

Assessment of development and regeneration urban projects: cultural and operational implications in metropolization context

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Abstract—It has been worldwide demonstrated that metropolization phenomenon is changing in an indelible way the structure, the shape, the livability and the environment of contemporary cities. This phenomenon can not be circumscribed in a specific national context but it involves the urban sphere of the entire planet.

Moreover, the suburban growth and the connected sprawl, have quite everywhere the same shape and present the same problems: the most critical concern the environmental issue, considered in an extensive meaning, that involves both natural and anthropic elements.

Considering the ecological approach the paper explores cultural and operational implications of assessment methodologies able to control and address new developments to sustainability.

First the Metropolization phenomenon is analyzed throughout general data and specific thematic studies, considering the reasons of the birth and diffusion of the suburban model and the related critics; than the level of complexity that integrated assessment principles involve is connected to European Community proposals and to ethical concepts capable to guide aware plans.

Finally a case study is presented with reference to the Italian context and in particular to the city of Pavia in which a research, developed by the author, about renewal plans of urban dismissed area, permitted to define a set of integrated criteria that can support planners and designers in finding sub-optimal revitalization solutions.

Keywords—Environmental assessment, evaluation methodology, metropolization, urban planning and design.

I. METROPOLIZATION PHENOMENON AND URBAN DEVELOPMENT

POPULATION Division of the Department of Economic and Social Affairs of the United Nations Secretariat calculated the rate of urbanization of world's population: it grew from 29.1% in the '50s to 48.3% in 2003, with a forecast in 2030 about 60.8% [1].

In 2007 largest cities in the world ranked by land area were first New York metropolitan area, with 8.683 sqKm of land area, 17,8 million inhabitants an 2.050 inhabitants per sqKm; second Tokyo/Yokohama with 6.993 sqKm of land area, 33,2 million inhabitants and 4.750 inhabitants per sqKm. In 2006 the first 10 megacities were (inhabitants in million): 1) Tokyo, Japan, 35,53; 2) Mexico City, Mexico, 19,24; 3) Mumbai,

India, 18,84; 4) New York, USA, 18,65; 5) São Paulo, Brazil, 18,61; 6) Delhi, India, 16,00; 7) Calcutta, India, 14,57; 8) Jakarta, Indonesia, 13,67; 9) Buenos Aires, Argentina, 13,52; 10) Dhaka, Bangladesh, 13,09 [2].

Worldwide statistic studies [3], [4], [5], synthesized in Table I and Table II, demonstrate that the more cities and megacities grow, the more the core part loses inhabitants that prefer the suburban area. This fact causes a progressive impoverishment of cities identity and urban rehabilitation assume a strategic role for contemporary and future towns.

Metropolization is the result of a complex set of inter-scalar phenomena that always do not have an adequate planning dimension. The regional dimension, considered as a territory affected by similar phenomena and not as an administrative perimeter, is the best working space. But the lack of a bureaucratic reference risks to reduce the effectiveness of the reasonable considerations that any responsible planner can elaborate.

On the other hand, the new metropolis is built with a low density by single and mutually independent shares that are often proposed and approved at the local government scale; the joint is rarely perfect, since these additions are frequently local variations of the general plan.

A. Birth of the suburban model

As the urban planning historian Robert Bruegmann said [6] the leaving of the proper residence from the city, where remains the workplace, is a fact that goes in parallel with the urban history.

The reasons are simple: traditional city is the centre of culture, richness, exchanges, sometimes of architectural beauty, but it is also a noisy place, sometimes dirty and not safe. Who has the economical possibility, move to a house from where easily reach the workplace, in which the components of the family who don't participate to the civic or economic life can live.

Dolores Hayden in [7] described the fast creation of a mass market, cultural and material, oriented to the new suburban inhabitants.

The new suburbs follow from the beginnings two typologies: the first, qualitatively high for the richest social classes, the second is the "mass suburb", that uses with a low density and monofamiliar houses the simplified street schemes of the peripheral urban quarters.

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Obviously, the second type has been quantitatively greater, and the cities grows with large external quarters characterized by a very high soil consumption.

