

Muratori, Simona et al.

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EXPLORING THE PILLARS OF BUSINESS MODELS FOR SMART CITIES AND THEIR APPLICABILITY IN SERBIA

Simona Muratori

POLIEDRA, Politecnico di Milano, Italy

✉ simona.muratori@polimi.it

Irene Bengo

Politecnico di Milano,

Department of Management, Economics and Industrial Engineering, Italy

✉ irene.bengo@polimi.it

Davide Chiaroni

Politecnico di Milano,

Department of Management, Economics and Industrial Engineering, Italy

✉ davide.chiaroni@polimi.it

Vittorio Chiesa

Politecnico di Milano,

Department of Management, Economics and Industrial Engineering, Italy

✉ vittorio.chiesa@polimi.it

Alessandro Luè

POLIEDRA, Politecnico di Milano, Italy

✉ alessandro.lue@polimi.it

Jelena J. Stanković

University of Niš, Faculty of Economics, Serbia

✉ jelena.stankovic@eknfak.ni.ac.rs

Marina Stanojević

University of Niš, Faculty of Economics, Serbia

✉ marina.stanojevic@eknfak.ni.ac.rs

Silvia Pezzoli

POLIEDRA, Politecnico di Milano, Italy

✉ silvia.pezzoli@polimi.it

Luca Tamini

Politecnico di Milano, Department of Architecture and Urban Studies, Italy

✉ luca.tamini@polimi.it

UDC 711.4: 502.131.1 (497.11)	<p>Abstract: This paper focuses particularly on the pillars of business models for smart cities. The paper is based on the project Smart Sustainable District, and outlines the opportunities and limits of the application of certain guidelines in an extra-EU country, Serbia, through the Horizon Europe project UR-DATA. The Smart Sustainable District project started in 2021 and one of its outcomes was the publication of a 'white paper' that aims to describe principles, solutions, tools for the realisation of the SSD model in urban areas, constituting a methodological and operational support to public and private actors involved, for urban transformations in the SSD key.</p>
Review paper	<p>In the paper, objectives, trends, solutions, tools and some good practices are presented for the following three pillars of business models for smart cities:</p> <p>Collaborative models and symbiosis, promoting outcome based PPPP (public-private and people partnership), and sustainable co-production and co-management of both material and immaterial resources and goods.</p> <p>Innovative consumption patterns, including, for instance, attention to sustainability and local needs, sharing practices, collaborative consumption of goods and services, new “prosumption” practices.</p> <p>Modular systems for circular economy, an economy based on the maximization of resources over time through the re-design of both the property concept and products and services through their whole life-cycle, including processes and consumption models. Then, their application in Serbia, specifically/ with a specific analysis of the city of Nis, also comparing, as a benchmark, Italian and Serbian reference strategies and policies.</p>
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1. Introduction

The SSD–Smart Sustainable Districts project, promoted by Politecnico di Milano and coordinated by Consorzio Poliedra, started in 2021 and it involved more than 100 researchers from all the Departments and Consortia of the Politecnico.

The project has aimed at tackling the needs and has intended to suggest actions for the sustainable development, the ecological transition and the enhancement of the resilience of places and communities at a local scale, considering the objectives set by the UN 2030 Agenda, the Green Deal and the Recovery plan for Europe (NextGenerationEU).

The SSD research has defined a series of paths, actions and tools to deal with urban transformations at a local scale, proposing sustainable and smart solutions,

leading to the preparation of a White Paper¹ (in Italian), that aims to draft some practical guidelines to deal with the different phases of urban transformation during regeneration and ecological transition processes. The White Paper gathers technical-scientific approaches with humanistic and social ones, proposing the methods and solutions that work together at different scales, considering material and immaterial assets and suggesting how to direct urban regeneration processes, coordinating different plans and proposing integrated tools.

Although we focus here on business models for smart cities, the other key elements presented in the White Paper (e.g. mobility, social inclusion, financial models, data management) have strong connections with it. In fact, the guidelines and solutions suggested are enabling the birth of economic activities capable of supporting collaboration between the different actors of the city and the transition to virtuous models, green, circular and smart, enhancing local capabilities and resources.

The three pillars of business models discussed in the White Paper are:

- *Collaborative models and symbiosis*. The implementation of new business models for both production and services is the basis for the activation of economic dynamics, substantially renewed in mission and form. Collaboration is deeply integrated in the new models: it is a value for the activities that concern the management of the services, for local economies that can benefit from mechanisms of symbiosis between enterprises and for the greater sustainability of shared management of tangible and intangible assets and resources.
- *Innovative consumption patterns*. Endorsing a more sustainable consumption is an important action to guide production systems and can be achieved by offering and supporting new models to reduce environmental impacts, and by activating new forms of collaboration between different actors involved in the supply chain. These models are based on the interception of local needs and must, at the same time, develop in a network with supra-local consumption systems. Examples can be found in the practices of sharing, in the substitution of the sale of products with the supply of services that guarantee its use (product as a service), and in new “prosumption” practices.
- *Modular systems for circular economy*. Circular economy establishes relationships between the initiatives of reuse and sharing, connected to local trade, to community networks, to the supply chain system at urban or supra-urban scale, related to the supply of products and services and the recovery of end-of-life goods. The implementation of incentive and dialogue mechanisms (e.g. rewards, exchange platforms), as well as models of collaboration between actors working at different scales and in different sectors (production, trade, waste management, etc.), are the key initiatives to support these modular systems.

