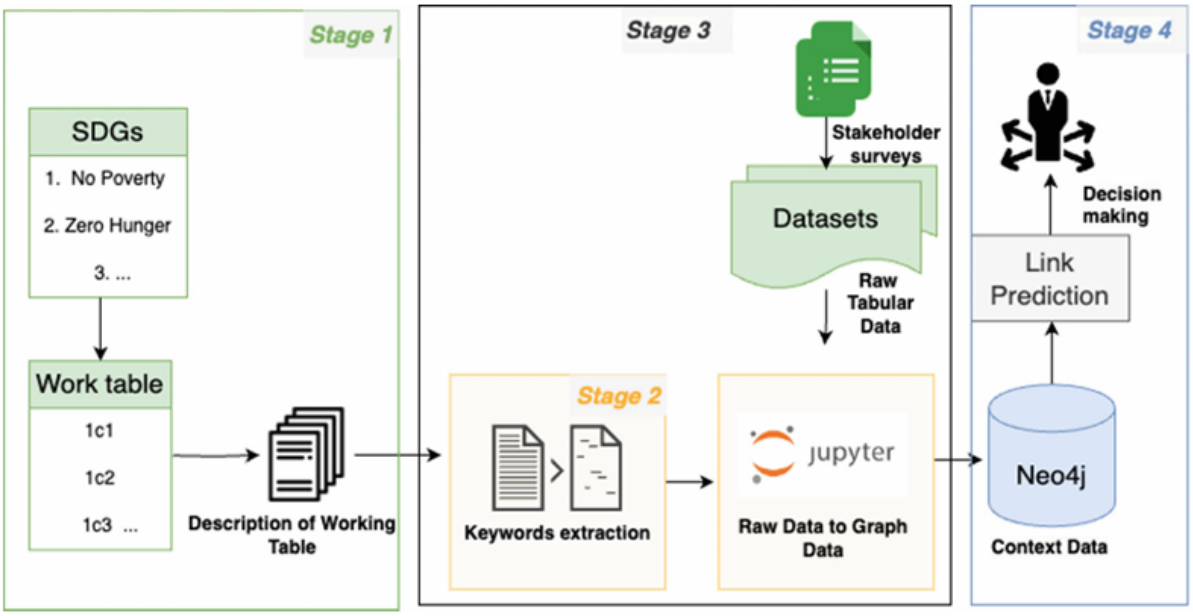


*Figure 14. Methodological pipeline of the semantic and graph-based platform for SDG localization, integrating policy text analysis, stakeholder profiling, and predictive modeling. Source: Galluzzo & Gennusa (2023).*

The *Horizon Europe Programme Guide* in particular divides the "Global Challenges and European industrial competitiveness" into six clusters: "Health", "Culture, Creativity and inclusive society", "Civil security for society, digital, industry and space", "Digital, Industry and Space", "Climate, energy and mobility", "Food, bioeconomy, natural resources, agriculture and the environment". The research activities of the Joint Research Centre further complement these six clusters.

Each cluster is composed of several “Destinations”, which correspond to the expected impacts outlined in the strategic plan. Each cluster is also aligned with a specific SDG, as illustrated in Table 4. For example, the activities of the Health cluster are directly linked to two UN SDGs: SDG 3 (*Good Health and Well-Being)* and SDG 13 *(Climate Action).*

The *Horizon Europe Program Guide 2021–2027* (Apre, 2021) was used as the basis for simulating the work tables for potential stakeholders to work on. In this framework, each “Destination” functions as a work table, characterized by a title and an accompanying mission description. For this study, all mission descriptions provided in the original document (Apre, 2021) were translated into English (see Table 2).

| Cluster | Destination Title | Description |
|---|---|---|
| HEALTH | Staying healthy in a rapidly changing society | It focuses on the main social challenges outlined at European level: diet and obesity, ageing and demographic change, mental health, digital empowerment in health literacy and personalized prevention. For 2022 it also requires design proposals to improve the availability and use of artificial intelligence (AI) tools to predict the risk of chronic disease occurrence and progression |

*Table 4. Example of one Destination with its description and Cluster.*

The “Descriptions of the working tables” in Figure 1 are represented in our framework by the descriptions of the Horizon EU Destinations.

Figure 15 provides a detailed view of the length of the textual descriptions associated with *Horizon Europe* Destinations, grouped by cluster. In general, on average, the length of the texts considered, from which the keywords are extracted (in the second stage), is equal to 329 characters (an average of 45 words on each text).

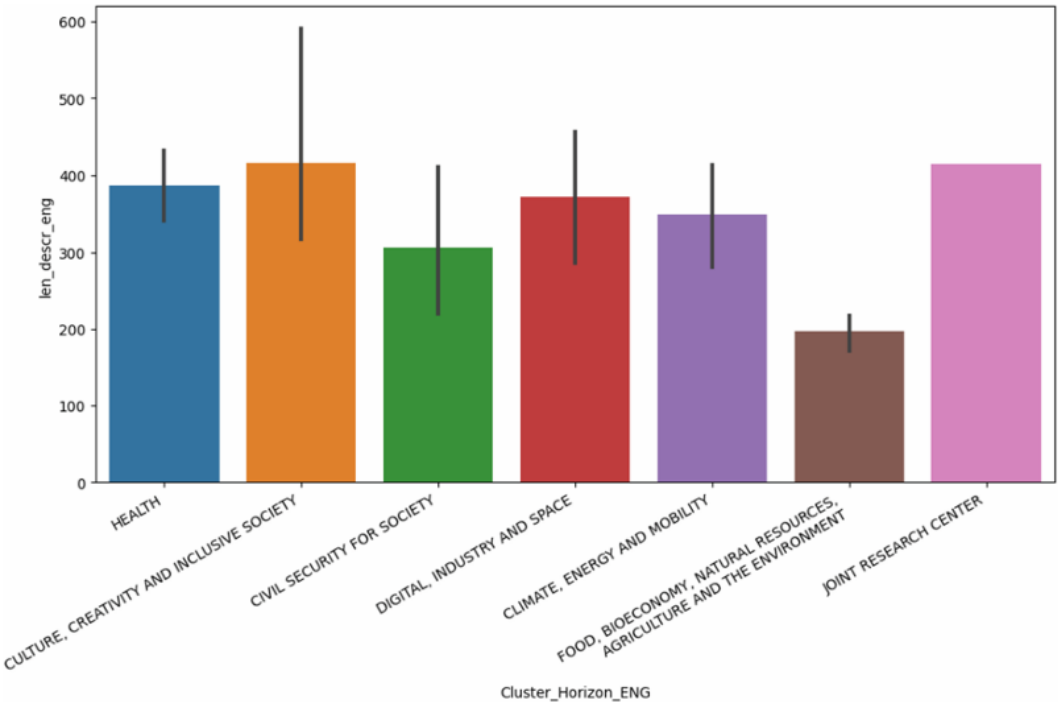


*Figure 15. Length of the texts present on Horizon EU Destinations for each Cluster. The minimum length of the considered texts is 147. The maximum length is 590. The average length of the texts is 329.*

The second stage of the proposed framework involves extracting keywords from the text. In this phase, the description of each work table (i.e., each Destination) undergoes to manual processing by a domain expert, who identifies relevant keywords, including both single and compound terms. Subsequently, the keywords are automatically processed via Jupyter Notebook for a data cleaning phase (e.g., removing duplicate words).

To assess semantic similarity among the selected keywords, the terms are subsequently converted into word embeddings. Specifically, FastText's pre-trained word vector model for English (Mikolov et al., 2017) is employed. This model includes one million word vectors trained on Wikipedia 2017 (16 billion tokens), utilizing subword information to more accurately capture morphological structure.

Cosine similarity is then calculated between the previously extracted words. If the value exceeds the similarity threshold set to 0.80, then the word is incorporated. The process is thus iterative and continues until there are no more similarities greater than or equal to the threshold. This step is important because it is necessary to incorporate similar words to improve the quality of the data that will constitute the KG. Moreover, incorrect

processing of raw data can significantly impact the generation of new knowledge, as well as contravene FAIR principles (Wilkinson, 2016).

| Cluster Horizon ENG | # Destinations | # keywords extracted |
|---|---|---|
| HEALTH | 6 | 33 |
| CULTURE, CREATIVITY AND INCLUSIVE SOCIETY | 3 | 21 |
| CIVIL SECURITY FOR SOCIETY | 6 | 30 |
| DIGITAL, INDUSTRY AND SPACE | 6 | 35 |
| CLIMATE, ENERGY AND MOBILITY | 6 | 30 |
| FOOD, BIOECONOMY, NATURAL RESOURCES,AGRICULTURE AND THE ENVIRONMENT | 7 | 35 |
| JOINT RESEARCH CENTER | 1 | 2 |

*Table 5. The total number of Destinations for each Cluster is represented in the "# Destinations" column. Instead, in the "# keywords extracted" column, the total number of extracted keywords, after processing all the texts from the Horizon EU Destinations (in Figure 2) for each Cluster, is represented.*

In the third stage of the framework, the data processed in the previous phase are merged with data from surveys compiled by stakeholders. Stakeholders in the survey select their interests and skills from a set of selectable possibilities. In addition, they list their generalities (e.g., the sector public/private/non-profit, the number of employees of the organization of which they are part). Stakeholder data is linked to keywords extracted from the description of the work tables. The graph is generated from raw and tabular data using the specific Jupyter Notebook and Py2Neo library, and then stored in the Neo4j database.

The final stage of the framework involves generating node embeddings from the Neo4j graph, based on a projection of a relevant subgraph. These embedded vectors enable the identification of potential new links, both among stakeholders and between stakeholders and work tables (Destinations). The outputs of this phase are intended to support decision-makers by providing insights into latent connections and collaborative opportunities within the ecosystem.

#### 4.2.2.3 Experiments

The framework is based on a labeled property graph (LPG) built on the Neo4j graph data platform. The LPG graph is used to represent complex, connected data structures. This type of graph is widely used in graph databases, such as Neo4j, as it provides a flexible and efficient way to represent complex data structures and relationships. They differ from RDF graphs because in the LPG graph, each node and each arc can have a set of properties and thus an internal structure. Furthermore, LPG is typically queried using Cypher, a

query language specifically designed to query complex graphs and perform operations (e.g., aggregation, sorting) efficiently on databases such as Neo4j. Specifically, for this research, a prototype of the framework was developed using Neo4j Sandbox (a free, cloud-based instance of Neo4j). We also used the Neo4j Graph Data Science (GDS) 1 library to analyse relationships between data and to improve the prediction of links between entities. The entire graph consists of 342 nodes (representing 5 entity types, as shown in Figure 16) and 6,598 links between them.

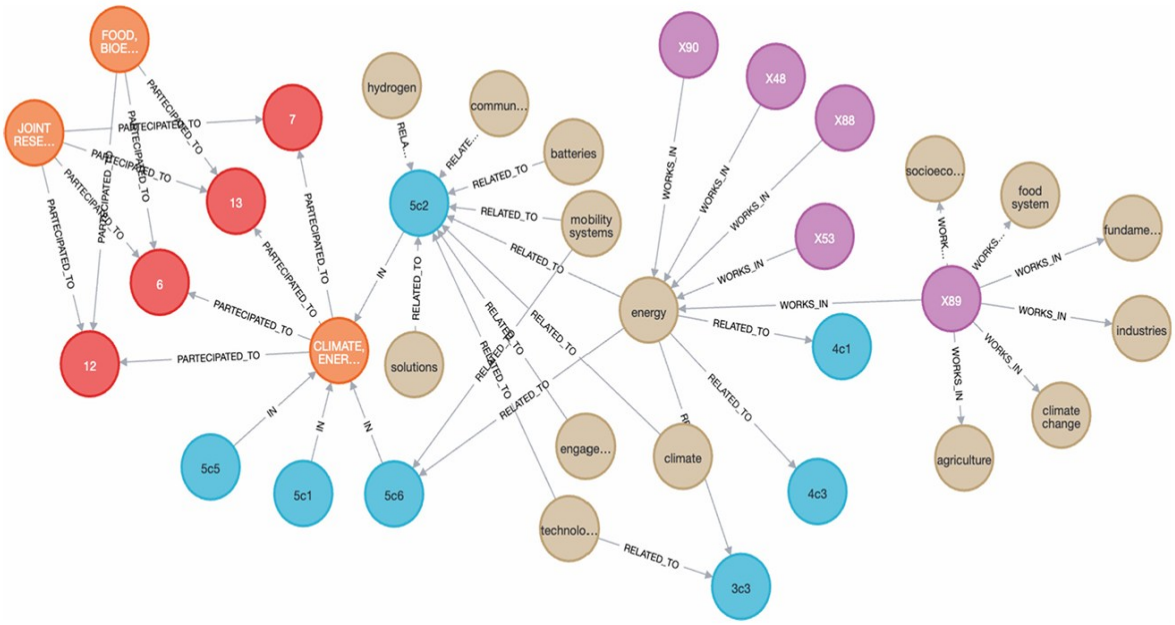


*Figure 16. Sub-sample of association between the 5 types of entity: SDG (red nodes), Clusters (orange nodes), Destination/Working Tables (blue nodes), Keywords (brown nodes) and Stakeholders (purple nodes). Source: Galluzzo & Gennusa (2023).*

In addition to the raw data from stakeholder surveys and destination-derived keywords, collaboration-weighted undirected links named [CO WORK] among stakeholders were added based on the counts of shared keywords. An indirect link [WORK ON] between Stakeholders and Destinations/Working tables was also added. In particular, the links [WORK ON] were created considering the keywords corresponding to each Stakeholder with the intersection of the keywords corresponding to each Destination (of each Cluster). This approach enables the construction of a direct connection between stakeholders and Destinations, thereby allowing this type of relationship to serve as a target arc for the subsequent link prediction task.

#### 4.2.2.4 Results Analysis

To assess the effectiveness of the proposed approach, the learning model was tested on two specific graph projections for the task of link prediction.

In the first experiment, the Link Prediction Pipeline was trained and evaluated on the whole graph. The Target relationship type to be predicted in this case is (Stakeholder-[WORK ON]- Destination). In the second experiment, the evaluation focused on a reduced projection of the graph, limited to Stakeholder nodes and the corresponding [CO_WORK] relationships (as illustrated in Figure 17). In this configuration, the target relationship type for prediction was [CO_WORK], aiming to identify potential collaborations among stakeholders based on shared interests and expertise.

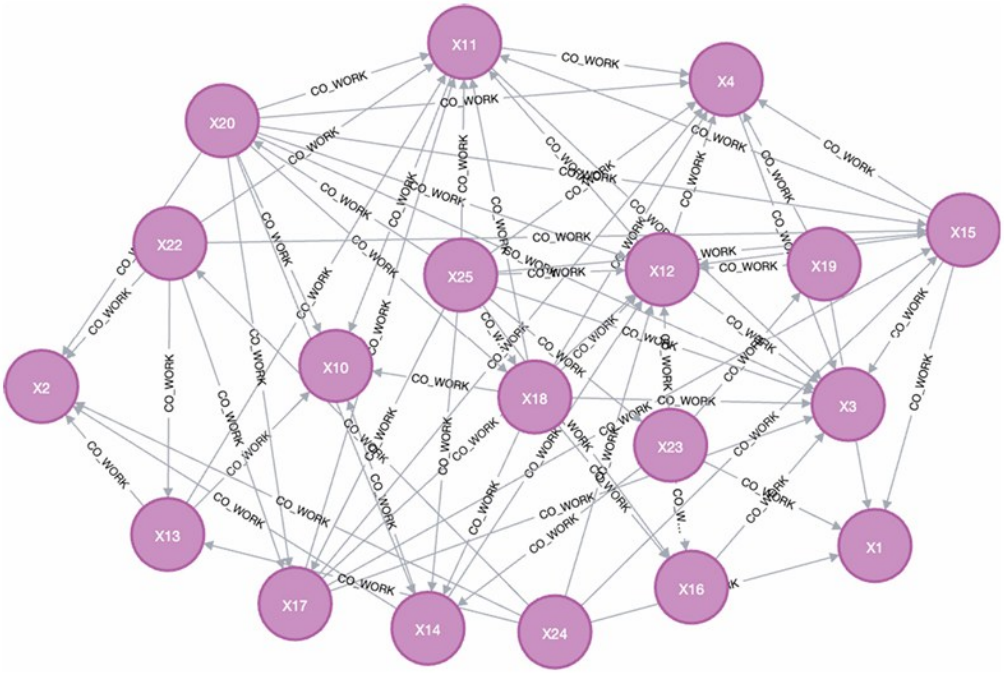


*Figure 17. Sub-sample of sub-graph projection with only Stakeholders nodes. Source: Galluzzo & Gennusa (2023).*

The Link Prediction training pipeline operates by splitting the graph's relationships into sets and adding negative relationships to some of these sets. The configuration of the data split is optional; if not explicitly defined, default parameters are applied. In this study, the splitting configuration was set to have a fraction of the graph reserved for training (0.6) and a fraction of the graph reserved for testing (0.4).

Internally, the Neo4j pipeline divides positive relationships in the train and test sets. Then, "negative" relationships are added randomly to each set of the graph (train set and test

set), which are complementary to the “positive” relationships, and do not overlap with each other. It is essential to incorporate the sampled negative relationships into the training pipelines, as this enables the model to receive examples of relationships that do not exist in the real graph, thereby helping it distinguish between positive and negative relationships (the negativeSamplingRatio is predefined as 1.0 by default).

Cross-validation with k-folds (validationFolds) is also used to evaluate the performance of the machine learning model on our limited dataset. The number of divisions in the training graph is k = 10. In the end, the performance of the models used is evaluated on the average of the results obtained on the k tests.

Several standard machine learning models for link prediction were compared, including Logistic Regression, Random Forest, and an MLP. Finally, the model with the best AUCPR (Area Under the Precision-Recall Curve) results on the test set was automatically selected and saved. An AUCPR value approaching 0.5 indicates that the model’s predictions are not reliable.

Node embeddings were generated using the Fast Random Projection (FastRP) algorithm (Chen et al., 2019), which performs dimensionality reduction while preserving relative distances between nodes. This technique dramatically reduces dimensionality while preserving information on the distance between nodes. Two non-similar nodes do not have to be assigned similar embedding vectors. In the GDS library, the FastRP algorithm is extended from the original algorithm, as the algorithm implemented in GDS considers the properties of the nodes. The resulting embeddings can therefore represent the graph more accurately. For this study, an embedding dimension of 56 was used, and the resulting vectors were stored as additional node attributes.

