TÉCNICO LISBOA

The Challenge of the Cities

Sustainability, Resilience and Complexity

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Catarina Esteves de Sousa Martins

ABSTRACT

This dissertation addresses the question on how the sustainability component is applied to Western cities, giving more emphasis to aspects connected to the social component of urban spaces and architectural interventions. The term sustainability integrates an unrealistic conceptual notion, dealing mostly with aspects merely pertaining to environmental and ecological concerns, and not social and anthropological.

The work developed observes these problems through an architectural and urban lens. It gathers information about the way architecture and urbanism can answer these questions, when beign designed and/or built in different urban spaces. This survey involves the suggestion of a method of urban evaluation that intends to mesure how sustainable a given space of the current city is. The method result is supposed to break with the conventional static way architetural and urban projects are shown.

Keywords: sustainability, urban innovation, enviormental determinism, social behaviours, city dynamics

INTRODUCTION

João Guerra states that «at a time when it is unpostponable the start and consolidation of a set of decisive environmental policy measures under the context of spacial planning, quality of life and sustainable development (...) the effort to collect more information about the main difficulties and constraints, receptivity and commitment, sensitivity and dynamism, is justified (...)» (2005:32). While meetings of different orders discuss on how to apply sustainability in today's society, little has been evaluated when it comes to impact and consequences — negative and/or positive — of different strategies applied in the urban context. More than the development of the term sustainable on a theoretical debate level and the debate itself, it becomes necessary to initiate procedures to assess the measures already implemented, both at a domestic or international level.

It is useful for the architect or planner to analyse the theoretical and practical study of the various interventions and strategies undertaken that seek to respond conscious or unconsciously to sustainable principles.

OBJECTIVES

General objectives

I. Critically discussing the concept of sustainability applied to urban areas;

II. Evaluating the life cycle and its urban interference after studying the components connected to the concept of sustainability;

III. Presenting general parameters with which to evaluate a city or urban design according to the concept of sustainability.

Specific objectives

I. Identifying blockages and potential application of the concept of sustainability;

II. Describing the gradual deepening of its application;

III. Presenting gains, limitations and uncertainties of applying the concept.

METHODOLOGY

In order to achieve those goals, the best strategic option was the division of work written in five moments, which correspond to the main point of the issues addressed in the chapters. The moments are, in order of approach:

I. Theoretical research on the term sustainability and on sustainability applied to cities;

II. Urban-sustainable evaluation suggestion;

III. Gathering of standards for the evaluation;

IV. Evaluation of a case study;

V. Final conclusions.

In order to get a better understanding of the concept of Sustainable City, the written work primary focus is the context of historical events that led to the first use of the term, and on some of the theoretical foundations developed by several authors on this same theme. The studied authors encompass different points of view on how to address and intervene within the urban fabric, yet sharing the same intention to gather perspectives that work to achieve a more liveable, sustainable and beautiful city.

The second part of the work is the culmination of the above data, along with some statements drawn form the document of the UN-Habitat. Within this framework, the paper proposes a method of urban-sustainable assessment based upon five separate groups where architecture and urbanism can intervene in a sustainable and conscious way.

Therefore, the third chapter includes the gathering of different urban parameters that can be addressed at the time of elaboration of urban plans and/or buildings in the city, and may be applicable in many different contexts as well. The parameters found are the base of the evaluation, and are divided according to the adequate group. They were established according to the various sustainable aspects architecture and urbanism could/should offer, such as: fortification and reintegration of the sense of community, of the surrounding environment and of the reinterpretation and encouragement of local and/or global economies, working together to guaranteeing and increasing the quality of life of populations and rooting the sense of civic responsibility.

The fourth chapter includes the application of the assessment in order to verify its problems and constraints. The paper intended to expose the potential advantages obtained through the different readings of the evaluation result.

The fifth and final chapter encompasses the general conclusions to be drawn from the development of this essay.

1. THE TERM SUSTAINABILITY

We live in an era where scientific and technological progresses are the factors that lead to the development of civilization, especially on the economic front. But throughout history, it has also proved its capacity to damage the planet. With the evolution and creation of new products, industries tend to produce in large quantities and consume resources uncontrollably. The car is a good example of that. It has become one of the main reasons for the booming oil consumption worldwide since the start of its mass production in the 1890s. About 50 years later, the world is facing the first conflicts over oil market dominance by groups such as the Seven Sisters[1] and, during the 1960s, the OPEC[2] (Kelly, 2007).

