Sustainable Neighbourhoods

Contributions for a Sustainable Rehabilitation Strategy – Bairro do Rego

Abstract

Sustainable rehabilitation is a topic that has been gaining visibility both in academic terms as in experiments already launched. However, these interventions occur mainly at a dwelling unit level, or even at a building level. The "eco-urbanism" or sustainable urbanism has been applied almost exclusively in cases of building from scratch. Therefore the application of these sustainability principles to cities' rehabilitation is particularly suitable, since, on one hand, cities are home to a relevant part of the world population, and on the other, the existing economic crisis calls for cost reduction.

In this paper will be analysed different case studies, namely sustainable neighbourhoods and isolated interventions - illustrative of good practices in key components of sustainable neighbourhoods. The aim is to understand what are the different necessary components for creating a sustainable neighbourhood and which principles, whether environmental or social and economic, should be apply. These components are connected in particular to urban design, but also to the equipment foreseen, thus bringing different paradigms in each of the components shown.

This essay intends to highlight the different solutions found for each component required to build sustainable neighbourhoods. After this analysis, the viability of rehabilitation of existing neighbourhoods in consolidated urban areas, in order to evolve into sustainable neighbourhoods, will be studied through the presentation of a strategy applied to Rego's Neighbourhood, in Lisbon.

The study of the different case studies presented in this paper shows a significant improvement in residents' quality of life, in various aspects. Examples include less need for water and energy consumption and waste production, reducing motorized traffic in the neighbourhoods and consequent promotion of smooth modes, the increase in green areas and the variety of uses, and the enhancement of relationship among people, with the integration of values such as equity and social solidarity, among others.

Keywords:

Sustainable development

Eco-neighbourhoods / sustainable neighbourhoods

Sustainable rehabilitation

Bairro do Rego

Introduction

The consequences of world's climate change are notorious and the pressure exercised in the natural environment is proportional to world population growth, which has been increasing exponentially since the middle of the 20th century, reaching nowadays an estimated number of more than seven billion, which is estimated to continue its rising (Crossette, 2011).

Since the first oil crisis, in 1973, and the United Nations Conference of the Human Environment, held in 1972, we are witnessing a global conscious awareness of limits to urban development. The concept of sustainable development is based on environment, social and economic principles, which spread in a wide range of time (Herrmann *et al.*, 2012).

More than half of the world population lives in urban areas, and this percentage tends to increase. Although cities only occupy 3% of the world area, they are responsible for a big part of waste production, greenhouse gas emissions and use of natural resources. Indeed, the impacts of cities human activities go far beyond their borders (UNEP, 2012). Due to its population concentration, cities seem to be a starting point for implementation of sustainable principles, which will be more efficient as they affect a bigger amount of people (Peter & Swilling, 2012).

Since the 90's we're witnessing a growing awareness of buildings impact on the environment, in both construction and its use, highlighting the preponderant role of architecture and urbanism, together with technical and technological innovations, can accomplish. Nevertheless, these concerns apply mostly in new constructions, of both isolated buildings and new expansion areas, and in renovations which intend to improve the energy performance of dwellings (Charlot-Valdieu & Outrequin, 2006).

In order to become sustainable, city's neighbourhoods should be too, being clear that sustainable development at a district scale and at city scale are complementary. The neighbourhood has its own characteristics, but its identity results mostly from the social context that brings people a feeling of belonging. Its scale is capable of including the whole sustainable issues, as well as it is capable of promoting engagement among residents (Charlot-Valdieu & Outrequin, 2006).

The terms eco-neighbourhood and sustainable neighbourhood are similar, being distinguished by the fact that the first concept is more interested in the environmental aspect, mainly focusing on the technical part of the work, whilst sustainable neighbourhood also integrates social and economical concerns (Souami, 2011; Boutaud, 2009). There are quite a number of definitions about these two models which try to express the diversity of the existing approaches.

Sustainable communities emerge in the 60's, and its model has been developed, reaching its first stage in the 80's, where they were actually eco-villages. In a second phase, in the beginning of 90's, projects gained visibility, as they were started by public entities, becoming learning spaces and technological showcases. Taking advantage of this knowledge, starting from the second half of the 90's, sustainable neighbourhood's projects got more common-sense and focus on the environmental quality and social and economical issues (Souami, 2011; Boutaud, 2009).

As building rehabilitation and construction of sustainable neighbourhoods are a reality, the attempt is to transpose this knowledge in rehabilitation of urban areas.

Sustainable Neighbourhoods – Case Studies

Geographic situation of a district is crucial to determine how sustainable it can be, depending on the local microclimate and biodiversity specificities, available resources, existing equipment, close infrastructures and collective transports, urban intervention type and density. Aiming to prove their sustainability, some urban projects tend to isolate, generating important costs as well as negative impacts in periurban's biodiversity (Souami, 2011). Therefore cities densification comes first through rehabilitation of vacant areas, or by urbanizing empty spaces. For some areas however, the capacity to stand a new urban intervention is limited and must be respected (Lefèvre & Sabard, 2009).