Table 4 summarizes the AUCPR scores obtained for the two graph projections made on their corresponding target relationships: [WORK ON], [CO WORK].

| Projection | Target Link | Winning Model | Test Score |
|---|---|---|---|
| Whole Graph | WORK_ON | {maxDepth: 2147483647, minLeafSize: 1, criterion: 'GINI', minSplitSize: 2, numberOfDecisionTrees: 10, methodName: 'RandomForest', numberOfSamplesRatio: 1.0} | **0.94** |
| Whole Graph | CO_WORK | {maxEpochs: 500, minEpochs: 1, classWeights: [], penalty: 0.0016619220722602157, patience: 1, methodName: 'LogisticRegression', focusWeight: 0.0, batchSize: 100, tolerance: 0.001, learningRate: 0.001} | **0.96** |
| Stakeholders Graph | CO_WORK | {maxDepth: 2147483647, minLeafSize: 1, criterion: 'GINI', minSplitSize: 2, numberOfDecisionTrees: 10, methodName: 'RandomForest', numberOfSamplesRatio: 1.0} | 0.72 |

*Table 6. Link Prediction results.*

The results of both target link predictions are appreciable and satisfactory, but further analyses and experiments should be carried out considering different configuration models for the learning and trying different embedding models (e.g. Node2Vec, HashGNN, GraphSAGE (Grover, 2016; Hamilton, 2017) as well as different embedding sizes. It can be deduced from the preliminary results obtained that the creation of node embeddings for the projection of the entire graph is more suitable for the prediction of the target relations we considered: [CO WORK] and [WORK ON]. The training times of the constructed predictive models are shown in Table 7. The experiments were conducted using a MacBook Air with an M1 chip, based on Apple's Silicon technology, which features an ARM processor. It is equipped with an octa-core CPU, octa-core GPU, a 16-core Neural Engine, and 8 GB of unified memory in its hardware. It is essential to note that when the entire graph is projected, training the predictive model for the target relation [CO WORK] becomes more time-consuming. This type of result is expected, since we consider a larger number of arcs (there are 3516 stakeholder-directed relationships) on which we need to do the training, as well as using the entire graph.

| Projection | Target Link | Training Time |
|---|---|---|
| Whole Graph | WORK_ON | 4min 30.0s |
| Whole Graph | CO_WORK | 19min 36.9s |
| Stakeholder Graph | CO_WORK | 5min 59.7s |

*Table 7. Training time of the models.*

The prediction of the target relation [CO WORK] is more accurately predicted when we utilize the entire knowledge graph. To refine the learning of the predictive model of connections between nodes, and avoid potential cases of overfitting, the KG will also be populated with more data from additional stakeholders in future implementation of the framework.

### 4.2.3 Results from case study 3: Enhancing Value Creation in Inner Areas through Dynamic Performance Governance

This sub-section presents the empirical results of the case study 3, which analyzes the application of the DPG framework in the context of structurally fragile inner areas. The objective of this research, co-authored with Dr. N. Grippi and under publication in the volume *Sidrea Covales Young Scholars*, is to explore how DPG can support stakeholder collaboration, foster public value creation, and address the interconnected wicked problems (e.g., depopulation, socio-economic decline, and service gaps) that typically affect these territories.

The case study focuses on the Monti Sicani area in Sicily, highlighting how a performance governance perspective can make visible the dynamic feedback relationships between strategic resources, performance drivers, outputs, and community outcomes. The DPG approach was applied to structure a shared understanding among stakeholders of the systemic nature of local challenges, while facilitating the design of integrated and future-oriented policy actions.

The following sections show the main empirical insights derived from this application. First, the systemic conditions of the territory are illustrated through a feedback-oriented diagnosis. Then, the DPG model is used to visualize the causal structure underlying local value creation processes. These results offer a basis for rethinking governance models in

rural contexts and contribute to the broader discussion on how to operationalize sustainability at the territorial level.

#### 4.2.3.1 Applying the DPG approach to inner areas' performance governance

DPG triggers an open discussion of the complex dynamics characterizing inner areas and stakeholder collaboration. This improves a continuous dialogue and promotes a shared understanding of the system, providing a strong foundation for developing effective policies and gaining insights from how they are implemented.

Such an approach also supports the design of performance management systems by enhancing trade-off analysis in time and space through the detection of performance delays. The first involves weighing the impacts of policies in the near term versus the distant future. The second implies assessing the effects of policies on one subsystem compared to another subsystem (Bianchi & Williams, 2015; Bianchi, 2022).

DPG, furthermore, helps to improve boundary spanning (Craven et al., 2018) in inner areas through early identification of a lack of performance sustainability and policy resistance, as these contexts have fluid and open boundaries that are not limited to institutional or administrative clusters. This occurs when policy actions result in feedback from the environment that undermines the policy and sometimes even worsens the initial problem (Ghaffarzadegan et al., 2011, p. 24).

For example, regional governments may choose to decrease funding allocated for educational and healthcare services in response to the declining population in inner areas. Although this may temporarily stabilize the regional budget, it would ultimately hurt the quality of life in these areas. This will exacerbate the decline of essential local infrastructure and services, potentially leading to a further migration of residents from inner areas.

This approach also promotes consistency in policy analysis by considering both the inside-out and outside-in views to achieve holistic and sustainable public value.

Adopting a holistic and in-depth approach to inner area policy design, implementation, and evaluation may contribute to framing and addressing the dynamic complexity

underlying inner areas' wicked problems by enhancing the efficiency and effectiveness of public service delivery to individuals, groups, and organizations through stakeholder engagement and collaboration. In this perspective, policy design and implementation are first about the inner area as a whole, rather than a single organization. This enables stakeholders to design collaborative policies that both create shared strategic resources (common goods) at the community level and strengthen performance at the agency level, thereby fostering quality of life and enhancing place attractiveness (Bianchi, 2022). Such an outside-in view carried out by the DPG approach fosters accountability in cross-sector collaboration (Bryson et al., 2006) and enhances trust and consensus among networked and external stakeholders. In this perspective, DPG by encouraging collaboration among stakeholders and fostering trust among them through facilitated learning, promotes the development of a cohesive community that extends beyond mere compliance with laws and regulations. A community thrives when its citizens are actively involved and contribute to its growth and value creation. The concept refers to a widespread sense of belonging to a group, as experienced by individuals within a specific community (Bianchi, 2021, 2022). This sense of belonging is marked by more than just physical proximity, adherence to rules, or fulfillment of legal obligations. Shared objectives, values, and cultural practices also define it. The mentioned condition establishes a moral basis for the practice of civic commitment and loyalty (Cooper & Gulick, 1984; Cooper et al., 2006). The challenge of community lies in the need for ongoing commitment and active involvement. Successfully managing the process of learning together, supporting one another, building upon ideas, creating shared resources, and fostering a supportive learning environment necessitates a significant investment of time and commitment, which requires an increasing demand for sustainable and inclusive development (Wenger et al., 2011). Indeed, as communities grapple with complex social, economic, and environmental challenges, the ability to draw upon shared values and resources becomes increasingly critical. Community value catalyzes collective action, enabling communities to mobilize resources, address common problems, and pursue long-term goals that reflect the aspirations and needs of their members.

By prioritizing the goal of enhancing active citizenship, it has a positive impact on societal quality of life. Without active citizenship, collaborative efforts among PSOs, private organizations, individuals, and groups (including volunteers) may not be sustained in the

long run. Ansell and Gash (2008) have highlighted the importance of involving the private sector and civil society in policy development and implementation to achieve sustainable community outcomes. Active participation is, therefore, crucial to gathering and utilizing a wide array of ideas, skills, experiences, capabilities, contacts, and energies that can effectively tackle complex social issues, enhance the appeal of local areas, and improve the overall quality of life (Bianchi, 2021). The DPG approach, through its "outside-in" perspective, can also help evaluate sustainable performance outcomes concerning to the three layers mentioned above. Considerations such as time horizon (short-term vs. long-term), field (social, competitive, and financial), and object (organizations vs. local area) have been explored in various studies (Bianchi, 2016, 2021, 2022; Bianchi et al., 2019; Xavier & Bianchi, 2019). From this perspective, policies that aim to achieve sustainable outcomes must consider both social and competitive aspects, while also striking a financial balance.

Such an approach, by cascading community goals at the departmental level and through the continuous monitoring of outputs and outcomes through performance drivers can implement a control process that is based on both a feedback mechanisms while maintaining a feedforward logic (Otley, 1999) which implies that problems or opportunities arising from the implementation of policies at the organizational level can contribute to the identification of possible adjustments at the community level. Such feedback and feedforward logic embedded in the DPG approach facilitate strategic performance dialogue among stakeholders at both organizational, interorganizational, and contextual levels (Bianchi, 2022). For instance, counteracting inner-city depopulation requires that municipalities coordinate their policy efforts through collaboration with various stakeholders. A small town in the inner part of Sicily, to counteract such a depopulation phenomenon, has enacted a series of interventions aimed at leveraging inert strategic resources, i.e., abandoned housing in the historic center, to counteract the loss of place attractiveness and low quality of life (Ferreri, 2021). Such interventions aimed to attract external funding for refurbishing the housing, thereby attracting new residents and potentially tourists, and reversing the current trend in the inner area. Such interventions cannot be sustained in the long term without consensus and collaboration among the stakeholders in the area.

The illustrated example demonstrates how an outside-in view, embedded in an outcome-based performance management and governance approach, can enhance the ability to address wicked problems. This implies that through stakeholders' collaboration, it is possible to balance inner area financial equilibrium, competitiveness, and social inclusion (Bianchi, 2022), thereby contributing to the creation of holistic and sustainable public and community values. The ability of local area stakeholders to achieve such a balance may lead to smart growth and sustainable community and organizational outcomes (Bianchi et al., 2021; Bianchi, 2022).

Thus, the DPG approach has the potential to effectively address the intricate nature of local area performance and improve collaborative governance regimes that focus on developing shared resources and public benefits.

#### 4.2.3.2. Pursuing value creation by identifying inner area dynamic complexity through DPG: the Sicani Mountains example

The "Sicani Mountains Inner Area" is an example of a region in Sicily that is currently experiencing several wicked problems undermining the resilience of the place, leading to public value destruction processes.

**Box 1. The Sicani Mountain inner area example.**

The Monti Sicani area is located between Palermo and Agrigento in Sicily (Italy) and is distinguished by its biodiversity, cultural richness, and natural beauty. The 18 municipalities of the Monti Sicani are characterized as non-coastal, hilly, or mountainous centers, each with an average population of fewer than 7,000 inhabitants, with a total population of 54,969 as of 2019 (Lino et al., 2022).

Despite its beauty, the Monti Sicani area faces significant challenges. The region is experiencing a significant population decline, primarily due to factors such as outmigration, low birth rates, and an aging population. This trend poses challenges in maintaining essential services for the resident population, including healthcare and educational systems, thereby further diminishing the quality of life in the area. Moreover, the infrastructure system exhibits significant deficiencies that adversely affect both internal connectivity and the links with adjacent areas. Furthermore, there

exist concerns regarding hydrogeological instability and the degradation of natural and environmental heritage, which arise from inadequate management, protection, and enhancement of protected areas, landscapes, forests, and trails. Ultimately, these issues result in considerable abandonment and neglect of historic centers, which further diminishes the area's attractiveness (Badami, 2019; Pidalà, 2023; Strategia Area Interna Sicani, 2020).

The existing interconnections among these problems pose a risk of generating vicious cycles that adversely impact various dimensions of social and economic life. Beginning with depopulation, which encompasses the most dynamic segments, there will be a deterioration of the socioeconomic fabric and a gradual reduction in the area used for agriculture, leading to subsequent degradation of landscapes and historic centers. The provision of personal services, encompassing offerings from both private and local public organizations, is anticipated to experience a gradual decline due to diminishing economic viability. This trend is likely to yield adverse consequences for individuals who remain in the area (SNAI Sicani, 2020).

Ongoing efforts to counteract depopulation are represented by local projects to promote ecotourism and organic farming. Others seek to establish "smart villages", which connect rural communities and increase their appeal to remote workers through the use of technology. However, to make rural living more viable and alluring, significant transformation necessitates a holistic approach that incorporates infrastructure upgrades, financial incentives, and educational opportunities.

Based on the Monti Sicani example, Figure 4 provides valuable insights into how DPG can help stakeholders frame the cause-and-effect relationships behind wicked problems and offer methodological guidance to foster collaboration and public value creation.

Figure 18 shows how the stock of “Resident Population” impacts the outcome of “Change in Infrastructure and Services” through the performance driver “Population Ratio”, which gauges the information on the population present in the area compared to a specific target and the in the past years, and, together with the stock “Public Sector Organizations”, the ratio “Allocated Budget for Infrastructure & Services Ratio” which shows the percentage of allocated budget to infrastructure and services for the area compared to others. These

causal relationships illustrate the impact that population trends may have on infrastructure and service pressure, as well as the willingness of public sector organizations at local, regional, and national levels to allocate specific budgets for implementing infrastructure and services in the area. The stock of infrastructure and services can be divided into four categories, each representing the different crucial services serving the area, namely mobility, healthcare, education, and essential private services. These stocks affect two primary outcomes, i.e., “Change in Urban Decay” and “Change in Quality of Life”. This causal relationship illustrates the impact of inadequate infrastructure and services in the area on urban decay and residents’ quality of life. There is a strong connection between urban decay and quality of life and inner area attractiveness, as this may lead to the relocation of businesses from decaying areas, leading to higher unemployment rates. This connection is illustrated by the stock “Urban Decay,” which influences the outcomes of “Change in quality of life” and “Change in inner area attractiveness” through the performance driver “Urban decay ratio,” which compares the level of decay in the area to that of other areas.

Moving forward in the DPG in Figure 18, the stock of “Inner area Attractiveness” is influenced by the driver “Attractiveness Ratio”, which impacts two outcomes: “Change in Business Population” and “Change in Resident Population”. The presence of fewer businesses in the area results in diminished job opportunities, which subsequently contributes to a decline in the resident population, as individuals may opt to relocate to another city or region in search of employment. The stock of “Business Population” also impacts the outcome of “Change in Soil Abandonment”; this relationship illustrates the tendency of agricultural business owners to abandon their land in response to diminishing revenue streams and profitability. When agricultural enterprises encounter persistent financial difficulties, it is more probable that business owners will exit the sector, resulting in a decline in active cultivation and exacerbating the issue of soil abandonment. The abandonment of soil leads to an increase in the hydrogeological instability of the area, as gauged by the performance driver “Soil Degradation Ratio,” which indicates the degree and speed at which soil quality deteriorates due to various factors, including erosion, nutrient depletion, salinization, and compaction. The higher the ratio, the faster the deterioration of soil health, resulting in decreased crop yields, diminished profitability, and a reduction in land value. This measure is essential as it illustrates the influence on

the hydrogeological stability of the area, which further decreases the quality of life in the area.

Such a reduction may lead PSOs, non-profit and for-profit organizations, as well as residents, to work together to foster a change in the area. Collaborative initiatives facilitate the sharing of skills, labor, financial resources, and knowledge among communities, which would be challenging to amass independently. Furthermore, diminished quality of life engenders a collective motivation to enhance their conditions, fostering solidarity as individuals acknowledge the interrelated nature of the challenges affecting the area, which can be more effectively tackled through collaborative efforts.

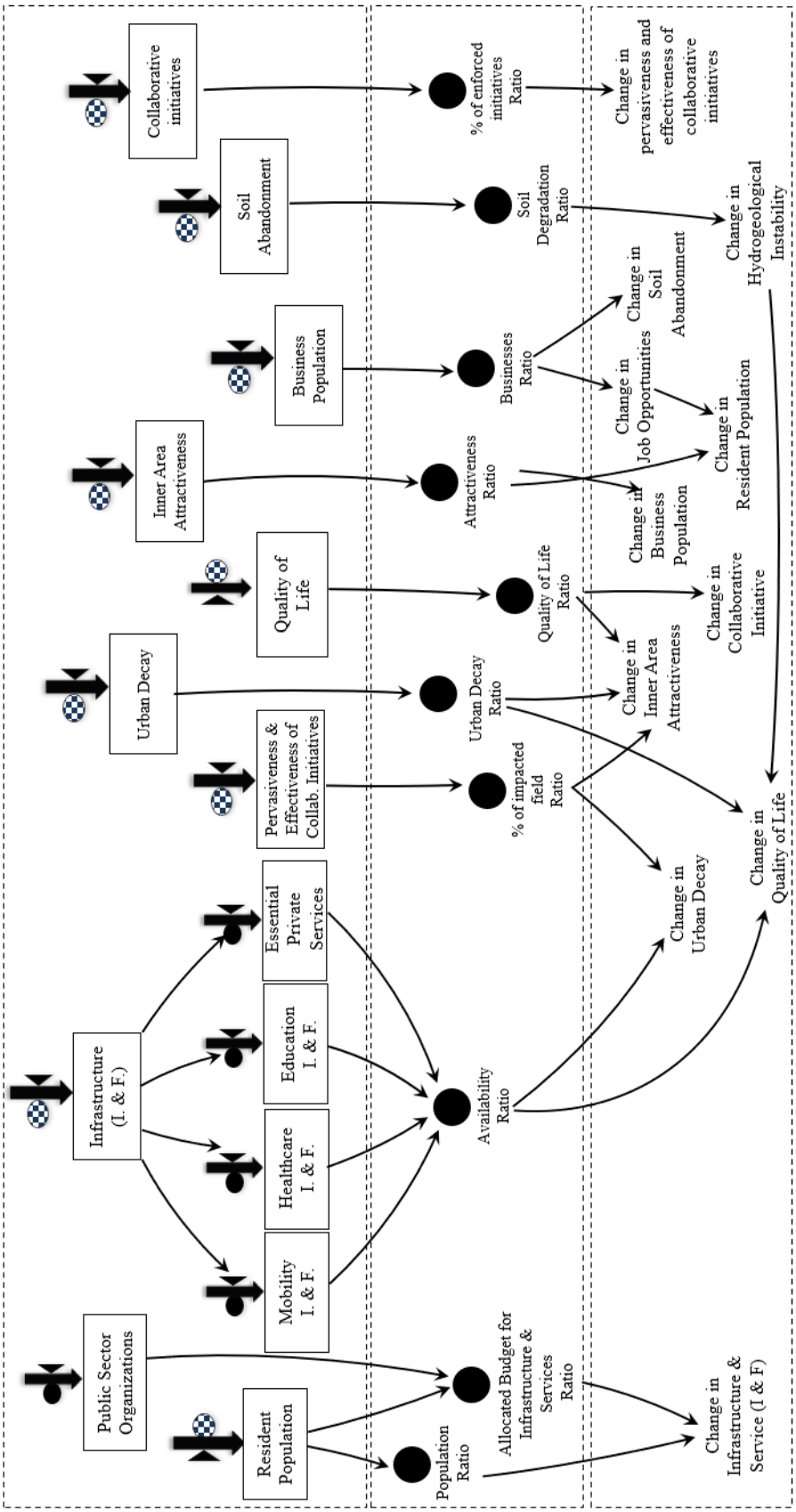


*Figure 18. A Dynamic Performance Governance chart mapping the relationships among outcomes, public value drivers, and associated strategic resources for inner area resilience to wicked problems.*

This causal relationship is portrayed in the DPG chart through the stock “Collaborative Initiatives” that impacts the “Change in pervasiveness and effectiveness of collaborative initiatives” through the performance driver “% of enforced initiatives ratio”, which measures the percentage of implemented activities and initiatives compared to the target level identified by collaborating stakeholders. Within this specific domain, the focus is not on the sheer number of collaborative initiatives but on the depth and scope of activities undertaken within a specific field, as reflected by the ratio of '% of impacted fields ratio.' This approach is essential, functioning as a method to facilitate transformative changes. Moreover, these two critical indicators are also closely related to the extent of coordination among collaborating stakeholders, necessitating a continuous and well-organized approach. Indeed, a rise in the intensity and exchange of information and resources will lead to greater benefits for the area. As a result, the extent to which the implemented activities are delivered and implemented in a widespread manner will have a corresponding impact on the change in urban decay and inner area attractiveness, leading to a change in the resident population.