One of the first voices to reveal concern over the mismanagement of natural resources was Rachel Carson (2002), stating her opinions in her book Silent Spring in 1962. Her critique on the uncontrolled use of pesticides in agricultural fields and its serious consequences, extended to other ecological and social components. Carson recognizes the moral responsibility of humanity in preserving the earth and its biodiversity, promoting a sense of ethical responsibility for the planet's ecosystem and an admiration for the beauty and harmony of nature.

New information regarding industrialization, economic growth, increase in population and resources availability was discussed in the main reports: Limits to Growth and the Club of Rome Report. The conclusions were coincident in both: if the resource exploitation and industrialization remained apace, world resources would run out quickly (Duarte, 2004). The Biosphere Conference in Paris, in 1968, had a scientific and enviornmental nature, and produced another pessimistic prognosis. In 1972, the General Assembly of the United Nations convened the UN Conference on the Human Environment in Stockholm. The conference results in the public awareness for the seriousness of environmental problems, and in a rethinking about the outstanding gap that separates developed from developing countries.

Despite efforts to fight bad ecological and social trends, 1973 and 1979 became dates where the oil was used as a political boycott weapon: production was decreased in order to cut supplies to countries like the USA and the UK, increasing the oil price and causing an economic recession in many countries (Cam-

[1] Seven big oil companies: Royal Dutch Shell and Brtitish Petroleum (BP), Brittany; Exon, Gulf, Texaco, Mobil and Standard Oil of California (Chevron), USA.
[2] Organization of the Petroleum Exporting Countries.

pbell, 2005). To join this scenario came news about the ozone layer being weakened[3], deriving from solar radiation and the greenhouse effect[4], both results of improper human action on Earth (Duarte, 2004). The two-oil shocks[5] were warning signs: for the first time, the population had to face the constraints and limits of the use of resources, such as oil. But spending habits and economic production increased once again with the oil saturation in 1985, when oil prices fell sharply and flow production performed at maximum rate. The subsequent question was if the world could continue to sustain economic growth indefinitely, fact synthesized by the Studies of Limits to Growth (Campbelll, 2005).
The UN then organizes the World Commission on Environment and Development in 1983, a meeting of experts summed urgently, chaired by Norwegian Gro Harlem Brundtland. Five years later, the commission produced the report Our Common Future, exposing the outcome of the discussion on the ecological theme and consolidation of expression of sustainable development (Campbelll, 2005). This was the document that set the definition of the term sustainability, stating that it should rest on a triangular balance between three pillars/vertices: environmental, economic and social (Fig.1).

After this report, the term sustainability is thereafter linked to social aspects: the relationship between Mankind and the planet Earth. Sustainable development refers to a process whose resource usage is meant to suit both human needs and the preservation of the environment. The term encompasses a concern for future generations of today's society, since it gains awareness that natural resources are finite, making their conservation a vital matter to the livelihood of future generations (Bettery Magazine, 2012).

In 1992, the UN Conference on Environment and Development, better known as the Earth Summit in Rio de Janeiro, was convened. The summit gave origin to the Local Agenda 21 (Duarte, 2004). It is a long-term action plan at different scales, deployed in a specific territory and involving various groups of actors. Its goals are to contribute to a type of local development that integrates the needs of economic feasibility, environmental protection and the promotion of better living conditions. The Agenda is endowed with a character of democratization, where public participation and shared responsibility are seen as key elements of the whole process, since it allows citizens the right of consultation in decision-making happenings and enhances the efficiency of the planning (Guerra, 2005).

In 1992, the Maastricht Treaty was signed. It is a document which «proclaims the promotion of sustainable development, stressing the need for integration of environmental goals and public participation in the implementation of most EU policies» (Guerra, 2005:18).
The treaty that followed the previous one was the Aalborg Charter in 1994, reference document that «establishes a set of basic values and defines the need for a campaign to divulgue, publicize and support the implementation of local sustainability policies» (Guerra, 2005:126). This document promotes the participation of the local communities, always searching for an intrinsic understanding of the site's specificities, and encourages reflection on urban sustainability, suggesting a diffusion of best practices at a local level. The charter includes a political commitment to the concept of sustainable development and its objectives, stressing the importance of the recognition of responsibilities within and as a community.

2. THE CITY SUSTAINABLE PERCEPTIONS

After World War II, a «basis set with a view of orderly development of cities along with the problems of industrialization and the need to ensure healthy conditions in urban centers» arised (Amado, 2005:14). The answer to these problems emerged with cities' plans built from scratch, with reduced densities and greater connection with urban green spaces and the countryside (Satellite

Fig. 1. Triangle of Sustainability, supported by the schemes drawn from the content of the report Our Common Future.

