Neighborhood Sustainability Assessment: The Case of Casal Bertone Neighborhood in Rome

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Abstract. The role of cities in sustainable development is increasingly prominent so much so that they have been defined as "the cornerstone of a battle to defend the planet". Moreover, since the raising number of people living within a city will reach the figure of 5 billion by 2030, cities should prepare themselves through developing efficient planning and best practices. In this light, a large number of environmental assessment tools and frameworks have been developed to moving towards sustainability the cities. More recently the focus has been moved on neighborhoods and districts interpreted as the building blocks of cities and as the more adequate level for trigger and enhance citizens participation. The identification of the neighborhood as a basic planning unit results in various theories and models aiming to create better and more livable urban environment. The increasing awareness of the inadequacy of a development model based on a unlimited growth is pushing towards the concept of sustainable development and on the importance of the local level. In this framework, aim of the paper is to present an assessment framework developed in coherence with the CAT-MED urban model and tested in the Casal Bertone neighborhood in Rome.

Keywords: Sustainable development · Urban models · Neighborhoods assessment

1 Introduction

Since the publication of the Brundtland (1987) report "Our common future", the terms "sustainability" and "sustainable development" have been entered in the society common language. Since then, the definition of these terms has generated a large debate (Gibson 2006) with the emergence of a plethora of competing definitions (Hopwood et al. 2005; Robinson 2004) and multiple interpretations (Tanguay et al. 2010) nevertheless, there is a broad consensus on the so called "three pillars" of sustainability: the "environmental," "social," and "economic" dimensions (Elkington 1999).

The role of cities in sustainable development is increasingly prominent so much so that Bhatia et al. (2019) have defined cities are "the cornerstone of a battle to defend the planet".

In line with the 11th Sustainable Development Goal on "sustainable cities and communities", cities are considered as a place where culture, science research, labour productivity, social development etc. may advance for the wellness of the people of the world and in particular for the increasing citizens due to the constant urbanization phenomenon. Since the raising number of people living within a city will reach the figure of 5 billion by 2030, cities should prepare themselves through developing efficient planning and best practices.

In this light, a large number of environmental assessment tools and frameworks have been developed to moving towards sustainability the cities.

The United Nations (1992) started the urban monitoring in term of sustainability with the Local Agenda 21 (Marsal-Llacuna et al. 2015). In the following decades urban sustainability indicators has been produced by several organizations (McManus 2012) - environmental organizations, organizations promoting green citizenship and sustainable capitalism, consultancy organizations, research organization - and other aspects, such as quality of life or livability with respective indicators, have been added (i.e. Mercer's annual quality of life survey, the Economist Intelligence Unit's quality of life index, City prosperity index, Monocle's Most Livable City, International Living's Quality of Life Index). Moreover, these indicator systems imply the development either of city rankings or benchmarking tools.

However, according to the consideration that cities cannot contribute to the sustainability unless their different components are sustainable (Choguill 2008), recently there has been a change in the focus of both planners and policymakers that instead of single buildings have increasingly focused their actions on neighborhoods and districts as the building blocks of cities (Searfoss 2011) and also considered them as the most adequate level for the citizen participation and for a meaningful environmental, social, and economic assessment (Berardi 2013; Haider et al. 2018) because able to consider simultaneously built environment, mobility and services (Haapio 2012). Moreover, some scholars (Cloutier et al. 2018) look at the development of sustainable neighborhoods as promoter of the pursuit of happiness.

The importance of neighborhoods in the fabric of the city is testified by the fact human settlements have been spatially divided into districts and neighborhoods since the early stage of urbanism (Friedmann 2010; Smith 2010). The identification of the neighborhood as a basic planning unit (Rohe 2009) resulted in various theories and models aiming to create better and more livable neighborhoods. More recently, the increasing awareness of the inadequacy of a development model based on a unlimited growth is pushing towards the concept of sustainable development and on the importance of the local level (Farr 2008; Rohe 2009; Wheeler 2004). This interest has led, throughout the world, to a strong interest in developing initiatives to pursue sustainability through appropriate planning at the neighborhood level (Luederitz et al. 2013; Farr 2008; Komeily and Srinivasan 2015; Sharifi and Murayama 2012).

From the early 20th century onwards urban planning and design have sought to develop livable and environment-friendly neighborhoods. Sustainable neighborhood initiatives can be regarded as a prosecution of these trends. It's possible to find some criteria related to sustainability in the agenda of the Garden City (Farr 2008), Neighborhood Unit (Lawhon 2009), Modernism (Wheeler 2004; Watson 2009) and

Neo-traditional Planning (Duany et al. 2000) Movements. However, it's with the Eco-urbanism Movement (Register 2006) that the sustainability plays as central role in the neighborhood planning.

