TeMA

Journal of
Land Use, Mobility and Environment

print ISSN 1970-9889 e-ISSN 1970-9870
FedOA press - University of Naples Federico II

DOAJ anvur Rivista scientifica di classe A - 08/F1 Scopus WEB OF SCIENCE

Special Issue 3.2024

Living and Walking in Cities

New challenges for sustainable urban mobility

This Special Issue intended to wonder about the new challenges for sustainable urban mobility, aligning with the European Sustainable & Smart Mobility Strategy. Contributions come from selected papers of the XXVI International Conference "Living and Walking in Cities" and have been collected around two main topics: the relationship between transport systems and pedestrian mobility and the transformative potential of temporary urban changes. Reflections and suggestions elaborated underline a collective great leap forward to reshaping urban mobility paradigms.

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TeMA Journal of
Land Use, Mobility and Environment

Special Issue 3.2024

Living and walking in cities: new challenges for sustainable urban mobility

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

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Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | online ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
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Cover photo: Herrengasse street in Graz (Austria), baroque pedestrian avenue and centre of public life, provided by Michela Tiboni (June, 2024)

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TeMA Journal of Land Use, Mobility and Environment

TeMA Special Issue 3 (2024) 53-66
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6093/1970-9870/10910
Selection and double blind review under responsibility of "Living and Walking in Cities 2023" Conference Committee.

www.tema.unina.it

A smart and active mobility assessment protocol for urban regeneration. Application to regeneration projects of medium-sized cities in Emilia-Romagna

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Abstract
Active mobility, within the context of sustainable urban development, plays a crucial role by positively affecting carbon and greenhouse gasses emissions, promoting healthy lifestyles, relieving urban traffic congestion, and therefore enanching the overall quality of urban life. Nowadays, active mobility plays a crucial role also in the contexts of urban regeneration projects, as highlighted both within the framework of Smart City assessments and within the main urban regeneration evaluation protocols.
This paper pursues to establish a protocol for assessing the transformation of public spaces in the context of urban regeneration, using specific indicators to measure impacts on active mobility. The proposed assessment method aims at benchmarking urban regeneration initiatives, with a particular focus on mobility and accessibility issues.
The methodology has been tested in several case studies within the major medium-sized cities of the Emilia-Romagna Region (Parma, Reggio Emilia, Modena, Cesena and Rimini), in the North of Italy, outlining potential guidelines for the integration of active and smart mobility in the processes of urban regeneration.

Keywords
Active mobility; Urban regeneration; Assessment protocols

How to cite item in APA format
Pellicelli, G., Rossetti, S. & Zazzi, M. (2024). A smart and active mobility assessment protocol for urban regeneration. Application to regeneration projects of medium-sized cities in Emilia-Romagna. *TeMA - Journal of Land Use, Mobility and Environment*, (3), 53-66. http://dx.doi.org/10.6093/1970-9870/10910

1. Introduction

The transport sector is recognised as a main responsible for energy consumption and pollution in cities. At European level, transport emissions represent around 25% of the total greenhouse gasses (GHGs) emissions, of which CO_2 represents 98.9% (European Environmental Agency, 2023).

At the global level, transport decarbonization issues are central both within the main European directives on urban development, environmental sustainability, renewable energy, smart and sustainable mobility (see, i.a., Agenda 2030; European Green Deal; New European Bauhaus) and in the research (Banister, 2008; Conticelli et al., 2018; Garau et al., 2016; Kenworthy, 2006; Litman & Burwell, 2006; Niglio & Comitale, 2015; Pinna et al., 2017).

Urban Mobility also represents one of the six axes on which the framework of Smart Cities, a research field that has been steadily growing in the last decade, roots (Giffinger et al., 2007). Smart Mobility also plays a crucial role within several Smart City initiatives (e.g. 'Smart cities and communities', 2011; 'Smart cities and communities and social innovation', 2012). It is usually implemented both through Information and Communication Technologies (Behrendt, 2019), and through complex sets of projects and actions aimed at improving the efficiency, effectiveness and environmental sustainability of nowadays cities with the goal of increasing the life quality of citizens (Benevolo et al., 2016; Gaglione et al., 2019; Gaglione, 2023). Smart mobility intertwines to sustainable mobility and aims at reducing traffic congestion within urban areas and improving road safety. These objectives also closely relate to active mobility, which allows addressing several issues: the physical network, the role of urban functions according to their multimodal accessibility, the mixed use of the same spaces by different users and the positive and healthy behaviours related to bicycle and pedestrian mobility (D'Amico, 2023; De Lotto et al., 2022; Garau et al., 2016). For this reason, some authors (see, i.a., Francini et al., 2021; Ketter et al., 2023; Garau et al., 2023; Torres et al., 2021) use the term 'smart sustainable mobility' in their studies.