[3] The phenomenon of global warming derived from the mistreatment of the ozone layer corresponds synthetically to high temperatures consequent imprisonment of certain gases, especially CO_2, in the lower layers of the atmosphere.
[4] The increase in temperature causes changes in the patterns of nature, being able to generate phenomena such as droughts, floods, hurricanes, melting glaciers and modification of agricultural areas.
[5] These two shocks coincide with the fact that OPEC has failed in regulation of markets and governments producers opted for the kidnapping of nations that had resources. The cases were: Iraq in 1972, Kuwait in 1975, Venezuela in 1976, and Saudi Arabia in 1979.

Towns). Modern urbanism introduces a new city model, whose plans for new urban areas have more aesthetic options in architecture and in the buildings' layout. There was a will to implement completely different ideas so far achieved, and the environmental premise had little importance to this process (Benévolo, 1993).

Ebenezer Howard was one of the first authors to formulate a remedy for the big cities' problems, «in the form of a new urban structure that would remove the antagonism between town and countryside» (Biermann, 2003:669). The Garden City (1898) encompasses a project that tries to recreate the romantic idea of bringing back the green to the cities, whose size and growth were controlled and the different functions (housing, commerce, industry, agriculture, etc.) were strictly ordered and disassociated (UN- Habitat, 2009). «The Howard report was credited with having been the first to understand the architectural development of the city is supportive of the field» (Biermann, 2003:670). Authors such as Tony Garnier and Bruno Taut developed their own city models based on Howard's assumptions. However, these trends lost importance in actions facing the economic part of urban planning in the developted society (Amado, 2005).

In 1935, Le Corbusier proposes the Radiant City, part of the plan of demolition and restructuring of the old city of Paris, dividing it according to an orthogonal grid into functions and areas (zooming), with well-defined wooded paths, trying to restore the machinist society to its natural order. Transforms beauty into useful, with a though that favors functionalism and the minimalization of form. The ten principles of the Charter of Atenas are published in 1942, defining the main functions of urbanism — living, working and leisure —, and its goals — land use, circulation and organization of the legislation. The new urbanism issues were raised, resulting from the social development pressure on cities and on the quality of life of inhabitants.

Postmodernism arrives during the 1970s. Urbanism turns back to morphological models of cities supported by blocks, squares and streets. It was based upon the theory of «continuous built with total abandon of major assumptions such as solar orientation of buildings, implementation of the free volume in the soil, functional separation of programs and systematic use of the zoning of the city» (Amado, 2005: 15). Still, it was by this time that a new urbanism concerned about ecological issues emerged. In 1997, Victor Papanek (2007) publishes his work Architecture and Design — Ecology and Ethics, a reflective text about the role that ecology, designers and the work of each individual has in determining tomorrow's environment and its accountability.

Generally speaking, today's understading of the process of sustainable urban planning must «ensure greater satisfaction of the needs of the population, more efficient management of renewable and nonrenewable resources and a follow-up monitoring through broad participation of the population» (Amado, 2005:41). Planning should be a process with greater pro-activity and transparency, involving the concept of citizenship and avoiding promoting conditions for the occurrence of situations of social exclusion and economic discrimination.

The goals of a sustainable planning are: increasing the efficiency of the mode of operation of the urban economy; providing good quality residential venues in various scenarios attractive; uplifting/enhancing the quality of urban society; providing efficient systems for movement/transportation of people and goods; protecting and enhancing natural landscape (Hall, 2000). Urban planning should contribute to the ensurance and protecttion of natural resources, and preserve and develop the urban form, culture and landscape of the local buildings. Currently, the parks gain prominence in the context of either urban or rural planning. Aiming for an integrated urban plan is to ensure the necessary infrastructure to the site (Bettery Magazine, 2012).

Thus, this essay presents four authors whose works integrate theoretical principles defended in the definition of urban planning explained above:

I. Richard Rogers and the *City Metabolism* (1998). The author stresses that the city should take responsibility in the management and use of resources in order to obtain a healthy city. He criticizes the current system of production, consumption and disposition of natural and human resources, called linear metabolism. Rogers' concern about waste reduction and recycling or reuse of resources lead to the proposal of a new system, called circular metabolism, that integrates sustainable accountability by the industries, economies and society.