The push toward a sustainable neighborhood development grounds its roots in the awareness that the next future will be a very crucial phase for cities and human life particularly when 70% of the population will be living in urban settings. This has created a strong need for transitioning cities toward sustainable communities pushing the public administrations to use increasingly sustainable development indicators to confirm cities' sustainable development strategies especially by enabling assessment and monitoring activities (Tanguay et al. 2010). As a result, several neighborhood sustainability assessment (NSA) tools have been developed worldwide (LEED-ND, North America; BREEAM Communities, UK; DGNB-NSQ, Germany; CASBEE-UD, East Asia-Japan; Pearl Community for Estidama, West Asia-UAE; Smart cities challenge, IBM; GSAS/QSAS, Quatar; Green Star Sustainable Communities, Green Building Council of Australia; PETUS, European Commission; SBToolPT-UP, Portugal; EarthCraft Communities, US; HQE2R, EU; Ecocity, EU; SCR, Australia; Sustainable Neighborhoods for Happiness Index). Although these tools are being continuously revised and improved (Tam et al. 2018), generally they lack a context specificity (Komeily and Srinivasan, 2015) and have a strong environmental focus (Berardi 2013; Robinson and Cole 2015; Tanguay et al. 2010) rather than an integrated approach with a simultaneous consideration of economic, environmental and social impacts. Moreover, the limitations linked to the use of such indicators systems are the absence of a systemic interactions and of normative indications (Huang et al. 2009) and the lack of participatory approaches because mostly has been developed top-down by expert organizations (Berardi 2013; Reed et al. 2006; Robinson and Cole 2015; Turcu 2013).

Cities, on the contrary, need to be understood as complex ecosystems in which a continuous interaction between its social, biological and physical components is happening (Nilon et al. 2003). The understanding of these relationships is the key to achieve sustainability. Moreover, to properly address these interactions a systemic approach is needed, able to focus on the spatial structures and character of a city, the spatial distribution of activities and accessibility of different services, urban forms, functions and their connections (Bourdic et al. 2012; Salat and Bourdic 2012).

In this framework, aim of the paper is to present an assessment framework (tested in the Casal Bertone neighborhood in Rome - urban area of the V sub-municipality) as application of the CAT-MED urban model[1], able to consider the citizen participation and contextual characteristics and so don't provide overwhelmingly similar guidelines.

The CAT-MED model aims to leading to a configuration of a city which facilitates not just greater energy efficiency, but also an increase in mobility and accessibility amongst people and the distribution of goods and services, thereby increasing accessibility and human connectivity, and social cohesion which arises from an improved quality of life and therefore health for the population in general.

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[1] The CAT-MED model has been developed co-financed by the European Union- http://www.catmed.eu/index.php.

The basic idea aims to recover the classic European and Mediterranean city as an example of urban organisation. This model is not new, although until recently we were unable to appreciate it. In particular, the classic Mediterranean city epitomises two complementary concepts which make it more accessible to the human habitat and at the same time to the use of natural resources: compactness and complexity. Compactness means the grouping of buildings with a minimum of density, enough so that there can be a range of different activities, and consequently a transfer of information and relationships. Complexity is the other side and represents the diversity in human activity which occurs in the different parts of the city.

Coherently with this vision the main focus of the model, described in the second section, is the selection of a common system of indicators (and of their optimal values) based on the characteristics mentioned, such as urban density, building compactness, complexity of uses and functions, access to and proximity of basic services and facilities and mobility in the urban environment. Moreover, the model application foresees the choice of actions able to maximize the indicators actual values trough a participatory process. As showed in the third section, in the case of the Casal Bertone neighborhood this process of choice has been developed through the assessment of different development scenarios according to four different criteria:

- Social Evaluation
  - Citizen evaluation (sample investigation)
  - Local stakeholders' evaluation (sample investigation)
- Feasibility (technical and economic) evaluation (expert panel)
- Impact analysis on the common indicator system (expert panel)

Finally, in the fourth section the conclusions are presented.

2 The "CAT-MED" Urban Model

Given the urgent need for action to combat climate change, eleven Mediterranean cities (Malaga, Barcelona, Valencia, Seville, Community of the Countries of Aix, Marseille, Genoa, Rome, Turin, Thessaloniki, Athens) in 2009 have decided to cooperate and join forces to limit the risks of this phenomenon by developing and promoting a sustainable, coherent and multifunctional urban model.