https://www.poliedra.polimi.it/wp-content/uploads/SSD-SmartSustainableDistricts-LibroBianco_Poliedra-Polimi-1.pdf

In this paper, we present these three pillars, their application in Italy, as well as descriptive insight into the current status, challenges, opportunities, and strategic recommendations for applying smart city concepts in Serbia. The adoption of smart city models in Serbia represents a promising and practical approach to transforming urban areas into efficient, sustainable, and citizen-centric environments. Through strategic planning, international collaboration, citizen participation, and targeted investments, Serbian cities can effectively overcome existing challenges and seize opportunities to significantly improve urban living conditions and achieve sustainable growth.

In Serbia, where urban areas are densely populated and the government is supportive of technological advancements, the applicability of smart city models presents both unique challenges and opportunities. By examining international case studies and adapting their successes to the Serbian setting, this research seeks to contribute valuable insights into the practicalities and strategic planning required to transform Serbian cities into smarter, more efficient, and more sustainable urban environments.

In the context of the City of Niš, the UR-DATA (www.urdataport.com) project holds significant applicability. By focusing on local urban challenges, the project aims to develop data-driven strategies that address issues such as infrastructure optimization, environmental sustainability, and efficient public service delivery. The insights and methodologies derived from UR-DATA are intended to inform policy-making and urban planning in Niš, contributing to the city's transformation into a smarter and more resilient urban environment. Moreover, the project serves as a platform for capacity building within Niš, offering training and development opportunities for researchers, city planners, and policymakers. By leveraging the expertise of international partners, UR-DATA facilitates the adoption of innovative solutions tailored to the specific needs of Niš, thereby enhancing the city's ability to respond to contemporary urban challenges effectively.

2. Collaborative models and symbiosis

A smart sustainable city should support the growth and dissemination of models that include increasing levels of collaboration in the activities and services provided.

The base level is the involvement of stakeholders (both public and private, and third sector) and citizens in the *co-design of services* (Selloni, 2017), and then to support the effective *coproduction* of those services and, therefore, assign roles and tasks in the delivery of the various activities (Bovaird and Loeffler, 2012).

The next level of collaboration is *co-management* (Berkes, 2009), which is the participation of the various actors in the organization of the services itself, with an effective sharing of responsibilities.

The highest level of collaboration is *co-ownership*, in which the various actors come to share the 'ownership' of services (Borroni and van Tulder, 2019). A virtuous collaborative model, therefore, proposes the creation of a *collective subject* that is not only the designer, but also the provider, organizer and owner of a series of services distributed in a district.

Currently, two aspects seem particularly important to develop collaborative models and symbiosis:

- Working for smart neighbourhoods through actions that link the physicality of the context to the production of economic and social advantages. reactivation of common goods (Meroni and Selloni, 2022)
- Innovating models of entrepreneurship that enhance sustainability in the long term (Ben Youssef et al., 2018), transforming opportunities for collaboration into structural initiatives that promote the strengthening of the social and economic fabric. This is also a tool to promote the development of a city inclusive of peripheral areas and the areas with high social need, through an approach that starts from the analysis of the needs of the territory.

2.1. Objectives

- Favour the *sharing of material and immaterial resources* through the co-production and co-management of services;
- Support the *local dimension of collaborative models* to increase their effectiveness and efficiency;
- Promote forms of entrepreneurship and social and inclusive social innovation able to sustain *co-production and co-management* in the long term;
- Promote *PPPP* (public-private and people partnership) based on the outcome based logic

2.2. Solutions and tools

Possible methods of engagement are, for example, founded on a variety of call processes aimed at creating inclusive business projects:

- Call for challenges: a first call with the aim of identifying the main social and environmental challenges of the territory and the related needs through a concerted process with working tables involving different stakeholders.
- Call for impact: a second call aimed at selecting solutions capable of responding to growing needs. The selection of solutions can use crowdsourcing tools and be based on the potential to respond to social needs and generate impact.
- Call for matching: a third call addressed to entrepreneurs and organizations able to develop sustainable business models to market the selected innovative solutions

Ensuring the *regulated sharing of data* has an increasingly strategic role. Data support impact analysis and effectiveness, and assume the effective role of enablers (insights, content...) to allow the building of new digital solutions for citizens and decision-makers. A set of rules, processes and tools for the creation of a Digital Ecosystem for data exchange is needed to ensure a process that simultaneously stimulates the matching of data supply and demand, and at the same time allows the owners of databases not to lose control of it.