II. Jaime Correa and the *Auto-suficient Town* (2008). It is vital that the production of our needs is done in a eco-frienldy way, in a process that incorporates a request for companies to take more ecological resilience. Correa advocates a self-sufficient and vigilant town planning, based on the strength of community and on the sharing of concerns and needs among the different members: they all work for the greater good when it comes to resource production and processing. The agricultural sector is the one that will support future communities, in which gardens grow either on private household gardens or on public green areas.

III. Jane Jacobs and the *Diversity and Mix of Uses* (2000). The current zoning requires flexibility in the uses and activities established for each portion of the territory, leveraging the plan to the current and future aspirations of the population (Amado, 2005). According to Jacobs, the enviornment of the civilized city is preserved thanks to a mix of uses and diversity, which must be sufficiently complex to promote urban safety, public contact and uses interaction.

IV. Christopher Alexander and the *Process of Unfolding the Wholeness* (2002). The author believes that when a new building is constructed in the urban fabric, it should contribute to the identity of the area, leaving the pre-existing whole undisturbed and beautiful. This should happen like the process of unfolding: smooth and natural, step-by-step in a sequence. When applied to arqchitecture, this belief incorporates the notion of time and review, embracing the idea that a structure requires time to be properly recognized and integrated in the area and to become a part of the existenting *whole*.

3. THE URBAN-SUSTAINABLE DIMENSIONS

As far as urban planning is concerned, the way to intervene and to evaluate if a given project in the city is successful is if the intervention is done according to a strategic spatial planning process, agreeing with the precepts of the Local Agenda 21. It is understood that the common urban plan does not address the entire city, so to «be strategic means focusing only on aspects or areas that are important to the general objectives of the plan» (UN-Habitat, 2009:101) integrating long term plans and actions. Therefore, Jaime Lerner (2003) introduces the concept of Urban Acupuncture, an urban transformation method that works with ponctual and functional interventions scattered throughout the city, obtaining a much wider impact. To date, this type of planning with little achievement, seems to be able to respond to the cities' needs, given that it is able to (UN-Habitat, 2009):

- Respond to the needs of a society-civil sector and strong technical planning and governance;
- Coordinate and integrate economic, infrastructural and social space, in the interests of the global economic position of the city;
- Occupy a strong position protecting aspects pertaining to resources and environment, cultural heritage and local features;
- Support a focus of implementation.

The cities are in constant metamorphosis, with constant urban and architectural projects undertaken. The city image and living follow this constructive changes, in which each projectual addition contributes to the essence of the urban network. But how does one measure the impact that these interventions have on the city, sustainably?

The answer undergoes a first approach that seeks to identifying what types of impacts projects executed may trigger within the city. In other words, how far goes the impact that the urban plan and architectural have within the sphere sustainable and which fields covers similar impacts. This essay estimates five major components to which projects should respond sustainably:

I. Social Investment	(S)
II. Resourses of the Territory	(R)
III. Mobility in the City	(M)
IV. Public Space	(P)
V. Urban Uses	(U)

The second part of the answer is the development of an new evaluation method. A method that integrates this five dimensions and that is applicable in any project of urban genesis.

Arising from a geometric exploration, the five groups were organized around a pentagon, where the position of each vertex in the geometric dimension is not made in a hierarchical manner. A curious morphological parallelism was then found between this shape and the triangle of sustainability supported by the report Our Common Future (1987), whose vertices correspond to the environmenal, social and economical components. The sustainability concept supported by this triangular equilibrium, when applied to cities, is supported by a pentagon (Fig.2). The precepts associated to the concept of sustainability suffer a deepening in the urban context, reflected in a geometric transformation.

But how may an urban assessment be done by identifying the above-mentioned fields?