Table I: Urbanization phenomenon in USA, sorted by percentage of increasing of suburban area

POPULATION	1950			2000		
	Urban Area	Urbanized Area	Core City	Suburbs	Urbanized Area	Core City	Suburbs
Miami	4.460	113	4.347	971.7%	45.4%	2070.0%
Houston	3.121	1.358	1.763	445.2%	227.9%	1679.0%
Atlanta	2.993	85	2.908	590.3%	25.7%	1652.3%
Dallas-Fort Worth	3.291	1.011	2.280	384.9%	141.8%	1605.6%
San Diego	2.241	889	1.352	517.6%	266.2%	1365.7%
Phoenix	2.691	1.215	1.476	1245.8%	1146.2%	1341.8%
Washington	2.647	230	2.877	205.7%	-28.7%	593.2%
Philadelphia	2.227	554	2.781	76.2%	-26.7%	327.2%
Chicago	3.387	725	4.112	68.8%	-20.0%	316.3%
Los Angeles	7.792	1.725	6.067	194.9%	87.6%	299.3%
New York	5.504	116	5.388	44.8%	1.5%	122.3%

Table II: Urbanization phenomenon in Europe, sorted by percentage of increasing of suburban area

POPULATION	1965			Recent		
	Metropolitan Area	Metropolitan Area	Core City	Suburbs	Metropolitan Area	Core City	Suburbs
Madrid	2,512	489	2,023	97.6%	20.0%	1618.4%
Marseille	646	20	626	74.3%	2.6%	680.4%
Barcelona	1,591	(146)	1,737	73.1%	-8.8%	330.9%
Valencia	738	233	505	111.8%	46.1%	325.8%
Naples	1,385	(178)	1,563	78.5%	-14.5%	289.4%
Rome	735	310	425	29.4%	13.2%	265.6%
Lisbon	950	(238)	1,188	73.1%	-29.7%	238.6%
Dublin	314	(42)	356	45.5%	-7.8%	232.7%
Helsinki	435	83	352	68.5%	17.4%	221.4%
Zurich	505	(100)	605	70.6%	-22.7%	220.0%
Lyon	649	(123)	772	64.9%	-22.6%	169.7%
Turin	200	(189)	389	14.8%	-17.0%	162.1%
Rotterdam	315	(133)	448	31.2%	-18.2%	161.2%
Stuttgart	1,178	(55)	1,233	83.3%	-8.6%	159.5%
Nuremberg	343	25	318	50.8%	5.4%	152.2%
Stockholm	504	(42)	546	42.7%	-5.3%	143.7%
Milan	1,015	(359)	1,374	36.6%	-21.6%	123.8%
Munich	394	53	341	26.3%	4.5%	104.9%
Hamburg	293	(129)	422	12.7%	-7.0%	94.8%
Athens	1,238	95	1,143	63.5%	14.6%	87.9%
Paris	3,175	(675)	3,850	39.7%	-24.1%	74.0%
Porto	285	(40)	325	38.0%	-13.2%	72.7%
Frankfurt	447	(54)	501	30.8%	-7.8%	66.4%
Copenhagen	144	(204)	348	10.4%	-28.9%	51.6%
Glasgow	(15)	(367)	352	-0.8%	-35.6%	41.2%
Amsterdam	145	(153)	298	8.4%	-17.7%	34.5%
Brussels	525	(28)	553	26.6%	-17.0%	30.6%
London	1,015	(409)	1,424	7.8%	-12.9%	14.6%
Manchester	(90)	(249)	159	-3.2%	-38.2%	7.2%
Berlin	76	147	(71)	1.9%	4.5%	-9.1%
Vienna	(200)	(110)	(90)	-9.9%	-6.6%	-24.7%

B. Critics on suburban model

James Howard Kunstler says he wrote *The Geography of Nowhere*, "Because I believe a lot of people share my feelings about the tragic landscape of highway strips, parking lots,

housing tracts, mega-malls, junked cities, and ravaged countryside that makes up the everyday environment where most Americans live and work" [8].

Which are the reasons of the creation of such a "tragic landscape"? Andres Duany, Elizabeth Plater-Zyberk and Jeff Speck in [8] put in evidence that many factors allow the diffusion of the sprawl. The first reason sets in its "seductive simplicity, in its consistence made of a few homogeneous elements" which can be adapted in quite every context.

As it happens in most of the worldwide diffuse cities, if these models are assumed merely as formal and simplified schemes renouncing to all the positive aspects (mainly social), what come by is only a series of similar and neutral spaces.

Every single element singularly develops in an independent way: even if one part is adjacent to another, the main character of the sprawl is that every part is highly segregated from the others. That is why the general urban shape, the global operation, the global environmental performance are difficult to be evaluated.

This deformed application in suburban area, overdraws the negative aspects of the diffuse city. In particular, the spreading of monofunctional (residential) wide area produces serious mobility problems mainly caused by the necessity, that every citizen has, to access to all the urban functions, that in this particular urban shape are concentrated in a few sites: wide origin area, with a few punctual destination ones.

This is a serious question about the localisation of urban facilities in the diffuse city, that urban planning has to face and that still remains hard to be solved.