Through this collaborative approach, the subjects that co-produce the services make their own data flows accessible to other stakeholders for the development of services, enabling only win-win scenarios (for example integrating mobility and culture). Exploiting information and communication technologies to *foster cooperation between public and private operators* is a key element of collaborative models.

In addition, the smart strategy can and must rely on those resources of creativity and cultural richness that the particular conditions of livability, "slowness" and sustainability of the *local environment* allow to enhance. One possible operational solution could be the implementation of initiatives that *combine the production of new culture to spatial regeneration*. Micro-interventions on abandoned or scarcely used spaces and places, through which to educate for the common good, through the informative and collaborative exchange between public and private interest and the co-planning and co-production of products and services.

2.3. *Good practices*

- Energy communities (e.g. *énostra*²), where various actors collaborate at several levels up to the establishment of a single collective owner;
- Collaborative supermarkets / local Food Coop, where customers are also co-producers of the service and in some cases co-managers³;
- WeMi, the participated and shared welfare system of the municipality of Milan where many services adopt collaborative models⁴;
- The E015 Digital Ecosystem of the Lombardy Region⁵ is a concrete example of an environment that enables the exchange of data for the co-production of services of different sizes: district, city, and region. The same approach finds a specific declination at the district level in the MIND Data Exchange Marketplace (DXM) concept of MIND⁶.

² <https://www.enostr.it/>

³ <https://www.mesanoa.org/>, <https://www.foodcoop.com/>

⁴ <https://wemi.comune.milano.it/>

⁵ <https://www.e015.regione.lombardia.it/>

⁶ <https://fondazionetriulza.org/nuove-call-4-ideas-per-universitari-da-mind-education/>

3. Innovative consumption patterns

The successful *co-creation and co-management of community services and places* necessitate the development of innovative, integrated governance models and partnerships that consider multiple factors (Mahmoud et al. 2022). Additionally, urban planning should incorporate new forms of support, incentives, and rewards to promote this collaborative approach. All this constitutes a possible design orientation within smart sustainable cities.

For example, it is important to selectively consider urban economic activities (innovative production activities with social impact, neighborhood networks, administration and crafts, historic shops, public area markets, social enterprises...) as *services of public or general interest*. This hypothesis, in addition to introducing, in challenging terms, an element of experimentation in a context of changing *public-private actions*, can concretely assign a public interest to the new aggregates of services of proximity (Tamini, 2018).

The *co-implementation and co-management of common good and public or public-use spaces* through tactical urbanism (Rossitti et al. 2023) and forms of sponsorship and adoption stimulates a pro-active behavior of the local community and needs new models of collaborative business.

The *enhancement of local production* (Correia Loureiro et al., 2020), also by approaching e-commerce and the digital market for local trade operators (Bettiga et al., 2018), is a fundamental lever to revitalize these economic forms in a context of natural convergence towards large platforms.

3.1. Objectives

- Assess *changes in the commercial offer* in response to the service demand of the new generations, characterized by the use of new technologies and by preferences, needs, consumption habits and behaviour very different from the previous generations;
- Support *local sustainability and networking of consumption* through sharing practices, collaborative consumption of goods and services, progressive substitution of the sale of products with Product-Service Systems (Product-as-a-Service);
- Strengthen the *digital skills of consumers* and prefigure a *marketplace* to enable the meeting between the supply of products of the food chain and the Ho.Re.Ca. demand, enhancing agro-food production and ensuring chain control through innovative tracking technologies such as blockchain;
- Foster new practices of *prosumption* that is integrated and simultaneous models of consumption and production of services, resources and data for individuals or groups. New perspectives of local co-production open up,

typically in the field of renewable energy (energy community), of many-to-many services (sharing and collaborative consumption), of places, and in the broad sense of knowledge and skills in local communities.

3.2. *Solutions and tools*

Innovative circular consumption patterns require a close integration of projects and strategies of urban regeneration, characterized by *proximity* between demand and offer, by *giving value to the public space*, by the use of *digital* as enabler of services, and by *new forms of logistics of the goods* (lockers/pick-up point/drop-off point).

Smart cities can be considered a concrete declination of the 15-minute city in a perspective of a measurable urban, social and economic sustainability, a real polyfunctionality, and a quality of living less polarized. This means that the gravitation of users takes place at the minute scale of networks and relationships, in a process of hybridization of spaces and functions that zeroes the logic of the sector, in a context increasingly characterized (from the point of view of settlement and space) from the progressive reduction of sales areas (and stocks) in favour of complementary activities and service. In this global framework, *retail* has to be *redefined* as a space for omnichannel interaction with users that is ennobled for proximity to the citizen-consumer.

Among the tools that support this process, beyond building a picture of the situation including its potentialities and challenges to base strategic guidelines:

- Activation of an integrated working table with public bodies and with the main entrepreneurial and category associations, finalized to the shared identification of initiatives of advanced governance (e.g. district manager, digitisation of common services, urban attractiveness and territorial marketing, urban regeneration and public space qualification, real estate involvement...).
- Advanced training course for new professional figures of smart city/smart district manager.⁷
- Training courses for local retailers on commerce and the digital market;
- Development of marketplace platforms with Customer Relationship Management capabilities, that allows access to eCommerce for interested retailers.