The aim of this network is to prevent the natural risks arising from climate change by bringing Mediterranean cities' initiatives into a single common strategy. The starting point is that classic Mediterranean city combines two complementary concepts that make it more suitable to human habitat, while being conducive to the lower consumption of natural resources: the compactness and complexity. The compactness of a city means that the buildings are grouped together closely, creating a dense environment and sufficient population critical mass so that there is a high level of different activities taking place, and therefore a transfer of in- formation and

relationships. Complexity goes hand in hand with compactness, representing the diversity of human activities that are located in different parts of the city.

The relationship between the urban model - dense, compact, complex in activities and uses, easy to reach - and energy consumption are very different from those observed in sprawling cities. The historic Mediterranean city created a blend of compactness and complexity from the medieval period facilitating communication as well as the exchange of goods and services among citizens on a pedestrian scale. Today, we still retain the best features of the Mediterranean city; it is possible to go by foot from home to the market or to businesses, to take children to school or even allow them to go alone.

The compact and complex city not only provides mobility and accessibility, but also enables the commitment of more time to social or personal activities; time which is often lost in the traffic jams of sprawling cities.

This idea of recovering the best characteristics of the traditional Mediterranean city, its organization, and the introduction of innovative elements from new energy-saving technologies, are the element of the CAT-MED model, which aims to reflect the complementarity of territorial and social cohesion.

The CAT-MED model aims to recover the classical European and Mediterranean city as an example for urban organisation. Is not a new model but one we fortunately already have but did not necessarily fully appreciate until recently.

According to this common model of urban organisation, the model aims to take into account the main and common features of the Mediterranean city: a certain population density, sufficient levels of urban compactness and high complexity in the mix of uses and functions. In terms of urban planning, it's possible underline five characteristics that usually describe the quintessential compact and complex Mediterranean city, and that clearly differentiate these from the scattered and diffused urban models. These characteristics closely linked to each other, so much so that separately they would be meaningless, and would not be related to issues such as energy efficiency or greenhouse gas emissions: urban density, building compactness, complexity of uses and functions, accessibility and proximity to services and basic equipment, and mobility in the urban environment. In this framework the need for a comprehensive approach is clear according to the main reference documents, such as the Aalborg Charter (1994), the Leipzig Charter (2007) and the Toledo Declaration (2010).

Considering these background reference works, the CAT-MED model is structured around four axes of work: the territory and configuration of the city, mobility and transport, natural resource management as well as social and economic cohesion.

The idea is that the organisation of the territory and configuration of the city has a direct impact on the prevention of environmental risks related to climate change.

The commitment to the compact and complex city model is, at the same time, the choice of shorter distances to reach activities, implying improved urban mobility and urban accessibility, resulting in lower energy consumption, lower air pollution levels and increased availability of time for personal or social activities.

Mobility and transport, clearly related to the configuration of the territory and the organisation of the city, thus acquires a special significance because of its direct relationship with energy consumption and greenhouse gas emissions released into the atmosphere. The need to balance the modes of transportation, so that public transport and alternative means, such as pedestrian or bicycle, taking precedence over private vehicles - even making private transport the alternative mode-, is a key factor to according traffic congestion and minimising the impact of mobility on the environment.

The management of natural resources is also clearly dependent on the urban organisation model of a city. An increased need for the exploitation of natural resources: materials or energy, is related to and is therefore influenced by greater inefficiency in shaping the city.

This relationship between the inefficiency of the urban organisation model and the environmental impact is also reflected in increased generation of waste and pollutants, particle emissions into the atmosphere and greenhouse gases, with the consequent contribution to the effects of climate change.

Finally, social cohesion is established as a priority objective of the sustainable city urban model. However, the idea of social cohesion is not abstract, but rather physically develops over the territory, a space people conduct their activities. Thus, social cohesion and territorial cohesion are part of the same concept.

In this framework specific objectives of the model are:

- to promote the convergence of cities towards behaviors and city habits consistent with a sustainable model;
- promote a common and strongly shared strategy through the definition of specific targets on the abatement of CO2 emissions and on the adoption of preventive actions against climate change thanks to the optimal values assigned to each transnational indicator;
- define an assessment tool and a help tool for defining the strategies to be adopted;
- to stir the conscience of political decision-makers, socio-economic stakeholders and the public on the importance of changing the daily behavior of citizens to prevent the risks deriving from global warming;
- ensure that the strategies developed are appropriate for the stakeholders in the area, without which the strategic approach could not be effective, involving them in identifying concrete solutions and making them participants through a process of cross-cooperation.