Lyon Confluence project, in France, comes out from the junction of industrial and railway areas creating an isolate peninsula contiguous with the city centre which has now twice its previous area. This project consists in three phases, fitting in a 30 years long term strategy, the urban forms proposed give continuity to the existing urban centre, being the new urban fabric characterized by high densities (Lefèvre & Sabard, 2009).

Another French project, the Seine-Arche project, in Nanterre, results from the need to restructure an historical axle. The link created between La Défense Neighbourhood and Seine River presents a big functional diversity and allow North and South neighbourhoods to be connected (Lefèvre & Sabard, 2009).

Energy consumption is the largest contributor to the emission of greenhouse gases. Energy comes essentially from fossil fuels, namely, oil, coal and natural gas, which together provided 81,6% of global primary energy in 2011, against only 13,3% provided by renewable sources (IEA, 2013).

Energy consumption can be divided in three categories: direct (lightning, heating and cooling or even displacements), indirect (related with construction, fabrication and transport of materials and equipment and its lifespan) and induced (needed on daily products' fabrication and distribution). Concern for direct consumption is a recurrent theme in sustainable neighbourhoods. Some projects, however, go beyond this initial issue and show interest in reducing indirect and/or induced consumption through the embodied energy, a new concept that refers to the energy needed at all stages of materials lifespan, from its production to recycling, being the BedZED project, in South London, a good example to mention, since it was able to reduce about five tonnes of the CO_2 emissions, through the use of local and recycled material, 52% of which produced in an area no bigger than 50 km, and 15% from recovering (CeRDD, 2007; Charlot-Valdieu & Outrequin, 2009).

The best way of solving energy problem is by reducing the need for consumption, which can be done by applying bioclimatic principles and using more suitable construction systems and efficient equipment. Eco-neighbourhood EVA-Lanxmeer, in Culembourg in Netherland was able to reduce about 50% of energy consumption comparing to the country's average, partly due to housing energetic efficient construction and ventilation system with heat recovery unit, but mostly due to solar passive energy design (EVA Lanxmeer, 2010). The whole Vauban Neighbourhood, in Freiburg, Germany, uses solar energy both for heating and electric production. Most of the roofs have solar panels on it, to heat water, and the green roofs enhance thermic isolation, as well as absorbs rain water and increases air quality. Part of the electricity needs is granted by a granulated wood electric plant, also providing heat (d'Erm, 2009).

An analysis of the available energy resources carried out before starting a project, allows the optimization of the devices to be installed and can multiply the systems that best suit the different areas of the district. Sustainable neighbourhoods aim to a new technical organization of the territory in which any point of the region is simultaneous a potential consumer and producer of energy, unlike the traditional scheme, where there is a production core and a consumption network. This logic also applies to water, where any point in the territory is at the same time a potential rainwater collector and consumer (Charlot-Valdieu & Outrequin, 2009; Lefèvre & Sabard, 2009; Souami, 2001).

The right to water in sufficient quantity and quality is recognized as a fundamental human right. Regarding its social, cultural and economic dimension, access to water at a socially acceptable cost, would combat discrimination and social exclusion or mitigate its effects (Serra, 2003). In 2004, for example, nearly 20% of the drinking water that reached Lisbon municipality was lost through leaks in the distribution network (Branco, 2004). Reusing grey water and rainwater in activities that do not require drinking water, such as watering, cleaning and flushing, avoids wasting water and helps reducing discharges into the city sewer. BedZED in London, realized savings of 70% in the consumption of drinking water, mainly due to the recovery of rainwater and reuse of grey waters for flushing and watering, after treatment with Living Machine (CeRDD, 2007).

The current consumption behaviour and the fact that population is increasingly concentrated in urban areas, increases significantly the amount of produced waste, particularly due to the need for packaging, representing 22.9% of garbage, in Portugal, in 2011. Municipal waste collected in Portugal have different destinations, mainly, direct landfill, about 59%, followed by energy recovery by incineration, with 21% and the remaining 20% sent for organic or material valorisation[1]. The uncontrolled dumping of waste is a serious environmental issue and an important source of soil, water lines and underground aquifer reserves contamination (Braga & Morgado, 2007). In Eva Lanxmeer neighbourhood, in the city of Culembourg, Netherlands, a biogas plant was installed, combined with a Living Machine system. The used water and the organic waste are then treated at different levels, through energy and organic valorisation (Van Timmeren & Tawil, 2006). In Kronsberg Neighbourhood, Hanover, Germany, besides the selective collect of house waste, inhabitants also dispose of compounding areas and all materials or waste resulting of excavations or demolitions are, as far as possible, reused within the neighbourhood or its surrounding areas (ARENE, 2005).

