Chapter N 114

Smart City and Internet of Things

**Abstract.** The aim of the research is the analysis of smart cities, as an application of the Internet of Things ( IoT ): the concept of Smart City (SC) can be identified as one of the areas in which IoT technology finds its natural application. According to the Agid , the term Smart City / Community (SC) means that place and / or context where the planned and wise use of human and natural resources, appropriately managed and integrated through the numerous ICT technologies already available, allows the creation of an ecosystem capable of making the best use of resources and providing integrated and increasingly intelligent services (i.e. the value of which is greater than the sum of the values of the parts that compose it). The axes on which the actions of a SC are developed are many: mobility; environment and energy; building quality; economy and ability to attract talent and investments; safety of citizens and city infrastructures; citizen participation and involvement. Essential conditions are connectivity and the digitization of communications and services. SC is therefore a new conception of urban reality which, through an intelligent direction of the many human activities that take place within it, aims to raise the standards of sustainability, liveability and economic dynamism of the cities of the future. Specifically, the aim of the research is to analyze the Italian situation and the development prospects of Iot in SC, discussing the main present and future applications.

**Keywords .** Smart City / Community (SC ); Internet of Things ( IoT ); Applications

**Introduction**

Smart city (SC) is an emerging strategy that aims to improve the quality of life of citizens by using the most innovative technologies to support the specific needs of each city. The Smart city was conceived to address the problems arising from the growing trend towards urbanization. In the future, migration to urban centers will tend to increase. According to UN estimates, the percentage of the population living in cities will increase from the current 55% to almost 70% by the end of 2050. To date, cities occupy less than 2% of the total world territory but produce 80% of the Global Gross Domestic Product (GDP) and over 70% of carbon dioxide emissions (United Nations, 2020 ). Cities therefore have a strong impact on climate change. The goal of a SC is to respond to these challenges related to urbanization, with the ultimate goal of improving the overall quality of life of citizens.

**1.Definition**

The basis of the definition of SC are the theories on industrial districts (Becattini, 1989), cluster (Bagnasco, 1977), technopolis (Shilling, Izzo, 2013), which identify three main elements that favor the innovation of a territory (Auci, Mundula , 2012): the concentration of different experiences in various fields of knowledge and production; a cooperation network between the actors involved; the presence of catalysts that facilitate the combination of different capacities and actors. The evolution of the Smart City concept is also subsequently linked to the following models: NSI - National System of Innovation (Lundvall, 1992), Regional and Local Innovation System (Cooke et al., 2004), Triple helix (Etzkowitz, 2008). The “Triple Helix” models were later integrated with others, focusing above all on the role of creativity for a more sustainable development in an urban context; creativity is therefore seen as a key factor in pursuing both environmental and social sustainability (Gabe, 2006).

A smart city connects human capital, social capital and ICT infrastructure in order to address public issues, achieve sustainable development and increase citizens' quality of life: the smart city is not only a tough technology-based strategy, it also requires the deep involvement of the city's human capital to produce its benefits. SCs can be classified according to six main axes or dimensions (Giffinger et al., 2007): smart economy, smart people , smart environment , smart governance, smart mobility and smart living. These six parameters identify the essence of a Smart City, which in addition to being a digital or technologically advanced city, according to Giffinger et al (2007), is the organic and multifaceted set of physical, economic, intellectual and social capital.

**2. Reference regulatory context**

***2.1. European programs***

The European Union has been investing in the SC model for some time: at European level there is no specific fund dedicated to smart cities , but a plurality of access possibilities to different types of financing. Beyond the programs of the Member States which are based on the integration between national resources and structural funds ( ERDF , ESF , EAFRD ), the main programs with directly managed European funds which can finance particular aspects of a SC are:

* Horizon Europe (APRE - Agency for the Promotion of European Research, 2021), EU Framework Program for Research and Innovation for the period 2021-2027. It is the successor to Horizon 2020. The program has a duration of seven years and a total budget of 95.5 billion (at current prices), a figure which includes the 5.4 billion euros allocated to the Next Generation EU recovery plan. By supporting research and innovation, Horizon Europe is structured on the following four pillars: Excellence Science, Global Challenges and European Industrial Competitiveness, Innovative Europe, Widening participation and strengthening the European Research Area
* The European Digital Plan - Digital Europe Program 2021-20278 (European Commission , 2021). On 9 March 2021, the European Commission presented a vision and perspectives for Europe's digital transformation by 2030. The Commission has proposed a digital compass for the EU's digital decade that develops around four cardinal points: Skills , Infrastructure , Business, Government .
* LIFE, the EU flagship program for the nature, protection of biodiversity and fight against climate change (CINEA, 2021). The general objective of the new LIFE (2021-2027) is to contribute to the transition to a clean, circular, energy-efficient, climate-neutral and climate-resilient economy;
* Single market program 2021-2027 (European Commission, 2020), which will replace in the seven-year period 2021-2027, the activities which have so far been funded under six different programs, including COSME (Competitiveness of enterprises and Small and Medium- sized Enterprises). With €4.2 billion over the period of 2021-2027, it provides an integrated package to support and strengthen the governance of the single market. The programme protects European consumers and allows many small and medium-sized enterprises to take full advantage of a well-functioning single market, providing support in areas such as: Food safety, Consumer protection, Support to small and medium-sized businesses , A more effective single market, Effective European standards.
* Connecting Europe Facility 2.0 (CEF 2.0 ) 2021-2027, which aims to accelerate investments in the field of trans -European networks and stimulate both public and private investments. The programme, worth €33.71 billion, to fund the development of high-performing, sustainable infrastructure in the fields of transport, digital and energy. The budget is divided into sectors: transport, energy, digital (Council of the European Union, 2019).