The Cat Med model quantify these objectives through the use of indicators identified on the basis of a systematic approach focused on the principles of sustainable development. Twenty indicators (Fig. 1), representing a common basis with which to objectivize the notion of urban sustainability and a tool to evaluate urban policies in a sustainability perspective, has been selected. For each indicator, optimal levels have been established, which became the convergence targets to which the metropolis should refer in the fight against climate change.

	Indicator	Calculation	Desiderable level	Measurement unit
Territorial management & urban design	1. Population density	Number of inhabitants / Urban area	120	Inhabitants per hectare
	2. Urban compactness	☐ Buiding Volume/ ☐ urban area	5	Metres (Cubic meters per square metre)
		☐ buiding volume / ☐ pedestrian public space area	10-50	
	3. Urban complexity	Shannon index H	4-6	Entropy (Shannon index H)
	4. green zones & recreation areas	Green zone & recreation areas m2 / numer of inhabitants	10	Square meters per inhabitant
		Green zone & recreation areas m2 / urban area square meters	0,15	Percentage of green zones
	5. green zones & recreation areas proximity	(Inhabitants that live next to a green zone / total number of inhabitants)*100	100	Percentage of population
Mobility & transport	6. Traffic modal split	(Trips made by car/total number of trips)*100	>20	Percentage of trips
		(Trips made by public transport/total number of trips)*100	33	
		(Trips made by bycicle/total number of trips)*100	33	
		(Walk Trips / total number of trips)*100	16.5	
	7. Proximity of public transport stops	(Inhabitants that live next to a bus or tube stop/total number of inhabitants)*100	100	Percentage of population
	8. Proximity of bicycle lanes and paths	(Inhabitants that live next to the cycle lanes network/total number of inhabitants)*100	50	Percentage of population
	9. Percentage of pedestrian streets and walkways	(Pedestrian streets &walkway lenght/total streets and roads lenght)*100	0,1	Percentage of pedestrian streets (length)
		(Pedestrian streets &walkway area/total streets and roads area)*100	75	Percentage of pedestrian streets (area)
	10. CO2 emissions	http://ec.europa.eu/environment/urban/common_indicators.htm	4	Tonnes per year
Natural resource management	11. Energy consumption	Electricity+Natural gas+Hidrocarbon+LP Gas Consumption/Number of inhabitants	1,5	Toe (tonnes of oil equivalent) per inhabitant per year
	12. Water consumption	Domestic water consumprion volume/(number of inhabitants*365)	82,15	litres per inhabitant per day
	13. Waste management & removal	Totale urban solid waste volume per year/(Number of inhabitants *365)	1,3	Kilograms per inhabitant per day
		Selective urban solid waste volume per year/(Number of inhabitants *365)	50	Percentage of selective solid urban waste
	14. Air quality	SO2: Number of days with more than 125 µg/m3	3	Number of days with bad air quality
		CO: Number of days with more than 10 mg/m3	0	
		NOx: Number of days with more than 50 µg/m3	18	
		O3: Number of days with more than 120 µg/m3	25	
		PM10: Number of days with more than 50 µg/m3	35	
	15. Noise pollution	(Number o people exposed to more than 65 dB during the day/Total number of inhabitants)*100	0	Percentage of population
		(Number o people exposed to more than 55 dB during the day/Total number of inhabitants)*100	0	
Social and economic cohesion	16. Proximity to basic services	(Inhabitants that live near a basic service center/Total number of inhabitants)*100	90	Percentage of population
	17. Social housing ratio	(Number of social houses/Total number of houses)*100	20	Percentage of social housing
	18. Labor force participation & unemployment rate	(Number of people in the labour force/Number of working age people)*100		Percentage of population
		(Number of unemplyment people /Number of people in the labour force)*100	<10	
	19. Tourist frequency trends	(Number of tourist in each month/Total number of tourist)*100		Number of tourists and overnight stays per month and per year.
		(Number of overnight stays in each month/total number of overnight stays)*100	6-11	Percentage of seasonality per month.
	20. Environmental activities in primary school	(Pupil participating in environmental activities/ Total numbers of primary school pupils)*100	75	Percentage of primary school children

Fig. 1. The common system of indicators of the CAT-MED model

The definition of a common system of urban sustainability indicators enables to track the evolution of urban systems in time. The indicators are designed precisely to check whether cities are approaching the desirable ranges set or, conversely, whether cities are moving farther away from them.