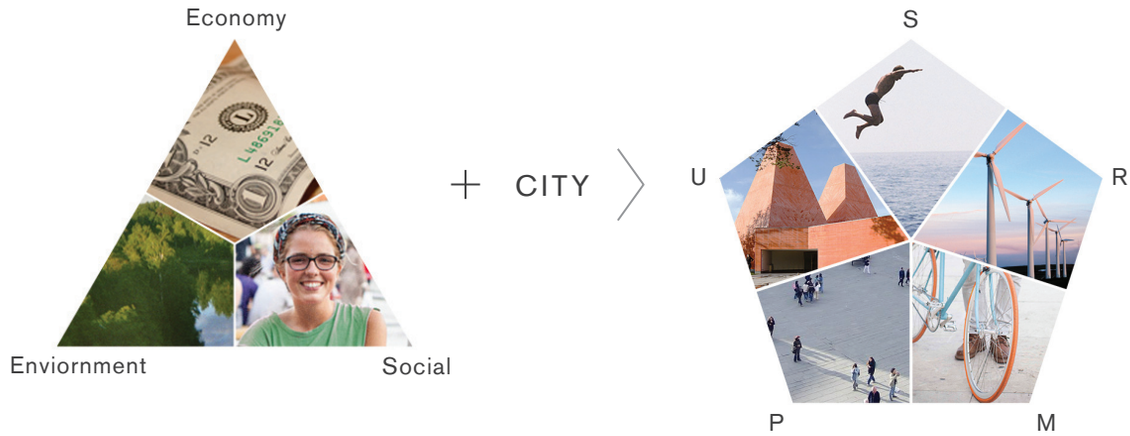

Fig. 2. Geometric transformation of the term sustainability applied to the city.

4. THE PENTAGONAL ASSESSMENT

In order to develop an evaluation method based on that same pentagon, this essay analysed a study about the exposal of information through the use of radial graphs. It became clear how the pentagon could be transformed into a graph. From the center of the pentagon, scaling lines are drawn towards the 5 vertices, showing the answers the project gives to each dimension (Fig.3). It is assumed that a project that can respond perfectly to the sustainable urban parameters in each group is illustrated with a perfect pentagon, with maximum area/perimeter. Thus, within the framework of urban sustainability, each project is illustrated by a specific pentagon, more or less deformed in accordance to the way it satisfies each group. For the purpose of this essay, the scale adopted for each dimension ranges from 0 to 5 (Fig.4)[6], and it is advised that is is used on projects integrated within strategic spatial planning processes. It is also recomended its aplication after a minimum period of 6 months following the conclusion of the intervention constructive works, in order to give time for the population to acknowlege its presence. Only then will be possible to measure the urban responses that a certain intervention had, according to each one of the 5 dimensions (Fig.5).

There are other methods of sustainable evaluation of urban and architectural designs, such like BREAM, LEED and GB Tool. Their aim is to evaluate and classify the projects according to their environmental performance (Valverde, 2010). The method proposed in this essay is inovative since it proposes an assessment that includes parameters for the most important aspects in the urban context, and is not restricted to a purely environmental and ecological analysis.

The research carried out to find the right parameters for each group lead to the identification of sub-dimensions within each one of them:

I. Social Investment
- Density and distribution
- Image and activities qualification
- Process of public involvement
- Labour and residential attractiveness

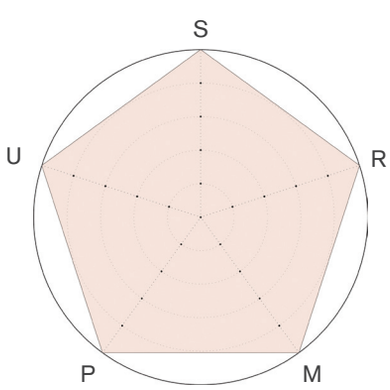

Fig. 3. Evalutaion's radial graph.

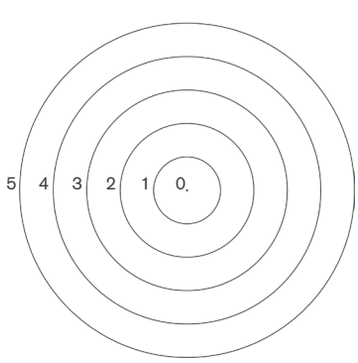

Fig. 4. Scale of the of pentagon-assessment.

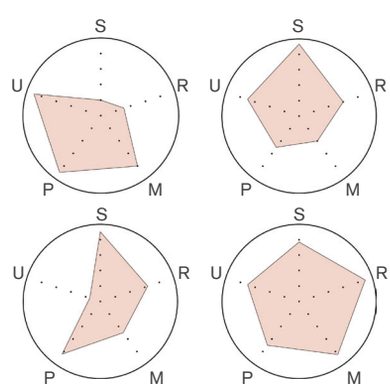

Fig. 5. Random examples of the usage of the pentagon-assessment.

[6] The scale is: 0 — no urban response; 1 — very weak urban response; 2 — weak response urban; 3 — median urban response; 4 — strong response urban; 5 — very strong urban response.