It is not a technical problem; even if models, technical instruments and calculation systems can find optimal or sub-optimal solutions for traffic assignation, the distribution of functions in the city remains the primary cause of traffic congestion.

With reference to this last aspect, it is possible to observe as the common answers given to the inevitable birth of the congestion, has baited a negative spiral which still today occurs:

1. growth of the traffic;
2. congestion;
3. new great road infrastructures;
4. limitation of public transport;
5. acceleration of the sprawl;
6. new growth of traffic;
7. new congestion.

Camagni, Gibelli and Rigamonti [10], defined the critical issues of the cost (in terms of assets and goods) of urban dispersion:

- the economic cost of consumption/wastage of agricultural soils and natural assets;
- the environmental cost of negative externalities discharged on neighboring municipalities in terms of mobility;
- the cost of an accelerated depreciation of the city center;
- the costs of environmental impact on the consumption of limited or scarce resources;

- social costs in terms of loss of the *city effect* and in terms of segregation;
- the costs of aesthetic pollution;
- the cost for the construction of transport infrastructure.

It is important to observe that, in authors' opinion, pollution aesthetic and environmental cost are treated the same way as the economic costs.

II. LEIPZIG CHARTER: THE EUROPEAN COMMUNITY RESPONSE FOR SUSTAINABLE CITIES

As it has been stressed by the worldwide debate about urban planning, the most critical aspects of urbanization toward a sustainable development concern environmental issues; the most obvious are: direct and indirect soil consumption, increasing of air pollution due to the need of large volumes of private car traffic, soil sealing, landscape impact. For these reasons, nowadays the reuse and revitalization of urban voids is a key point, mostly considering the necessity to limit the urban sprawl.

How to evaluate a correct strategy to improve the environmental performance of urban development and renewal projects toward a sustainable behavior in planning?

To achieve the objective of sustainable cities, an integral approach to urban issues must be chosen. In addition, the European structural funds should be made available for local projects that embrace the integral approach. This is the most important message of the Leipzig Charter, which was adopted by the European ministers responsible for urban policy on 24 May. The ministers also decided to continue the European Urban Knowledge Network (EUKN), the knowledge exchange network for European cities [11].

The main feature of the informal meeting of the Council of Ministers in Leipzig was the discussion of the Charter. The Leipzig Charter is a step towards an agenda for a 'European large cities policy'. The Charter is an initiative of the German EU Presidency. By adopting the document, the EU recognizes the important social, cultural and economic role that cities play.

The Leipzig Charter is above all a political document. It does not contain any specific action points. Urban policy is a matter for national governments. The importance of the Leipzig Charter should not be underestimated, though. By adopting the Charter, the ministers have committed themselves to initiate a discussion in their own countries on how the urban dimension can be integrated into national, regional and local policy.

The central message in the Leipzig Charter is the necessity of 'integrated strategies and coordinated action', that means to implement simultaneously in a balanced way: social, economic and environmental objectives. In the past, the Urban Acquis and the Bristol Accord stressed the importance of an integral approach.

The necessity of an integral approach imposes requirements on the institutional setting in which the (European) large cities policy is enacted. All levels of government – local, regional, national and European – have an interest in healthy cities and

share the responsibility for the success of cities.

The Leipzig Charter mentions areas on which urban policy should now focus in any event:

- dealing with deprived neighbourhoods;
- improving the public spaces;
- modernising infrastructure with a focus on saving energy;
- better education for young children and refresher training for workers;
- better and more efficient public transport in and between cities.

III. ASSESSING CITIES DEVELOPMENT: ECOLOGICAL APPROACH AND A NEW COMPLEXITY LEVEL

Approaching environmental and landscape assessment, the two complex systems involved (environment and city/metropolis) are evaluated in their mutual interactions.

The ecological approach, borrowed from urban sociology by Charles Booth at the end of the XIX century [12], deepens the relationship between the individual and the environment in mutual interactions. To paraphrase the concept, designing a new plan or project means to define a very close relationship between manufactured goods and the environment (in an extensive meaning) in which they lie and that modify; in the same time, that means to build a new landscape and to transform the territory in an indelible way [13].

These concepts are well summarised in the definition of ecological planning by Frederick Steiner, that is *the use of biophysical and socio-cultural information to suggest the opportunities and limitations to consider when taking decisions on land* [14].

Moreover, it is worldwide accepted that the complex systems science helps planners to develop a comprehensive analysis of urban and metropolitan settlements; the city is considered as a complex system, the ecosystem is a complex system itself: the interaction among these two entities creates a further level of complexity.