The CAT-MED model is so based on common notions of complexity and urban compactness as well as a set of shared priorities: the density and mix of uses and functions, the recovery of public space as vertebral axis of planning, the affirmation of the pedestrian scale as the urban landscape reference, proximity, social cohesion and promotion of social housing, preservation of cultural and historical heritage and the preservation of natural resources. In the meantime it recognises and values the diversity of Mediterranean cities adapting the solutions to different local contexts trough a participatory and multi-level approach (primarily a human process rather than a planning action in the strict sense) where elected officials must commit, technicians share their skills and knowledge and people collaborate and get involved in the development of the projects.

In light of this, the CAT-MED model favour synergies between three levels: the technical level, the citizen level and the political level.

At a technical level, it's foreseen the creation of working groups coordinated with the heads of the different municipal areas with the objective of calculating the local indicators values. Moreover, the creation of these groups aims to generate a debate on the different concepts analysed through the indicators, the results obtained and the desirable range to be applied for each specific indicator, taking into account the reality of each territory. This effect is particularly interesting as it obliges them to analyse existing data and promotes the exchange of information within the offices of the local administration of the participating cities.

At a citizen level, it's foreseen the organisation of different public seminars to promote the exchange of information and experiences as well as giving more visibility and diffusion of the work carried out in the project. Furthermore, the creation of a Metropolitan group, bringing together various different people in each city, including representatives of citizen groups and neighborhood associations, creating forums where people could reflect on key issues and propose their ideas, has foreseen.

At the political level, the application of the model foresees the official commitment of the local institution (the mayor) to share objectives and initiatives through the Charter of Sustainable Mediterranean Neighborhoods, signed for the first time in Malaga on the 7th of February 2011 by the eleven cities' mayors that defined the model. This commitment on behalf of the elected representatives above all offers scope for the consolidation of a network capable of conveying a strong political message about urban sustainability in the Mediterranean, with the accompanying commitment towards constructive work, projects and thinking.

3   The Casal Bertone Neighborhood in Rome

The CAT-MED model has been applied in several case among which the Casal Bertone neighborhood in Rome where, who is writing, has been the scientific responsible.

The neighborhood, in the urban area of the V sub-municipality (Fig. 2), is mostly residential, counts around 11000 inhabitant and shows a building structure mainly composed of 5–6 floors. They were built, in the area of via Prenestina, in the 20's, and, in the area of via Tiburtina, in the 70's.
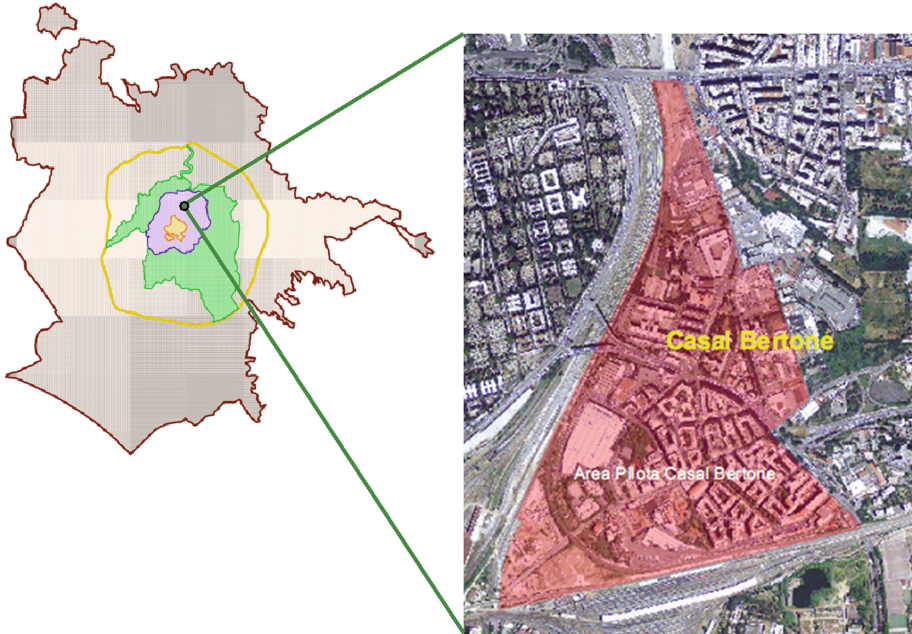

Fig. 2. The Casal Bertone neighborhood in Rome

The main element that has characterized the application of the CAT-MED model in this neighborhood has been the choice process of the actions able to maximize the value of the indicators in order to reach the optimal values defined by the model. First of all, an expert group from the "Sapienza" University of Rome – Faculty of Engineering has been involved to identify potential projects to be implemented in the area. After a knowing phase aimed to describe in depth the potentialities and the weakness of the area and to measure the values of the common indicator system, the experts were asked to focus their proposal about six themes: transport and mobility, territorial management and urban planning, natural resources and environmental impact management, economic and social cohesion, Mediterranean specificity, governance. The interventions identified have been further grouped defining four different integrated scenarios focused on a particular development strategy and studied in depth (Fig. 3).