Some measures to achieve sustainable mobility are the promotion of the local public transport instead of private vehicles and the integration of urban and transport planning. Participation and communication are important as well as sensibilisation actions that can act directly on the behaviour and habits of people (Spadaro et al., 2023).

Highlighting active mobility rather than motorised traffic, as emerged from studies on the 15-minute city in recent years, has positive implications in spatial as well as environmental, functional and social terms too (Pinto & Akhavan, 2021; Venco, 2021). And medium-distance bicycle and pedestrian routes are seen as essential elements for the sustainable development and renewal of the urban texture (De Lotto et al., 2022).

At the operational level, Sustainable Urban Mobility Plans (SUMPs) represent the main planning tool to solve transport inefficiencies in cities with an integrated and sustainable approach. These plans show to be especially significant since they prioritise the well-being of citizens and an effective performance of activities rather than traffic flows. The criteria with which these new plans address the problems of urban space have deep similarities with quality criteria expected from urban regeneration processes (Bollini et al., 2018; Bollini et al., 2018; Niglio & Comitale, 2015).

In this context, the enhancement of accessibility to public services and facilities and the re-design of the road system became essential to achieve sustainability within urban regeneration processes (see, i.a., Carra et al., 2022; Ignaccolo et al., 2020; Spadaro et al., 2023; Tiboni et al., 2021; Tira, 2018).

Within this framework, this paper aims at defining a protocol to assess smart and active mobility indicators in urban regeneration projects, and at applying it to urban regeneration interventions recently developed in medium-sized cities of the Emilia-Romagna Region, in Italy. Based on the outlined framework, the protocol roots on indicators derived from the Smart Cities rankings and/or adopted to evaluate urban regeneration processes.

The paper is structured as follows: section 2 frames review the mobility issue within existing Smart City rankings and urban regeneration evaluation protocols. Section 3 illustrates the proposed protocol to assess smart and active mobility within urban regeneration projects. It also presents the summary of the five urban regeneration study cases in the Emilia-Romagna Region in Italy. Section 4 presents the results of the assessment and outlines a comparison among the studied cases. Section 5 provides a discussion of the results and discusses the results. Finally, section 6 illustrates some conclusive remarks and outlines possible guidelines for the implementation of urban regeneration projects.

2. A review of assessment methodologies for smart and active mobility

Smart City rankings (e.g. ICity Rank, European Smart City Ranking of the medium-sized cities, Smart City Index) and existing urban regeneration protocols (e.g. the GBC Quartieri protocol of Green Building Council Italia, the ITACA protocol and the AUDIS Urban Quality Matrix) already proposes several indicators to assess smart and active mobility.

This section provides a review of existing indicators and protocols, in order to frame a methodological approach to assess the impacts of urban regeneration projects on active mobility and accessibility.

In particular, the review considers the analysis of five Smart City rankings and of three existing protocols for evaluating urban regeneration interventions.

2.1 Mobility indicators within Smart City rankings

Data from Smart City rankings, which were analysed among those at European, Italian and regional level, can be summarised as follows:

- The 'European Smart City Ranking of the medium-sized cities', developed at European level, considers four factors in the field of mobility: local accessibility; international accessibility; availability of ICT infrastructure; and sustainable, innovative and safe transport systems (Ranking of European medium-sized cities, 2007);
- The 'Smart City Index' is instead developed in Italy, and it is annually updated by Ernst & Young. It includes indicators related to mobility for different purposes: traffic reduction; decrease of polluting vehicles; electric and hybrid mobility promotion; and the development of alternative mobility options. Regarding active mobility issues, it includes specific data as the kilometers of cycle lanes or the number of shared bicycles (Smart City Index, 2020);
- The third ranking considered is the 'ICity Rank', which, like the previous one, is national. It consists of 16 indicators related to mobility areas, including public transport development, impact of vehicle traffic, mobility governance tools, dissemination of participatory processes, and pays attention to the density of cycle lanes and the square meters of pedestrianised areas (Icity Rank, 2021);
- The fourth classification is the 'International Standard ISO 37122- Sustainable cities and Communities' developed by the International Organization for Standardization, in particular by the committee "ISO/TC 268, Sustainable cities and communities", drawn up in 2019. It adopts 14 indicators, including the use of traffic sensors, low-emission vehicles, the availability of sharing services, public transport, and innovative vehicles (ISO 37122, 2019);
- Finally, the SmartER measurement, developed in 2018 by the Emilia-Romagna Region, analyses the technological, environmental, and human dimensions. It includes indicators on the density of cycle lanes, bike sharing availability and some qualitative indicators (SmartER, 2018).