The analysis of the DPG chart highlights the importance of fostering collaboration among PSOs, non-profit and for-profit organizations, as well as civil society, to enhance inner-area resilience to wicked problems.

The analysis has been intentionally centered on a particular array of strategic resources, performance drivers, and both intermediate and final outcomes that predominantly influence wicked problems within the *Monti Sicani* inner area. This chart has been used to refine the analysis and highlight the benefits associated with adopting this approach.

Building upon the previous case, which emphasized the relevance of performance-based governance systems in supporting collaborative action and long-term value creation in inner areas, the following section turns to a specific policy innovation implemented in the municipality of Sambuca di Sicilia. This case further explores the role of DPG in addressing rural depopulation through an innovative strategy known as the “Houses for 1€” initiative. Here, the focus shifts to how DPG can serve as both a diagnostic and planning tool for designing integrated solutions to wicked problems, while enhancing the sustainability and attractiveness of structurally fragile territories.

### 4.2.4 Results from case study 4: Enhancing Policy Innovation to Tackle Rural Depopulation and Foster Public Value Creation through Dynamic Performance Governance

This sub-section presents the results of the case study 4, which investigates the use of the DPG framework to support policy innovation in the rural municipality of Sambuca di Sicilia, Italy. The focus is on analyzing the "Houses for 1€" initiative, a strategic intervention aimed at reversing the negative spiral of rural depopulation by enhancing local attractiveness, socio-economic revitalization, and long-term community sustainability.

The case illustrates how public administrators, confronted with wicked problems such as outmigration, economic stagnation, and urban decay, can leverage innovative policy tools and collaborative governance mechanisms to generate sustainable outcomes. Through the lens of DPG, the initiative is explored in terms of its underlying feedback structures, the strategic resources it mobilized, and the value it co-created for local stakeholders and external actors.

#### 4.2.4.1 A causal loop perspective of Sambuca di Sicilia's strategy to deal with rural depopulation

Figure 19 portrays the main feedback loops describing the underlying processes shaping rural depopulation in Sambuca di Sicilia.

In SD, there are two categories of feedback loops: reinforcing and balancing. These are framed through causal loop diagrams that investigate the system structure and related performance behaviour over time (Sterman, 2000).

Reinforcing loops are indicated through an "R" and define a self-reinforcing process; balancing loops are indicated through a "B" and represent goal-seeking behavior (Sterman, 2000: 12–14). The feedback loop polarity is specified by a symbol in its center. It is determined by multiplying all the signs of the arrows linking the variables in a loop (a positive polarity identifies a reinforcing loop, while a negative polarity indicates a balancing loop) (Peters & Bianchi, 2023).

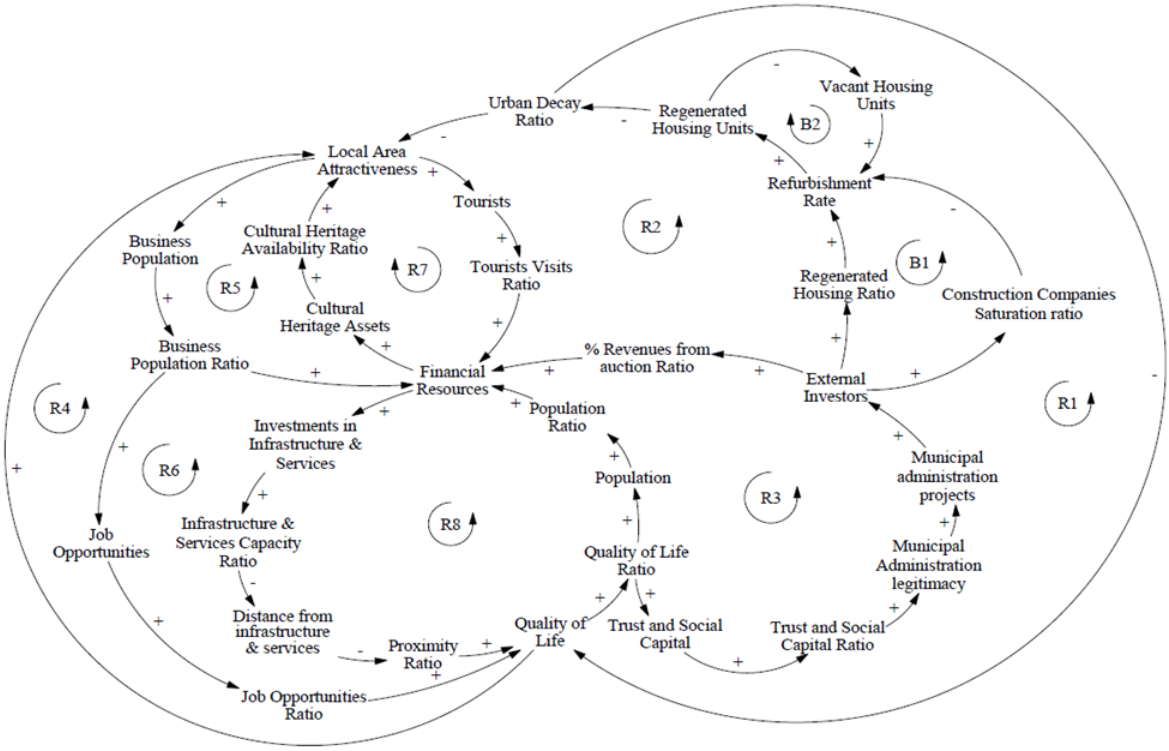


*Figure 19: Causal Loop Diagram portraying the Sambuca di Sicilia case study*

The reinforcing loop R1 describes the policy adopted by the municipality aimed at mitigating the negative effects of post-earthquake recovery laws, regulations, and incentives. Despite the positive short- and medium-term economic outcomes, these recovery measures have produced new neighborhoods lacking services and infrastructure, while leaving behind entire historic neighborhoods. By leveraging the abandoned real estate assets, the municipal administration issued a public tender to reverse the depopulation trend and the ongoing urban blight by attracting external investors. The higher the regenerated assets are, the lower the urban decay will be. The decreased urban decay improves both local area attractiveness and quality of life (R1 and R2). Enhancing the quality of life in Sambuca di Sicilia will boost social capital and increase citizens' trust in the municipal government, thereby contributing to its legitimacy and fostering innovative initiatives.

At the same time, as portrayed by the reinforcing loop R3, the municipality increases its cash flow by selling the municipal properties to these investors. The reinforcing loop R4 illustrates the impact that quality of life has on the attractiveness of the local area. A neighborhood with distant infrastructure and services, and residents' low living

conditions, all key components of quality of life, impacts local area attractiveness. The refurbishment process, as portrayed by the reinforcing loop R2, is slowed down due to the high demand for construction companies, which is exacerbated by the high delay in refurbishing the housing units (balancing loop B1). However, the virtuous loop described in R2 is not endless; indeed, as shown by the balancing loop B2, the gradual increase in refurbished housing units would, in the long run, reduce the stock of vacant housing units.

The gained attractiveness has other positive, cascading effects, such as those portrayed in the reinforcing loops R5, R6, and R7. Indeed, the more attractive Sambuca di Sicilia is, the greater the number of businesses (e.g., restaurants, B&Bs, shops, companies, etc.) will be. This will benefit both municipal tax revenues (R5) and labor demand, which will further improve the quality of life, hence retaining and attracting residents and increasing the cash flow (R6).

At the same time, economic dynamism is further boosted by higher tourist arrivals due to increased local area attractiveness. The improved municipal financial resources enable the municipality to invest not only in preserving and promoting cultural heritage assets but also in expanding infrastructure and enhancing service capacity. Investment in cultural heritage assets will enhance Sambuca di Sicilia's attractiveness, increasing tourists and, consequently, a boost in municipal cash flow (R7). By investing in infrastructure and services, municipal administration reduces the existing distance between strategic assets and residents, thereby directly affecting the population's attraction and retention through improved quality of life (R8).

The causal perspective presented provides a solid foundation for designing a DPG chart to illustrate the benefits that policy design and implementation may have acquired in the process of achieving sustainable outcomes and generating public value.

#### 4.2.4.1 Reframing the case of Sambuca di Sicilia through the Dynamic Performance Governance framework

Figure 20 illustrates various levels of connected outcomes resulting from the implemented policy in Sambuca di Sicilia. These end results represent changes in the availability of strategic resources that cannot be acquired on the market. Therefore, such shared resources (e.g., quality of life, place attractiveness, trust, and social capital) will

be developed as a result of policy implementation (Bianchi, 2019). Among them, Sambuca di Sicilia's attractiveness, a performance measure that assesses the place's ability to be appealing to residents, businesses, external investors, and tourists, is a final outcome since it synthesizes the policy impact on the area. The place's attractiveness is influenced by the first-level intermediate outcome "change in the quality of life" (related to residents). It refers not only to the living conditions of a place, as provided by the existing job opportunities, but also to how infrastructure, services, and urban spaces are developed and maintained.

In this specific case, the strategic assets were destroyed by the earthquake, and the planning process for recovery measures and incentives inadvertently contributed to urban sprawl. The creation of new neighborhoods, such as the *"trasferimento"* one, has led to the abandonment of housing units in the city center, further exacerbating urban decay. In parallel, such urban sprawl increased the distance between infrastructure and services and the new neighbourhoods, negatively affecting residents' quality of life.

To counteract this trend the area municipality adopted the "Houses for 1€" project. This innovative initiative aimed to enhance the quality of life and the area's attractiveness by utilizing the stock of abandoned houses in the historic city centre through a public tender process. In doing so, the municipality was able to attract external investors, thus decreasing urban decay through the renewal of the vacant housing stock.

This regeneration process requires taking into account the potential delays and distortions that may affect the speed and effectiveness of such a change. Indeed, an experienced delay is related to the bounded capacity of construction companies, which, due to high demand, slowed down the process of urban area redevelopment.

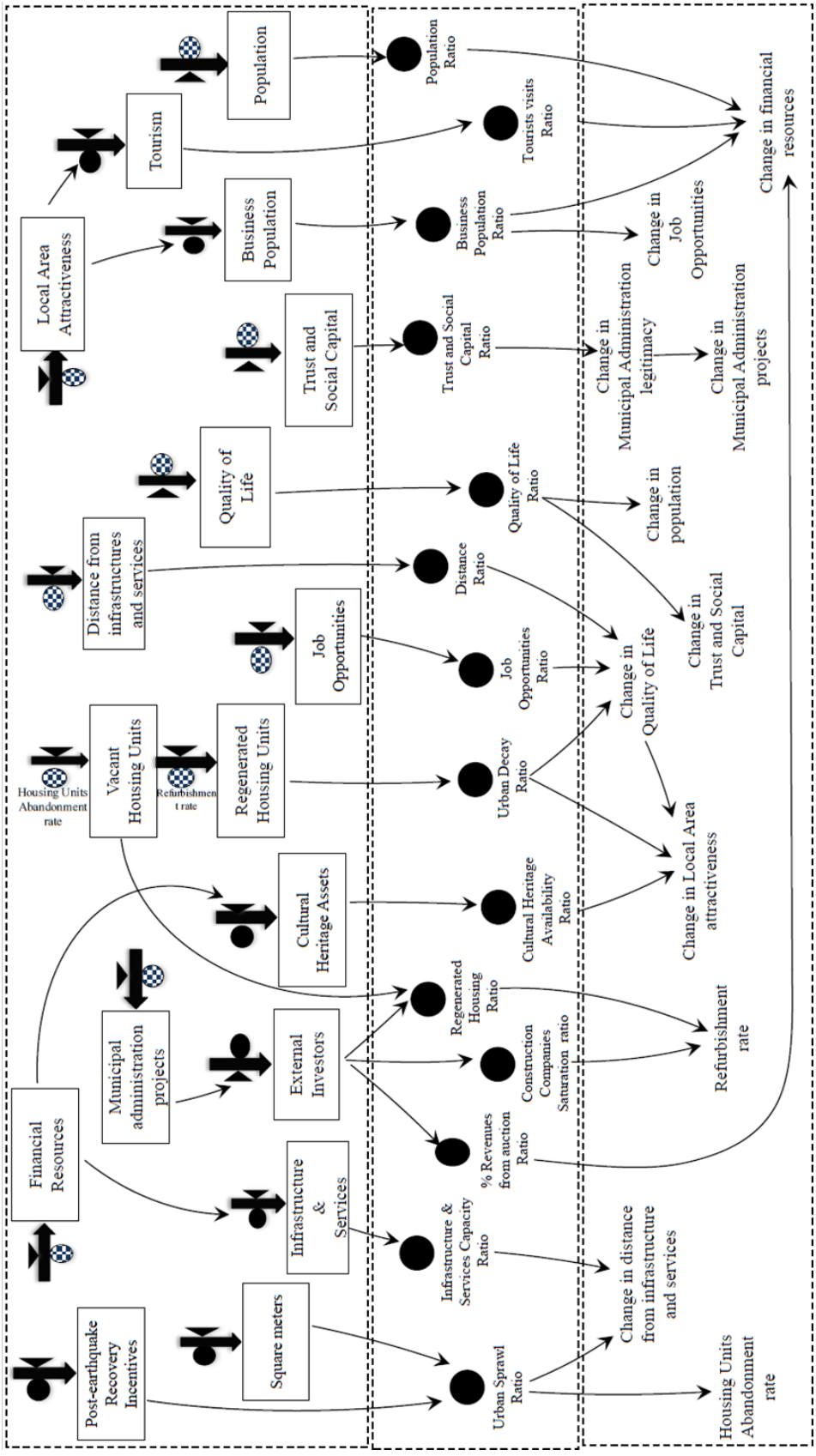


*Figure 20: Dynamic Performance Governance chart portraying the Sambuca di Sicilia case study*

Enhancing Sambuca di Sicilia's quality of life and attractiveness is instrumental in retaining and attracting people to the area, as well as boosting socio-economic and cultural development. Therefore, a change in the population represents another final outcome as a result of the municipality's willingness to counteract the negative demographic trend and improve the economic dynamism of the area. Indeed, the Sambuca di Sicilia financial resources leverage the existing tangible and intangible cultural heritage assets, infrastructure, and services capacity by further enhancing the quality of life and attractiveness of the area. At the same time, this economic outcome is affected by four performance drivers: the population ratio, the business ratio, the tourism revenues ratio, and the percentage of revenues from the auction ratio. These drivers relate to the public and private cash flows generated both from taxation and revenues. The higher such ratios are, the higher the cash flow will be, thereby contributing to enhancing the quality of life and attractiveness of the place through new public and private investments.

This virtuous cycle would be further boosted by the increased residents' trust in the municipality, which is profoundly influenced by the perceived quality of public services, income, and perceived community well-being, all components affecting the level of quality of life in an area (European Quality of Life Survey, 2016). As a result, the greater the trust, the higher the municipality's legitimacy will be, thereby contributing to its willingness and promptness in designing and implementing such innovative initiatives.

However, municipal administrators should be aware of the inherent limitations of such initiatives. Due to the limited capacity of the abandoned housing stock, the municipality should focus on other projects that will enable the system to avoid potential pitfalls and ensure sustainable socio-economic and cultural growth. A long-term approach would require involving stakeholders in policy formulation and implementation and leveraging shared strategic resources, such as tangible and intangible cultural heritage assets, to attract new residents, stimulate economic dynamism, and pursue sustainable public value.

The DPG chart presented in this Section has been narrowed to a sample of outcomes, drivers, and strategic resources that have the most significant impact on the attractiveness of Sambuca di Sicilia, as well as the area's quality of life, to highlight the benefits of using this framework.

#### 4.2.4.3 Critical Insights into Sambuca di Sicilia's successes and failures

The case of Sambuca di Sicilia presents various perspectives on the recent strides made by local communities towards socio-economic development through the recovery and enhancement of existing assets (Ferreri, 2021a). Quite a few criticisms, however, have been raised by numerous scholars.

For Cersosimo and Teti (2021), "selling a house for one euro has the potential to erase collective memory and disrupt the cherished 'family spirit' that is valued by many. Rebuilding entails revitalizing the community, establishing the necessary prerequisites, empowering those who wish to remain, motivating those who desire to return, and embracing those who have developed aspirations for village life. Renovating and reclaiming real estate is only a component of regeneration. According to Delon and Graziano (2023), the "Houses for 1€" projects, by creating an enthusiastic narrative through global territorial branding slogans, risk being more media narratives than true stories from everyday life that have a limited impact on the area.

Lino (2022, p. 2) states that "new visions of development, from marginal areas and depopulated, are candidates to become, certainly not without difficulty, places where agro-food, craft or artistic communities, experiment with settlement forms capable of translating knowledge, economies, and lifestyles into an innovative and creative key".
Pera (2021, p. 539) suggests that "Houses for 1*€"* projects could have a positive influence on the Italian real estate market by facilitating access to homes for young people, who are finding it increasingly difficult to obtain a mortgage". Moreover, "the repopulation of these small villages promotes tourist activities, which can help to regenerate the local economies in these areas". However, Delon and Graziano (2023) remind us that these houses have been abandoned for decades, and the necessary work still requires significant investment.

According to Ferreri (2022), the "Houses for 1€" initiative has had mixed results, with some cases resulting in the selling off of the country or poor branding efforts. However, he also suggests that under specific conditions, this initiative has the potential to revitalize the cultural heritage of individual territories and generate future opportunities.

Although the project is still in its embryonic stage, evaluating the desired effects from socio-economic perspectives, the Sambuca di Sicilia case suggests exploratory ideas. In our opinion, this type of innovative policy may contribute to injecting capital into the local economy, which in turn attracts new businesses and creates job opportunities. Secondly, it may lead to increased demand for real estate in rural areas, potentially driving up property costs. Thirdly, it can contribute to revitalizing rural communities, as new residents may bring opportunities to link new energies and ideas by enhancing forms of relational tourism, preserving cultural heritage in new ways, and implementing agricultural and business innovations. However, such initiatives are unlikely to become sustainable without investments in mobility, infrastructure, and cultural development.

## 4.3 Discussion and concluding remarks

### 4.3.1 Concluding remarks for case study 1: European Project Management and SDG Localization: Evidence from the CiD project

This case study explores how a European innovation alliance in circular design operates at the intersection of transnational communities of interest and place-based innovation ecosystems, and what this implies for the localization of the SDG. Interpreted through the theoretical lenses developed in earlier chapters, particularly the motivational trajectory and the continuum between communities of interest and territorial ecosystems, the empirical data suggest that EPM can serve as a means for SDG localization. It does so by coupling instrumental resources (e.g., funding, visibility, access) with organizational learning mechanisms (co-design, curricular renewal, networked experimentation), thereby strengthening relationships across the quadruple helix and, under certain conditions, anchoring transnational collaboration within local systems (Oksanen & Hautamäki, 2014; Rissola, 2017)

The interviews revealed that motivations for participation were rarely opportunistic. Instrumental benefits were acknowledged but generally regarded as insufficient unless they enabled pedagogical renewal, capacity building, and cross-sectoral collaboration. In terms of the motivational trajectory outlined earlier, most responses clustered between the "instrumental" and "strategic/transformative" stages. This is theoretically significant: it implies that EU alliances can reconfigure the hierarchy of motives, subordinating short-term incentives to more durable institutional aspirations. In this sense, EPM's value exceeds resource mobilization; it orchestrates conditions under which temporary incentives become drivers of organizational change—an interpretation consistent with collaborative governance scholarship, which emphasizes trust-building, shared understanding, and iterative "small wins" (Ansell & Gash, 2008).