In order to choose the optimal scenario, an assessment of the scenarios based on 4 comparison criteria has been performed as following:

– Social evaluation - citizens (sample investigation);
– Social evaluation - local stakeholders;

– Technic and economic evaluation - expert panel;
– Analysis of relationship between common indicator system and project actions with
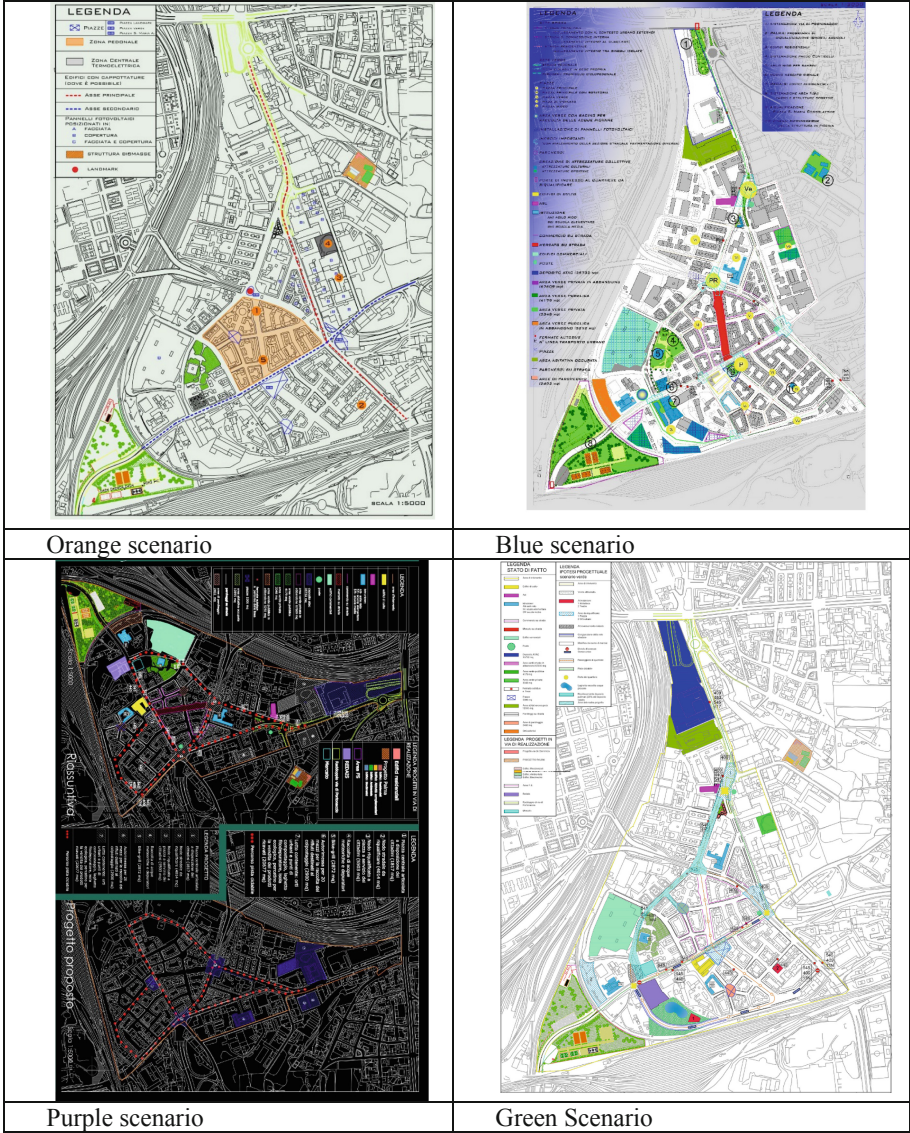 regard to optimal threshold

Fig. 3. The four scenarios

For each scenario evaluation, specific measures have been defined. They are essentially ranking measures as follows:

1. for the "Social evaluations" has been used the inverse of the coefficient of variation, which is based both on the mean term and standard deviation, and can express, the preference for a particular project measures and/or scenario on the whole, and a certain harmony in the judgments recorded.
2. for the "Technic and economic evaluation" has been used a measure giving best score to a specific action if this is characterized by the attributes of speed of deployment, low cost both for implementation and maintenance.
3. for the "Relationship with the common indicator system" has been used a measure that gave a higher score to a specific scenario action if it helps to achieve the objectives of the optimal values in relation to the set of common indicator system.