II. Resourses of the Territory
- Integration of climatic, topographic and geographic resources
- Contribution to environmental quality
- Promotion and production of local resources

III. Mobility in the City
- Motorized transports and alternatives
- Integration of public transportation
- Pedestrian displacement
- Parking in the urban environment

IV. Public Space
- Gathering spaces
- Circulation network
- Green interventions
- Integration of urban art

V. Urban Uses
- Diversity of uses within the Intervention Area
- Diversity of uses within the building
- Temporary events reception
- Urban rehabilitation

The parameterization of each dimension consists on finding the main aspects to be answered in each one, so that it provides a result covering the widest field of application possible.

The dimensions' parameters are displayed in a list associated to each sub-dimension. This list is made so that the check system can be applied, in order to verify if a certain parameter had an urban answer or not. Each parameter is rated 1 point for all the parameters of the dimension. The quotation of each dimension will be made mathematically, using the direct proportionality method: the score 5 is given when the dimension checks for all the parameters. The rule is therefore applied to the result of the sum of all parameters evaluated, in order to obtain a more accurate corresponding value.

The parameters differ from one another: they go deeper and/or they generalize in order to better fit the scale and context of the project under evaluation. Thus, the pentagon method recognizes two different situations that may occur during the time of its application:

I. A given parameter may not be appropriate for the project evaluation, and so it cannot be considered;

II. A new parameter can be added, if the project's specificities demands so, and so it can be added to the list.

Even so, the two situations are inseparable from the following fact: the sum of all the parameters and the mathematical calculations that follows it alter.

To obtain the information that addresses each dimension of the evaluation at this moment on a particular project, suggests the existence of four forms:

I. Inquiring institutional and technical data, near the company, agency, or private/public institutions behind the intervention, asking for documentation and/or conducting interviews;

II. Inquiring the users, residents and holders of the establishments of the insertion site, using surveys or interviewing the people who use and live the space;

III. Collecting information through observation and direct experimentation;

IV. Observation of records of how the site was before the intervention.

5. CASE STUDY: PAVEMENT INTERVENTION ON CÂNDIDO DOS REIS STREET

The intervention made on Cândido dos Reis Street in Cacilhas (Almada, Portugal) was part of a rehabilitation project, developed within the Regional Operational Programme of Lisbon, focused on interventions in historic areas of the city of Almada (Fig.6). The project was proposed by the city's council, and was a proposal made by the autarchy to the National Strategic Reference Framework[7]. The project is within the context of developing one of the first Urban Reabilitation Areas[8] (URA) of the country, a program with tax incentive, financial

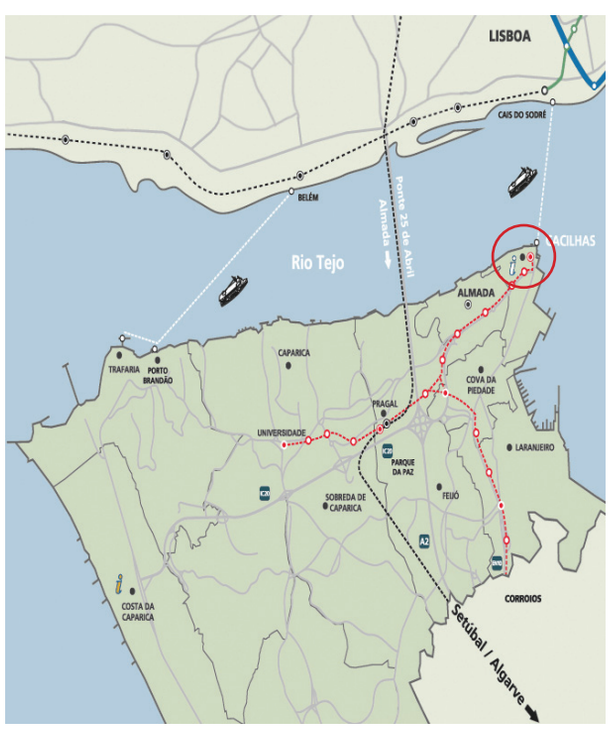

Fig. 6. Schematic map that includes: the accesses from Lisbon to Almada; the subway line, in red; the internvention area, in the red circle.

[7] English translation from: *Quadro de Referência Estratégico Nacional* (QREN).
[8] English translation from: Área de Reabilitação Urbana (ARU).

Fig. 7. Intervention plan of Cândido dos Reis Street (Almada, Portugal)

support and population involvement/participation.
The main design goal was the pedestrianization of the street, in order to qualify the street in terms of tourism and shopping. The intervention aimed at promoting tourism in the area, improving the conditions for local restaurants (a typical feature of that street), and the refurbishment of the historic center of the area of Cacilhas. Before the intervention, the street was degraded with traffic conflicts and safety problems, aspects associated with the fact that the street was a very narrow road, filled with parking lots.