A. Ecosystem: a complex system

The ecosystem is a complex system made up of organisms that live in a particular environment. Animals and plants are the biotic components of the ecosystem, while subsoil, air and water, light, temperature, climate, rainfall, etc. are part of abiotic component.

Biotic and abiotic components establish among them a set of relationships that characterize the ecosystem itself and led him in a state of temporary "equilibrium".

The history of an ecosystem, from birth to maturity, is called "ecological succession". The ecological succession is a sequence of continuous changes of biotic and abiotic components to make a stable ecosystem (climax) characterized by a balance between its various components.

B. The city: a Complex System

The city can be conceived as a large set of shares in relation to each other: residential, manufacturing, services areas, etc.. Spread on the ground and connected through various

communications networks, physical (transport, mobility) and immaterial (telecommunications). The city is a system, and it is a complex system [15], [16].

In fact, the interactions between urban actors are non-linear, they consist of competition, cooperation, complementarities, symbiosis.

In the types of interactions there are also the positive reaction rings, which for certain conditions of the parameters can amplify insignificant and uncontrollable disruptions; i.e. large scale economies, agglomerate propensity, increasing yields, etc..

While the competition for space, for resources, for the conquest of markets, the trend towards segregation, the deterrent effect on the movements due to the distance and traffic congestion are examples of negative feedback. In addition, there are several interpretations to the urban phenomenon: its social, cultural, morphological and spatial, demographic, economic, political dimensions. It is possible to describe not uniformly the various aspects of the city, presenting its different and important ways of being, but almost always in an incomplete and not comprehensive ways.

The city is a complex system for nonlinear interactions among components, for the presence of positive and negative reaction rings, for the plurality of non equivalent possible descriptions.

C. Hypercomplexity

In an ecological meaning, new level in the global system depends on the sum of the elements and on their relation which is not linear. Approaching environmental and landscape assessment, the two complex systems involved (environment and city/metropolis) are evaluated in their mutual interactions.

That means to develop a new level of complexity in the global system depending on the sum of the elements and on their relation which is not linear, and a new interpretation code must be defined.

In this sense, a proper definition is *hypercomplex system*.

As Qvortrup said [17, pag. 7] "*a short definition says that hypercomplexity is complexity inscribed in complexity, e.g., second-order complexity. As an example, hypercomplexity is the result of one observer's description of another observer's descriptions of complexity, or it is the result of a complex observer's description of its own complexity*".

Based on this concept and regarding the social aspects, the emerging society can be characterized as a polycentric and thus polycontextural social system applies different codes of self-observation related to different positions of observation: the economy applies the code of profit and loss; the religious system the code of transcendence and immanence; the scientific system the code of truth; the political system the code of power; and so on.

This means that the concept of universal "truth" or consensus is replaced by the need for transjunctional operations, which make it possible to switch codes and to decide which code is appropriate for specific social operation.

One precondition for this is that a code must be capable of

observing the world (and itself) as the differentiation of other codes.

IV. TIME AND LIMIT: CODES FOR A SUSTAINABLE HYPERCOMPLEX SYSTEM

The attention to environmental protection pays particular awareness to the consequences on environmental, social and economic conditions that a plan can cause. These consequences are the main subject of urban planning discipline.

In particular, recently environmental ethics assumed great importance, and it is often associated with the concept of "culture of liability", defined as a branch of ethic which seeks to establish the criteria for men's actions in respect of the environment in which they live.

Two fundamental aspects must be considered: the time and the concept of limit.

Time can be deemed in two contrasting dimensions: the one of the research of immediate profit, and the one needed for environmental regeneration.

Limit is considered as a set of connotations and natural conditions over which the development is no longer acceptable.

Planner lives his professional and research practice with specific barriers that consist in the period of validity of a particular choice that is made within well-defined physical and cultural boundaries.

The most banal examples is the imposition of an ordinary bond, the most complex the definition of strategies for the pursuit of sustainable development.

A. Time

The uncertainty triggered by the increasing speed at which everything changes, stresses the need to define the coordinate system of the time in which our action is placed.

The time of the request for an operator or administrator to get a profit from the territory, derives from commercial laws; the time of natural regeneration and environmental recovery does not follow the rules defined by human economic systems.

A clear example is the interpretation of *weak sustainability*, which defines the economic and environmental assets as equivalent and leads to accept *economic compensation to an environment damage*.

About governance processes: on one side the official practices of participation in decision-making and subsidiarity, which broadened the social involvement especially in the territory, was welcomed with great satisfaction, but seeking unanimity instead of democratic choice is a harmful utopia because it risk to consumes precious time in permanent and deliberative assembly. Similarly should be judged another degeneration of democracy, the *veto power* that can nullify lengthy negotiations, and too often chronicles offer striking examples of it.