More in detail, the social evaluation aimed to catch the citizens and the local stakeholders' opinions. The objective of the survey was to reveal the preferences of the interviewees, in relation to some interventions in the project area, which would have an impact mainly on the following topics:

– social development;
– territorial redevelopment;
– energy efficiency;
– mobility.

To rank the answers has been used the inverse of a common coefficient of variation which is a satisfactory index because:

– as the value of the index increases and therefore the average meets the so-called non-convexity principle of the index definition compact, so that as the value increases, the degree of preference expressed by respondents also increases;
– as the index decreases, the degree of dispersion (measured by the standard deviation) of the respondents' modalities increases and therefore there appears to be greater disagreement in the opinions of citizens.

In summary, as the value of the index increases there is a greater preference of citizens towards a given scenario and/or action and greater consistency in the judgment on them.

The citizens opinion and the stakeholders' opinion has been grasped in two different ways.

In the case of citizens has been used a sample survey using a structured questionnaire administered through a telephone interview system in CATI mode (Computer-Assisted Telephone Interviewing)[2], and involved the execution, for each single statistical unit of survey, of 5 closed-ended questions[3]. For each question all the units of the sample had to rank four options, on a scale of 1 to 4 (where with 1 the

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[2] 3164 telephone calls were made for a sample of 400 useful interviews.

[3] The first question aim to rank the topics (social development, territorial redevelopment, energy efficiency, mobility), the other four questions aim to rank four alternative actions for each topic.

highest value is expressed in the liking of choice/preference). The ordinal value 4 has been associated with the first preference, the value 3 with the value of the second preference, the value two with the third preference, and the value 1 with the latter.

In the case of the local stakeholders has been used a survey where, all the units of the sample have been requested to assess all the interventions defined by the expert group of "Sapienza" University, attributing for each one a score from 1 to 10 (where 10 identifies the higher level of preference). Once the ranking index score is determined for each intervention, this score is associated with the scenario to which that particular action belongs (it should be noted that a single action can be associated with different scenarios). Finally, the final score for each scenario has been calculated as the average of the indexes of the various actions belonging to it.

The technic and economic evaluation has been carried out trough a feasibility survey where all the units of the sample (an expert panel named "Metropolitan Group") has been requested to express an opinion, for each intervention, in relation to:

- realization times;
- realization cost;
- resources necessary for its maintenance/management.

For each of these three assessments the experts could choice among 5 forecasting gradually increasing. A score on a scale between 1 to 5 was assigned to each of the forecast with 5 is the maximum value. Finally, the scores obtained by the three indices (in correspondence with each of the three evaluations) were added together and the average was calculated.

The last evaluation is referred to the impact of the scenarios' action on the common indicator system. With this aim metropolitan group was asked to indicate, in a 6-mode qualitative scale, the effect that an action could have on one or more project indicators.

The positive effect, indicated with one or more symbols (up to three) " + " suggests that the action examined has a positive effect on the indicator, in the sense of increasing the recorded value (in the same way as if we treated in a linear model of impact the regression beta). Mutatis mutandis for the negative valuations identified with the symbol "–".

As the four assessments have not the same measurement criteria, ranking scale and definition intervals, they needed to be normalized to be aggregated and so express a obtain a single summary assessment. To this end the punctual values of the ranking indices obtained for each scenario has been transformed using the following formula (1):

$$x_n = [x_i / max \ x_i \ (per \ i = 1. \ldots . n) * 100] \tag{1}$$

In this way we get indices having the range of existence between a minimum value (not absolute) and a maximum value equal to 100 (Fig. 4).