***2.2. Italian programs***

All the initiatives regarding the SC, proposed and implemented at the European level, also find correspondence in Italy, thanks to specific action plans undertaken in part and programmed for the next few years by the Public Administration. They are:

* The Digital Italy 2026 Plan, which is developed along two axes, in line with the Digital Compass 2030 objectives (MITD, 2021): broadband deployment (all EU households will have 1 Gps connectivity, all populated areas will be covered by 5G); digitalization of the PA, with the aim that by 2026: 70% of all adults uses digital identity and have basic digital skills; 80% of public services are available online. As regards the digital PA, the main actions are: to adopt the "cloud first" principle for at least 75% of central and local public administrations by 2026; to make all public data interoperable, i.e. able to communicate with each other safely; to ensure that 70% of Italians have a digital identity by 2026.
* Italian strategy for ultra-broadband “towards the Gigabit Society” (25.05.21) with both national and EU resources. In this context, the National Federated Information System for infrastructures (SINFI) was also established and the procedures for the construction of infrastructures for fiber optic networks were simplified. A public wi-fi network is also under development (MITD and MiSE, 2021 ).
* Three-year plan for IT in the PA 2021-2023 (Agid and DT, 2021). The plan's update is characterized by the following new elements: objectives and expected results related to the PNRR implementation and maximum supervision on digital transformation obligations. The Three-Year Plan for IT in the PA is a summary of the digital transformation in relation to the use of PNRR resources (190 billion euros of which 9.75 billion "Digitization, innovation and security in the PA", in which 6 , 14 billion is the share for "PA Digitization") and the implementation of the Digital Italy Strategy 2026 plan, focused, on the one hand, on digital infrastructures and ultra-broadband connectivity and, on the other, on those interventions aimed at transforming the PA digitally. The Plan establishes the evolution and more widespread dissemination of digital services (electronic identity card, SPID, pagoPA) and aims at strengthening managerial and digital skills within public administrations.

**3. Smartness measurement**

There are several organizations that have drawn up a series of models to evaluate the smartness of a city. The main indices are:

* Desi 2021, the ranking of EU Member States (European Commission, 2021). The DESI (Economic and Society Digitization Index) is the tool through which the European Commission has been monitoring the digital competitiveness of the Member States since 2015. Italy's digital competitiveness is significantly lower than in other European States: according to data from DESI 2021, referring to the year 2020, Italy is twentieth, with the worst data in Human Capital and Connectivity.
* IMD Smart city Index 2021, IMD is an index which classifies smart cities in the world, created by the Smart City observatory of the IMD ( Institute for Management Development) World Competitiveness Center, in collaboration with SUTD ( University of Technology and Design). Singapore (1st), Zurich (2nd) and Oslo (3rd) are on the podium of the IMD-SUTD Smart City Index 2021, while with reference to our national reality we see Bologna (77th), Milan (81 st) and Rome (112th) unfortunately in the lower-middle part of the ranking. (IMD-SUTD, 2021).
* ICity Rank 2021, the ranking of Smart Cities in Italy elaborated by Forum PA (Forum PA, 2021). ICR 2021 is characterized by the introduction of indicator, which seek to measure not only the presence but also the ability to communicate and make the tools of digital transformation usable. ICity Rank 2021 puts on the podium the triad of metropolitan cities, Florence, Milan and Bologna, followed by Roma Capitale and by medium-sized cities such as Modena, Bergamo, Turin, Trento and Cagliari (the only city in the South). The gap between North and South of Italy in digital transformation processes still remains wide: two thirds of the southern capitals are placed in the lowest third of the ranking. The year 2022 will be a crucial year for the implementation of the PNRR for which the role of urban realities is decisive.