B. Limit

Whatever were the sparks that have turned the debate on sustainable development, purely environmental, linked to human health, or economic and social issues, it certainly has laid the foundation for analyzing, enunciate and define a new set of "limits" for humanity: limits on harmful to humans emissions; limits to the use of non-renewable resources; limits to uncontrolled expansion of cities; limits to the exploitation of politically weak but rich in resources countries; limits on the endless possibilities that technology sets.

No prohibitive or authoritarian barriers, but they find their dimension in considering the consequences of human actions in a broader horizon than it was considered until the '90s. The whole world discovers that the logic of the first modernism must come to terms with the pace of change, with the scope of change and with the nature of institutions.

Ecological and environmental planning become an integral part of the cultural baggage of every planner, but it was necessary the intervention of laws on Strategic Environmental Assessment to give fresh energy to an integrated approach that had slowly left its pitch due to the efficiency paradigm. Environmental protection in the discipline of the territory represent a cost and one of the actual issues that is being debated is how to make the environment preservation an economic opportunity. Some famous cases are the future Eco-City of Dongtan, near Shanghai, and the great project Masdar City in Abu Dhabi.

Today these hypothesis are expensive, luxurious, probably not replicable in full, but probably pioneering solutions within range of everyone in the near future, even if we do not know a certain date.

C. A Cultural necessity: Environmental Ethics

A net of global knowledge, not only information, able to feed a system of shared values is rising around the sustainability issues; it is necessary that it permeates the layers of healthy political thinking, austere in the sense of beauty as *little and smooth*, which promotes a moral capitalism in which the limit is the ethic of liability, and liable as sustainable [18].

A very important role has the Sustainability Science, which produced depth analysis on new indicators to measure the wealth, prosperity and the overall sustainability of natural systems and human ones. The concept of ecological resilience defines the capacity of natural systems to absorb the shock retaining its own functions, this ability is measured by the degree of disturbance that a natural system can absorb before the system changes its structure, changing variables and processes that control the behaviour.

Ecosystems have more than a state of equilibrium after a disturbance and restore a balance that is often different from the previous one.

V. EVALUATION METHODS IN ITALIAN CONTEXT

A. Environmental Assessment

Depending on the type of territorial intervention there are

different procedures for Environmental Assessment, as specified in the Legislative Decree 2006, n. 152 "Rules relating to the environment": the Environmental Impact Assessment (EIA), the Strategic Environmental Assessment (SEA), the Incidence Assessment (IA). Introduced by several European regulations in different times, they are now the subject of coordination acts at the National and Regional level.

The Environmental Impact Assessment (EIA) has been introduced by the EU Directive 85/337/EEC on the assessment of the environmental impact of certain public and private projects, which was amended by Directive 97/11/CE as fundamental instruments of environmental policy.

The Strategic Environmental Assessment (SEA), was introduced into European legislation by EC/42/2001 Directive (also implemented at Italian national level by Legislative Decree 152, 2006). The Directive has however found in the dimension of regional legislation its scope. Many Italian Regions acknowledged the European Directives in their Urban Planning laws.

The SEA is defined as a systematic process for assessing environmental, but also economic and social effects, of the proposed plan or a program that aims to determine the transformability of the territory and to point planning choices in perspective of sustainable development. In the construction of plan process, the SEA is a tool used to build plan scenarios, to evaluate, to manage and to supervise the performance effects during the implementation of the plan or programme.

The Strategic Environmental Assessment and is connected and internal to the decision-making process, and took its proper value only if it is considered as a way to increase the "efficiency" of the plan in terms of environmental, social, economic sustainability and of quality of life.

The scale of its application is on Regional, Provincial, Municipal and sectoral Plans and it is an *ex-ante* process, while the Environmental Impact Assessment regards specific projects and intervenes *ex-post*.

The Impact Assessment, consistent (Directives 92/42/EEC and 79/409/EEC) has the aim to preserve natural habitats of particular value.

B. Landscape Assessment

The process of Landscape Assessment, standardised in many European countries basing on the European Landscape Convention, consists in considering primarily the sensitivity of the site and therefore the impact of the proposed project, evaluating the degree of disturbance produced in that context by the project.

From the combination of the two assessments comes the level of landscape impact of the transformation proposal.

The judgment about the sensitivity landscape of a site is determined by taking into account three different types of evaluation:

- structural-morphological (belonging/contiguity to landscape systems; belonging/proximity to a place marked by a high level of consistency in terms typological, linguistic

and image values);

- visual (belonging to panoramic viewpoints or items of historical, artistic and monumental value);
- symbolic (belonging/contiguity to places covered by the status of representation in the local culture).