The project included the renovation of sanitation infrastructure (stormwater and sewage) by municipal services. The project was developed just like a laboratory model of land management. The goals of the intervention were:

- Reduction of the presence of cars on the street, improving the quality of life for residents by consecutive reduction of noise and air pollution;
- Adaptation of the road traffic system to the new requirements of mobility available ofering new ways of public transport;
- Improvement of traffic conditions in the public space (given those with reduced mobility) by promoting the use of means of soft mobility (bicycles) and conditioning car traffic to access for locals and loading/downloading;
- Intensification of the animation of public space;
- Valuing commercial front (fitted with high density);
- Enhancement of tourist services for visitors travelling by ferryboats planning to visit the nearby Cristo Rei (local monument), the local cuisine and landscape
- Revitalization of the local economy;
- Promotion of the installation of public space's structures that serve as terraces for the catering establishments on the street .

This project also contributes to the contingency plans to be made on the path that starts at the river terminal Cacilhas, passes through Cândido dos Reis Street, and goes towards Cristo Rei, the major tourist attraction of the city of Almada.
The chosen strategy operates in two fronts with distinct works (Fig.7):

The strategy chosen operates in two fronts with distinct works (Fig.7):

I. The first aspect pertains to the pedestrianization of the street, through the redesign of car routes and the enlargement of sidewalks;

II. The second one binds with the rehabilitation of the

buildings of the street, with main focus on the facades. The main intention of the intervention was a reappropriation of the space by the owners of establishments and residents. The intervention incorporated the belief that the redesigned of public áreas could offer new experiences to the area.

Thus, the street became almost exclusive for pedestrians that are now able to use the street freely. The projectual part of the intervention went under a careful choice of tradicional constructive method, materials, and aesthetic choice of patterns. The intervention was intended to be minimalist, giving clarity to street elements. Other aspects, such as street furniture (street lighting, trash receptacles, benches, etc.), were also addressed.

In order to obtain the necessary information for the elaboration of the pentagon-assessment, this essay work had diferent processes of data gathering:

- Many documents and old photographs of the street, given by Almada's city council, were revised;
- New observations were made in situ;
- Interviews were made to the population affected by the intervention and to some city council's members who were involved in thos matter.

The assessment began aproximately one year after the intervention was concluded[9]. After all information was gathered under the supervision of the architect responsible for the project, the parameters of the different dimensions and sub-dimensions were checked. The quotation for each dimension was obtained by the following equations and steps:

I. Total parameters = (the total of parameters on the list) — (the total of parameters that weren't considered/were inadequate)

II. Total checked = (the total of parameters checked)

III. Dimension quotation[10] = (5 x total checked) / (total parameters)

Finally, the quotations for each dimension were obtained, and it was now possible to draw the pentagon-assessment for this case study (Fig.8):

▪ Social Investment	S	= 4,5
▪ Resoureces of the Territory	R	= 2,4
▪ Mobility in the City	M	= 3,5
▪ Public Space	P	= 4,0
▪ Urban uses	U	= 4,8

From this values it is also possible to obtain the average urban-sustainable value for the intervention, in order to give an overall assessment result. In this case, the assessment for the Cândido dos Reis intervention obtained as a result the value of **3,8** (out of 5).

The pentagon allows the observation of the following immediate conclusions according to the urban-sustainable terms:

- The most successful dimension was Urban Uses;
- The dimensions Social Investment and Public Space also had a very positive response;
- The dimension Mobility in the City had an average response;
- The dimension Resources of the Territory had a low response;

From the information above, further conclusions may be drawn:

- When new interventions in the area, an investment should be made on the weakest dimension, in this case, Resources of the Territory;
- Upon processes of population participation, ask for suggestions and opinions on aspects integrated in the dimension with the lowest urban-sustainable index;
- In case of monitoring and intervention in the area, check the dimensions with better urban-sustainable index, in this case, Urban Uses, Social Investment and Public Space;
- Investigate aspects that can lead to improvement and/or weakening of dimension with the median urban-sustainable index, in this case Mobility in the City, in order to devise strategies that aim to increase its control and avoid its decline;
- Understand that, in general, the project achieved a good urban-response indicator, within the urban-sustainable context.

