ALEXANDRU IOAN CUZA
UNIVERSITY of IAȘI

CENTRE FOR EUROPEAN STUDIES
FACULTY OF LAW

A Quadruple Helix smart governance framework through Living Labs

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Introduction to smart governance and the Living Lab model

Governance in smart cities can be understood as a framework of principles designed to guide actions related to the challenges that arise from interactions among public administrations and stakeholders. Good governance, supported by information technology is at the basis for a smart city. The democratic system supports the legal framework that shapes principles of good governance. This framework facilitates citizen collaboration through active participation and engagement. An approach within smart city projects is the establishment of Living Labs (Bifulco et al., 2017).

Living Labs create a user-centered innovation environment, designed to foster innovation in real-life settings. This approach starts by focusing on people's ideas, experiences and knowledge, as well as their everyday needs for support from products, services or applications. By integrating these user-driven factors, Living Labs shape and challenge the development process. User feedback enables technology to be tailored for real-life use and accelerate the innovation lifecycle. This framework also introduces bottom-up, socially-driven policies to complement traditional top-down economic drivers.

In the centre of a living lab there are the processes of collaborative search and shared learning and the collective contribution to societal challenges. In living labs, stakeholders collaboratively learn by exploring the obstacles and opportunities and work together to co-create feasible and effective solutions. Participants in a living labs aim are continuously involved to assess the living lab performance as it evolves, in order to meet the needs and expectations at community level.

Report's objectives and scope:

- → To explore how smart governance can address urban challenges by citizen engagement.
- → To examine the living lab model from the perspective of urban governance as a way to facilitate participative governance.
- → To identify living lab framework in Romania and its relevance to smart governance.

Engagement process of Quadruple Helix stakeholders through a Living Lab model

Identification of stakeholders involved and their role

Public authorities

Public authorities are expected to develop strategic plans that include financial support, policy-making, innovation system assistance and business advisory services to enable active participation, collaboration and transparent decision-making. Public authorities enable the development of policies at national, regional and local levels. Through collaborative spaces and digital tools, public authorities empower stakeholders to take an active role in response to community challenges (González-Martinez et al, 2023).

Private sector

The private sector provides technologies for products and services, such as ICT-based solutions to increase expertise in innovation systems, business clusters or collaborative practices. As business model developers, private sector contributes to transform collaborative network outcomes into concrete solutions for the challenges addressed, developing competencies and process innovations in entrepreneurial ventures.

Academia

Academia provides training and education, as well as access to scientific research, a knowledge generator to reflect on the ongoing socioeconomic changes. It combines and develops different principles of knowledge production and knowledge application in the teaching and research mission, producing and disseminating knowledge within the existing institutional order (Morawska-Jancelewicz, 2022).

NGO/citizens

Civil society facilitate collaboration among stakeholders, contribute to innovative social practices and to creating knowledge and new technological solutions to the community needs. They also co-organize and facilitate collaborative networks, encouraging a proactive commitment towards the society. NGOs further contribute to bridge the gap between citizens and public authorities.

Involvement of stakeholders in the living lab phases

Exploration (needs assessment)

Motivation

Identify the reasons and purpose for establishing the Living Lab and engage Quadruple Helix (4H) stakeholders and define common goals in accordance with each stakeholder's motivation to participate. Discuss and document each stakeholder's interests, values contributions and goals for setting the framework for the collaboration. Consider how new technologies, innovative policies or community-oriented strategies could benefit the lab.

Design and setup the Living Lab activities

Ensure the Living Lab activities address issues that are relevant to all stakeholders (academia, private sector, government, civil society) and take into consideration regulatory, resource or social limitations of each group in order to support the shared goals. Collect data from within each stakeholder group to identify community needs and expectations and inform stakeholders on public perceptions and potential opportunities.

Experimentation (citizen and stakeholder engagement activities, testing and solution design)

Interactions and collaborative dynamics

Ensure that the Living Lab establishes strong connections with external initiatives and encourage co-creation, where participants contribute to setting goals and outcomes. Prioritize actionable steps and ensure they benefit all stakeholders aligned with the overall goals of the Living Lab.

Actions

Initiate activities that keep stakeholders actively involved and provide regular updates and opportunities to contribute help maintain engagement of all sectors. Promote the Living Lab's activities through targeted communication strategies that reach the community. Focus on producing products, services or policies that address stakeholders' needs and contribute to the Living Lab's objectives.

Evaluation (feedback collection and impact assessment)

Assess the Living Lab's social, economic and environmental outcomes and ensure that all stakeholders understand the impact of their efforts. Solicit regular feedback from stakeholders to identify challenges or areas for improvement, to refine assessment methods, adjust priorities and improve the collaborative process.