This analysis should be extended to the wider context in which the area or manufactured object of intervention are set, both to the environment close surrounding, and to the buildings or areas on which it intervenes.

Like the procedure followed to the sensitivity of the site, the impact of the project is determined in relation to the context using criteria and parameters of evaluation related to:

- morphological and typological incidence (i.e. alteration of the morphological characters, place and subject of intervention);
- linguistic incidence: styles, materials, colours (i.e. language of the draft different from that prevailing in the context, understood as around immediate);
- visual impact (visual obstruction, visual concealment of relevant panorama);
- symbolic impact (interference with the symbolic places recognized by the local community).

VI. ASSESSING NEW DEVELOPMENT OF CITIES AND MEGACITIES: A PROBLEM OF SCALE

These evaluation methods are technical and legislative tools to assist the improvement of the quality of plans and projects.

If the General Government of the metropolis must be enforced at a wide scale, this scale is the most appropriate to manage the environment, and the Strategic Environmental Assessment, as described by IAIA (International Association for Impact Assessment) has in this aspect its strength.

At the SEA is rightly recognised the honour to contribute to the redefinition of the planning process, especially in the follow-up and circularity of the process that through the verification and monitoring defines corrections to be made to the plan.

A. Assessment in the implementation phase: critical aspects

In regions where law provides SEA, it is applied to the structural plan. This choice is consistent with the strategic dimension of the assessment, but leaves open a number of issues that are fundamental in metropolization phenomena.

Many environmental issues, from soil consumption to optimization of mobility nets, are faced by the general plan, while many others (i.e. energy efficiency and control of urban microclimate) relate with the implementation and design phases.

Whether the SEA should introduce very restrictive criteria or indicators for example on buildings, it would mean to have a plan and an assessment that run at two different speeds: a strategic land management, and a regulatory SEA (which must necessarily integrate with other municipal rules such as the Building Regulation).

On the other hand, the most brutal metropolization occurred

approving variations of the general plan, often small and therefore, taken individually, with a little environmental and landscape impact [19], [20].

Today it still remain very urgent to define the effectiveness of environmental monitoring in the implementation phase.

Interventions involving urban variant must be subjected to the "screening" phase, which checks the opportunity to involve a full SEA process. During the screening the potential of significant environmental effects will be determined, and with particular reference to Annex II of the European Directive 2001/42/CE, they should be described the characteristics of the action, taking into account in particular, of the following elements:

- the degree to which the plan or programme sets a framework for projects and other activities, either with regard to the location, nature, size and operating conditions or by allocating resources,
- the degree to which the plan or programme influences other plans and programmes including those in a hierarchy,
- the relevance of the plan or programme for the integration of environmental considerations in particular with a view to promoting sustainable development,
- environmental problems relevant to the plan or programme,
- the relevance of the plan or programme for the implementation of Community legislation on the environment (e.g. plans and programmes linked to waste-management or water protection).

They must also be assessed the characteristics of the effects and of the area likely to be affected, having regard, in particular, to:

- the probability, duration, frequency and reversibility of the effects,
- the cumulative nature of the effects,
- the transboundary nature of the effects,
- the risks to human health or the environment (e.g. due to accidents),
- the magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected),
- the value and vulnerability of the area likely to be affected due to special natural characteristics or cultural heritage, exceeded environmental quality standards or limit values, intensive land-use, the effects on areas or landscapes which have a recognised national, Community or international protection status.

VII. MASTERPLAN ASSESSMENT

As it has been stressed in the paper, considering the ecological approach in metropolization context, an accurate and integrated methodology of assessment applied to single plans or projects has a strategic role.

Approaching an urban plan about a new expansion or about the revitalization of ex industrial area, it is important to

understand the exact scale of the consequences that a new urban organization have on the existing system, and it requires a specific evaluation process.

It is necessary to find an integration among all the evaluation procedures (SEA, EIA, Landscape Assessment) and among the specific themes that they develop (environmental and landscape issues); here it is presented a way to make a comparative evaluation among different renewal masterplan proposals.

The “Masterplan” synthesizes classical planning issues (such as density, built volume quantity, building height, percents of green area, private and public area ratio, etc.) with architectural ones (typology, relation among buildings, morphological texture, etc.) and it is the most useful instrument for a preliminary design of a renewal project.