**Conclusions**

In the next few years, a development of the SC is foreseeable thanks to the PNRR funds which allocates over 10 billion euros of investments for the SC and in particular for issues such as urban regeneration, sustainability and digitalization of services. The PNRR Missions in which there are elements and objectives related to the SC theme are the following (Risi, 2022):

* Mission 5, Inclusion and Cohesion with investments in Urban Regeneration, among which the reform of the Integrated Urban Plans (2.5 billion euros), which includes participatory urban planning projects, with the aim of transforming vulnerable territories into smart and sustainable cities;
* Mission 1, "Digitization, innovation, competitiveness, culture", which promotes, among other things, Mobility as a Service (MaaS) projects, an initiative aimed at creating a sustainable mobility system through the integration of different transport through a single digital channel, facilitating travel in urban centers;
* Mission 2 “Green Revolution and Ecological Transition”, which includes various interventions attributable , directly or indirectly, to the network of interventions enabled by Smart Cities (development of a more sustainable local public transport, with the strengthening of cycling mobility, rapid transport of mass and electric charging infrastructures; Smart Building projects; Smart Grid and strengthening of the electricity distribution network).

**References**

* Agid and DT (2021). Piano Triennale per l’informatica nella Pubblica Amministrazione-Aggiornamento 2021-2023. [https://www.agid.gov.it/sites/default/files/repository\_files/piano\_triennale\_per\_linformatica\_nella\_pubblica\_ipendenza\_2021-2023.pdf](https://www.agid.gov.it/sites/default/files/repository_files/piano_triennale_per_linformatica_nella_pubblica_amministrazione_2021-2023.pdf)
* APRE - Agenzia per la promozione della ricerca europea (2021), Horizon Europe, La Guida. <https://apre.it/wp-content/uploads/2021/04/guida-Horizon-Europe.pdf>)
* Auci S., Mundula L. (2012). Smart Cities and a Stochastic Frontier Analysis: A Comparison among European Cities. XXXIII AISRe Annual Scientific Conference , Rome, 13-15th September . <https://mpra.ub.uni-muenchen.de/51586/1/MPRA_paper_51586.pdf>
* Bagnasco A. (1977). Tre Italie. La problematica territoriale dello sviluppo italiano. Il Mulino, Bologna
* Becattini G. (1989) Riflessioni sul distretto industriale marshalliano come concetto socio-economico. Stato e Mercato, 25: 111-128
* CINEA (2021). LIFE Programme. <https://cinea.ec.europa.eu/programmes/life_en>
* Cooke P., Heidenreich M., Braczyk H. (2004) Regional Innovation System: the Role of Governance in a Globalized Word. Routledge, London
* Council of the European Union (2021) CEF - Connecting Europe Facility 2021-2027. Regulation (EU) 2021/1153 <https://eur-lex.europa.eu/eli/reg/2021/1153>
* Etzkowitz H. (2008). The Triple Helix: University-Industry-Government Innovation in Action. Routledge, London
* European Commission (2020), Single Market Program. <https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/single-market-programme/overview_en>
* European Commission (2021), The index of the digital economy and society (DESI). <https://digital-strategy.ec.europa.eu/en/policies/desi>
* European Commission, Europe’s Digital Decade: digital targets for 2030.
* Forum PA (2021) ICity Rank 2021, <https://www.forumpa.it/icity-rank/>
* Gabe TM (2006) Growth of Creative Occupations in US Metropolitan Areas: A Shift-Share Analysis. Growth and Change, 37: 396–415
* Giffinger R., Fertner C., Kramar H., Kalasek R., Pichler-Milanovic N., Meijers E. (2007) Smart cities: Ranking of European medium-sized cities, Vienna <http://www.smart-cities.eu/download/smart_cities_final_report.pdf>
* <https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en>
* IMD-SUTD (2021) Smart City Index 2021. <https://www.imd.org/smart-city-observatory/home/#_smartCity>.
* Lundvall BA (1992). National System of Innovation-toward a Theory of Innovation and Interactive Learning. Pinter Publishers . London
* MiTD (2021) Italia digitale 2026. [https ://in Tecnologia.gov.it/italia-digitale-2026](https://innovazione.gov.it/italia-digitale-2026)
* MiTD and MiSE (2021), Strategia Italiana per la Banda Ultralarga “Verso la Gigabit Society”. [https://assets.in Tecnologia.gov.it/1622021525-strategia-bul.pdf](https://assets.innovazione.gov.it/1622021525-strategia-bul.pdf)
* Risi M. ( 2022) Smart City: smarter and more connected cities from PNRR? [https://blog. Osservatori.net/it\_it/smart-city-pnrr](https://blog.osservatori.net/it_it/smart-city-pnrr)
* Shilling AM, Izzo F. (2013). Gestione dell’innovazione. McGraw - Hill Education, Milano
* United Nations (2020) Report of the UN Economist Network for the UN 75th Anniversary: Shaping the Trends of Our Time <https://unric.org/en>