Framework for digitalisation and smart governance

Technological tools and platforms that facilitate smart governance (IoT, AI, data analytics)

Smart governance relies heavily on digital platforms and tools to enhance citizen engagement, improve service delivery and foster transparency and accountability. These technologies bridge the gap between government agencies, businesses and citizens, making governance more efficient and responsive (Gil et al., 2019; Kankanhalli et al., 2019; López-Quiles & Rodríguez Bolívar, 2018).

- **ICT** is a foundational component of smart governance. E-government portals allow citizens to access services online, report issues and provide feedback, which enhances public service accessibility and efficiency. Additionally, some public administration use social media and mobile applications for real-time communication and citizen feedback on policies and services. Through these channels, governments increase transparency and public awareness, making information more accessible and fostering an open relationship with citizens.
- **Digital media and e-participation platforms** are also essential in smart governance systems, as they empower citizens to contribute directly to city planning and policies. Through these platforms, citizens can share ideas, report issues and participate in government initiatives. **Open data portals** are another digital asset, providing public access to government data, which supports transparency and enables stakeholders (citizens, businesses, researchers), to make data-driven decisions and propose solutions.
- **The internet of things (IOT)** and **Artificial Intelligence** have become transformative in data-driven smart governance. IoT devices, such as sensors and cameras, collect data from various settings, including traffic flow and pollution levels. This data is essential for real-time monitoring, resource management and improved public safety. AI provides advanced data analytics, enabling predictive capabilities and automation. AI applications can help predict, for example, infrastructure maintenance needs, optimize energy usage.
- **Collaborative platforms** are key to facilitating engagement among stakeholders. Public consultation websites and crowdsourcing portals enable government collaboration with

stakeholders, aligning diverse urban actors to address shared challenges. These tools are essential in co-creating solutions that reflect the community's needs and enhance the adaptability of governance structures. Through such platforms, smart governance promotes active stakeholder involvement and builds a framework where collaborative problem-solving succeeds.

Public engagement platforms, applications

In the context of smart cities, **public engagement platforms** constitute essential tools for fostering citizen participation, enhancing transparency and enabling collaborative governance. These platforms harness digital technologies to create interactive environments where citizens, public authorities and other stakeholders can collectively address urban challenges. By promoting transparency and inclusivity, these platforms strengthen democratic processes and facilitate data-driven decision-making.

The rise of collaborative public engagement platforms has shifted urban governance towards a more inclusive and open approach. Grounded in open innovation, these platforms empower citizens to actively contribute to the innovation process, from the conception of ideas or solutions to their practical implementation.

Living Labs, widely adopted across Europe, exemplify this collaborative approach by integrating citizen feedback into urban development projects. By positioning citizens as active co-creators in the policy-making process, these platforms harness the collective intelligence and diverse expertise within communities, addressing multifaceted urban issues such as traffic congestion, pollution and economic diversification (Kakderi et al., 2018).

Living lab model in Romania

Legislative/policy framework

The integration of Living Lab model into innvoation and urban development strategies is still emerging in Romania, although a comprehensive legislative or policy framework is not yet established. The adoption of Living Lab framework is progressing through various initiatives, primarily within academic institutions or collaborative projects.

Academic institution based Living Labs

Many Romanian universities have initiated Living Labs that leverage their institutional frameworks for research, student involvement, and community engagement. These labs often

integrate user-centered research and aim to foster interdisciplinary collaboration. Such Living Labs focus on areas like digital innovation, sustainable development, and urban planning, benefiting from the resources and organizational structure of the universities.

- Universitatea de Vest Timișoara hosts a Living Lab focused on integrating STEAM disciplines with social sciences, arts, and digital technologies, using an open-innovation framework.
- Universitatea Alexandru Ioan Cuza din Iași operates Living Labs under the EC2U Virtual Institutes, involving citizens in research around themes like health, well-being, and sustainable urban development.

Project-based Living Labs

Living Labs established as part of specific research or development projects often involve public, private, and academic partnerships. These projects are typically co-funded by national or EU grants and operate under the legal structures of their host organizations, such as research institutions or NGOs. These Living Labs bring together diverse stakeholders, including local communities, to co-design and test solutions in real-world environments.

Collaborative innovation networks and partnerships

Romanian institutions are increasingly engaging in international networks that facilitate cross-border collaboration and knowledge sharing. Participation in networks like the European Network of Living Labs (ENoLL) enables these labs to align with international standards, access best practices, and implement the Living Lab model in alignment with EU innovation frameworks. These networks support collaborative innovation while still operating under the respective national legal frameworks of participating institutions.