Due to the detail level of the masterplan (1:2000, 1:1.000), it is impossible to implement a complete Landscape Evaluation (which regards the architectural scale), and in the same time many strategic aspects of the SEA can not be considered. However it is very useful to assume the SEA procedure as an ex-ante check with a specific spotting of the main evaluation criteria (or indicators), and as instrument to compare different scenario in order to improve the final environmental performance.

A well proved (and well known) technical methodology is the impact matrix (Table III): it evaluates the impact and the efficiency of a plan (or masterplan or project) about some specific criteria (or sustainability aims, or indicators).

The most difficult aspects in the implementation of such a procedure are:

- the choice of the criteria that (more than others) synthesize the positive aims that the renewal plans have to reach;
- the assignment of specific weights for each criterion, in order to define a hierarchy among them.

Table III: Impact matrix structure

CRITERIA/ SOLUTIONS	Cr.1	Cr.2	.....	Cr.M	TOTAL
	Weight 1	Weight 2	.....	Weight M	
Solution 1	X ₁₁	X ₁₂	.....	X _{1M}	T1
Solution 2	X ₁₂	.....	.....	.....	T2
.....
Solution N	X _{N1}	.....	.....	X _{NM}	TN

The column Total expresses the global performance of the Solution, and it can be evaluated using different mathematical formula such as: Multi-criteria Analysis, Shimpeler and Grecco Method, Schlager Anaysis.

Every value (X_{ij}) can represent an absolute performance (if

the criterion is a real indicator) or a relative one; in this last case, every proposal is evaluated in relation with the others, and it is not relevant the precise value that it assumes.

VIII. CASE STUDY IN PAVIA

Since September 2007, an application of this method has been developed in the University of Pavia, considering the three largest ex industrial area that are involved in renewal plans in the city of Pavia, a small city (around 70.000 inhabitants) sited 50 km south from Milan. Considered plans regarded: SNIA area, NECA area, Railway Storage (R.S.) area.

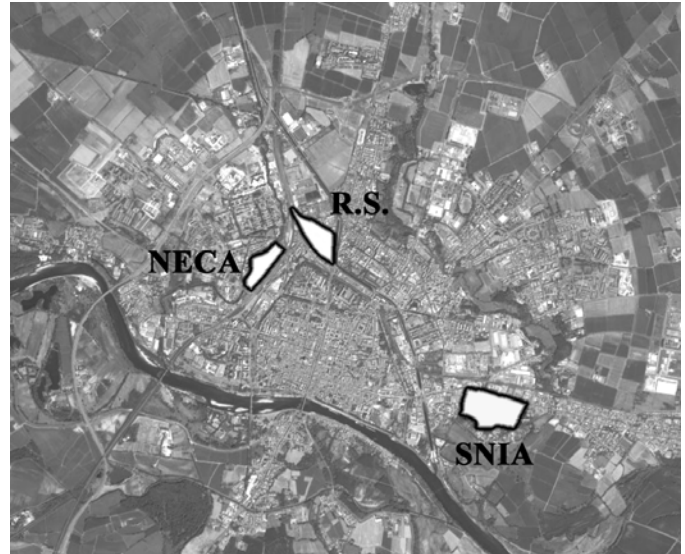


Fig. 1: main dismissed area in Pavia



Fig. 2: SNIA area in Pavia



Fig. 3: NECA area in Pavia



Fig. 4: Railway Storage area in Pavia

SNIA area is almost 17 hectares wide and it is the largest

ex-industrial area in Pavia. The relevance of the area is connected not only to its dimension but also to the specific localization: close to the city center it is very close to the area of the Ticino river Park.

NECA area is one of the eldest industrial areas in Pavia, it is 8 hectares wide and it is close to the railway station and to the main city access infrastructures.

Railway Storage area is 7,5 hectares wide and it is close to one of the main monuments of the city, the Visconti Castle and the Naviglio.

Even if these areas have different locations and dimensions, the Municipality program provides for them the same urbanistic parameters (volume indexes and distribution of functions); this fact permits to compare a set of criteria defined for each specific area.

In fact, a series of criteria has been defined basing on a SWOT (Strength, Weakness, Opportunity, Risk) analysis of the whole city and of the specific contexts, and considering the large available bibliography [21], [22], [23], [24], [25].

To simplify the identification of the set, the global urban system has been analysed in the three sub-systems: built and settlement system, environmental and green system, mobility and accessibility system.

Comparing the different lists of criteria, and considering only the common ones, a final list has been defined. These elements can be used in different ways: as main planning goals, as formal check-list, as planning criteria. Supposing to evaluate various hypotheses, in the first case a benchmarking analysis points out the better solution; in the second case the more desirable solution is the one that satisfies the maximum number of requirements; in the last one, the mathematical processing detects the best performance. The different calculation methods, cited above, usually provide similar but not identical results: Multi-criteria Analysis underlines the weight of each criterion; Shimpeler and Grecco Method privileges the proposal with the greatest number of best partial performances; Schlager Analysis leads to a more feasible solution.