Collaboration within the consortium functioned more as a generative mechanism than as a procedural requirement. Trust-based interaction, reciprocal teaching, and the joint development of educational artefacts fostered a shared repertoire of practices, features aligned with the literature on collaborative governance (Ansell & Gash, 2008). The Observatories, in particular, acted as boundary infrastructures, simultaneously serving as mechanisms for internal coordination and platforms for external engagement. They

enabled iterative feedback between transnational learning and territorial experimentation. From a systems perspective, these arrangements produced reinforcing dynamics while also revealing balancing constraints (e.g., staff time, administrative workload).

Territorial anchoring, however, proved uneven and contingent. Where motivated intermediaries, pre-existing networks, or strong professional mandates were present, activities moved beyond knowledge exchange to skill formation and coalition building among local actors. Elsewhere, impacts were more modest, often constrained by project temporalities. The recurring observation that "three years are not enough" points to a structural misalignment between the time required for institutionalization and typical EU project cycles. Rather than a binary embedded vs. non-embedded outcome, what emerges is a process of scaffolded localization: transnational structures seeding local experimentation, whose stabilization depends on the quality of governance, the inclusion of civil society, the absorptive capacity of host institutions, and the availability of continuation instruments. This reading resonates with SDG-localization guidance that stresses the role of local governments, multi-level coordination, and durable review/learning arrangements (Perry et al., 2021)

Time architecture matters: if alliances are to catalyze territorial ecosystems, bridging devices (such as staged calls and light-touch continuation schemes) must narrow the gap between project time and institutional time (European Commission, 2019).

Future research should compare program families (e.g., Erasmus+, Interreg, EIC), trace post-project trajectories, and employ mixed methods (e.g., network analysis combined with qualitative process tracing). The framing is consistent with EU missions that position cities as experimentation hubs linking transnational learning to local trials.

This case study portrays EPM as a hybrid infrastructure that can translate global goals into local practice, provided that temporal and governance conditions for institutionalization are in place.

### 4.3.2 Concluding remarks for case study 2: Knowledge Graphs Embeddings for Link Prediction in the Context of Sustainability

This preliminary collaborative system based on KG offers an innovative pathway for advancing the SDGs. By representing heterogeneous entities and their interrelationships in a single, queryable structure, the graph captures the logic of participatory models and makes complex, multi-actor systems legible for analysis and action.

In future iterations, the framework will be broadened by integrating additional data sources, such as unstructured textual documents (e.g., calls, reports), geospatial layers, and relevant administrative records, to enrich the graph with new entities and non-trivial connections. The KG will also be expanded with temporal information about stakeholders' participation, including time-stamped records of past involvement at specific work tables, as well as current time commitments ("time holdings"). This temporal layer will refine recommendations for end users by indicating which stakeholders are realistically available to join a given table within a specific deadline.

To support practice, an interactive dashboard tailored to facilitators and SD experts. The interface will expose suggested stakeholder–table matches, allow filtering by theme, location, or timeline, and provide transparent rationales (e.g., shared topics or past co-work) so that recommendations are interpretable and auditable.

Ultimately, the goal is to maintain a high-quality, comprehensive knowledge base that is kept up to date and easy to use, serving scientific inquiry, economic development, and social and cultural progress. The system is not a substitute for collaboration but a scaffold that makes relationships visible and actionable, helping translate SDG ambitions into coordinated local practice.

### 4.3.3 Concluding Remarks for case study 3: Enhancing Value Creation in Inner Areas through Dynamic Performance Governance

This case study illustrates the potential of adopting a DPG approach to tackle inner-area wicked problems by enabling stakeholder collaboration, thereby fostering public value creation and enhancing place resilience. In line with this, it was emphasized that there is a need to overcome the potential limitations arising from traditional policymaking and static approaches. Indeed, addressing inner area wicked problems requires engaging with

stakeholders to understand their needs and perspectives, as well as involving them in co-planning (Ansell and Gash, 2008, p. 2). These collaborative arrangements may contribute to the achievement of shared goals and values such as economic dynamism, quality of life, and inner area attractiveness. To be effective in the long term, such collaborative settings should be supported by proper methods to frame public value creation and performance determinants.

From this perspective, the DPG approach can assist policymakers and stakeholders in designing and implementing alternative solutions aimed at creating public value in an inner area while improving policy outcomes and fostering accountability and legitimacy (Bianchi, 2021; Bianchi, 2022).

In line with this, the provided example has shown how such an approach may support stakeholders in collaborative settings in developing a robust cause-and-effect analysis underlying inner-area dynamic complexity. This may help collaborating stakeholders identify the critical strategic resources, performance drivers, and outcomes underlying inner-area wicked problems. In the investigated domain, public value refers to the creation of place-based collaborative initiatives that may impact the community. The Monti Sicani example has demonstrated how identifying the driving forces impacting the area requires collaboration among stakeholders to effectively influence the provision of infrastructure and services, thereby enhancing the attractiveness and quality of life in the inner area.

Through DPG, it is possible to bridge three research fields that often utilize different methods, vocabulary, and tools that have been kept separate, i.e., performance management, governance, and SD, to foster a holistic approach (Bianchi et al., 2019). DPG, by leveraging feedback analysis, has the potential to enhance the quality and comprehension of performance reports, accountability, communication processes, policy design, and implementation. This approach also fosters a progressive cultural transformation towards performance management and governance that focuses on achieving desired outcomes. From this perspective, DPG may serve as methodological guidance, enabling the framing of the main cause-and-effect relationships underlying inner areas. It also highlights the main tangible and intangible organizational and shared strategic resources that stakeholders should leverage by collaborating to achieve the

desired sustainable short- and long-term outcomes. In doing so, it emphasizes the crucial role played by performance drivers as key success factors, enabling the dynamic adaptation of performance information to impact such outcomes. Indeed, by focusing on such drivers, stakeholders can understand the effect of their policies and create public value.

We argue that DPG can be a powerful tool for stakeholders who are willing to engage in collaborative initiatives. This requires engaging with stakeholders to understand their needs and perspectives, as well as involving them in the co-creation of solutions (Torfing & Ansell, 2017). From this perspective, DPG supports the collective knowledge of local problems, enhances interaction between service policy and delivery within a specific setting, and combines a public service perspective with an institutional point of view (Bianchi, 2021; Bianchi, 2022).

In this sense, DPG can be regarded as a learning-oriented tool that may help policymakers and stakeholders in collaborative settings develop a common shared view of wicked problems affecting inner areas, thereby designing and implementing policies that foster public value creation. Such a "maieutic machine" (Busco & Quattrone, 2018) role of DPG enables a continuous questioning of the currently adopted logic and assumptions, as well as the established meanings associated with performance information, to foster an outside-in view of performance and, therefore, collaboration among stakeholders.

This contribution aims to be a preliminary phase towards a potential following analysis stage to further improve decision-making and collaborative settings through simulation modeling in specific field studies. More theoretical and empirical efforts will be necessary to strengthen the theoretical foundation of this approach and investigate how it can foster public value creation through stakeholder collaboration, while improving policy outcomes, enhancing accountability and legitimacy, and promoting innovation.

As further research avenues, continuing to investigate stakeholder collaboration as a source of public value creation in inner areas could provide benefits for the resilience of such contexts and the long-term sustainability of inner area stakeholders.

### 4.3.4 Concluding Remarks for case study 4: Enhancing Policy Innovation to tackle Rural Depopulation and foster Public Value Creation through Dynamic Performance Governance

The analyzed case presents an interesting example of policy innovation aimed at addressing rural depopulation and creating public value through the lens of the DPG framework.

The DPG chart illustrated in this paper highlights how the implemented policy, by leveraging existing strategic assets, has stimulated the creation of public value by enhancing Sambuca di Sicilia's quality of life and attractiveness, and boosting economic development. Additionally, the policy has led to the generation of new cultural and social perspectives, thereby enhancing existing social capital by attracting people from diverse nations.

By mapping the existing cause-and-effect relationships among strategic resources, performance drivers, outputs, and outcomes, the DPG framework, through facilitated learning, supports the design and implementation of innovative solutions aimed at tackling wicked problems and pursuing sustainable community outcomes (Bianchi et al., 2019). Moreover, it fosters a shared understanding of community problems and outcomes, strengthens the interplay between service policy and delivery within a context, and combines a public service perspective with an institutional point of view (Bianchi, 2021; Bianchi, 2022).

To foster endogenous and sustainable growth, it is essential to overcome the potential limitations of traditional policymaking. Indeed, addressing rural depopulation implies generating the ability of rural communities to leverage tangible and intangible resource capacity while creating a long-term aspiration for community development. This requires engaging with stakeholders to understand their needs and perspectives, as well as involving them in the co-design of innovative solutions. In this perspective, innovative policies based on collaboration may foster "out of the box" thinking and lead to a holistic understanding of the key resources that can be leveraged to address wicked problems like rural depopulation. These collaborative arrangements may contribute to the achievement of shared goals and values such as economic dynamism, quality of life, and local area attractiveness. To be effective in the long term, such collaborative settings should be

supported by proper methods to frame public value creation and performance determinants.

From this perspective, the DPG framework can help policymakers and stakeholders design and implement alternative solutions that create public value in a local area, while improving policy outcomes, fostering accountability and legitimacy, and promoting innovation (Bianchi, 2021; Bianchi, 2022).

Applying this approach to the rural depopulation phenomenon is a preliminary step towards a potential next stage of analysis, aiming to further improve decision-making and collaborative settings through the use of simulation modelling. The benefits of using this approach can be further investigated in the subsequent phases of the Sambuca di Sicilia strategy to address this phenomenon. Moreover, a possible comparative case-study analysis in other inner areas may contribute to having a more in-depth understanding of these interrelated complex problems and learning from different experiences.

### 4.3.5 Cross-case discussion and conclusion

When examined comparatively, the four cases illuminate how SDG localization unfolds through an interplay of organizational, cognitive, and informational infrastructures that enable public actors to translate global development agendas into situated practices. Although each case originates from a distinct configuration of actors, capacities, and governance traditions, together they reveal a set of recurring mechanisms through which the SDGs can be operationalized into local systems of action. These mechanisms require scaffolding arrangements that give shape to collaboration, define shared goals, and structure how evidence is produced and interpreted over time.

The CiD alliance provides a first entry point into these dynamics. Operating across multiple European territories, it mobilized a combination of funding, technical assistance, monitoring practices, and institutional roles typical of Project Management applied to European initiatives. These elements created a transnational infrastructure that facilitated the circulation of knowledge, supported joint experimentation, and offered a shared frame for discussing sustainable development challenges. Despite the ambition of its thematic agenda and the density of its activities, the alliance struggled to institutionalize its results within local administrations, especially where existing organizational capacity was weak

or where project-driven processes lacked continuity beyond the programmed milestones. Even in locations where Observatories acted as promising boundary infrastructures, their effectiveness depended on local leadership, stability of staff, and alignment with existing governance routines. The CiD case, therefore, illustrates both the potential and the fragility of EPM-based collaborations: they can catalyse attention and coordination around the SDGs, but they cannot guarantee local anchoring unless they are coupled with territorially embedded mechanisms capable of sustaining learning and collaboration after the project cycle ends.

A different but complementary form of infrastructure emerges in the development of the KG prototype. While CiD is centred on organizational infrastructures and shared procedures, the KG focuses on data infrastructures that aim to make visible the heterogeneity of the territorial landscape. By representing stakeholders, thematic clusters, SDG targets, working tables, and keywords as nodes within a unified graph, the prototype exposes patterns of interaction that are usually dispersed across administrative silos. This visibility is crucial for SDG localization because it enables practitioners to interrogate the structure of collaborations, identify gaps in stakeholder engagement, and align initiatives that otherwise proceed independently. At the same time, the KG case reveals the structural challenges of using BI tools in public governance. Their value depends on having reliable and timely data, on actors who can interpret the results, and on the continued maintenance of the underlying database. Thus, this case illustrates both the promise and the constraints of adopting BI to support the localization of the SDGs: when embedded in institutional routines, they can act as cognitive platforms that enhance strategic coordination; when isolated or insufficiently supported, their contribution remains marginal.

The two DPG applications in Monti Sicani and Sambuca di Sicilia introduce a third layer: systemic governance infrastructures that help actors reason about the causal underpinnings of development challenges. Unlike the KG, which provides descriptive visibility, or CiD, which establishes procedural scaffolding, DPG offers a generative perspective through the articulation of feedback loops, time delays, and strategic resources. In Monti Sicani, the mapping effort exposed how structural constraints, such as transport accessibility, social services, and institutional fragmentation, influence long-term outcomes such as population dynamics and territorial attractiveness. In Sambuca, the modelling illuminated the reinforcing mechanisms of the “Houses for 1€” policy and

clarified the conditions under which the initiative might generate sustainable trajectories instead of short-lived success. Across both settings, DPG fostered cognitive alignment among diverse actors and provided a shared language for prioritizing actions based on systemic leverage.

Across cases, these three infrastructures do not operate as substitutes but as complementary components within a broader ecosystem for SDG localization. Their interplay suggests that different governance challenges require different types of scaffolding: EPM logics help create the organizational and procedural coherence needed to sustain multi-level initiatives; BI infrastructures provide visibility and informational grounding for coordination; and systemic approaches help frame problems and guide collaboration toward shared outcomes. Crucially, the cases indicate that localization succeeds not simply when tools are available, but when they are combined and aligned over time. For example, data infrastructures such as the KG become more effective when embedded within collaborative arrangements like those developed under CiD, which give actors a reason and a context to use them. Similarly, DPG becomes more influential when its analytical insights feed into BI-supported monitoring systems or EPM-driven planning cycles. These interactions suggest that the SDGs are not localized through a single intervention but through an evolving architecture of interdependent infrastructures.

At the same time, the divergences across cases are instructive. They reveal that no single model of localization exists and that each infrastructure is effective only under specific contextual conditions. Transnational partnerships generate momentum but rely heavily on local absorptive capacity; BI tools offer visibility but depend on the availability of high-quality data and analytical skills; holistic approaches and methodologies support long-term thinking but require institutional stabilization to move beyond conceptual exercises.

Taken together, these cross-case insights form the empirical foundation for the governance architecture proposed in Chapter 5. The cases collectively demonstrate that SDG localization is best understood as a scaffolded and iterative process in which organizational infrastructures (EPM), informational infrastructures (BI), and cognitive infrastructures (SD/DPG) work together to sustain collaboration, align interpretations, and support adaptive learning. Chapter 5 builds directly on these findings, translating

them into a generalizable framework that territories can use to design integrated, outcome-oriented strategies capable of operationalizing the SDGs in diverse contexts.

# CHAPTER 5

# FINDINGS AND CONCLUSIONS

This concluding chapter synthesizes the principal findings of the dissertation and contextualizes them within broader debates on sustainable development governance and the localization of the Sustainable Development Goals (SDGs). It summarizes how the findings collectively address the research questions and articulates the study's contributions to theory, methodology, practice, and policy, while also outlining its limitations and directions for future research.

Building on the cross-case results presented in Section 4.3.5, the governance architecture proposed here synthesizes recurring patterns observed across the cases and formalizes them into a coherent set of design principles for SDG localization.

While the preceding chapters presented the conceptual foundations, methodological choices, and case-based evidence, this chapter synthesizes the key findings learned across the study. It reflects on its implications and is organized into five sections. Section 5.1, Towards Place-based Resilience: Integrated Governance Tools for Localizing the SDGs, addresses the cross-case findings and interprets them as lessons for how integrated governance infrastructures such as System Dynamics (SD), Dynamic Performance Governance (DPG), European Project Management (EPM), and place-based Business Intelligence (BI) can operate together within facilitated collaborative platforms. Section 5.2 includes Subsection 5.2.1, which explicitly answers the research questions stated in Chapter 1. In section 5.3, the limitations of the research are presented, while section 5.4 suggests avenues for future investigation. Finally, section 5.5 offers concluding reflections on the overall significance of the dissertation.

## 5.1 Towards Place-based Resilience: Lessons from Integrated Governance Tools for SDG localization

Wicked and super-wicked problems, such as the localization of the United Nations 2030 Agenda and the challenges associated with sustainable development, present particular governance challenges related to the deeply intertwined policy domains, shaped by feedback loops and time delays, and often resistant to linear interventions (Lejano, 2019; Bianchi, 2021; 2022). These problems, which cut across socio-economic, cultural, and

ecological subsystems, demonstrate that sectoral and static provisions overlook cross-effects and unintended consequences. While the 2030 Agenda supplies a comprehensive global frame and ambitious targets, the evidence reviewed in this dissertation shows that global goals rarely translate automatically into local practice; the well-documented implementation gap persists, particularly at the subnational level, where capabilities and data are uneven and responsibilities overlap (Perry et al., 2021; OECD & SDSN, 2020; UN-Habitat, 2015). This means that localization is not a by-product of projects or policies, but a situated and iterative process that must be framed.

From this perspective, SDG localization depends on governance architectures that are simultaneously systemic, dynamic, and place-based. “Systemic” refers to the capacity to make interdependencies visible, how choices in one domain reverberate elsewhere through reinforcing or balancing loops. “Dynamic” emphasizes the need for continuous learning and adaptation, rather than relying on one-off planning cycles. “Place-based” emphasizes sensitivity to territorial assets, constraints, and identities, as well as the multilevel pressures that local administrations face (Hambleton, 2020; Jönsson & Bexell, 2021). Without such structures, initiatives risk becoming project-bound, where, on the one hand, they produce outputs for compliance, and on the other, struggle to affect systemic drivers or last beyond the financing window.

The cross-case evidence developed in Chapter 4 suggests that an integrated use of governance tools (SD, DPG, EPM, BI) can provide this scaffolding when deployed together within collaborative platforms. Integration here does not mean merging them into a single tool; it means making them interoperable: SD’s causal hypotheses are translated into outcome pathways; EPM derives intervention logic, work packages, and milestones from those pathways; BI selects indicators aligned with the same drivers and reviews them on the cadence of decision forums, so that results feedback to update maps and plans. In this tight coupling, each module remains distinct yet mutually reinforcing, with shared hand-offs, roles, and data lineage.

This is precisely what sustainability needs: different methods and professional groups working together on the same outcome pathways without losing their tools or identities in a single unit.

Properly configured, these are not just administrative requirements but project architectures through which local priorities can gain traction and persist across cycles. The orchestrator, an institution or boundary role with legitimacy and convening power, is necessary to oversee hand-offs, maintain a review cadence, align responsibilities across organizations, and protect the integrity of data and indicators, ensuring that evidence is incorporated into decisions.

When incorporated into collaborative platforms, such integrated methodologies as a collection of boundary infrastructures that create long-lasting and goal-oriented collaboration (Ansell & Gash, 2018; Emerson, Nabatchi, & Balogh, 2012; Bryson et al., 2015). Through collaborative platforms, public authorities, businesses, civic organizations, and communities can negotiate priorities, manage interdependence over time, and coordinate contributions. In these settings, SD models serve as boundary objects for discussion, DPG charts establish a common language for outcomes, EPM transforms agreements into logical plans and accountability, and BI grounds conversations in facts. The outcome is a collective ability to recognize interdependencies, test collaborations, and iteratively modify strategies rather than consensus in and of itself.