In Italy, several Smart projects developed in the national context also serve as examples of the focus placed on active mobility (Caselli et al., 2022; Pinna et al., 2017). According to the Italian Smart Cities platform, the particular interest of administrations emerges in the theme of cycle mobility, shared mobility, pedestrian

mobility and improving local public transport. There are some recurring measures that can be highlighted, not only from the indexes listed above, but also within the literature, and that refers to sharing mobility, traffic calming and slow mobility. They aim at enhancing road safety (as in Batomen et al., 2023), at giving to active transportation modes a more central role in urban transportation (as in Tight et al., 2011), at improving environmental sustainability (also with e-mobility solutions, as in D'Acierno et al., 2022) and at reducing private cars use (with particular reference to the sharing systems, as in Tesoriere et al., 2020).

2.2 Mobility indicators within Urban Regeneration protocols

In the literature, there are many protocols to assess urban regeneration interventions, which consider all the aspects of a regeneration project (social, economic, environmental, etc.) often adopting holistic and comprehensive approaches. They also include measures for 'mobility' both to incentive the environmental sustainability, and 'traditional' needs like car parkings. With reference to active mobility issues, the three Italian protocols anlysed (the GBC Quartieri protocol of Green Building Council Italia of 2015, the ITACA protocol of 2016, the Urban Quality Matrix of AUDIS - Associazione Aree Urbane Dismesse - of 2017), highlight the following characteristics:

- The Green Building Council (GBC) protocol stresses accessibility to the public transport system within a 400-metre radius of the buildings, proximity (400 metres) to the bicycle network, and pedestrian accessibility of the streets network, which mainly involves the continuity of footpaths (GBC Quartieri, 2015);
- The Itaca protocol pays attention in particular to public transport, to the improvement of cycle and pedestrian accessibility, and also the development of innovative systems such as the bike sharing (ITACA protocol, 2016);
- The Urban Quality Matrix considers mobility from a wider perspective. It includes the urban quality (the urban equipment of infrastructure for public and private mobility), and the quality of public spaces (accessibility, usability and safety) (AUDIS urban quality Matrix).

Furthermore, the cities of the Emilia-Romagna Region have set up some indicators in the occasion of the Regional Call for Urban Regeneration in 2018 for their projects (Pellicelli et al., 2022). These include: the presence of pedestrian and bicycle accesses, the increase or decrease in the length of bicycle lanes, bike sharing stations, street furniture (seats, water elements, bicycle racks), green spaces and trees.

3. Defining a protocol of smart and active mobility indicators for urban regeneration contexts

As highlighted in the previous section, in the literature, indicators belonging to Smart City rankings were originally designed for an application at the municipal scale, with the aim of comparing different cities, while indicators developed within urban regeneration evaluation protocols are already applicable at the neighbourhood scale. How can those indicators be merged, elaborated and integrated to evaluate urban regeneration contexts?

The proposed protocol aims at defining an assessment method that integrates the inidcators implemented so far through the urban regeneration protocols with the Smart City mobility assessment, by creating a schedule of analysis to assess with a single set of indicators the accessibility of services, in particular to the sites under intervention, within urban regeneration processes.

To integrate existing indicators and derive a comprehensive assessment protocol, an evaluation sheet has been developed. Indicators have been divided into 'qualitative', i.e. those indicators which require the verification of the existence of certain elements, and 'quantitative', i.e. those that relate different variables and measures the increase or decrease of certain factors (Tab.1).

Topic	Indicator	SC ranking	UR protocol
Public transport	Pedestrian accessibility to public transport within 400 m		GBC / ITACA
Ciclability	Density of bicycle lanes: km bicycle lanes per 100 km^2 of municipal area	ICity Rank / SmartER	
	Km of cycle paths and lanes per 100,000 inhabitants	EY Smart City	
	A maximum distance of 400 m from an existing cycle network connecting the area to a workplace, school service, basic service or rapid transport stop located within 4 km.		GBC
	Availability of safe cycling routes		ITACA
	Contiguity of bicycle and vehicular routes		ITACA
Walkability	m^2 pedestrianised road surface per 100 inhabitants	ICity rank	
	Pedestrian accessibility of streets		GBC
	Accessibility of footpaths		ITACA
Innovative services	% of non-motorised travel out of total transport	EY Smart City	
	Bike Sharing Diffusion (n. bikes/100 in.)	ICity Rank / ISO 37122 / SmartER	
	Number of shared bicycles per inhabitant	EY Smart City	
	Number of sharing economy transport users per 100,000 inhabitants	ISO 37122	
	Municipalities with car sharing service	SmartER	
	Municipalities with LTZ (Limited Traffic Zone)	SmartER	
	Municipalities participating in the regional platform "Mi muovo"	SmartER	
	Accessibility to shared mobility (in %) of the population within 400m of the sharing station or within 300m of the sharing station		GBC / ITACA
Safety	% LTZ on total area	ICity rank	
	% of residential roads with a speed limit of 30 km/h		GBC
	Reduction of parking areas (max. 8,000 m^2)		GBC
	Security of public space		AUDIS

Tab.1 Qualitative and quantitative indicators divided in main clusters and referred both to the Smart City ranking and urban regeneration protocols assessment

3.1 Case studies selection

The protocol was applied to some medium-sized cities that are similar in conditions, location, and population size to test the methodology and verify the possibility of identifying the project that most improves the existing conditions concerning smart and active mobility in the regeneration areas.