Urban development programs

Some Romanian Living Labs are designed as community-centered urban development programs that align with local government initiatives. These labs function as civic engagement platforms where local governments collaborate with universities, private companies, and NGOs to address urban challenges such as transportation, energy efficiency, and public health. These labs operate within municipal regulations, often receiving support from local policies promoting public-private collaboration.

Synergies and cooperation among actors

The Romanian innovation ecosystem is characterised by a dynamic interplay among various actors, including academic institutions, government bodies, private businesses and non-

governmental organisations. This collaborative environment fosters synergies that drive research, development and technological advancement.

- Academic and research institutions play a central role in the innovation landscape. They engage in partnerships with industry and government to facilitate knowledge transfer and commercialisation of research outcomes.
- The public sector contributes significantly to the country’s innovation ecosystem through investments and collaborations. IT companies have partnered with public agencies to enhance operational efficiency.
- The Romanian Government has initiated several programs and strategies to foster collaboration among stakeholders. The National Strategy for Research, Innovation and Smart Specialisation 2022-2027 emphasizes the importance of public-private partnerships and aims to align national research priorities with European Union frameworks to maximise funding and collaborative opportunities.
- Romania's integration into European frameworks enhances its innovation capabilities. Participation in initiatives like the European Network of Living Labs (ENoLL) underscore the country's commitment to collaborative innovation on an international scale.

Added value of digitalisation through Living Lab
Case studies

Normandy Living Lab is the network of living labs in Normandy, supported and run by the Secure Electronic Transactions competitiveness cluster (TES cluster).

Normandy Living Lab's focus is on the efficient development of innovative products and services in the fields of digital agriculture, industry, health, smart territories, and creative digital content, by systematically placing the product or service user at the heart of the innovation process. Thanks to its wide variety of members and its continuous work with local authorities and communities, NLL is building a life-size testing environment covering all of Normandy. That way, it aims at being a vector for the co-creation of digital innovations, between designers and end-users, for a wide number of economic sectors.

Normandy Living Lab is a space and a methodology for testing the uses of an innovation that involves end-user representation.

Testing innovations in everyday life provides an opportunity to:

- finalise products, services or uses;
- reduce the risks involved in bringing them to market;
- identify new usage needs.

The Normandy Living Lab works to:

- setting up experiments in real-life conditions,
- finding partners and testing sites,
- communicating collective successes,
- sharing best practice in new digital uses.

Areas of work: Agriculture & (Agri-)Food, AI and Emerging technologies, Circular Economy, Culture & Creativity (creative sectors), Education and/or vocational training, Energy, Health & Well Being, Industries & Manufacturing, Media, Mobility, Rural, Smart Cities & Regions, SME & Start-ups, Urban.

Contact:

Pôle TES, France

contact@pole-tes.com

https://www.pole-tes.com/projet/normandy-living-lab/

AMS Institute is a public-private institute founded in 2014 by Wageningen University & Research and Delft University of Technology, together with Massachusetts Institute of Technology.

The mission of AMS Institute is to develop a deep understanding of the city – sense the city – to design solutions for its challenges, and integrate these into the city of Amsterdam. Our research portfolio revolves around applied technology in themes such as smart urban mobility, urban energy, climate resilience, metropolitan food systems, circular economy, urban data & intelligence.

AMS Institute ambition is to create sustainable metropolitan solutions by realizing a cross-fertilization of ideas: in our research, innovation and educational activities, but also by creating an innovative environment where connections are made between knowledge institutes, private and public organizations.

AMS Institute research portfolio revolves around six urban challenges that cover the most important urban transitions. We run over 125 research projects. All are defined and executed by interdisciplinary consortia of knowledge institutes, public and private partners, in close collaboration with the City of Amsterdam.

It works based on urban experimentation, collaboration and partnerhsips, citizen engagement, urban data and data visualization.

Contact

AMS Institute

https://www.ams-institute.org/

ROCESP – Living lab for circular economy

ROCESP is a platform set up as a network of networks whose aim is to create a point of national convergence on the initiatives, experiences, critical issues, perspectives and expectations regarding the circular economy that Romania wants and can represent in Europe with one voice, promoting the Romanian way of adapting the economy, also through specific actions dedicated to the economic, social and environmental pillar.

The Institute for Research on Circular Economy and Environment "Ernest Lupan" has founded the ROCESP platform as part of the ASIST project starting in 2019. The platform is financed by the European Social Fund through the Human Capital Operational Program 2014-2020/ POCU/449/4/449/4/16/16/126610, within the ASIST- Social Entrepreneurship and Social Enterprises in Transylvania project.