Framed through collaborative governance, the value of this approach lies in cultivating holistic resilience as a collective property rather than a static attribute of individual organizations (Berkes & Folke, 1998; Folke, 2006). By making causal structures legible, aligning around outcomes, institutionalizing execution and review, and grounding decisions in an updated dataset, collaborative platforms build the adaptive capacity needed to respond to unintended consequences and recalibrate efforts without losing sight of longer-term goals.

Read across cases, several cross-case lessons stand out. First, localization requires infrastructures, not only resources. Funding and plans are necessary but insufficient. Progress becomes more predictable when there are explicit scaffolds that connect ideas, actors, and actions, such as alliances that translate instrumental resources into organizational learning, data systems that render relationships analyzable and actionable, and outcome-oriented routines that link effort to results over time.

Second, considering that sustainability challenges are inherently multidisciplinary, integration matters and should be understood as interoperable modularity: distinct tools

linked by clear handoffs and shared timing, with a trusted orchestrator keeping the process coherent so that evidence, governance, and execution reinforce one another rather than drift apart.

Third, temporality and continuity are crucial, as project cycles, data refresh dates, and governance protocols rarely align with the more gradual processes of institutionalization. Durability is contingent upon ongoing processes (e.g., post-grant arrangements, bridging funding), systematic monitoring integrated into current meetings, and administrative capabilities that facilitate the transfer of knowledge between electoral and program cycles. In their absence, even promising partnerships tend to evaporate.

The fourth lesson focuses on roles and objects. Platforms benefit from established orchestrators and from models and charts (such as observatories, relational maps in Knowledge Graphs, DPG charts, and Causal Loop Diagrams) that people can gather around. These tools improve collaboration by exposing challenged assumptions, making conflicts explicit and hence discussable. In other words, border infrastructures strengthen legitimacy by combining inclusive processes with disciplined representations of challenges and progress (Ansell & Gash, 2018; Bryson et al., 2015).

Fifth, data needs more than just being collected. BI is useful when data are also updated and interpreted. When datasets are infrequently updated or broken up, learning stops, and monitoring shifts to reporting after the fact. On the other hand, a lightweight dashboard can aid in daily decision-making as long as it utilizes indicators linked to the outcome pathways and is reviewed on a schedule that suits the organization. The goal is not to get valuable data, the right indicators, at the right level of detail, and at the right time.

Sixth, EPM is a tool for governance when it reflects outcome logic. European project management is often viewed as merely a means to follow rules in the back office. The cases demonstrate that EPM becomes a meso-level infrastructure that helps anchor transnational outputs locally and prepares for continuation beyond the grant when intervention logics and work packages are based on outcome pathways. Milestones mark progress on drivers that truly matter, and reporting routines are utilized for joint sense-making (not just audit readiness). Linking EPM to performance governance and fed by BI, it can transform program constraints into opportunities for coordination and skill development.

Finally, while localization is dependent and context-based, there is no single model that can be scaled in diverse circumstances. What transfers are the principles of coupling, between analytical, managerial, and data tools; boundary objects that focus collaboration; role clarity for orchestration; and routines that embed monitoring and learning into ordinary work. These principles must be adapted to institutional capacities, data availability, and existing networks. In some contexts, alliances provide the initial impetus, while in others, data infrastructures or outcome maps serve as the entry point.

Taken together, these lessons support a pragmatic proposition: SDG localization is best understood as a scaffolded, iterative process built from interoperable modules - SD for causal structure, DPG for outcome alignment, EPM for program-coherent execution, and BI for evidence-informed learning - embedded in collaborative platforms. None is sufficient alone; in combination, they increase the probability that initiatives move beyond pilots, survive beyond funding cycles, and accumulate capacities that persist. Such replicable architecture, when adapted to a place, can convert global goals into local value while building the resilience necessary to navigate uncertainty and change (Perry et al., 2021; OECD & SDSN, 2020; UN-Habitat, 2015; Hambleton, 2020; Jönsson & Bexell, 2021).

### 5.2. Research contribution to the field

This dissertation contributes to the study and practice of sustainable development governance by reframing the localization of the UN 2030 Agenda as an iterative process that requires the deliberate integration of SD, outcome-performance management, EPM, and BI within collaborative platforms. By grounding the analysis and proposed governance architecture in the vocabulary and structures of the UN and EU sustainability agendas, this thesis contributes to their operationalization in real-world local settings. The alignment with institutional terminology is intentional, aiming to facilitate policy uptake, interoperability, and dialogue with practitioners and public administrations. The central premise is that SDG localization is not a passive by-product of projects or policies but a complex undertaking that unfolds across multiple governance levels and time scales. Building on the literature on wicked and super-wicked problems (Rittel & Weber, 1973) and on multilevel governance (Ansell & Gash, 2018; Emerson & Nabatchi, 2015), the study shows how global goals become locally actionable when analytical, managerial,

and data infrastructures are tightly coupled as modular components rather than collapsed into a single tool.

The first contribution is conceptual. By treating SD, DPG, EPM, and BI as interoperable modules, the dissertation clarifies the pathways through which causal reasoning, outcome alignment, program-coherent execution, and evidence-informed learning reinforce one another in real territorial settings. System Dynamics provides the causal language to make feedbacks, delays, and trade-offs explicit; performance governance translates those insights into outcome pathways and driver structures that align heterogeneous organizations; EPM converts pathways into place-based intervention logic, work-package design, milestones and deliverables, co-financing and procurement choices, and reporting routines that are consistent with European programs. BI supplies indicators to ground deliberation and monitoring. On this composition, stakeholder evidence is routed into causal maps; causal maps become outcome pathways; pathways are institutionalized in plans and routines; and those plans are monitored and adapted using indicators selected for operational use. This articulation advances a place-based perspective in which complexity is rendered governable without being simplified away, and in which resilience is cultivated as a dynamic, collective capacity rather than a static attribute of single organizations (Berkes & Folke, 1998; Folke, 2006; Hambleton, 2020; Jönsson & Bexell, 2021).

From a methodological perspective, the research proposes a replicable toolkit that addresses a well-noted knowledge-to-practice gap in SDG implementation. The work demonstrates how qualitative SD artifacts (in particular causal loop diagrams) can be used with DPG chart to structure multi-actor collaboration around results, clarify responsibilities, and identify enabling capacities; how EPM devices such as intervention logic and work-package structures can be derived from those pathways so that milestones track what actually matters; and how BI models (e.g. indicator dictionaries, territorial snapshots, and lightweight dashboards) can be embedded in routine meetings to support course-correction rather than only ex-post compliance. In this sense, EPM is reinterpreted as a meso-level governance infrastructure that, when linked to outcome logic and fed by SD and BI, converts program constraints into levers for coordination and capability building.

From the empirical perspective, drawing on literature review, documentary analysis, semi-structured interviews with key stakeholders, and the construction of CLD, DPG charts, and KG, the dissertation documents how the integrated architecture functions across different territorial configurations and identifies the conditions under which it gains traction. The cases show that progress is most likely when there is a recognized orchestrator, explicit outcome pathways linked to role clarity, EPM routines that mirror those pathways, and data stewardship that keeps indicators current and usable at the cadence of decision forums. They also surface recurring constraints, including fragmented datasets, intermittent participation, frictions around co-financing and procurement, and difficulties in carrying learning across electoral and program cycles, which explain why apparently similar initiatives diverge in practice. By situating these patterns in context, the study adds practice-proximate evidence to a literature that often remains prescriptive or descriptive.

Finally, the dissertation makes a practical contribution to measurement and learning by describing a place-sensitive measurement setup that connects global commitments to local accountability. In practice, this means turning some SDG goals into a small number of indicators that are linked to agreed-upon outcome pathways and performance drivers. If there is not enough data, proxies can be used. These indicators should be reviewed on the same schedule as existing decision-making forums (such as monthly coordination meetings) so that numbers can be discussed while choices are still open (OECD & SDSN, 2020; UN-Habitat, 2015). Dashboards and reports are not viewed as final products; instead, they are seen as tools that help people understand trends, weigh options, and make informed decisions about how to adjust their course. This will only work if someone is in charge of curation, updates, and interpretation, and if there is a basic governance routine that brings evidence into the room at the right time (Bryson et al., 2015). When stewardship fails or updates become infrequent, monitoring quickly reverts to compliance, and learning stops.

The study also describes the limits and what can actually move. A minimum set of capabilities is necessary: a recognized orchestrator, a data steward, and a permanent forum for reviewing outcome pathways and indicators against current work plans; without these, tools become disjointed. Institutional arrangements that facilitate clear transitions between analytical tasks, project routines, and measurement, as well as a

review cadence synchronized with operational cycles, are essential. Risks include excessive dependence on a limited number of boundary spanners and persistent misalignment between project timelines and institutionalization (Bianchi, 2021, 2022). The dissertation proposes a transferable architecture comprising SD for causal structure, DPG for outcome alignment, EPM for program-coherent execution, and Business Intelligence for evidence-informed learning, to be sequenced and tailored to specific contexts, rather than a uniform model. In this context, the contribution to the 2030 Agenda is tangible: it elucidates not only the significance of localization but also the methods by which it can be pursued in a manner that is analytically robust, administratively practical, and conducive to the development of adaptive capacity over time (Perry et al., 2021; Folke, 2006).

### 5.2.1 Answers to the research questions

This subsection provides explicit answers to the five research questions presented in Section 1.2. Each answer synthesizes the empirical evidence generated across the case studies in Chapter 4 and the cross-case insights discussed in Section 5.1. The aim is to offer a clear and concise account of how the dissertation addresses its core research objectives, while making transparent the links between the findings and the broader governance architecture developed in this chapter.

Regarding the first research question, which examines the mechanisms that sustain the local SDG implementation gap and how time delays, feedbacks, and organizational boundaries shape that gap, the evidence from the cases shows that the problem is not primarily a lack of initiatives, but the interaction of several structural dynamics. SDG-related projects operate on cycles that are far shorter than the time needed to influence deeper drivers such as demographic decline, institutional capacity, or territorial attractiveness. These delays push organizations to prioritize visible outputs and procedural compliance, reinforcing short-term loops that reward spending and delivery rather than outcome consolidation. At the same time, institutional responsibilities are fragmented across multiple organizations with weak coordination mandates, meaning that no single actor is accountable for shared outcomes. This fragmentation interacts with feedback structures that perpetuate limited capabilities, reducing the ability to coordinate, which in turn leads to scattered interventions that fail to alter underlying trajectories. As

a result, the gap between declared SDG ambitions and actual territorial outcomes persists, even in the presence of numerous funded activities.

Regarding the second research question, which concerns how SD, DPG, and BI can be operationally combined to support real governance processes, the cases show that integration becomes feasible when these approaches are treated not as standalone technical tools but as complementary components of a single learning and coordination architecture. SD provides a structured way to elicit causal mechanisms, feedback loops, and time delays, allowing stakeholders to articulate how local challenges evolve and how different interventions may interact. DPG then translates these shared causal assumptions into outcome pathways, strategic resources, and performance drivers that clarify who is expected to contribute to which parts of the system and through which organizational levers. Finally, BI operationalizes these pathways by offering a minimal, coherent set of indicators aligned with the identified drivers and reviewed on a cadence that matches the governance routines of the actors involved.

Regarding the third research question, which focuses on how collaborative platforms help align heterogeneous stakeholders around shared outcomes and which practices enable learning across the policy cycle, the evidence indicates that alignment does not emerge automatically from participation but from the presence of concrete boundary infrastructures that make interdependencies visible and negotiable. Across the cases, by externalizing assumptions and showing how actions in one domain affect others, these infrastructures reduced the ambiguity that often characterizes multi-actor governance settings and helped stakeholders converge on a small set of meaningful, place-based priorities.

Regarding the fourth research question, which examines how EU funding requirements and multilevel governance arrangements shape the design and delivery of SDG-related initiatives, and which project-management choices help mitigate the resulting frictions, the evidence across the cases shows a dual effect. On the one hand, EU programs provide essential financial resources, visibility, and mission-oriented frameworks that encourage collaboration, particularly in territories with limited endogenous capacity. On the other hand, their strict procedural requirements, short implementation windows, and complex accountability chains introduce rigidities that often exceed local administrative

capabilities. These constraints can fragment attention, prioritize compliance over learning, and reinforce short-term project logics that are misaligned with the long-term transformations required by the SDGs.

The cases indicate that the key to managing these tensions lies in how project-management practices are designed and enacted. When intervention logics, work packages, milestones, and reporting routines are explicitly derived from outcome pathways, EU projects become vehicles for coordination instead of sources of administrative overload. This was particularly visible in the CiD project, where project routines were used to anchor cross-departmental collaboration, clarify responsibilities, and maintain continuity across actors and phases

Regarding the fifth research question, the cross-case analysis highlights a small set of design principles that reliably turn participation and evidence into durable, place-based outcomes. First, effective processes depend on the presence of a credible orchestrator able to convene actors, maintain focus on shared outcomes, and bridge organizational boundaries. Second, explicit outcome pathways, developed through SD and DPG tools, help stakeholders align their actions by clarifying how desired results depend on specific drivers, resources, and interdependencies. Third, lean and coherent BI architectures, aligned with those pathways, provide a stable evidence base that supports monitoring and joint reflection rather than one-off reporting.

Finally, durability requires recurring routines, such as periodic review meetings, integrated monitoring sessions, and coordinated reporting, that embed collaboration across the policy cycle. In the cases where these elements coexisted, participation translated into sustained territorial improvements.

### 5.3 Research limitations

This dissertation is subject to limitations that should be acknowledged when interpreting its findings. The empirical analysis has primarily been conducted within the context of local or European projects, whose brief funding cycles inevitably make it challenging to observe systemic change and long-term institutionalization. As a result, the findings capture dynamics that are still frequently developing and may change after project-driven incentives and outside assistance cease. The insights are also highly situated because the

chosen cases are interconnected in particular institutional and territorial contexts. Their applicability to different governance structures, cultural contexts, or administrative skill levels must be contextualized, even though they provide lessons with broader applicability.

System Dynamics has been employed primarily in its qualitative form through causal loop diagrams and outcome–driver structures. While this approach is appropriate for problem structuring, stakeholder learning, and identifying systemic drivers, it does not include the quantitative modeling and simulation components that characterize full SD practice. This choice reflects the thesis's focus on governance processes and collaborative platforms, yet it constitutes an important methodological boundary that future research should address.

The methodological approach also has limitations. Semi-structured interviews yielded significant insights, but they are inherently shaped by the respondents' perceptions and strategic views, whereas secondary sources may be biased or outdated. Furthermore, not all stakeholder groups could be represented equally; some viewpoints, especially those of marginalized or dissenting individuals, may remain insufficiently investigated. The analytical tools used helped identify patterns and facilitate collaboration in decision-making, but they rely on simplifying assumptions and data infrastructures that are still being validated. Their validity and robustness across various contexts necessitate additional testing and refinement. Finally, the study employs a cross-sectional lens, which reveals how things change at a specific point in time but cannot fully capture the longer processes of learning, adaptation, and institutionalization that are essential for effective governance over time.

These limitations do not diminish the research's contribution; instead, they outline potential directions for future investigation. Longitudinal studies could evaluate whether the enabling mechanisms identified herein evolve into sustainable governance practices over time. Comparative analysis across nations and governance traditions can help assess the transferability of the proposed framework. More inclusive and participatory research designs could incorporate a broader range of stakeholder perspectives, particularly from individuals who are often marginalized in formal governance processes. More new

methods could make it easier to combine qualitative and quantitative tools, which would make them better at supporting evidence-based and flexible policymaking.

Temporal scope is a further constraint. The observation window records design phases and initial implementation rather than prolonged institutionalization. Some mechanisms that were analyzed in the cross-case discussion were still being worked on when the analysis was done. Consequently, a comprehensive evaluation of the observed routines' persistence amid electoral transitions, staff turnover, or the conclusion of program funding is unattainable. Assertions regarding durability and scalability should be approached with caution until more extensive time series and subsequent studies are accessible.

By addressing these challenges, future research can consolidate and expand the foundations laid by this dissertation, reinforcing the potential of integrated governance architectures to localize the SDGs and build resilience to wicked problems.

### 5.4 Future directions

Given the complexity of research on SDG localization, the next wave of studies should broaden the empirical lens and deepen the analytical spine simultaneously. The architecture examined in this dissertation advanced in a specific set of European contexts. Future inquiry should follow analogous configurations across different geographies and administrative cultures, including regions that operate outside European program logics. Comparative work of this kind would not only test transferability but also illuminate the roots of the implementation gap in settings where capacities, incentives, and data ecosystems diverge markedly (Perry et al., 2021; OECD & SDSN, 2020; UN-Habitat, 2015).

A promising direction is to use a performance-governance lens as the primary analytic scaffold for cross-case and within-case work. DPG charts can structure deliberation around what results matter locally, which strategic resources and enabling capacities condition those results, and how responsibilities should be distributed across organizations. Studying how these maps are adopted, revised, or abandoned in real-world decision-making forums would clarify when they function as genuine boundary infrastructures and when they remain mere exercises on paper (Bryson et al., 2015; Ansell

& Gash, 2018). In parallel, EPM should be examined not as compliance, but as a design space: which combinations of intervention logic, work-package structure, milestones, procurement, co-financing, and reporting best maintain governance orientation towards outcomes under different program rules and audit cultures. Comparative designs that place similar initiatives under distinct managerial and funding regimes would be especially revealing.

It will also be important to make the modeling dimension deeper. In the examined cases, SD was predominantly employed in its qualitative form to reveal feedback loops, delays, and leverage points. When data permit, subsequent research should progress towards calibrated simulations capable of stress-testing policy portfolios, examining sensitivities, and predicting unintended consequences prior to resource allocation.

Building such quantitative models would allow researchers and practitioners to explore nonlinear dynamics, assess the effects of time delays, and examine counterintuitive policy outcomes that are not visible in qualitative structures alone. By grounding simulations in empirically validated stocks, flows, and behavioral parameters, future work could improve the anticipatory capacity of local administrations and support the co-design of more robust policy portfolios. This step would also align SD practice with the governance architecture developed in this dissertation, enabling iterative cycles in which qualitative problem structuring and quantitative scenario exploration reinforce one another. This means that SD models need to be connected to the BI layer. Indicator dictionaries need to evolve into measurement systems with clear provenance, refresh rates that match operational rhythms, and stewardship plans that work even when staff members leave. The same applies to data infrastructures like knowledge graphs: adding more coverage, temporal attributes, and verifying link-prediction pipelines against verifiable outcomes would transform exploratory prototypes into reliable orchestration tools.

Finally, documentation of protocols, maps, model skeletons, indicator catalogs with metadata, and charts can be assembled as open and place-adaptable packages. Doing so would allow territories to start from a higher baseline, learn from one another without flattening differences, and build the long-term learning arcs that SDG localization requires.