3.3. *Good practices*

- Examples of urban districts of commerce in Italian towns (Bergamo, Brescia, Mantova, Parma, Asti)⁸;

⁷ Starting from the diversity of the existing tools for the unitary and integrated management of urban centres: <https://www.tocema-worldwide.com/>

- Sharing cities,⁹ a H2020 project, funded under the Smart Cities and Communities call (SCC1), which involved more than 30 partners from 6 different European countries and aimed at creating smart districts in 3 lighthouse cities (London, Lisbon, Milan), and 3 follower cities (Bordeaux, Burgas, Warsaw). Innovative and smart solutions about electric mobility, building refurbishment, public lighting, ICT, citizen engagement were designed, implemented and tested in each city, ensuring effective results and a high replicability;
- Aree Produttive, Aree Proadattive project¹⁰ promotes strategies and actions of sustainability, mitigation and adaptation in the productive and commercial districts of the Metropolitan City of Milan, pursuing the ambitious goals of sustainable development (SDG), 2030 Agenda of the United Nations and the National Strategy for Sustainable Development. It develops co-production of solutions for pro-adaptive and resilient production micro-districts through living labs and new forms of multi-factorial local governance

4. Modular systems for circular economy

The foundation of the circular economy lies in the principle of maximizing the resource value over time through the re-designing of products, processes, and consumption and ownership models (Centobelli et al., 2020). In essence, it aims to extract the utmost value from resources by promoting their continuous use, recycling, and repurposing, rather than following the traditional linear approach of “take, make, dispose.”

This is true at every level, both in the *micro/local and systemic dimensions*. The applications of circular economy, also on local scale, have (more) sense if considered in their entirety, that is taking in consideration also the re-design of the products/services and their entire cycle of life. Similarly, circular economy systemic solutions must find their place at the local scale (because it is here where resources stand for most of the life cycle), and thus be able to adapt to the characteristics of the district in which they apply.

There are several theoretical tools available, starting with those that have to do with the evolution of the design concept, for example *System Oriented Design* (da Costa Fernandes et al. 2020), *Transition Design* (Irwin, 2015), and *Distributed Design* (Zha and Du, 2006).

The new discipline of *design for circularity* (Sassanelli et al., 2020), which ranges from the design of products to the design of products-services, is the

⁸ <https://www.maggiolieditore.it/commercio-e-distretti-un-patto-per-lo-sviluppo.html>

⁹ <https://sharingcities.eu/>

¹⁰ <https://www.areeproadattive.polimi.it/>

combination of these emerging fields of design and the more consolidated ones related to the sustainable design of products-services up to the design of policies for circularity.

The philosophy of sustainability assessment towards which the greatest convergence is observed by the technical-scientific community is that of *Life Cycle Thinking* (LCT) (Gheewala and Silalertruksa, 2021), that is, of a vision as complete as possible of processes or products, "from cradle to grave". Life Cycle Thinking is based on three methods of analysis that, if combined, allow to frame the theme of sustainability in the broadest sense: environmental (Life Cycle Assessment–LCA), economic (Life Cycle Costing–LCC), social (Social-LCA). Recently, circularity analysis models have been developed in an effort to define a common metric for the concept.

4.1. Objectives

- Address circular economy "*from the head*", i.e. from the moment the idea is born and the product/service is designed. To do this, it is necessary to start from the local scale, that is, from the consumer or user and the strengthening of its role of demand orientation.
- Revise the concept of property, in particular by favoring the *sharing models* and the *servitization of products*. The servitization is already quite common in the rental of smartphones or commercial vehicles, but also, especially at the industrial level, for services like air conditioning or heating of a building, carried out through the taking over of the ownership of the assets (air conditioners or boilers) connected to it. Sharing models are also widespread (cars, work space, etc.) and make the end customer more and more user, and less and less owner of products and resources. It is evident, here more than elsewhere, how the local scale is fundamental to ensure that resources return to the hands of producers through the creation of an ecosystem of actors that is able to manage the life of the good.

4.2. Solutions and tools

The *redesign of the products*. There is a profound rethinking of the patterns of production, consumption and ownership of many goods and services and their economic and social value. Understanding and accepting this step is essential to discuss, define and propose innovative solutions that address:

- the progressive disposal of products and services that are no longer sustainable and the abandonment of their use and consumption behaviour;
- the transformation of existing products and services according to their transition to circularity, realigning usage and consumption behaviour;

- the design and introduction of new products-services conceived with a circular logic and responding to new needs, which correspond to new habits of use and consumption.