Selected Urban Regeneration projects were evaluated from the perspective of sustainable mobility by checking smart and sustainable active mobility indicators taken from Smart City rankings and urban regeneration process evaluation protocols, as seen before, and partially adapted to the context of the medium-sized city.

The cities have been selected on the basis of the following considerations:

- the location must include municipalities throughout the Emilia-Romagna region;
- urban regeneration strategies must include not only the redesign of public space but also of mobility-related services;
- the size of the urban regeneration project areas must be of comparable size in all cities.

Five provincial capitals of the Emilia-Romagna Region, in the North of Italy, have been selected, referring to urban regeneration projects that the cities presented in the 2018 Regional Call for Proposals on Urban Regeneration and mostly focused on accessibility issues (Pellicelli et al., 2022). Selected projects are located in the cities of Parma, Reggio Emilia, Modena, Cesena and Rimini.

Selected urban regeneration interventions are located in different parts of the cities. The urban regeneration sites are comparable in size, occupying approximately a urban block. Moreover, calls for proposals that finance urban regeneration interventions are suitable for evaluation according to pre-established criteria due to their characteristic of competitiveness, and therefore of evaluation of their performance by the administration. Finally, the public call is an opportunity to implement urban regeneration projects, which, despite being promoted by the recent Regional Law No. 24 of 2017, are often realized by private operators. Public funding is instead an opportunity to redesign the urban space by improving mobility and accessibility, and more general the quality of the context and therefore the quality of life.

The selected urban regeneration project in Parma is located in the north-west sector of the city, outside the historic centre, and concerned the construction of a new library. The project involved the creation of a new urban centrality with a variety of services for citizens: greenery, car parking and meeting areas. It aimed not only at enhancing slow mobility, but also at a general reorganisation of the mobility system in the surrounding neighbourhood to make the area more easily accessible. Adopted solutions included the introduction of a 30 km/h zone and the extension of the bicycle network.

In Reggio Emilia the area interested by the urban regeneration project is located in the eastern part of the city, in the immediate proximity of the historical centre. The area is strategic since it connects the centre, neighbourhoods and polarities such as industrial areas and the train station. The project envisaged the construction of a new building to host the Municipal Police office as well as the reconnection between the different areas from a traffic point of view and the enhancement of the slow mobility network.

The project proposed by the Municipality of Modena was in the Modena East district, within a former industrial area. The regeneration aimed at re-functioning the area and creating a new district for the development of start-ups operating in the field of automotive technologies and sustainable mobility. The area is rich in cycle paths and bike sharing stations, while Zone 30 had to be enhanced.

The Urban Regeneration project of Cesena was located in the historic centre, and involved the redevelopment of three squares: Piazza Bufalini, Piazza Almerici and Piazza Fabbri. The area was before a road for vehicular traffic and was occupied by car parkings. The project involved expanding the green areas, and pedestrianizing nearly the entire square.

The project financed in the Municipality of Rimini was located in the Miramare coastal area, in the Esatern part of the municipal territory. The project included the redesign of the road section of the seafront, before exclusively dedicated to vehicular traffic, making it pedestrian and bicycle friendly. The redesign provided a pedestrian area, towards the beach, a cycle lane on the built-up area side, and in the central area an equipped band, with draining paving and green areas, which was lacking, street furniture and a bike sharing station.

4. Results

The following tables (Tab.2 and Tab.3) presents the results obtained, also to allow a more easily comparison among the cities' interventions.