## 5.5 Conclusions

This dissertation has analyzed how systemic, data-driven, and collaborative methodologies can enhance the localization of the SDGs and promote resilience to wicked and super wicked problems. The primary objective was to demonstrate how the integration of SD, DPG, and BI can support policy practitioners, decision-makers, and stakeholders in developing, coordinating, and refining sustainable development strategies within real-world governance settings. By integrating these viewpoints, the research aimed to make both theoretical and practical contributions to the ongoing discourse on the effective translation of global objectives into local outcomes.

The study proceeded as follows. Chapter 1 outlined the motivations, objectives, and research questions that guided the study, while situating the issue within the enduring disparity between the global goals of the 2030 Agenda and the limited progress achieved at the subnational level. Chapter 2 established the theoretical framework by examining the literature on wicked and super-wicked problems, collaborative governance, and the European policy context as a facilitative yet challenging landscape for the localization of the SDGs. Chapter 3 outlined the methodological framework, detailing the implementation of semi-structured interviews, the use of secondary sources, and the integration of SD, DPG, and BI as interoperable modules within collaborative platforms. Chapter 4 presented the real-world results from the chosen cases, demonstrating how DPG charts, CLDs, and BI dashboards can help identify interdependencies, connect stakeholders, and inform decisions based on evidence. Chapter 5 synthesized the results from all the cases and analyzed how the research contributed to the development of theory, methodology, and practice.

The findings indicate that SDG localization does not occur spontaneously from projects or policies; rather, it necessitates scaffolding infrastructures that facilitate the connection of actors, resources, and knowledge over time. The integrated approach proposed in this dissertation illustrates how systemic reasoning, performance alignment, and evidence-informed deliberation can be combined to facilitate adaptive governance, transforming onerous requirements into opportunities for capacity building and collaborative learning. The research simultaneously acknowledges its constraints, including the brief timeframes

of European projects, the particular nature of the cases, and the experimental characteristics of specific tools utilized.

The study remains bounded by the time horizons and data realities of the observed settings, and it privileges formative over fully calibrated modeling. These limits do not weaken the central finding; they indicate where effort should concentrate next: longer arcs of observation, deeper calibration where feasible, harder stewardship of data and indicators, and intentional design of project-governance routines that keep outcome logic in view.

In conclusion, this research shows that localizing the SDG requires more than just following global plans. It calls for governance systems that are flexible, fact-based, and open to everyone, and that can bring together diverse people and resources over time. The dissertation illustrates a method for transforming abstract commitments into tangible actions by integrating systemic analysis with performance-oriented practices and data-driven tools. The lessons learned here point to a type of collaborative governance that not only addresses today's sustainability challenges but also builds the resilience needed to tackle future problems.

REFERENCES

Ackoff, R (1974). Redefining the Future. Wiley: London.

Adom, D., Yeboah, A., & Ankrah, A. K. (2016). Constructivism philosophical paradigm: Implication for research, teaching and learning. Global journal of arts humanities and social sciences, 4(10), 1-9.

Alford, J., & O'Flynn, J. (2009). Making sense of public value: Concepts, critiques and emergent meanings. *International Journal of Public Administration, 32*(3–4), 171–191.

Almeida, M. A. (2018). Fighting depopulation in Portugal: Local and central government policies in times of crisis. *Portuguese Journal of Social Science, 17*(3), 289–309.

Al-Moslmi, T., Ocaña, M. G., Opdahl, A. L., & Veres, C. (2020). Named entity extraction for knowledge graphs: A literature overview. *IEEE Access, 8*, 32862–32881. https://doi.org/10.1109/ACCESS.2020.2973660

Alshukri, T., Seun Ojekemi, O., Öz, T., & Alzubi, A. (2024). The interplay of corporate social responsibility, innovation capability, organizational learning, and sustainable value creation: does stakeholder engagement matter?. Sustainability, 16(13), 5511.

Ammons, D. N. 2001. Municipal Benchmarks: Assessing Local Performance and Establishing Community Standards (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory, 18*(4), 543–571.

Ansell, C., & Gash, A. (2018). Collaborative platforms as a governance strategy. *Journal of Public Administration Research and Theory, 28*(1), 16–32. https://doi.org/10.1093/jopart/mux030

Ansell, C., & Torfing, J. (Eds.). (2014). *Public innovation through collaboration and design*. Routledge.

Ansell, C., (2019). Coping with Conceptual Pluralism: Reflections on Concept Formation. Public Performance & Management Review, 44(5), pp. 1118–1139

APRE. (2021). Horizon Europe: La guida. Agenzia per la Promozione della Ricerca Europea. https://apre.it/wp-content/uploads/2021/04/guida-Horizon-Europe.pdf

Aprile, M. (2009). Il terremoto del Belice o del fraintendimento. In G. Campione (Ed.), *Messina 1908 e dintorni* (pp. 221–234). Silvana Editoriale.

Arif, I., & Dutta, N. (2024). Legitimacy of government and governance. *Journal of Institutional Economics, 20*, e14. https://doi.org/10.1017/S1744137423000334

Baars, H., & Kemper, H.-G. (2008). Management support with structured and unstructured data: An integrated Business Intelligence framework. *Information Systems Management, 25*(2), 132–148. https://doi.org/10.1080/10580530801941058

Badami, A. (2019) Gibellina, la città che visse due volte, FrancoAngeli, Milano.

Bădîrcea, R. M., Doran, N. M., Manta, A. G., & Cercel, C. (2025). Do European Social Funds Matter in Achieving the Sustainable Development Goals? *Sustainability*, *17*(2), 381. https://doi.org/10.3390/su17020381

Baldwin, J. R., & Dixon, J. (2008). Infrastructure capital: What is it? Where is it? How much of it is there? *Canadian Productivity Review Research, 16*. https://ssrn.com/abstract=1507883 or http://dx.doi.org/10.2139/ssrn.1507883

Balland, P. A., Boschma, R., Crespo, J., & Rigby, D. L. (2019). Smart specialization policy in the European Union: relatedness, knowledge complexity and regional diversification. Regional studies, 53(9), 1252-1268.

Barca, F., Casavola, P., & Lucatelli, S. (Eds.). (2014, o.l.). *Strategia Nazionale per le Aree interne: definizione, obiettivi, strumenti e governance*. Presidenza del Consiglio dei Ministri, Dipartimento per le politiche di coesione. https://politichecoesione.governo.it/media/2289/numero-31_documenti_2014_aree_interne.pdf

Bastos, J. L., Duquia, R. P., González-Chica, D. A., Mesa, J. M., & Bonamigo, R. R. (2014). Field work I: Selecting the Instrument for Data Collection. Anais Brasileiros de Dermatologia, 89(6), 918–923.

Berkes, F., & Seixas, C. S. (2008, July). Community-based enterprises: The significance of horizontal and vertical institutional linkages. In *th Biennial Conference of the International Association for the Study of the Commons-Governing shared resources: connecting local experience to global challenges*.

Bianchi, C. (2016). *Dynamic performance management*. Springer International Publishing.

Bianchi, C. (2021). Fostering sustainable community outcomes through policy networks: A dynamic performance governance approach. In J. W. Meek (Ed.), *Handbook of collaborative public management* (pp. 349–372). Edward Elgar Publishing.

Bianchi, C. (2022). Enhancing policy design and sustainable community outcomes through collaborative platforms based on a dynamic performance management and governance approach. In B. G. Peters & G. Fontaine (Eds.), *Handbook of policy design* (pp. 407–429). Edward Elgar.

Bianchi, C. (2023). Looking at the impact of collaborative policies on intangibles and outcomes through dynamic performance governance. In Building Collaborative Governance in Times of Uncertainty: Pracademic Lessons from the Basque Gipuzkoa Province (pp. 213-219). Leuven University Press.

Bianchi, C., & Rivenbark, W. (2014). Performance management in local government: The application of system dynamics to promote data use. *International Journal of Public Administration, 37*(13), 945–954.

Bianchi, C., & Noto, G. (2015). Dealing with multi-level governance and wicked problems in urban transportation systems: The case of Palermo Municipality. *Systems, 3*, 62–80.

Bianchi, C., & Tomaselli, S. (2015). A dynamic performance management approach to support local strategic planning. *International Review of Public Administration, 20*(4), 370–385.

Bianchi, C., & Williams, D.W. (2015), “Applying system dynamics modeling to foster a cause-and-effect perspective in dealing with behavioral distortions associated with a

city's performance measurement programs", Public Performance & Management Review, Vol. 38, No. 3, pp. 395-425.

Bianchi, C. Bovaird, T., & Loeffler, E., (2017). Applying a dynamic performance management framework to wicked issues: How coproduction helps to transform young people's services in Surrey County Council, UK. International Journal of Public Administration, 40 (10), 833–846.

Bianchi, C., Winch, G., & Cosenz, F. (2018). Experimenting lean dynamic performance management systems design in SMEs. International Journal of Productivity and Performance Management, 67(7), 1234-1251.

Bianchi, C., & Vignieri, V. (2020), "Dealing with "abnormal" business growth by leveraging local area common goods: An outside-in stakeholder collaboration perspective", International Journal of Productivity and Performance Management, Vol. 70, No. 3, pp. 613-634

Bianchi, C., Bereciartua, P., Vignieri, V., & Cohen, A. (2021). Enhancing urban brownfield regeneration to pursue sustainable community outcomes through dynamic performance governance. *International Journal of Public Administration, 44*(2), 100–114. https://doi.org/10.1080/01900692.2020.1739077

Bianchi, C., Nasi, G., & Rivenbark, W. C. (2021). Implementing collaborative governance: Models, experiences, and challenges. *Public Management Review, 23*(11), 1581–1589. https://doi.org/10.1080/14719037.2021.1878777

Bianchi, C., & Grippi, N. (2025). Developing collaborative ecosystem platforms to trigger sustainable "place-based" value creation: a dynamic performance governance approach. International Journal of Productivity and Performance Management, 74(3), 1052-1078.

Biermann, F., Hickmann, T., Sénit, C. A., Beisheim, M., Bernstein, S., Chasek, P., ... & Wicke, B. (2022). Scientific evidence on the political impact of the Sustainable Development Goals. Nature sustainability, 5(9), 795-800.

Bilsky, E., Moreno, A. C., & Fernández Tortosa, A. (2021). Local Governments and SDG Localisation: Reshaping Multilevel Governance from the Bottom up. Journal of Human Development and Capabilities, 22(4), 713-724.

Bouckaert, G., & Halligan, J. (2007). Managing Performance: International Comparisons. New York, Routledge

Boulding, K. E. (2013). The economics of the coming spaceship earth. In Environmental quality in a growing economy (pp. 3-14). RFF Press.

Bovaird, T. (2007). Beyond engagement and participation: User and community coproduction of public services. *Public Administration Review, 67*(5), 846–860. https://doi.org/10.1111/puar.2007.67.issue-5

Boyle, L., Michell, K., & Viruly, F. (2018). A critique of the application of neighborhood sustainability assessment tools in urban regeneration. *Sustainability, 10*(4), 1005.

Brookfield Institute. (2018). *Exploring policy innovation: Tools, techniques + approaches*. https://brookfieldinstitute.ca/wp-content/uploads/BrookfieldInstitute-PIP-Landscape.pdf

Bryson, J., Crosby, B., & Stone, M. (2006). The design and implementation of cross-sector collaborations: Propositions from the literature. Public Administration Review, 66, 1, 44–55.

Bryson, J. M., Crosby, B. C., & Bloomberg, L. (2014). Public value governance: Moving beyond traditional public administration and the new public management. *Public Administration Review, 74*(4), 445–456.

Bryson, J. M., Crosby, B. C., & Stone, M. M. (2015). Designing and Implementing Cross-Sector Collaborations: Needed and Challenging. Public Administration Review, 75(5), 647–663.

Bryson, J., Sancino, A., Benington, J., & Hartley, J. (2017). Towards a multi-actor theory of public value co-creation. *Public Management Review, 19*(5), 640–654.

Burford, G., Hoover, E., Velasco, I., Janoušková, S., Jimenez, A., Piggot, G., ... & Harder, M. K. (2013). Bringing the "missing pillar" into sustainable development goals: Towards intersubjective values-based indicators. Sustainability, 5(7), 3035-3059.

Busco, C., & Quattrone, P. (2018). Performing business and social innovation through accounting inscriptions: An introduction. Accounting, Organizations and Society, 67, 15-19.

Butera, F. M. (2023). The ecological transition of cities. Rivista Tema, 09(01). https://doi.org/10.30682/tema0901a

Cashman, S. B., Adeky, S., Allen III, A. J., Corburn, J., Israel, B. A., Montaño, J., ... & Eng, E. (2008). The power and the promise: working with communities to analyze data, interpret findings, and get to outcomes. *American journal of public health*, *98*(8), 1407-1417.

Cepiku, D. (2017). Performance management in public administrations. In T. Klassen, D. Cepiku, & T. J. Lah (Eds.), *The Routledge handbook of global public policy and administration*. Routledge.

Cersosimo, D., & Teti, V. (2021). Paesi e slogan/La casa a 1 EURO. *Doppiozero.com*. https://www.doppiozero.com/la-casa-1-euro

Chakraborty, N., Lukovnikov, D., Maheshwari, G., Trivedi, P., Lehmann, J., & Fischer, A. (2021). Introduction to neural network-based question answering over knowledge graphs. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 11*(3), e1389. https://doi.org/10.1002/widm.1389

Chandak, P., Huang, K., & Zitnik, M. (2023). Building a knowledge graph to enable precision medicine. *Scientific Data, 10*(1), 67. https://doi.org/10.1038/s41597-023-01974-1

Chen, B., Bianchi, C., & Yu, J. (2023). Resilient urban governance: adaptation and innovation in the face of the Coronavirus pandemic. Urban Governance, 3(1), 1. https://doi.org/10.1016/j.ugj.2023.01.003

Chen, H., Sultan, S. F., Tian, Y., Chen, M., & Skiena, S. (2019). Fast and accurate network embeddings via very sparse random projection. In *Proceedings of the 28th ACM International Conference on Information and Knowledge Management* (pp. 399–408). https://doi.org/10.1145/3357384.3358023

Christensen, T., & Fimreite, A. L. (2006). Reform of the Employment and Welfare Administrations – the Challenges of Co-ordinating Diverse Public Organizations. 32.

Coda, V. (2010). *Entrepreneurial values and strategic management: essays in management theory*. Springer.

Comune di Sambuca di Sicilia. (2020). *Bando case a 1€*. https://www.servizipa.cloud/comuni/img/comune/allegato/PDAL_12217_0_20200806224509.pdf

Conteh, C., and Harding, B. (2023), "Boundary-spanning in public value co-creation through the lens of multilevel governance", Public Management Review, Vol. 25, No. 1, pp. 104-128.

Cooper, T. L., Gulick, L., (1984). Citizenship and Professionalism in Public Administration. Public Administration Review, Vol. 44, Special Issue: Citizenship and Public Administration, pp. 143-151. DOI: 10.2307/977223

Cooper, T. L., Bryer, T. A., Meek, J. W., (2006). Citizens-Centred Collaborative Public Management. Public Administration Review, special issue, 76-88. DOI: 10.1111/j.1540-6210.2006. 00668.x

Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT-enabled public sector reforms: A theoretical reflection. *Government Information Quarterly, 29*(4), 512–520.

Cosenz, F., & Noto, L. (2015). Combining system dynamics modelling and management control systems to support strategic learning processes in SMEs: A dynamic performance management approach. *Journal of Management Control, 26*, 225–248.

Craven, L., Dickinson, H., & Carey, G. (Eds.). (2018). Crossing boundaries in public policy and management: Tackling the critical challenges. Routledge.

Crosby, B. C., & Bryson, J. M. (2005). A leadership framework for cross-sector collaboration. Public management review, 7(2), 177-201.

Crosby, B. C., & Bryson, J. M. (2010). Integrative leadership and the creation and maintenance of cross-sector collaborations. The Leadership Quarterly, 21(2), 211–230. doi:10.1016/j.leaqua.2010.01.003

Crosby, B. C., 't Hart, P., & Torfing, J. (2017). Public value creation through collaborative innovation. *Public Management Review, 19*(5), 655–669.

Cui, T., & Osborne, S. (2018). Building public values through cross-sector collaboration: One possibility of creating public value. Paper presented at the *XXII IRSPM Annual Conference*, 11–13 April, 2018.

Czaja, R., & Blair, J., (2005). Designing Surveys: A Guide to Decisions and Procedures. Sage Publications: Pine Forge Press.

Dale, A. (2007). *At the edge: Sustainable development in the 21st century* (Vol. 6). UBC press.

Daly, H. E. (1973). Toward a steady-state economy. (No Title).

Davis, P., & West, K. (2009). What do public values mean for public action? Putting public values in their plural place. *The American Review of Public Administration, 39*(6), 602–618. https://doi.org/10.1177/0275074008328499

Daviter, F. (2017). Coping, taming or solving: alternative approaches to the governance of wicked problems. Policy Studies, 38(6), 571-588.

Davoodi, H., Ter-Martirosyan, A., & Montiel, M. P. J. (2021). Macroeconomic stability and inclusive growth (No. 2021/081). International Monetary Fund.WCED, 1987, Report of the World Commission on Environment and Development: Our Common Future, UN Doc. A/42/427, 4 agosto 1987.

Delon, M., & Graziano, T. (2023). L'iniziativa "case a un euro" contro la marginalità territoriale in Italia: mercificazione o rivitalizzazione? *Bollettino della Società Geografica Italiana, 4*(6[1]).

Dentoni, D., Bitzer, V., & Schouten, G. (2018). Harnessing wicked problems in multi-stakeholder partnerships. Journal of Business Ethics, 150(2), 333-356.

Dibsi, J., & Cho, J. (2023). Data management for environmentally sustainable and profitable business: Evidence from the food retail industry. *Sustainability, 15*(23), 16298. https://doi.org/10.3390/su152316298

Emerson, K., & Nabatchi, T. (2015). Evaluating the productivity of collaborative governance regimes: A performance matrix. Public Performance and Management Review. doi:10.1080/15309576.2015.1031016

European Commission. (2011). *EU framework programme for research and innovation – Horizon 2020 (COM 808)*.

European Commission. (2017). Commission Decision of 22 May 2017 on setting up the multi-stakeholder platform on the implementation of the Sustainable Development Goals in the EU. Retrieved from: https://commission.europa.eu/system/files/2017-06/commission-decision-22_may-on-sdg-stakeholder-platform_en.pdf

European Commission (2019). *Reflection Paper – Towards a Sustainable Europe by 2030* (COM(2019) 22). Brussels, 30 January 2019.

European Commission (2020). European Handbook for SDG Voluntary Local Reviews – Introduction (JRC). Retrieved from: https://sdgs.un.org/partnerships/handbook-local-sdg-monitoring-europe#:~:text=practical%20activities%20that%20are%20part,at%20all%20levels%20of%20governance

European Commission (2021). Horizon Europe – What is Horizon Europe? Retrieved from: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en#:~:text=It%20tackles%20climate%20change%2C%20helps,the%20EU%E2%80%99s%20competitiveness%20and%20growth

European Commission. (2023). Erasmus+ Programme Guide 2024. Publications Office of the European Union. Retrieved from: https://erasmus-

plus.ec.europa.eu/sites/default/files/2023-11/2024-Erasmus%2BProgramme-Guide_EN.pdf

European Commission (2024). Cohesion Policy supports progress towards sustainable development goals – Panorama Magazine, June 2024,

European Foundation for the Improvement of Living and Working Conditions. (2016). *European Quality of Life Survey*. https://www.eurofound.europa.eu/publications/report/2017/fourth-european-quality-of-life-survey-overview-report

EY. (2017). *Public sector innovation: From ideas to actions*. https://assets.ey.com/content/dam/ey-sites/ey-com/en_ca/topics/government-and-public-sector/ey-innovation-public-sector-en.pdf

Farazmand, A. (Ed.). (2023). *Global encyclopedia of public administration, public policy, and governance*. Springer Nature.