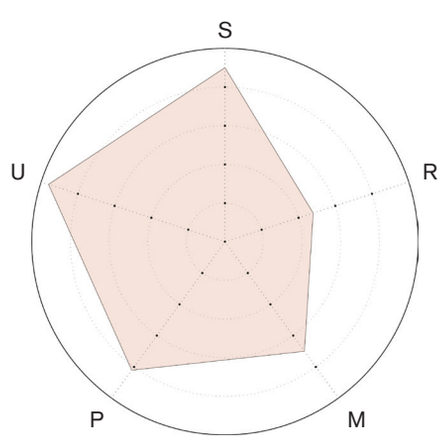

Fig. 8. Pentagon-assessment graphic for the intervention made on Cândido dos Reis Street (Almada, Portugal).

[8] The construction work beagun on March 2011, and ended on September 2012. The case study begun on August 2013.
[10] The multiplication by 5 is to scale the results into the pentagon scale.

6. CONCLUSIONS

The purpose of the assessment is to contribute to processes of sustainability measurements of a particular area, intervention and life installed. It is important to remember that the purpose is not to provide readings that dictate if a project is good or bad under urban-sustainable circumstances, but to measure its response in the same terms following its construction.

Each city consists of multiple cities organized in layers and separated by time and space (Lapple, 2006). This belief shows the key concepts of the assessment - sustainability measurement of urban and architectural pieces of the city according to the reactions triggered and the space's specifications.

Thus, it is clear that more attention should be given to urban form developed in the projects and the effect they have on the city's life. Architecture and urban interventions do not end with the completion of its execution works. Architectural and/or urban projects are presented in staticcally, no matter the platform expository assumed. The pentagon-graphic of the assessment proposes to break this static project explanation/ exhibition: taking up little space in a presentation of any type of support, it can offer succinctly and clearly a lot of information that is not transmited on photographs or tecnical drawings.

The assessment of the urban intervention on Cândido dos Reis Street was as a first test for the evaluation. The preview of its final pentagon facilitated the collection and reading of different types of data, since it works as a visual report, revealing the points more or less developed in certain intervention after its completion. One of the great advantages of the assessment is its presentation - the pentagon offers a strong and immediate visual communication, easy to read and understand.

Additionally, these were the positive aspects of the use of the pentagon:

- It is adaptable according to the intervention in question and their specificities and scales ;
- It can be used in various scenarios by different users within the fields of architecture and urbanism;
- When new interventions on-site or nearby come up, it reveals the dimensions that the project should invested on;
- It can be useful during comparison processes of similar projects in their conceptual and constructive genesis;
- Following this, it may contribute to the effect catalog of projects with the same genesis or type;
- If an entity intends to invest in a project that is intended to operate in one or more specific dimensions, research on typologies becomes easier and more realistic research if previous works have been under this assessment and show its specific pentagon;
- Since the assessment is a process that involves inquiring people - directly or indirectly - affected by a certain intervention, the assessment itself triggers processes of monitoring and population involvement;
- Since the assessment is a process that involves evaluating different components pertaining to architecture and urban planning, it encourages the establishment of teams covering distinct technical areas of study;
- It may assist or even provide a basis for architectural sustainable-urban awarding.

Although the use of Pentagon reveals many advantages in various aspects, the case study of Cândido dos Reis Street made possible the verification or prediction of some drawbacks:

- There migh be some incompatibility of information given by different entities interviewed ;
- There can be difficult access to entities to interview people directly affected by the intervention or the responsible companies (public or private);
- The access to technical documentation of the intervention can also be difficult;
- The duration of the process of collecting information for the preparation of the pentagon depends on being able to rech the entities and people involved.

Given the short period of time and lack of resources (human, technical, monetary, etc.) for the assessment trial, it was not possible to recognize more aspects related thereto. However, the following developments in the assessment techniques are designed and admitted:

- Assigning more than 1 value to specified parameters;
- Scale enlargement;
- Admission of percentages to be applied on the final value of each dimension, if it is found that certain dimensions are more or less important than others within the urban-sustainable sphere;
- The percentages given may also vary according to the type of project;
- In a hypothetical scenario, the pentagon could be a parameter to be integrated into the technical documents of architectural and/or urban, not changing the reading and clarity of other information, as it graphically occupies little space.

Although the case study was more connected to urban aspects rather than to architectural ones, this essay strongly believes that the pentagon-assessment fits perfectly the opposite situation. After all, the assessment and the pentagon aim is to answer the question:

which reactions were triggered in the different urban--sustainable dimensions?

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