New behaviours based on some fundamental concepts:

- the concept of *proximity* that concerns all forms of rapprochement (physical-territorial and digital-virtual) between the contexts of production and those of use and consumption of goods-services; it is a matter of imagining that the different phases of product-service have a local scale, focusing on possible rework or reuse;
- the concept of *symbiosis* that covers all forms of enlargement of productive metabolisms, that is, the use of circular processes and materials from industry to craft, up to the stages of consumption, disposal, recycling and regeneration of goods; the greater the chances of local symbiosis, the greater the actual probability that these will become reality;
- the concept of *responsibility* that regards the extension of the concrete engagement towards the circularity from the producers to the citizens, through new forms of cultural and material involvement; also here it is evident that the presence (direct or indirect) on a local scale is essential to “close the circle” of responsibility.

The *redesign of processes and technologies*. The path towards setting up new circular economy models cannot be separated from the assessment of their actual sustainability. Not necessarily what is circular is more sustainable than what is not: sustainability depends on many factors, productive but also behavioural ones, relying on all the actors involved.

The end-of-life management of products is a fundamental element of circularity: in the most advanced management systems, the linear model based on landfill disposal has now been superseded by the models focused on recycling and recovery, with an increasing interest towards the early stages of waste management.

The *redesign of the end of life of materials*. The European Union recognizes that materials are a focal point for the development of energy technologies. The world of materials, however, is the result of the exploitation of raw materials (for example, mining and the synthesis of polymers from hydrocarbons), therefore, the reconciliation of the ever increasing demand for products with environmental sustainability can only be achieved through the transformation of production and consumption cycles according to the circular economy model. Within the European Union, a mere 9% of the materials from manufactured products that reach the end of their life are intercepted and sent for recycling, and predominantly in the more established traditional sectors like metals, glass, and plastics. The good news is that the recycling of materials does not require cutting-edge innovations: we can solve the new problems with the existing technologies. It is important, however, to support the process with appropriate policies and eliminate the many bureaucratic

barriers that today prevent us from turning what was traditionally a waste in “secondary materials”. This applies not only to the cycles inherent in the recovery of materials but also to the entire chain of urban and industrial organic waste.

It is evident that the local scale of the recovery of the material and its valorisation is fundamental, and it needs the construction of a district scale ecosystem allowing the circulation of materials.

The enabling role of digital technologies. It is necessary to provide technological tools that can monitor and track the evolution of the circular system as a whole. In fact, circular solutions on a large scale cannot be separated from the realization of virtuous and effective practices on a local scale (district, street, condominium, home). Instruments capable of recording the behaviour of citizens and the evolution of the variables to be optimised are essential. Such tools include sensors of various kinds and a number of digital infrastructures for storing and analysing the collected data.

Monitoring processes, products, behaviours, allows drawing useful indications for good efficiency practices.

The redesign of business models. What we have seen so far represents the heart of circular economy, regarding new design trends; it is also necessary, however, to redesign business models. The only economic entity rationally interested in maximizing the value of a resource over time is the one who can utilise it over its useful life (to make different products from which to benefit). While it is clear that it makes economic sense for a company to reuse the components of a smartphone, the same is not true for the end customer, who is prevented from exploiting the resource again. The company can find different forms to maintain the ownership to achieve the result of recovering the product: for example, it can offer a discount to those who decide to bring the product back to the store to buy a new one, or act on a contractual basis, binding the customer to return the product. All these, however, are sub-optimal solutions, in the direction of a condition in which the enterprise has a full availability of the resources and the customer only the use.

4.3. Good practices

- *E-WASTE - The Intelligent Cycle project*¹¹. The aim of the project is to strengthen and optimise the entire electronic waste recycling system, in order to extract the rare earth elements and precious metals contained in e-waste through processes with low environmental impact. The pilot project is based on the renovation and conversion of the production capacities of the existing facilities in the Lombardy region, through the formation of a network of small and

¹¹ <https://www.polimi.it/en/scientific-research/research-at-the-politecnico/research-projects/smart-cities/e-waste-the-intelligent-cycle>

middle-sized businesses that are typically found in the area around Milano. The idea is to avoid creating a centralised, new treatment facility because it would probably not be very flexible, it would require considerable investments and take a long time to build. The strength of the project also lies in the transversal partnership that includes the involvement of two large companies (AMSA and STENA), a middle-sized business (Consorzio REMEDIA), three SMB (SEVAL, TECNOCHMIICA, GASER), two research organisations (Politecnico di Milano and Cefriel) and two public administrations (the Municipality of Milano and the Municipality of San Donato Milanese). The project was the winner of the Smart Cities and Communities call for tenders and it is co-funded by the Lombardy region.