Objectives:

- Promote the dissemination of knowledge;
- Promote dialog and possible synergies between Romanian actors in the initiatives;
- Map Romanian good practices;
- Promote the integration of initiatives at Romanian level;
- Create a permanent operational tool that can promote and facilitate cross-sectoral dialog and interactions;
- Spreading Romanian excellence and the Romanian way of doing circular economy based on the traditions and typicality of our country and our cultural, social and entrepreneurial models.

The platform includes 8 Advisory groups, 130 Organizations involved, 37 Good practices and 21 Social enterprises.

Contact

The Institute for Research on Circular Economy and Environment "Ernest Lupan"

https://rocesp.ro/

UVT Digital and Green Living Lab

Being a comprehensive University, that encompasses bothSTEAM domains, as well as Social Sciences & Humanities, Culture & Creativity and other associated topics, the West University of Timisoara is the first Romanian University to host a Living Lab. Focusing on meaningful transformation projects that contribute to enhanced community wellbeing, the UVT Digital &

Green Living Lab makes use of digital and green tools for transformation projects, benefitting from the education and research human capital & infrastructure. Contributing to community wellbeing is the ultimate goal of the UVT Digital & Green Living Lab. Along with the dedicated digital (AI, ML, IoT, HPC, Cloud Computing) and green (Circular economy, Renewable energies, Urban gardens and green buildings, Biodiversity and Sustainable Development) tools, health and wellbeing is being addressed by the UVT LL with capabilities related to green jobs & ergonomics, psychotherapy and spiritual wellbeing, physiotherapy and telerehabilitation, sports and healthy lifestyle, nutrition and dietetics, including functional foods and bioactive compounds.

Areas of work: AI and Emerging technologies, Circular Economy, Culture & Creativity (creative sectors), Education and/or vocational training, Energy, Environment/climate change, Gender, Health & Well Being, Media, Mobility, Policies, Regulatory learning, Research, Rural, Smart Cities & Regions, SME & Start-ups, Social Innovation & Inclusion, Soil, Urban, Water (Blue economy), Zero pollution & decarbonization.

Contact

West University from Timișoara, Romania

https://www.uvt.ro/cercetare/cercetare-si-inovare/inovare-si-transfer-tehnologic/living-lab/

Limerick's Citizen Innovation Lab is a place for observation, co-creation and experimentation in the city. It is a collaboration between the University of Limerick, Limerick City and County Council, and the citizens of Limerick, supporting them to work together on a sustainable future for the city.

It is a place where people can help shape a path to a climate neutral Limerick by 2050, guided by the Limerick Climate Action Plan. As a living lab, it leads and supports collaborative research projects, citizen-led initiatives, digital and citizen science tools, and public engagement activities. The shared approach is aligned with the UN Sustainable Development Goals and focuses on areas including decarbonisation, the clean energy transition, climate innovation, digitisation and technology, active travel, and urban development. The Citizen Innovation Lab puts people at the heart of Limerick's climate transition.

Areas of work: Culture & Creativity (creative sectors), Energy, Environment/climate change, Mobility, Policies, Regulatory learning, Research, Smart Cities & Regions, Social Innovation & Inclusion, Urban, Zero pollution & decarbonization.

It includes:

- Citizens' Observatory
- Engagement Hub
- Fab Lab Limerick

Contact

Limerick's Citizen Innovation Lab

https://citizeninnovationlab.ie/

Conclusions and recommendations

The report highlights the critical role of Living Labs as a user-centered, participatory model for driving innovation and addressing urban challenges within the framework of smart governance. By engaging the Quadruple Helix stakeholders—public authorities, private sector, academia, and civil society—Living Labs create a dynamic environment for collaborative problem-solving and co-creation of solutions. The integration of these labs into urban governance processes fosters citizen engagement, strengthens transparency, and supports the development of socially-driven, innovative policies.

In Romania, the adoption of the Living Lab model is still in its nascent stages, with initiatives primarily emerging from academic institutions and project-based collaborations. The lack of a comprehensive legislative or policy framework dedicated to Living Labs, however, poses a challenge to their systematic implementation. Despite this, the participation of Romanian stakeholders in international networks like the European Network of Living Labs and the alignment with EU strategies have demonstrated the potential for scaling these initiatives.

Digital tools and platforms, such as IoT, AI, and e-participation technologies, play a transformative role in supporting Living Labs and enhancing smart governance. These technologies enable real-time data collection, resource optimization, and increased transparency, empowering citizens to actively contribute to urban development processes. Moreover, the synergy between public and private sectors, alongside academic and NGO involvement, underscores the importance of collective action in achieving sustainable and inclusive urban solutions.

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