Fehling, M., Nelson, B. D., & Venkatapuram, S. (2013). Limitations of the Millennium Development Goals: a literature review. Global public health, 8(10), 1109-1122.

Ferreira, A., and Otley, D. (2009), "The design and use of performance management systems: An extended framework for analysis", Management Accounting Research, Vol. 20, No. 4, pp. 263-282.

Ferreri, F. (2018). *Coscienza di luogo e sviluppo locale: Analisi su Sambuca di Sicilia*. Giuseppe Maimone Editore.

Ferreri, F. (2021a). Place awareness and community tourism: The case of Sambuca di Sicilia. In F. Grasso & B. S. Sergi (Eds.), *Tourism in the Mediterranean Sea: An Italian perspective* (pp. 75–91). Emerald Publishing.

Ferreri, F. (2021b). *Case a 1 € nei borghi d'Italia. Sambuca di Sicilia: Un esempio di successo nel governo del territorio*. Flaccovio Editore.

Ferreri, F. (2022). Riconoscere e promuovere una nuova visione dello sviluppo locale: Il Biodistretto "Borghi Sicani". *Culture della sostenibilità, 29*(1).

Fischer, F., (1993). Citizen Participation and the Democratization of Policy Expertise: From Theoretical Inquiry to Practical Cases. Policy Sciences 26 (3), 165–187.

Fischer, G. (2001). Communities of interest: Learning through the interaction of multiple knowledge systems. In *Proceedings of the 24th IRIS Conference* (Vol. 1, pp. 1-13). Department of Information Science, Bergen.

Forrester, J., (1961). Industrial Dynamics, M.I.T. Press, Boston

Forrester, J., (1969). Urban Dynamics, M.I.T. Press, Boston

Forrester, J., (1992). Policies, decisions and information sources for modeling. In Morecroft, J. D., & Sterman, J. D. (Eds.) (1994). Modeling for learning organizations.

Fotopoulou, E., Ioannidis, L., Papakonstantinou, K., & Charalabidis, Y. (2022). SustainGraph: A knowledge graph for tracking the progress and the interlinking among the Sustainable Development Goals' targets. *Frontiers in Environmental Science, 10*, 2175. https://doi.org/10.3389/fenvs.2022.867369

Fox, S., & Macleod, A. (2023). Localizing the SDGs in cities: reflections from an action research project in Bristol, UK. Urban Geography, 44(3), 517-537.

Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). Stakeholder theory: The state of the art.

Fryer, K., Antony, J., & Ogden, S. (2009). Performance management in the public sector. *International Journal of Public Sector Management, 22*(6), 478–498. https://doi.org/10.1108/09513550910982850

Galluzzo, Y. (2022). A review: Biological insights on knowledge graphs. In S. Chiusano et al. (Eds.), *New Trends in Database and Information Systems: ADBIS 2022 Short Papers, Doctoral Consortium and Workshops* (pp. 388–399). Springer. https://doi.org/10.1007/978-3-031-15743-1_36

Galluzzo, Y., & Gennusa, F. (2023). Knowledge graphs embeddings for link prediction in the context of sustainability. In European Conference on Advances in Databases and Information Systems (pp. 452-464). Cham: Springer Nature Switzerland.

Ghaffarzadegan, N., Lyneis, J., & Richardson, G. P. (2011). How small system dynamics models can help the public policy process. *System Dynamics Review, 27*(1), 22–44. https://doi.org/10.1002/sdr.442

Giordano, S. (2020). Agrarian landscapes: From marginal areas to cultural landscapes—Paths to sustainable tourism in small villages—The case of Vico del Gargano in the club of the Borghi più belli d'Italia. *Quality & Quantity, 54*, 1725–1744. https://doi.org/10.1007/s11135-019-00939-w

Grippi, N. (2023). Tackling Social Exclusion In Peripheric City Neighborhoods Through Holistic Societal Transition: A Dynamic Performance Governance Approach An application to the cities of Palermo and Baltimore.

Grover, A., & Leskovec, J. (2016). node2vec: Scalable feature learning for networks. In *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (pp. 855–864). https://doi.org/10.1145/2939672.2939754

Guba, E. G. & Lincoln. Y.S. (1989). What is this constructivist paradigm anyway? In fourth generation evaluation. London: Sage Publications, 79-90.

Guo, Q., Zhang, S., Yuan, J., Li, Y., & Zhang, M. (2020). A survey on knowledge graph-based recommender systems. *IEEE Transactions on Knowledge and Data Engineering, 34*(8), 3549–3568. https://doi.org/10.1109/TKDE.2020.3008304

Hambleton R. (2020). The Bristol One City Approach to city governance: New Civic Leadership in action, Urban Research & Practice, 13:2, 228-237, DOI: 10.1080/17535069.2020.1752055

Hamilton, W., Ying, R., & Leskovec, J. (2017). Inductive representation learning on large graphs. In *Advances in Neural Information Processing Systems* (Vol. 30). https://proceedings.neurips.cc/paper_files/paper/2017/file/5dd9db5e033da9c6fb5ba83c7a7ebea9-Paper.pdf

Hariram, V., Sudhakar, K., & Singh, R. (2023). Sustainalism: An Integrated Socio-Economic-Environmental Model to Address Sustainable Development and Sustainability. Sustainability, 15(13), 10682.

Head, B. W., & Alford, J. (2015). Wicked problems: Implications for public policy and management. *Administration & Society, 47*(6), 711–739. https://doi.org/10.1177/0095399713481601

Head, B. W. (2022). *Wicked problems in public policy: Understanding and responding to complex challenges*. Palgrave Macmillan.

Hege, E., & Demailly, D. (2018). NGO Mobilisation around the SDGs. IDDRI Study N°01/18. Retrieved from https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Etude/ST0118_EH%20DD_SDGs%20NGOs.pdf

Hein, G. E. (1991). Constructivist learning theory. Institute for Inquiry.

Hickmann, T., Biermann, F., Sénit, C. A., Sun, Y., Bexell, M., Bolton, M., ... & Weiland, S. (2024). Scoping article: Research frontiers on the governance of the Sustainable Development Goals. Global Sustainability, 7, e7.

Hilton, C. E. (2017). The Importance of Pretesting Questionnaires: A Field Research Example of Cognitive Pretesting the Exercise Referral Quality of Life Scale (ER-QLS). International Journal of Social Research Methodology, 20(1), 21–34.

Hospers, G. J., & Reverda, N. (2014). *Managing population decline in Europe's urban and rural areas*. Springer.

Hughes, P. (2010). Paradigms, methods and knowledge. In G. Mac Naughton, S. Rolfe and I. Siraj-Blatchford (Eds.), Doing early childhood research. Maidenhead: Open University Press

Huxham, C., (2003). Theorizing Collaboration Practice. Public Management Review 5 (3), 401–423.

Igalla, M., Edelenbos, J., and van Meerkerk, I. (2021), "Institutionalization or interaction: Which organizational factors help community-based initiatives acquire government support?", Public Administration, Vol. 99, No. 4, pp. 803-831.

Incropera, F. P. (2015). Climate change: a wicked problem: complexity and uncertainty at the intersection of science, economics, politics, and human behavior. Cambridge University Press.

Interact (2024). The future of Interreg: Feedback on co-financing and flexibility (Interreg High-Level Group Paper, 2024).

International Association of Universities (IAU). (1992). Rio Declaration on Environment and Development – Full Text.

ISTAT - Istituto Nazionale di Statistica (2024), Bilancio demografico Sambuca di Sicilia (In English: *Demographic trends in Sambuca di Sicilia)*. https://demo.istat.it/

Johanesova, L. (2024). Impact Of Erasmus+ Youth Exchanges On The Civic Participation In The European Countries1. Ekonomické rozhľady–Economic review, 53(1), 79-92.

Johnson, K. M., & Lichter, D. T. (2019). Rural depopulation: Growth and decline processes over the past century. *Rural Sociology, 84*(1), 3–27.

Joint Research Centre (JRC). *Localising the Sustainable Development Goals (SDG)*. European Commission. Retrieved August 16, 2025, from https://joint-research-centre.ec.europa.eu/projects-and-activities/territorial-development/localisation-sustainable-development-goals-SDG_en

Jönsson, K., & Bexell, M. (2021). Localizing the sustainable development goals: The case of Tanzania. Development Policy Review, 39(2), 181-196.

Kalaycı, T. E., Bricelj, B., Lah, M., Pichler, F., Scharrer, M. K., & Rubeša-Zrim, J. (2021). A knowledge graph-based data integration framework applied to battery data management. *Sustainability, 13*(3), 1583. https://doi.org/10.3390/su13031583

Kalender, M. (2007). Applying the Subject „Cell“ Through Constructivist Approach during Science Lessons and the Teacher“s Journal of Environmental & Science Education 2 (1): 3–13

Kelly, G., Mulgan, G., & Muers, S. (2002). *Creating public value*. Cabinet Office.

Khatri, K. K. (2020). Research paradigm: A philosophy of educational research. International Journal of English Literature and Social Sciences (IJELS), 5(5).

Klijn, E. H., & Koppenjan, J. F. M. (2000). Public management and policy networks: The theoretical foundation of the network approach to governance. *Public Management, 2*, 135–158.

Klijn, E. H. (2008). Governance and governance networks in Europe. *Public Management Review, 10*(4), 505–525.

Klopp, J. M., & Petretta, D. L. (2017). The urban sustainable development goal: Indicators, complexity and the politics of measuring cities. Cities, 63, 92-97.

Knickel, K., Redman, M., Darnhofer, I., Ashkenazy, A., Calvão Chebach, T., Šūmane, S., Tisenkopfs, T., Zemeckis, R., Atkociuniene, V., Rivera, M., Strauss, A., Kristensen, L.S., Schiller, S., Koopmans, M.E., Rogge, E. (2018). Between Aspirations and Reality: Making Farming, Food Systems and Rural Areas More Resilient, Sustainable and Equitable. J. Rural Stud. 59, 197–210.

Kolk, A. (2016). The social responsibility of international business: From ethics and the environment to CSR and sustainable development. Journal of world business, 51(1), 23-34.

Kuhn, T. S. (1962). The structure of scientific revolutions (1st Edn). Chicago, IL: University of Chicago Press

Lægreid, P., & Rykkja, L. H. (2015). Organizing for "wicked problems": Analyzing coordination arrangements in two policy areas—Internal security and the welfare administration. *International Journal of Public Sector Management, 28*(6), 475–493.

Lah, O. (2025). Breaking the silos: integrated approaches to foster sustainable development and climate action. Sustainable Earth Reviews, 8(1), 1.

Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change. Policy sciences, 45(2), 123-152.

Lincoln, Y., & Guba, E. (1985). Naturalistic inquiry. Thousand Oaks, CA: Sage

Lino, B., Contato, A., Ferrante, M., Frazzica, G., Macaluso, L., & Sabatini, F. (2022). Re-inhabiting inner areas triggering new regeneration trajectories: The case study of Sicani in Sicily. *Sustainability, 14*(2), 976. https://doi.org/10.3390/su14020976

Local 2030 Coalition. (2018). Localizing the SDGs: Regional governments paving the way (p. 5). Local2030. Retrieved from https://www.local2030.org/library/473/Localizing-the-SDGs-Regional-Governments-Paving-the-Way.pdf

Mackenzie, N. & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. Issues In Educational Research, 16, 1-1

Madanipour, A. (2012). Neighbourhood Governance. In International Encyclopedia of Housing and Home (pp. 61–66). Elsevier.

Madden, J. R. (2015). The Collaboration Blueprint: Designing and Building Effective Strategies for Innovation and Rejuvenative Collaboration. Case Western Reserve University.

Mansuri, G., & Rao, V. (2012). Localizing development: Does participation work?.

Marín-González, F., Moganadas, S. R., Paredes-Chacín, A. J., Yeo, S. F., & Subramaniam, S. (2022). Sustainable local development: Consolidated framework for cross-sectoral cooperation via a systematic approach. Sustainability, 14(11), 6601.

McLaughlin, K., Osborne, S. P., & Ferlie, E. (Eds.). (2002). *New public management: Current trends and future prospects*. Psychology Press.

Melin M, Lieblein G, Breland TA and Francis C. Facilitating transformative innovations in sustainability education [version 2; peer review: 2 approved]. Open Res Europe 2022, **2**:22 (https://doi.org/10.12688/openreseurope.14407.2)

Menghwar, P. S., & Daood, A. (2021). Creating shared value: A systematic review, synthesis and integrative perspective. International Journal of Management Reviews, 23(4), 473-497.

Mertens, D. M. (2010). Transformative Mixed Methods Research. Qualitative Inquiry 16(6), pp. 469–474. Retrieved from: http://qix.sagepub.com.

Mikolov, T., Grave, E., Bojanowski, P., Puhrsch, C., & Joulin, A. (2017). Advances in pretraining distributed word representations. *arXiv preprint*. arXiv:1712.09405.

Mintrom, M. (1997). The state–local nexus in policy innovation diffusion: The case of school choice. *Publius: The Journal of Federalism, 27*(3), 41–60.

Moore, M. H. (1997). *Creating public value: Strategic management in government*. Harvard University Press.

Moore, M. H. (2014). Public value accounting: Establishing the philosophical basis. *Public Administration Review, 74*(4), 465–477.

Morecroft, J. D. W., & Sterman, J. (2000). Modeling for learning organizations. Taylor & Francis.

Morecroft, J. D. W. (2015). Strategic modelling and business dynamics: A feedback systems approach. Wiley.

Moreno-Luzón, M. D., Chams-Anturi, O., & Escorcia-Caballero, J. P. (2018). Organizational legitimacy and stakeholder trust in the organization: A feed-forward relationship. In E. Díez-De-Castro & M. Peris-Ortiz (Eds.), *Organizational legitimacy* (pp. 235–252). Springer. https://doi.org/10.1007/978-3-319-75990-6_18

Muntean, M. (2018). Business intelligence issues for sustainability projects. *Sustainability, 10*(2), 335. https://doi.org/10.3390/su10020335

Neumann, O., Matt, C., Hitz-Gamper, B. S., Schmidthuber, L., & Stürmer, M. (2019). Joining forces for public value creation? Exploring collaborative innovation in smart city initiatives. *Government Information Quarterly, 36*(4), 101411.

Neumayer, E. (2003). The determinants of aid allocation by regional multilateral development banks and United Nations agencies. International Studies Quarterly, 47(1), 101-122.

Newman, O. Community of interest. *Society* 18, 52–57 (1980). https://doi.org/10.1007/BF02694845

Nilsson, M., & Weitz, N. (2019). Governing trade-offs and building coherence in policy-making for the 2030 agenda. Politics and Governance, 7(4), 254-263.

Nogueiro, T., Saraiva, M., Jorge, F., & Chaleta, E. (2022). The Erasmus+ Programme and Sustainable Development Goals - Contribution of mobility actions in higher education. Sustainability, 14(3), 1628.

Nonet, G. A. H., Gössling, T., Van Tulder, R., & Bryson, J. M. (2022). Multi-stakeholder engagement for the sustainable development goals: introduction to the special issue. Journal of Business Ethics, 180(4), 945-957.

Noto, G., Noto, L., (2019). Local Strategic Planning and Stakeholder Analysis: Suggesting a Dynamic Performance Management Approach. Public Organization Review, 19, 292-310.

Noto, G. (2020). *Strategic planning for urban transportation: A dynamic performance management approach* (Vol. 3). Springer International Publishing. https://doi.org/10.1007/978-3-030-36883-8

OECD (2017), Systems Approaches to Public Sector Challenges: Working with Change, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264279865-en

OECD (2020). Strengthening Governance of EU Funds under Cohesion Policy. OECD Report, Paris.

Oksanen, K. and Hautamäki, A., 'Transforming regions into innovation ecosystems: A model for renewing local industrial structures', The Innovation Journal: The Public Sector Innovation Journal, Vol. 19, Issue 2, 2014.

Omong, M. D. (2021). *Enhancing collaborative governance to build active citizenship through social inclusion in historical neighborhood regeneration: A dynamic performance governance approach* [Doctoral dissertation, University of Palermo].

Oosterhof, P. D. (2018). *Localizing the sustainable development goals to accelerate implementation of the 2030 agenda for sustainable development*. UNDP.

Osborne, S. P. (2021). *Public service logic: Creating value for public service users, citizens, and society through public service delivery*. Routledge, New York.

Osborne, S. P., Nasi, G., & Powell, M. (2021). Beyond co-production: Value creation and public services. *Public Administration, 99*(4), 641–657.

Ostrom, E. (1996). Crossing the great divide: Coproduction, synergy, and development. World development, 24(6), 1073-1087.

Otley, D. (1999). Performance management: A framework for management control systems research, Management Accounting Research, 10, 10, 363–382.

Otley, D. (2012). Performance management under conditions of uncertainty: Some valedictory reflections. Pacific Accounting Review, 24 (3), 247–261. DOI: 10.1108/01140581211283869

Ottomano Palmisano, G., Sardaro, R., & La Sala, P. (2022). Recovery and Resilience of the Inner Areas: Identifying Collective Policy Actions through PROMETHEE II. Land, 11(8), 1181, https://doi.org/10.3390/land11081181

Pellicano, A. (2020). La valle del Belìce dopo il terremoto del 1968: Rappresentazione di una complessità territoriale tra nuovi paesaggi, città ricostruite e identità. *Bollettino dell'Associazione Italiana di Cartografia*.

Pera, A. (2021). One house for €1: Case studies on the governance of abandoned properties in small villages. *Global Jurist, 21*(3), 537–560.

Perry, B., Diprose, K., Taylor Buck, N., & Simon, D. (2021). Localizing the SDG in England: Challenges and value propositions for local government. *Frontiers in Sustainable Cities, 3*, 74633. https://doi.org/10.3389/frsc.2021.746336

Peters, B. G. (2010). Meta-governance and public management. In S. P. Osborne (ed.), The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance. London and New York: Routledge, pp. 36–51.

Peters, B. G. (2015). *Pursuing horizontal management*. University Press of Kansas.

Peters, B. G., & Bianchi, C. (2023). Moving away from patronage: A feedback approach. *The American Review of Public Administration, 53*(1), 36–48.

Peters, G. (2017). What is so wicked about wicked problems? A conceptual analysis and a research program. *Policy and Society, 36*(3), 385–396.

Petrini, M., & Pozzebon, M. (2009). Managing sustainability with the support of business intelligence: Integrating socio-environmental indicators and organisational context. *The journal of strategic information systems*, *18*(4), 178-191.

Pfeffer, J., & Salancik, G. R., (2003). The external control of organizations: A resource dependence perspective. Palo Alto, CA: Stanford University Press.