			Projects evaluation				
Domain	**Indicator**	**Factors**	**Parma**	**Reggio Emilia**	**Modena**	**Cesena**	**Rimini**
Municipality	Municipalities participating in the regional platform "mi muovo"		+	+	+	+	+
	Drafting the SUMP		+	+	+	+	+
	Existing LTZ		+	+	+	+	+
	Car sharing service		+	+	+	+	+
Project Area of Influence	The project contributes to the realisation of the SUMP	Cycle lanes	+	—	—	—	+
		Pedestrian connections	+	—	—	+	+
		Other elements	+	—	—	—	—
	Zone 30		+	—	—	—	—
Project area	Green	Grassland	—	—	—	+	+
		New trees	+	—	—	—	+
	Street furniture	Seating	+	—	—	+	+
		Bicycle racks	+	—	—	+	+
		Water surfaces	—	—	—	+	—
		Play areas	+	—	—	—	+
	Bicycle and pedestrian accessibility		+	—	+	+	+
	400 m distance from a cycle network		+	+	+	+	+
	Bike sharing station		—	—	—	0	+

Tab.2 Qualitative indicators assessed. The symbol '+' indicates that the requirement is satisfied, on the contrary '-' indicates that it is not considered in the regeneration project, finally, "0" means that the element is already present in the area

		Projects evaluation				
Theme	**Indicator**	**Parma**	**Reggio Emilia**	**Modena**	**Cesena**	**Rimini**
Sharing	Bike Sharing Diffusion (n. bikes/100 in.)	No stations	0.73 bikes/ 100 inh	No stations	0.35 bikes/ 100 inh	0.30 bikes/ 100 inh
	Potential service users (%) [(pop. within 5' from station)/(tot. in.)]*100	3.1 %	76 %	7 %	45 %	30 %
Cyclability	Availability of safe cycling routes (m cycle lanes/100 in.)	44 m/100inh	88m/ 100inh	105.7 m/ 100 inh	43.5 m/ 100inh	19 m/ 100inh
	Conjunction of cycle and vehicular routes (%) [(m cycle lanes / streets tot m)]*100	25 %	44 %	48 %	13.5 %	5.6 %
Walkability	Availability of pedestrianised area (m^2 pedestrian area / 100 in.)	1.6 m^2/inh	3.81 m^2/inh	2.4 m^2/inh	5.3 m^2/inh	3.2 m^2/inh
	Extension of pedestrian areas [(m^2 pedestrian area / m^2 area)]*100	1.5%	2.7%	1.4%	4.2%	1.3%
	Pedestrian accessibility of streets [(m street with sidewalks / streets tot m)]*100	75.4%	54.2%	43.6%	66%	40%
Safety	Zone 30 Extension [(m^2 area Zone30 / m^2 area)]*100	47 %	30 %	/	/	/

Tab.3 Quantitative indicators assessed within the urban regeneration framework

As mentioned above, unlike the indicators in Tab.1, those in Tab.2 involves the measurement of different factors and are the ones that will lead to an effective assessment, as explained in the following chapter.
Looking at the results, all municipalities has joined the regional mobility platform and have all approved a Sustainable Mobility Plan (SUMP) between 2017 and 2020.
Except for the Parma project, the analysed urban regeneration interventions do not, however, take into account possibilities of employing the redesign of urban space to address demands as outlined within the SUMP. In three examples (Parma, Cesena, and Rimini), 'urban furniture' is an essential component of the redevelopment effort; in the other two, it is not. The same happens with reference to urban green areas. Water mirrors and fountains are an exception because they are limited to the Municipality of Cesena's proposal. However, except for the Municipality of Reggio Emilia, where the area is zoned for a private development, each project's specific study highlights a positive impact on pedestrian and bicycle accessibility.
Lastly, bike sharing is an even more complicated factor to consider. Since urban regeneration projects are located in the immediate proximity of the historic centre, they do not provide new bike sharing stations (with the exception of Rimini), despite the fact that the accessibility to existing bike sharing stations is in 3 cases still limited, i.e. reachable on foot in 15 minutes or more (Fig.1).

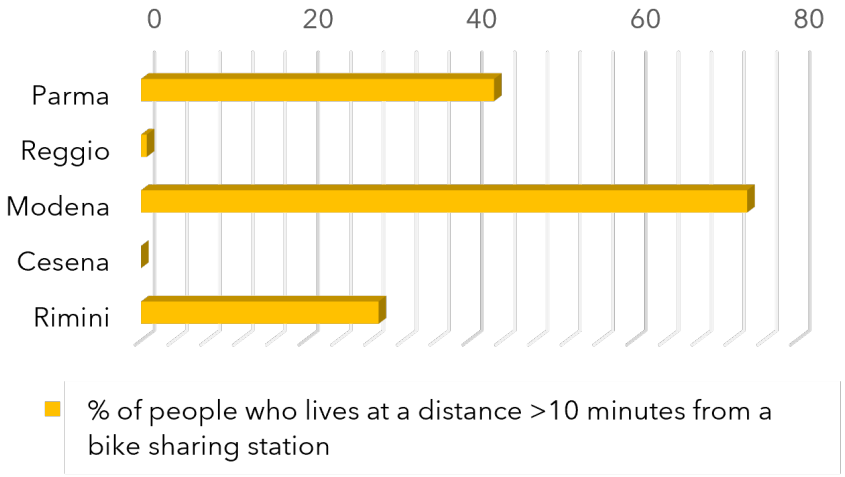


Fig.1 Percentage of residents living beyond a pedestrian distance of 10 minutes from the stations as a result of the regeneration project