- The *REFLOW project*¹²: together with 26 other partners across Europe, the Municipality of Milan was the winner of a H2020 call aimed at greening the economy in line with SDGs. The acronym stays for: constRuctive mEtabolic processes For materiaL fLOWs in urban and peri-urban environment across Europe. The vision of REFLOW is to develop circular and regenerative cities through the re-localization of production and the re-configuration of material flows at different scales. More specifically, by using Fab Labs and space-makers as catalysers of systemic change in urban and peri-urban environments, in order to reduce material consumption, maximize the multifunctional use of (public) spaces, and to envisage regenerative design practices. Milan's pilot of REFLOW aims to support the city's vision on circular food by providing sustainable solutions at the local market level, with the pilot's goal being to foster and test sustainable food logistics, develop market laboratories to disseminate circular practices, track the origin and quality of agricultural products and to analyse the interrelations between the rural-urban communities.
- The *Circular Housing project*¹³, co-funded by EIT Climate KIC, aims at the definition and validation of circular and regenerative economy experiments for a large number of households, identifying a sustainable and less carbon-intensive replicable business model able to scale up rapidly. The initiative intends to offer an innovative service to the tenants that include the renting of all the housing appliances and furniture. The objective is to redesign the economic systems around these products, avoiding waste generation and promoting behaviors that embrace circularity (in all assets lifecycle). The project includes the definition of the role of actors in each phase of the asset life. The project partnership involved: Redo Sgr (project leader), Politecnico di Milano – Department of Management, Economics and Industrial Engineering and Department of Energy, Poliedra, Ecodom.

¹² <https://reflowproject.eu/>

¹³ <https://www.5square.it/circularhousing>

5. Strategies and policies in Italy and Serbia

The definition of the *2030 Agenda* has established the definitive spread of the concept of sustainable development worldwide. The European Union has played a key role in this process: since 2015, the year of the 2030 Agenda, the European institutions have used 17 Sustainable Development Goals as a reference for all Community policies. With the establishment of the last Council in 2019, the 17 objectives were included in the guidelines of the new 2019-24 Strategic Plan.

Goal 12 identifies in production and consumption, therefore in the entire economic system, the areas for which a sustainable change is necessary. It highlights the importance of the company and in general the world of production, and, at the same time, the leading role of the citizen-consumer and the model of consumption, transformation that cannot be separated from the overcoming of the current economic system in favour of a circular model.

The *European Green Deal* is an integral part of the Commission's strategy for achieving the objectives of the 2030 Agenda for Sustainable Development. The Commission aims to make European industry's production processes and related supply chains increasingly circular, with the aim of cutting the emissions and waste production and having more efficient and less risky raw material management.

5.1. The situation in Italy

The *National Recovery and Resilience Plan*¹⁴ (NRRP) in Italy outlines the objectives, reforms and investments that Italy intends to carry out through NextGenerationEU funds to mitigate the COVID-19 socio-economic impact and make Italy a fairer, greener and more inclusive country, with a more competitive, dynamic and innovative economy. Component C1 within Mission 2 "Green Revolution and Ecological Transition" of the NRRP is dedicated to circular economy and sustainable agriculture. In addition, in the context of NRRP a *National Strategy for the Circular Economy* has been developed and approved in 2021, revising and updating the previous strategy dated 2017, in line with the action plan for the circular economy and the EU regulatory framework. The new strategy defines:

- the new administrative and fiscal tools to strengthen the secondary raw materials market;
- extended producer and consumer responsibility;
- the dissemination of sharing and "product as a service" practices;
- a roadmap of actions and measurable targets till 2040.

¹⁴ <https://www.agenziacoesione.gov.it/comunicazione/piano-nazionale-di-ripresa-e-resilienza/?lang=en#:~:text=The%20National%20Recovery%20and%20Resilience%20Plan%20outlines%20the%20objectives%2C%20reforms,competitive%2C%20dynamic%20and%20innovative%20economy.>

The new strategy also intends to affect the following areas of intervention: eco-design and product innovation, bioeconomy, blue economy, critical raw materials. In addition, the new traceability system will also be part of the national strategy, which will allow for the support of control bodies and law enforcement agencies in prevention and repression.

The FIS - *Fondo Innovazione Sociale*¹⁵ (*Social Innovation Fund*) aims at strengthening the capacity of public administrations to carry out social innovation interventions aimed at generating new solutions, models and approaches for the satisfaction of social needs, with the involvement of private sector actors - promotion of outcome based models - pay by results.

Various strategies exist and are developing at the local level, as for instance:

- Collaboration pacts - tools of collaboration between citizens and public administration used in various Italian cities, e.g. Milano¹⁶ and Bologna¹⁷
- Civic crowdfunding for the collective financing of projects of public interest with social impact, in match-funding with the Administration of the Municipality, to which individual citizens, non-profit organizations, private companies contribute, e.g. Milan¹⁸ and Venezia¹⁹

5.2. The situation in Serbia

The Serbian government has actively supported digital innovation through various national strategies, such as the Strategy for Smart Specialization, the Digital Skills Development Strategy, and the Sustainable Urban Development Strategy. This support is complemented by funding from EU sources, as well as public-private partnerships designed to foster technological growth. Serbia has developed several strategic documents and regulations to guide its digital transformation and the development of smart cities. Key among these are:

- *Public Administration Reform Strategy (PARS) 2021–2030*: This comprehensive strategy outlines reforms across six thematic areas, including service delivery and accountability. It aims to build digitally capable institutions and adaptable regulatory frameworks that embrace innovations.
- *Strategy for the Development of Artificial Intelligence in the Republic of Serbia (2020–2025)*: This strategy identifies AI as a key driver for economic growth, digitalization, and education. It addresses risks related to data protection and transparency and aims to create a legal, ethical, and institutional framework for AI development.