In particular, about Pavia context, the selected criteria are listed in the following sub.chapters.

A. Criteria for built and settlement system

- Morphological integration between the existing urban settlement and the new Masterplan;
- Poly-functionality of the texture with the introduction of lacking functions;
- Capacity to promote requalification of the surrounding area;
- Increase of services surface percentage in comparison to the urban average;
- Relationship with the surrounding built context about the height and the alignment of buildings;
- Readability of morphological texture;
- Typological articulation;
- Internal coherence of the intervention;
- Consistency of the urban design;

- Quantity and articulation of collective open spaces;
- Availability of collective open spaces;
- Locational choice of functions.

B. Criteria for environmental and green system

- Soil permeability percentage;
- CO2 balance (emissions compensated by trees planting);
- Connection and integration of the new green system of with the whole urban one;
- Reconstruction of units of the ecological network;
- Rescue of natural and para-natural elements;
- Compactness and continuity of green system;
- General quality of the environment and landscape;
- Creation of new priority visual axis;
- Usability and accessibility of green spaces;
- Percentage of equipped parks and green areas;
- Creation and protection of private green spaces.

C. Criteria for mobility and accessibility system

- Strengthening of the system of primary roads of traffic flows in the medium and short distance;
- Strengthening of exchanges between different modes of transport, by retraining and upgrading interchange among functional urban centers;
- Strengthening and integration of public transport services;
- Connection of slow mobility with public transport services;
- Breakdown of traffic for functions located inside areas;
- Percentage of pedestrian zone and restricted traffic areas;
- Accessibility and connection with the existing infrastructures;
- Connection of built and open spaces;
- Accessibility to green spaces;
- Permeability of the area and perception of internal paths.

Not all the criteria here presented are measurable, but the different solution are evaluated in a comparative way with respect to these criteria.

Moreover all the criteria can be considered as “positive” qualities (i.e.: it is not necessary that the buildings are similar to the closer context in their height and alignment) and some are contradictory; in example: the similarity with the closer context may not promote the surrounding renewal; there is a conflict among private car accessibility and compactness of green and public; the typological articulation may vitiate the unitarity of the project. For these reasons the assigned weights are fundamental to describe the evaluators (public administration, stakeholder, designer) aims.

In some design tests, it happened that a project that is not preeminent in singular aspects, is more desirable for the general performance. In these cases, the excellence is not rewarded, but looking at the design quality of most of the renewal plans in the contemporary cities (and not only at the ones that are published in the most famous architecture magazines) it is important to be able to demonstrate, forecast and impose a minimum quality level.

In fact, in general the assessment methods provide a

statistic evaluation among the several components of a complex system. Designing the new city, means to synthesize the complexity in a project; sharp and smart projects may elude an analytical analysis, because they can overturn the rating of values. But, to be pragmatic, it is evident that the most common practices in urban planning and architecture do not follow the excellence.

The lists of criteria here presented, that include planning, landscape, environmental and architectural aspects, have been tested in Pavia context in 36 different masterplans applied in three ex industrial area of the city; the methodology of comparative assessment demonstrated a satisfactory level of plausibility in selecting the solution with the best environmental and landscape general performance; it represents a useful instrument for stakeholders and administrators to identify the best among many renewal proposals.

IX. CONCLUSIONS

It can therefore be considered that every intervention will be provided with fewer potential environmental impacts and if necessary with appropriate compensation. Nowadays it is possible to provide a settlement that is *zero impact* regarding CO2 emissions, which maintains a high level of soil permeability, which is energy-efficient and has a low landscape impact.

What is always submitted to assessment only ex-post is the cumulative effects that the single new urban rehabilitation plans can create, considering the interactions that trigger inside the complex system.

A (hyper)complex system made up of environmentally sustainable elements is not necessarily sustainable as a whole.

For this reason it is necessary to deepen the research about plan typologies, standardized methodologies, best practices, scientific and technical instruments that public administration and planners professional orders should uptake to evaluate the impact of every single plan in relation with the general context and in the same time to foresee the global environmental performance of the new system that the planned modifications inevitably create.

Even if landscape and environmental assessment are not perfect systems for urban regeneration evaluation, and many critical aspects still must be solved, the recent applications, practices such as the case study about Pavia here presented demonstrate that evaluation is an excellent instrument to increase the awareness toward more liveable cities.

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