5. Discussion

The conducted investigations allowed a comparison of mobility performance and its improvement or decrease in the urban regeneration contexts of the analysed cities.
However, to what extent does an urban regeneration process actually succeed in influencing and improving the urban environment with regard to concerns like user safety, reconnecting long-distance routes and cycle lanes, and urban liveability? Do people who live in urban regeneration choose to walk or cycle instead to drive a private vehicle?
Urban areas chosen for regeneration interventions may, depending on the municipality, either still be largely devoid of adequate infrastructures for cycle and pedestrian accessibility, or they may already be effectively supplied. The pre-existing situation, i.e. the infrastructure already in place and accessible in the regeneration area, is in fact tied to the factors. How can we figure out which project performed best?
The variables are in fact closely intertwined to the pre-existing situation.
The most enhanced categories were defined using an algorithm derived by the multi-criteria analysis. Six of the criteria, related to slow mobility (pedestrian areas, pedestrian paths, cycle paths, bike sharing stations, 30 km/h zones, green areas) were considered as values, that means that their increase corresponds to an increase

in the overall rating. The other two criteria (parkings and vehicular roads) were considered as costs, so their decrease are considered a cost saving that led to a better overall rating. This explains why all values showed in Fig.2 are displayed as positive, e.g. the vehicular roads rate is high in Rimini case, thanks to the great reduction of road surface planned in its intervention.

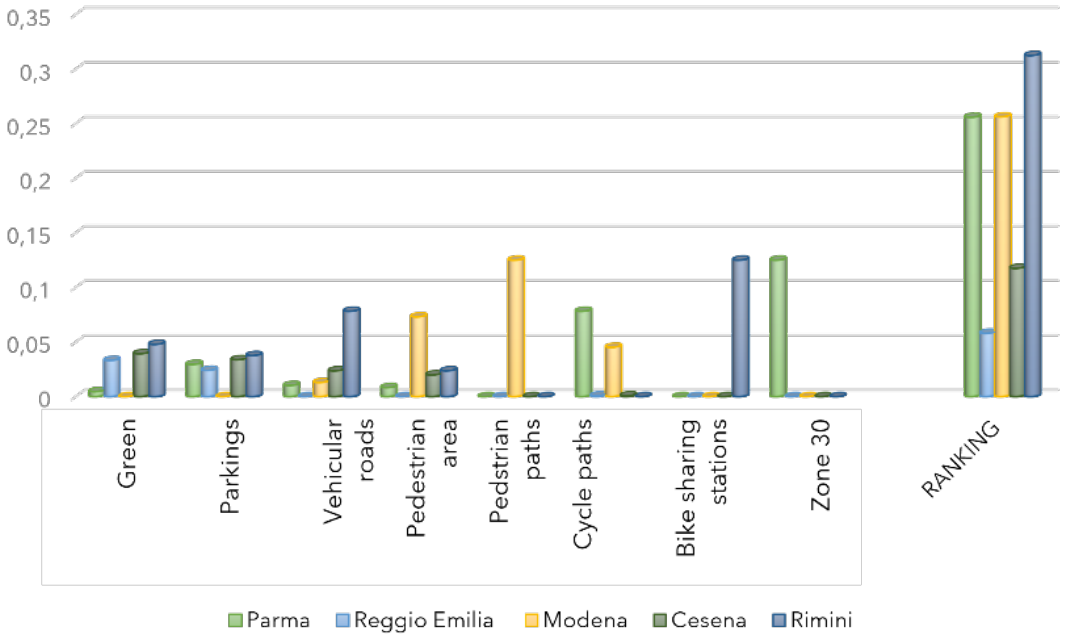
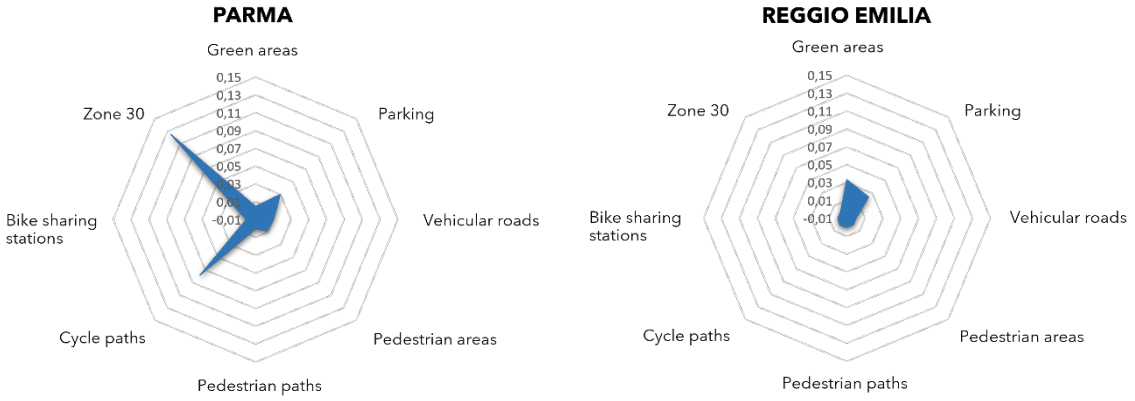