Pidalà A. M., 2023, Analisi del contesto Territoriale, in "Sicani Living Future: Processi di sviluppo incrementale e adattivo nell'orizzonte del 2040" (Eds) Carta, M., Ronsivalle, D., Lino, B., Contato, A., available at: https://iris.unipa.it/retrieve/eea0ae39-bf14-4301-b571-b3fa05788fac/Sicani_future%20-%20living_lab_WEB-v16a_compressed%20%281%29.pdf

Rajala, T., Laihonen, H. and Haapala, P. (2018). Why is dialogue on performance challenging in the public sector?, Measuring Business Excellence, 22(2), 117–129.

Rajala, T., Laihonen, H., & Vakkuri, J. (2020). Exploring challenges of boundary-crossing performance dialogues in hybrids. *Journal of Management and Governance, 24*(3), 799–820. https://doi.org/10.1007/s10997-019-09485-x

Raworth, K. (2017). A Doughnut for the Anthropocene: humanity's compass in the 21st century. The lancet planetary health, 1(2), e48-e49.

Rhodes, R. A. W. (1996). The new governance: governing without government. Political studies, 44(4), 652-667.

Rhodes, R. A. W. (2017). *Network governance and the differentiated polity* (Vol. 1). Oxford, UK: Oxford University Press. doi:10.1093/oso/9780198786108.001.0001

Rich, M., & Ginsburg, K. R. (1999). The Reason and Rhyme of Qualitative Research: Why, when, and how to Use Qualitative Methods in the Study of Adolescent Health. Journal of Adolescent Health, 25(6), 371–378.

Rissola, G. J., & Haberleithner, J. (2020). *Place-based innovation ecosystems. a case-study comparative analysis*.

Ritchey, T. (2013). Wicked problems. Acta morphologica generalis, 2(1).

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy sciences, 4(2), pp. 155-169.

Rizzo, A. (2016). Declining, transition and slow rural territories in southern Italy: Characterizing the intra-rural divides. *European Planning Studies, 24*(2), 231–253.

Roberts, J., Scapens, R., (1985). Accounting systems and systems of accountability—Understanding accounting practices in their organizational contexts. Accounting, Organizations, and Society, 10(4), 443–456.

Roberts, N., (2000). Wicked problems and network approaches to resolution. International Public Management Review, 1(1), pp. 1-19.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., ... & Foley, J. A. (2009). A safe operating space for humanity. nature, 461(7263), 472-475.

Roman, M., Varga, H., Cvijanovic, V., & Reid, A. (2020). Quadruple Helix models for sustainable regional innovation: Engaging and facilitating civil society participation. *Economies*, *8*(2), 48.

Romero, D., & Molina, A. (2011). Collaborative networked organisations and customer communities: value co-creation and co-innovation in the networking era. Production Planning & Control, 22(5-6), 447-472.

Rossitti, M., Dell'Ovo, M., Oppio, A., Torrieri, F., (2021). The Italian National Strategy for Inner Areas (SNAI): A Critical Analysis of the Indicator Grid. Sustainability, 13, 6927.

Rust, B., & Rust, S. (2024). Place-based innovation for sustainable and resilient human systems. *Sustainable Earth Reviews*, *7*(1), 19.

Ryen, A. (2004). Ethical issues. Qualitative research practice, 230-247.

Sachs, J. (2015). By separating nature from economics, we have walked blindly into tragedy. The Guardian, 10, 03-15.

Sachs, J.D., Lafortune, G., Fuller, G. (2024). The SDGs and the UN Summit of the Future. Sustainable Development Report 2024. Paris: SDSN, Dublin: Dublin University Press. doi:10.25546/108572

Salmon, P. M., Read, G. J. M., Thompson, J., McLean, S., & McClure, R. (2020). Computational modelling and systems ergonomics: a system dynamics model of drink driving-related trauma prevention. *Ergonomics*, *63*(8), 965–980. https://doi.org/10.1080/00140139.2020.1745268

Salvador, M., & Sancho, D. (2021). The role of local government in the drive for sustainable development public policies: An analytical framework based on institutional capacities. *Sustainability, 13*(11), 5978. https://doi.org/10.3390/su13115978

Sancino, A. (2016). The meta co-production of community outcomes: Towards a citizens' capabilities approach. Voluntas: International Journal of Voluntary and Nonprofit Organizations, 27, 409-424

Sanz Corella, B., Nicolas, J., & Veldkamp, T. (2020). Civil Society and the 2030 Agenda - An Initial Study. European Commission.

Saraiva, M., Nogueiro, T., Jorge, F., & Chaleta, E. (2022). Erasmus and international credit mobility in a contribution to the sustainable development goals associated with quality education and reducing inequalities. IJAEDU-International E-Journal of Advances in Education, 8(23), 149-162.

Satheesh, S.A., van Meerkerk, I., Verweij, S., Busscher, T., and Arts, J. (2022), "Enabling boundary spanners in public–private collaboration: The impact of support and role autonomy on reducing role stress, Public Administration. https://doi.org/10.1111/padm.12927.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2012). Research Methods for Business Students (6th ed). Pearson.

Schneider, P., Schopf, T., Vladika, J., Galkin, M., Simperl, E., & Matthes, F. (2022). A decade of knowledge graphs in natural language processing: A survey. *arXiv preprint*. arXiv:2210.00105.

Segal, L. J., Griepink, M., Boschetti, A., Marchioni, M., Vilajosana Guillén, X., Riera Duran, M., & Lupiáñez-Villanueva, F. (2025). Exploring synergies between Horizon Europe and the EU Cohesion Policy. Policy Department for Transformation, Innovation and Health, European Parliament.

Shao, B., Li, X., & Bian, G. (2021). A survey of research hotspots and frontier trends of recommendation systems from the perspective of knowledge graph. *Expert Systems with Applications, 165*, 113764. https://doi.org/10.1016/j.eswa.2020.113764

Smith, J., & Rossi, L. (2024). Breaking the silos: Integrated approaches to foster sustainable governance. Sustainable Earth Reviews, 7(1).

Sørensen, E., & Torfing, J. (2009). Making governance networks effective and democratic through metagovernance. Public administration, 87(2), 234-258.

Sørensen, E., & Torfing, J. (2019). Designing institutional platforms and arenas for interactive political leadership. Public Management Review, 21(10), pp. 1443-1463

Sotarauta, M., & Mustikkamäki, N. (2015). Institutional entrepreneurship, power, and knowledge in innovation systems: institutionalization of regenerative medicine in Tampere, Finland. *Environment and Planning C: Government and Policy*, *33*(2), 342-357.

Spicer, M. W. (2010). In defense of politics in public administration: A value pluralist perspective. University of Alabama Press.

Stephens, A., Lewis, E. D., & Reddy, S. (2018). Towards an inclusive systemic evaluation for the SDGs: Gender equality, environments and marginalized voices (GEMs). Evaluation, 24(2), 220-236.

Sterman, J. D. (1994). Learning in and about complex systems. *System dynamics review*, *10*(2-3), 291-330.

Sterman, J.D., (2000). *Business Dynamics: System Thinking and Modelling for a Complex World.* McGraw-Hill

Stiglitz, J. E., Sen, A., & Fitoussi, J. P. (2009, September). Report by the commission on the measurement of economic performance and social progress.

Strategia Area Interna Sicani, 2020, available at: https://www.agenziacoesione.gov.it/wp-content/uploads/2020/12/Sicilia-Strategia-Terre-Sicane-Maggio_2020.pdf

Strokosch, K & Osborne, SP 2020, 'Co-experience, co-production and co-governance: an ecosystem approach to the analysis of value creation', Policy and Politics, vol. 48, no. 3, pp. 425-442. https://doi.org/10.1332/030557320X15857337955214

Stuart, E., & Samman, E. (2017). Defining 'leave no one behind'. ODI Briefing Note. London: Overseas Development Institute.

Sultana, N., & Turkina, E. (2023). Collaboration for Sustainable Innovation Ecosystem: The Role of Intermediaries. *Sustainability*, *15*(10), 7754. https://doi.org/10.3390/su15107754

Sun, Y., Liu, H., Gao, Y., & Zheng, M. (2023). Research on the policy analysis of sustainable energy based on policy knowledge graph technology: A case study in China. *Systems, 11*(2), 102. https://doi.org/10.3390/systems11020102

Swain, R. B. (2018). A critical analysis of the Sustainable Development Goals. Handbook of sustainability science and research, 341-355.

Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. SSRN Electronic Journal.

Tan, Q., Wu, F., Zhang, X., Tang, J., & Xie, X. (2020). Learning to hash with graph neural networks for recommender systems. In *Proceedings of The Web Conference 2020* (pp. 1988–1998). https://doi.org/10.1145/3366423.3380250

Teherani, A., Martimianakis, T., Stenfors-Hayes, T., Wadhwa, A., & Varpio, L. (2015). Choosing a Qualitative Research Approach. Journal of Graduate Medical Education, 7(4), 669–670. https://doi.org/10.4300/JGME-D-15-00414.1

Thomson, A. M., Perry, J. L., & Miller, T. K. (2009). Conceptualizing and measuring collaboration. Journal of Public Administration Research and Theory, 19(1), pp. 23–56. doi:10. 1093/jopart/mum036

Torfing, J., & Ansell, C. (2017). Strengthening political leadership and policy innovation through the expansion of collaborative forms of governance. *Public Management Review, 19*(1), 37–54.

Turcotte-Tremblay, A.-M., & Mc Sween-Cadieux, E. (2018). A Reflection on the Challenge of Protecting Confidentiality of Participants while Disseminating Research Results Locally. BMC Medical Ethics, 19(S1), 45.

Turner, J. R., & Baker, R. M. (2019). Complexity Theory: An Overview with Potential Applications for the https://doi.org/10.3390/systems7010004

UN Global Compact. (2024). Policy Enablers for Private Sector SDG Acceleration. Retrieved from https://unglobalcompact.org/library/6239

UNDP. (2023). Challenges in reporting progress on the 2030 Agenda at local levels. United Nations Development Programme. Retrieved from https://www.undp.org/sites/g/files/zskgke326/files/2023-09/undp-challenges-in-reporting-progress-on-the-2030-agenda-at-local-levels.pdf

UNEP (1972), https://www.ipcc.ch/apps/njlite/srex/njlite_download.php?id=6471

Ungar, M. (Ed.), (2011). The social ecology of resilience: A handbook of theory and practice. Springer Science & Business Media.

UN-Habitat (2015). Localizing the post-2015 development agenda. New York: United Nations. Available at: https://www.uclg.org/sites/default/files/dialogues_on_localizing_the_post 2015_development_agenda.pdf, accessed on 21 May 2025. UN-WCED-United Nations World Commission on Environment and Development, (1987), ed.Report of the World

Commission on Environment and Development: Our Common Future. Oxford: Oxford University Press.

UN-Habitat. (2023). Multilevel Governance for SDG Localization: Final Report. UN-Habitat. Retrieved from https://unhabitat.org/sites/default/files/2023/05/mlg_for_sdg_localization_final_report.pdf

United Nations (2016). The SDG Principle of "Leave No One Behind". Available at: https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind

United Nations. (1992a). Report of the United Nations Conference on Environment and Development: Rio Declaration on Environment and Development. A/CONF.151/26 (Vol. I). United Nations, New York.

United Nations. (1992b). Agenda 21: Programme of Action for Sustainable Development. Rio Declaration on Environment and Development. United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, 3–14 June 1992. United Nations, New York.

United Nations. (1995). Report of the World Summit for Social Development: Copenhagen Declaration and Programme of Action. A/CONF.166/9. United Nations, New York.

United Nations. (2000). United Nations Millennium Declaration. Resolution adopted by the General Assembly, A/RES/55/2.

United Nations. (2002). Report of the World Summit on Sustainable Development: Johannesburg Declaration on Sustainable Development and Plan of Implementation. A/CONF.199/20. United Nations, New York.

United Nations. (2012). The Future We Want: Outcome Document of the United Nations Conference on Sustainable Development (Rio+20). A/CONF.216/L.1. United Nations, New York.

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development* (A/RES/70/1). United Nations General Assembly. https://SDG.un.org/2030agenda

Valdecañas, S. F., & Cuyegkeng, M. A. C. (2023). Engaging stakeholders to achieve the SDGs: The case of the province of Bataan. Journal of Management for Global Sustainability, 11(2), 4.

Vaz-Canosa, F. (2021). *Policy innovation by design: Understanding the role of design in the development of innovative public policies* [Doctoral dissertation, Loughborough University]. https://doi.org/10.26174/thesis.lboro.14339249.v1

Veeckman, C., & Temmerman, L. (2021). Urban living labs and citizen science: from innovation and science towards policy impacts. *Sustainability*, *13*(2), 526.

Vehovar, V., Toepoel, V., & Steinmetz, S. (2016). Non-probability sampling (Vol. 1, pp. 329-345). The Sage handbook of survey methods.

Vesto, A. (2014). *I beni. Dall'appartenenza egoistica alla fruizione solidale*. Giappichelli.

Vignieri, V. (2019). Framing the sources of image of a local area through outcome-based dynamic performance management. *Public Organization Review, 19*(2), 249–271. https://doi.org/10.1007/s11115-018-0402-1

Vignieri, V. (2022). *Enhancing performance regimes to enable outcome-based policy analysis in cross-boundary settings: A dynamic performance management approach* (Vol. 6). Springer Nature.

Vignieri, V. (2023). Active community for climate change: A dynamic performance governance analysis of a biodiversity preservation program. *Sustainability Accounting, Management and Policy Journal, 14*(6), 1150–1182.

Vignieri, V., & Grippi, N. (2024). Fostering the "Performativity" of Performance Information Use by Decision-Makers through Dynamic Performance Management: Evidence from Action Research in a Local Area. Systems, 12(4), 115. https://doi.org/10.3390/systems12040115

Waage, J., Banerji, R., Campbell, O., Chirwa, E., Collender, G., Dieltiens, V., ... & Unterhalter, E. (2010). The Millennium Development Goals: a cross-sectoral analysis and

principles for goal setting after 2015: Lancet and London International Development Centre Commission. The lancet, 376(9745), 991-1023.

Wenger, E., Trayner, B., & De Laat, M. (2011). Promoting and assessing value creation in communities and networks: A conceptual framework.

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., ... & Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data, 3*, 160018. https://doi.org/10.1038/sdata.2016.18

Williams, A., & Blasberg, L. A. (2022). SDG platforms as strategic innovation through partnerships. Journal of Business Ethics, 180(4), 1041-1057.

Williamson B (2015) Governing methods: policy innovation labs, design and data science in the digital governance of education, *Journal of Educational Administration and History*, 47(3) 251-271, DOI: 10.1080/00220620.2015.1038693

Wolstenholme, E. F. (1985, July). A methodology for qualitative system dynamics. In Proceedings of the 3rd International Conference of System Dynamics Society, USA. Retrieved from: https://www.researchgate.net/publication/244958745_A_Methodology_for_Qualitative_System_Dynamics.

Wood, D., & Gray, B., (1991). Towards a comprehensive theory of collaboration. Journal of Applied Behavioral Science 27: 139–62, doi:10.1177/0021886391272001

Xavier, J.A., & Bianchi, C., (2020). An outcome-based dynamic performance management approach to collaborative governance in crime control: insights from Malaysia. J Manag Gov 24, 1089–1114. https://doi.org/10.1007/s10997-019-09486-w

Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage.

Zheng, X., Wang, R., Hoekstra, A. Y., Krol, M. S., Zhang, Y., Guo, K., ... & Wang, C. (2021). Consideration of culture is vital if we are to achieve the Sustainable Development Goals. One Earth, 4(2), 307-319.

Zohrabi, M. (2013). Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings. Theory and Practice in Language Studies, 3(2), 254–262.

SITOGRAPHY

https://www.doppiozero.com/la-casa-1-euro

https://www.servizipa.cloud/comuni/img/comune/allegato/PDAL_12217_0_20200806224509.pdf

https://www.eurofound.europa.eu/publications/report/2017/fourth-european-quality-of-life-survey-overview-report

https://assets.ey.com/content/dam/ey-sites/ey-com/en_ca/topics/government-and-public-sector/ey-innovation-public-sector-en.pdf

https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Etude/ST0118_EH%20DD_SDGs%20NGOs.pdf

https://www.local2030.org/library/473/Localizing-the-SDGs-Regional-Governments-Paving-the-Way.pdf

https://www.agenziacoesione.gov.it/wp-content/uploads/2020/12/Sicilia-Strategia-Terre-Sicane-Maggio_2020.pdf

https://www.undp.org/sites/g/files/zskgke326/files/2023-09/undp-challenges-in-reporting-progress-on-the-2030-agenda-at-local-levels.pdf

https://www.ipcc.ch/apps/njlite/srex/njlite_download.php?id=6471

https://www.uclg.org/sites/default/files/dialogues_on_localizing_the_post2015_development_agenda.pdf

APPENDIX – Interview Guide

Dear participant,

This interview is part of a doctoral research project focused on the analysis of the CiD – Innovation Ecosystem Alliance, with particular attention to the relationship between *community of interest* (i.e., a group of actors connected by shared values, goals, or thematic concerns, regardless of their geographic location) and *place-based innovation ecosystem* (i.e., a geographically anchored system where innovation emerges from the interaction among local stakeholders, resources, and institutions within a specific territory).

The goal of this interview is to gather data about how the collaborative approach of the CiD project Alliance may contribute to the Localization of the Sustainable Development Goals, with particular regard to SDG 11 (Sustainable cities and communities) and SDG 17 (Partnership for the Goals). I am very interested in investigating your experiences on how your collaborative approach will create benefits for the socio-economic and ecological aspects of society.

Participation is voluntary. All data collected will be treated anonymously, in compliance with current privacy regulations (GDPR), and used exclusively for research purposes. By participating, you confirm that you understand the purpose of the research and consent to the data processing as described.

**Section A – General Information**

1. Role within the CiD project:

2. Affiliated organization and place of activity:

3. Geographical area of reference (city/region):

4. Stakeholder category (HEIs, VET, Business, PA, NGO, etc.):

5. How long have you been involved in the CiD project?

**Section B – Motivation and Engagement**

6. What were the main reasons that led you to participate in the CiD project?

7. What benefits has your organization gained from the project so far?

8. Would you describe your participation as mainly instrumental (e.g., access to funding, visibility), transformational (e.g., internal capacity, organizational change), or a mix of both? Please explain.

**Section C – Collaboration and Network**

9. How have you collaborated with other partners within the CiD network?

10. Have any meaningful outcomes emerged from these collaborations, such as exchange of knowledge, co-creation, or learning?

11. How do you evaluate the quality and sustainability of the partnerships developed through CiD?

**Section D – Relationship with the Territory (Place-based)**

12. Do you believe that CiD is contributing to lasting, sustainable local value? If yes, in which sectors?

13. What is the potential of CiD to evolve into a fully functioning local innovation ecosystem?

14. How inclusive is the CiD initiative in terms of local stakeholders? Are there any groups you think are underrepresented or not sufficiently involved (e.g., civil society organizations, associations)? What roles could they play in enhancing the project's territorial impact and fostering local ownership?

15. In your opinion, is the CiD network evolving towards a territorially rooted innovation ecosystem, or does it remain primarily a project-based collaboration? Why?

**Section E – Conclusion and Reflections**

16. What do you think will remain after the project is completed?

17. What would you recommend to ensure more inclusive and durable impacts in the territories involved?

18. Would you like to add any further reflections or suggestions?