¹⁵ <https://www.funzionepubblica.gov.it/innovazione-sociale>

¹⁶ <https://www.comune.milano.it/web/patti-di-collaborazione/cosa-sono-i-patti-di-collaborazione>

¹⁷ <http://partecipa.comune.bologna.it/patti-di-collaborazione/elenco>

¹⁸ <https://economiaelavoro.comune.milano.it/progetti/crowdfunding-civico-2022>

¹⁹ <https://www.comune.venezia.it/it/crowdfundingcivico>

- *Smart Specialisation Strategy of the Republic of Serbia (4S) (2020–2027)*: The 4S strategy focuses on directing resources to areas with the highest innovation potential, such as sustainable high-tech food production, sophisticated software solutions, and creative industries. It aims to enhance competitiveness and position Serbia in global markets
- *Sustainable Urban Development Strategy of the Republic of Serbia until 2030*: This strategy serves as the national urban policy framework, promoting integrated and participatory approaches to urban development. It supports the realization of Sustainable Development Goal 11, which focuses on making cities inclusive, safe, resilient, and sustainable.

Serbia has also implemented several important laws in the field of digitalization. The Serbian government has actively supported digital innovation through various national strategies, such as the Digital Skills Development Strategy. This support is complemented by funding from EU sources, as well as public-private partnerships designed to foster technological growth. Urban areas such as Belgrade, Novi Sad, Niš, and Kragujevac have high population densities and concentrated infrastructure, creating demand for improved city services, including transportation, waste management, energy optimization, and public safety. Additionally, Serbia boasts a robust IT sector with skilled professionals, startups, and innovation ecosystems capable of developing localized smart solutions tailored to community-specific needs.

Despite these opportunities, several notable challenges exist that could impede the development and successful deployment of smart city technologies:

Aging Infrastructure: Serbian cities often rely on outdated infrastructure, such as old electricity grids, inadequate water supply and sanitation networks, and inefficient transportation systems. This existing condition complicates the integration of advanced smart technologies.

Limited Financial Resources: Financial constraints and limited budget allocations can significantly slow down or even halt ambitious smart city projects. Identifying clear and sustainable sources of funding remains a substantial hurdle.

Public Resistance and Limited Awareness: Citizens, especially older generations, may exhibit skepticism towards adopting new technologies and urban innovations, creating barriers to broader societal acceptance and participation in smart city initiatives.

Institutional Fragmentation and Coordination Issues: Insufficient coordination among governmental agencies, unclear procedures, and fragmented administrative responsibilities often hinder effective and sustainable implementation of smart city projects.

6. Conclusions

The concept of smart cities refers to the integration of information and communication technologies (ICT) into urban infrastructure to enhance public services, improve sustainability, and increase quality of life. Both Italy and Serbia have recognized the strategic importance of smart city initiatives; however, their approaches, regulatory frameworks, and practical implementations exhibit significant differences.

Italy has adopted a structured and comprehensive approach towards smart cities, closely tied to the broader European Union (EU) initiatives and guidelines. The Italian regulatory framework includes clearly defined national strategies such as the Italian Digital Agenda (Agenda Digitale Italiana), the National Smart Specialization Strategy (SNSI), and regulations aligned with the European Union's Green Deal and Horizon Europe frameworks. Italian cities are required to align their strategies and plans with national and European-level guidelines to ensure integrated and interoperable smart solutions. Moreover, Italy emphasizes participatory governance, transparency, and open data, strongly supported by regulatory measures such as the Legislative Decree on Digital Administration (Codice dell'Amministrazione Digitale - CAD).

In contrast, Serbia's regulatory framework is still evolving and somewhat fragmented. While Serbia has strategic documents like the Smart Specialization Strategy (2020-2027), the Sustainable Urban Development Strategy until 2030, and the Strategy for the Development of Artificial Intelligence (2020-2025), practical implementation and harmonization between national and local authorities remains a challenge. Serbia's smart city regulations have been primarily aspirational, with less emphasis on mandatory guidelines for cities. Institutional fragmentation, limited coordination between different levels of governance, and occasional gaps in clear enforcement mechanisms remain barriers in Serbia.

Practical Implementation and Experiences:

In Italy, several cities have achieved notable success through practical implementation of smart city concepts. Cities like Milan, Bologna, Turin, and Florence serve as excellent examples of effective integration of smart technologies in transportation, energy efficiency, environmental monitoring, and citizen participation. Milan, for instance, has implemented comprehensive smart mobility solutions, open data platforms, and digital citizen engagement tools. Turin has effectively utilized EU funding for sustainable energy and transportation projects, while Bologna has focused on participatory governance and smart city applications related to urban services management.