Fig.2 Increase or decrease of accessibility factors as a result of regeneration projects, normalised

Furthermore, Fig.3 represents the graph reorganised by city, showing in which areas each case study achieved the best results, represented by the outward peaks.

We can have a clear idea of the major impacts generated by the urban regeneration intervention. The city of Parma developed the expansion of the Zone 30 and connected two cycle lanes to each other. The city of Reggio Emilia proved a contrary action, in public space it privileged vehicular mobility. The city of Modena increased the pedestrian paths, connecting the two sides of the former industrial compartment with walkways. The city of Cesena enhanced the pedestrian areas, transforming the vehicular roads into pedestrian ones, and completely pedestrianised the squares, but it did not impact very much because it was already rich in pedestrian paths, but we can see the increasing of the green areas. Finally, the city of Rimini as well intensify different sphere, the most conspicuous is the bike sharing service, but also the reduction of vehicular traffic and the boost of green areas are remarkable.



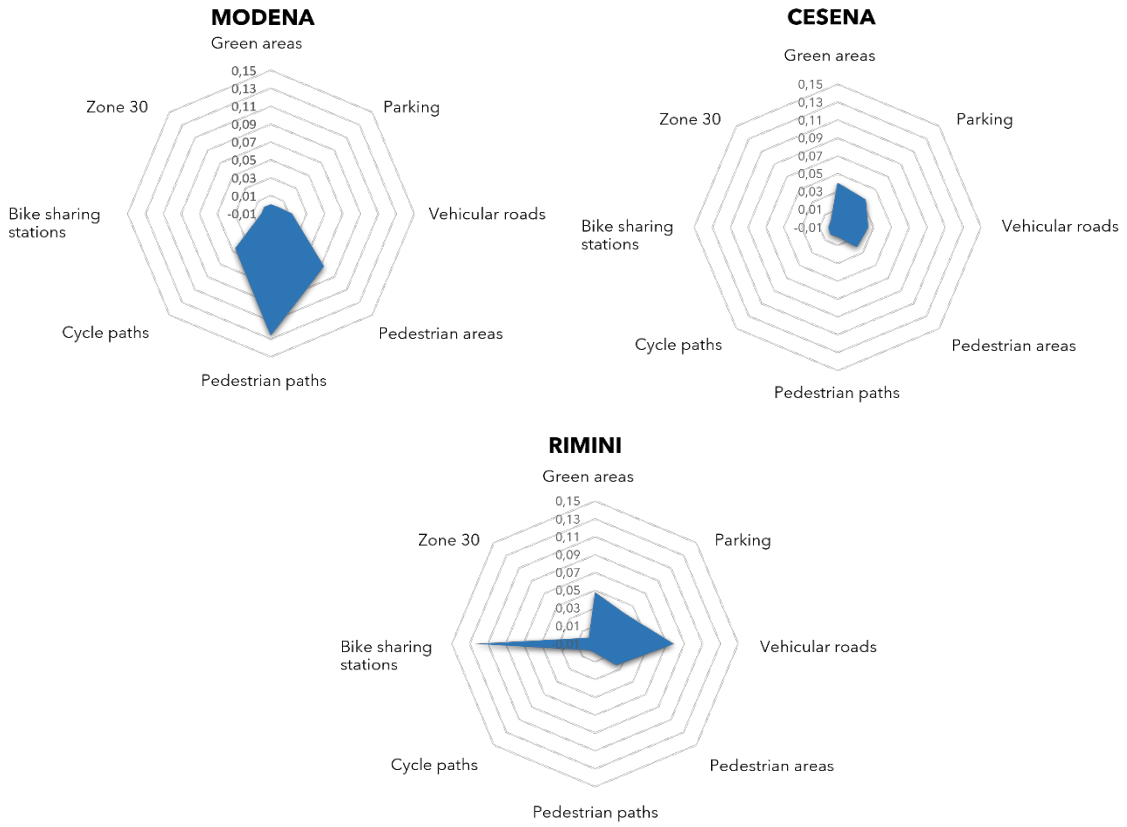


Fig.3 Overview of the enhancement of the criteria for the city of Parma, Reggio Emilia, Modena, Cesena and Rimini

6. Conclusive remarks

The paper proposed a protocol to evaluate smart and active mobility within urban regeneration interventions, deriving specific indicators for mobility re-elaborated from urban regeneration assessment protocols and Smart City rankings. The paper applied the protocol to five medium-sized cities in the North of Italy, to compare their projects form the smart and active mobility perspective.