So as to allow gaining two goals: on the one hand to evaluate scores of scenarios that are based on ranking measure exhibiting different units of measurement, and on the other to aggregate the different scenarios so you can get a definite synthetic evaluation of preference for a scenario over another.
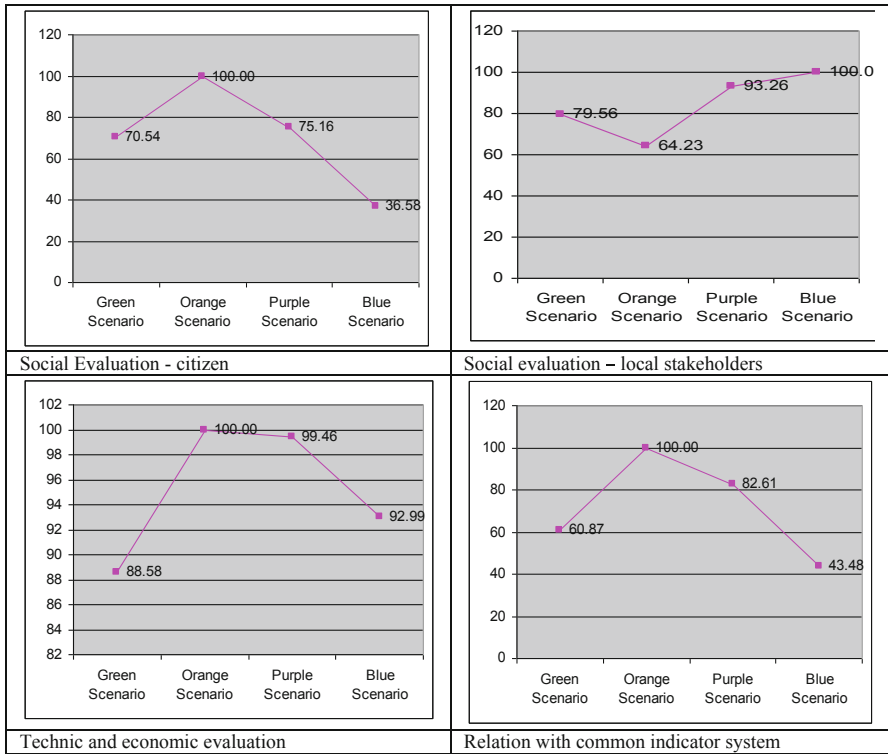
Fig. 4. Results of the four assessment criteria

Once normalized the indexes' values, the average of the results of the different evaluations has been calculated for each scenario. The result of the aggregation is showed in the Fig. 5 where the highest value belongs to the Orange scenario. It's interesting to note that the Orange scenario qualifies itself for a predominance of local redevelopment policy actions such as:

– redevelopment of the neighborhood streets;
– arrangement of green areas;
– enhancement of commercial and pedestrian areas;
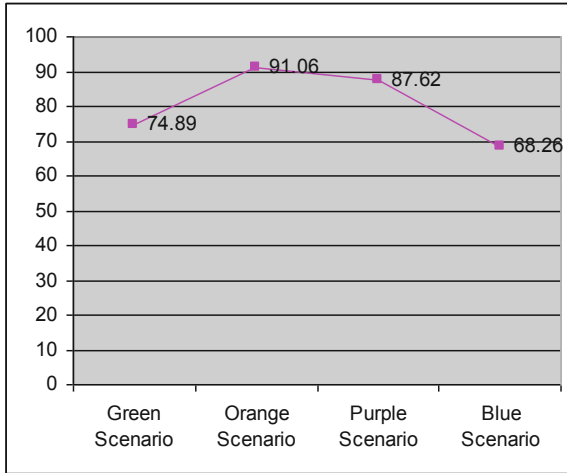– upgrading/construction of streets to promote public relations.

Fig. 5. The final assessment

4 Conclusions

The idea of sustainable development in the urban environment has been developed since the 1990s when the European Commission, conscious of the environmental challenges that our cities were facing, launched a number of measures such as the «Action Plan for Sustainable Urban Development» in 1998, the launch of Network 6 under the URB-Al programme «Urban Environment» from 2000 to 2006 and the white paper «Adapting to climate change: Towards a European framework for action» in 2009. Approaching to the 21st century, the various laws and institutional warnings regarding environmental issues have been complemented with long term commitments related to climate change. At the same time movements against the land consumption and the urban sprawl were grow up and suggestions were made regarding sustainable urban models and the configuration of our cities. In this light, the recovery of the peculiar configuration and structure of the ancient Mediterranean cities, such as a certain population density, sufficient levels of urban compactness and high complexity in the mix of uses and functions, could play an important role. According to that vision the proposed model aims to contribute to the shaping of the city with a participatory approach, focusing on neighborhoods, increasing mobility and accessibility between people and the distribution of goods and services, enhancing human connectivity and social cohesion and leading to a better quality of life for the whole population. Moreover, the assessment methodology, tested in the Casal Bertone neighborhood, highlights that can be not applied a "fit for all" solution, i.e. adequate for all the cities (or neighborhoods), but that, even if under a common umbrella, the central point to catch a real sustainable development is to find the solutions fitted with the specificity of each context and assessed by the different stakeholders.

From this point of view, the proposed methodology should help the decision maker to verify the compatibility of the envisaged changes to the objectives of sustainable

development and to seek socially shared solutions and yet economically feasible thorough the transparency in the evaluation process and the capacity to be flexible.

Compared to this target, further development of the methodology are required, in particular relatively to the implementation phase of the actions.

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