Conversely, in Serbia, practical implementations are still relatively isolated and pilot-based. Cities such as Belgrade, Novi Sad, and Niš have initiated pilot projects, including smart lighting, transportation monitoring, and energy efficiency

improvements, but these remain fragmented. Funding constraints, infrastructural challenges, and limited administrative capacities contribute to slower progress compared to Italy.

Serbia could effectively leverage Italian experience in several key areas:

Integrated Governance and Coordination: Serbia should consider adopting an integrated governance framework similar to Italy's, fostering stronger coordination between central government, local authorities, universities, businesses, and civil society. This can help create coherent national standards, enhance interoperability, and improve effectiveness of investments in smart infrastructure.

Regulatory Clarity and Enforcement: Clearly defined regulations, guidelines, and mandatory standards, as exemplified by Italy's CAD, would enhance compliance, facilitate interoperability, and encourage more uniform adoption of smart city solutions across Serbian municipalities.

Funding Mechanisms and EU Integration: Italy's effective use of EU funds and grants could serve as a model for Serbia, helping it better utilize EU financial instruments such as IPA (Instrument for Pre-accession Assistance), Horizon Europe, and other regional cooperation programs. Strategic use of these resources could significantly enhance financial sustainability and scalability of Serbian smart city initiatives.

Participatory and Transparent Approach: Adopting participatory governance and transparency practices from cities like Milan could improve Serbian cities' acceptance of smart technologies, increasing citizen trust, engagement, and overall effectiveness of implementation.

While Italy is considerably more advanced in terms of regulatory frameworks, practical implementation, and EU integration, Serbia can significantly benefit from studying and adapting Italian best practices. Key areas of focus for Serbia should be clearer regulation, enhanced institutional coordination, improved access to EU funds, and increased emphasis on transparency and citizen participation. Such an approach would strengthen the smart city ecosystem in Serbia, accelerating urban sustainability, innovation, and quality of life improvements. The adoption of smart city models in Serbia represents a promising and practical approach to transforming urban areas into efficient, sustainable, and citizen-centric environments. Through strategic planning, international collaboration, citizen participation, and targeted investments, Serbian cities can effectively overcome existing challenges and seize opportunities to significantly improve urban living conditions and achieve sustainable growth. While Italy is considerably more advanced in terms of regulatory frameworks, practical implementation, and EU integration, Serbia can significantly benefit from studying and adapting Italian best practices. Key areas of focus for Serbia should be clearer regulation, enhanced institutional coordination, improved access to EU funds, and increased emphasis on transparency and citizen participation. Such an approach would strengthen the smart city ecosystem in Serbia, accelerating urban sustainability, innovation, and quality of life improvements.

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ISTRAŽIVANJE STUBOVA POSLOVNIH MODELA ZA PAMETNE GRADOVE I MOGUĆNOSTI NJIHOVE PRIMENE U SRBIJI

Apstrakt: Ovaj rad posebno je fokusiran na stubove poslovnih modela za pametne gradove. Rad se zasniva na projektu Pametni održivi okrug (Smart Sustainable District - SSD) i prikazuje mogućnosti i ograničenja primene određenih smernica u zemlji van Evropske unije – Srbiji, kroz projekat UR-DATA u okviru programa Horizont Evropa. Projekat Pametni održivi okrug započet je 2021. godine, a jedan od njegovih rezultata je objavljivanje „bele knjige“ čiji je cilj opisivanje principa, rešenja i alata za realizaciju SSD modela u urbanim područjima, pružajući metodološku i operativnu podršku javnim i privatnim akterima uključenim u urbane transformacije u skladu sa SSD pristupom. U radu su predstavljeni ciljevi, trendovi, rešenja, alati i neke dobre prakse za sledeća tri stuba poslovnih modela za pametne gradove:

- Kolaborativni modeli i simbioza, kroz promociju partnerstva između javnog, privatnog sektora i građana (Public-Private and People Partnership - PPPP), kao i održivu koprodukciju i zajedničko upravljanje materijalnim i nematerijalnim resursima i dobrima.
- Inovativni obrasci potrošnje, koji obuhvataju pažnju prema održivosti i lokalnim potrebama, praksama deljenja, zajedničkoj potrošnji dobara i usluga, kao i novim praksama „prozumerizma“.
- Modularni sistemi za cirkularnu ekonomiju, koja se temelji na maksimalnom iskorišćavanju resursa kroz redizajn koncepta vlasništva, proizvoda i usluga kroz njihov celokupni životni ciklus, uključujući procese i modele potrošnje.

Rad dalje analizira njihovu primenu u Srbiji, posebno se fokusirajući na grad Niš, upoređujući pritom srpske i italijanske referentne strategije i politike kao uporednu osnovu.

Ključne reči: Pametni gradovi, održivost, kolaborativni modeli, obrasci potrošnje, cirkularna ekonomija