Indeed, this assessment protocol enables measuring the rise in active and smart mobility characteristics within urban regeneration projects, and, as a result, comparing different projects. Therefore, it can be applied as an evaluation tool for urban regeneration processes to qualifying and promoting active smart mobility.

The proposed methodology could be used to compare different project proposals, for example during the evaluation phases of public calls for urban regeneration to assess the improvement of active mobility and accessibility to the regeneration area.

The evaluation process measures the progress in accessibility rather than the optimal location of urban regeneration interventions. The evaluation process is therefore not appropriate to use it as a tool to identify the priority areas for urban regeneration initiatives. On the other hand, where there is a lack of accessibility via environmentally friendly modal choices, it may be able to improve regeneration performance using the indicated indications.

The Regional Urban Regeneration Call placed a strong emphasis on redesigning transport infrastructures to support active modes and, more broadly, sustainable mobility. This is a crucial component of the Sustainable Development Goals (SDGs) established by the United Nations 2030 Agenda (UN-GA, 2015), but it is also favored by UN-Habitat's New Urban Agenda (UN-HABITAT, 2017), which prioritizes non-motorised transportation modes like walking and cycling over motorised private transportation.

As seen, there are numerous methods that operate on various scales to evaluate active mobility in urban areas. Evaluation processes certainly contributes to focus attention to the topic.

The study shows how much urban regeneration and mobility issues are intertwined: urban mobility, safety and environmental sustainability represent pillars of all the analysed regeneration strategies. As the literature highlight, is important to achieve sustainability regarding the field of mobility, because clean and soft mobility combined with increased accessibility and the advent of new technologies can reduce environmental and social costs (D'Amico, 2023).

Because the methodology is implemented retroactively, and the administrations already received fundings for the interventions, this choice of analyse competitive calls is a pretext to test the effectiveness of the indicators, which may be used for future calls.

From the results of the analysed cities, some possible guidelines for regeneration processes clearly emerge. In particular, it is possible to stress the necessity of:

- Integration of SUMPs with urban regeneration interventions;
- Expansion of 30 kmph zones in contexts that are close to the historic centre or smaller urban centers;
- Checking the accessibility of bike sharing services. Although it is not possible for all people to be served by shared bicycle, it would be convenient for each location to be close enough to give numerous people the opportunity to reach it by walking. This could become an attractive alternative to private car use;
- Integration of traffic components that considers each user's demands and ensures their safety with appropriate traffic calming techniques;
- Integration of elements derived from SEAPs (Sustainable Energy Action Plans), that promote environmental sustainability in open spaces, especially near streets or pedestrian spaces, such as fountains, seating and street furniture elements. These would benefit the environment and act as attractive elements also for pedestrians.

The main limitations of this work are related to the indicators used. Although the most frequently used indexes in the literature for evaluating Smart Cities have been considered, there are numerous indexes that assess urban characteristics and quality of life.

Future developments to this work could include the improvement of the evaluation methodology, i.e. the recalibration of the indicators to take into account the use of the area after the project implementation, as well as the enrichment of the data for a more accurate evaluation and, finally, the improvement of the analysis' level of detail (i.e. including further criteria, like the presence and location of architectural barriers etc.).

Furthermore, despite the fact that each municipality has different needs, the protocol application may set maximum levels for each indicator to work towards, so that each example can be compared with an 'ideal' rather than just with other comparable cases.

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Image Sources

Figg.1, 2, 3: elaborated by the authors.

Acknowledgements

The authors jointly designed and contributed to the paper. Conceptualization: M.Z., S.R., and G.P.; Data curation, G.P.; Investigation, G.P.; Validation: S.R.; Methodology, G.P., S.R., and M.Z; Supervision: M.Z.; Writing—original draft, G.P., S.R.; Writing—review and editing, S.R., M.Z. All authors have read and agreed to the published version of the manuscript.

Attribution

Research funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.5 - Call for tender No. 3277 of 30/12/2021 of Italian Ministry of University and Research funded by the European Union – NextGenerationEU. Award Number: Project code ECS00000033, Concession Decree No. 1052 of 23/06/2022 adopted by the Italian Ministry of, CUP D93C22000460001, "Ecosystem for Sustainable Transition in Emilia-Romagna" (ECOSISTER).

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