Monitoring plays a central role in the optimization of all devices, allowing to know savings carried out and to correct any errors. By transmitting the information to involved people, a collective environmental awareness can be created, in Vauban ecodistrict, in Freiburg, there are information panels, which show the production and consumption made (Charlot-Valdieu, Outrequin, 2009).

Some projects adapt Richard Rogers (2001) idea of cities circular metabolism to a neighbourhood scale, using urban solid waste and residual domestic waters to reduce incoming energy as well as waste production.

[1] APA, MRRU. (2011). *Portugal continental e regiões autónomas* http://www.apambiente.pt/index.php?ref=16&subref=84&sub2ref=933&sub3ref=936 [Acedido em 2 Mar 2014].

Biodiversity is a concept that comprehends all living organisms in different ecosystems of our planet. Most of the world's biodiversity is concentrated in non urban areas, however urban areas have significant impacts on biodiversity (Santos, 2012). Ecosystems provide three major types of services to cities: food and fuel supply, droughts and floods regulation and aesthetic enrichment[2].

In addition to help preserving biodiversity, the integration of nature in urban areas allows a reduction of energy needs for heating and cooling of buildings whilst improving air quality by reducing the amount of carbon (Bull, 2013). Aerial view of BedZED neighbourhood in London shows a large green area, due to its green roofs and other green areas, which promotes insects and birds development and proliferation. (BioRegional, 2009). In addition to the green areas, the use of permeable coatings and the creation of public flooded spaces are likely to reduce water runoff and avoid flooding (Lefèvre & Sabard, 2009). Daylighting is a process of water management in cities that allows bringing to surface and naturalising watercourses that were buried. The Leipzig Integriertes Gewässerkonzept (Integrated Concept for Watercourses) is a concept of flood protection for the water network of Leipzig, aiming to minimize flood risks (Bender & Bigga & Maier, 2012).

In 2011, the transport sector was responsible for 62.3% of the worldwide oil consumption, which represents more than 2200 million tons, contributing considerably to the greenhouse gas emission (IEA, 2013). Most individual displacements in urban areas occur under the home-work link, which is characterized by a great regularity, both in time and in space. Car is the most used means of transport in Portugal and their number is now estimated in more than five and a half million for a ten million population (INE, 2013). The widespread use of cars leads to deterioration in the quality of public space and environmental quality and affects pedestrian and bicycle users. While the indiscriminate use of private vehicles contributes to the lack of response of public transport, the solution for the increasing traffic problems is, in general, building new infrastructure, which in turn promotes a vicious circle, not solving the problem, but enhancing and amplifying it (CMO, 2009). In order to reduce car traffic, neighbourhoods must be permeable and mixed-used, and the use of bicycles and walking should be encouraged through the creation of continuous and safe bike and footpaths (Rogers, 2001). Mobility policies cannot be limited to reduce private transport use, at the same time, there should be a comprehensive and efficient public transport network (Charlot-Valdieu, Outrequin, 2009; Lefèvre & Sabard, 2009).

In Vauban neighbourhood, cars are kept out of its limits, in a collective parking located at the entrance. Most streets have no parking and the speed limit is 30km/h, creating a security feeling that allows a mixed use of streets. In addition, a tram crosses the whole neighbourhood, connecting it to Freiburg's city centre in only 15 minutes, and a car-sharing system exists (d'Erm, 2009).

Another example is the BedZED Neighbourhood, in South London, where a plan of ecological mobility (Green Travel Plan) was created with the aim of reducing by half, compared to the UK average, the distance covered by cars powered by fossil fuel. This plan is based on three points: to

[2] UNEP, Urban Environment Unit. http://www.unep.org/urban_environment/issues/biodiversity.asp [acedido em: 14 Março 2014].

offer alternatives to private vehicle use, to promote public transport and to reduce the need to travel of inhabitants (Bioregional, 2009).

The prioritisation given to motorized mobility, the lack of infrastructure for pedestrian and cycling use and the increase in ticket fares have created a negative connotation of cycling and public transport in Portugal, creating barriers to alternative mobility (IMTT & GPIA, 2012).

Richard Rogers (2001) defends the idea of dense cities as the solution for sustainable cities, preventing their expansion into rural areas. Such a project should take into account energy efficiency increase and resource consumption and pollution levels reduction. Michael Neuman (2005) defends as well the idea of the compact city characterized by high densities and diverse land uses, ensuring thus a higher quality of life.

Urban expansion is a recurring and very complex problem in our cities, having echoes in all sustainability areas (IMTT & GPIA, 2012). Future cities need, therefore, to improve density and attractiveness of its centres, namely through functional diversity, in order to promote the establishment of different social strata population (Lefèvre & Sabard, 2009).

Questions must be raised regarding the growth of sustainable neighbourhoods, and how to promote its densification without, however, compromising public spaces (Lefèvre & Sabard, 2009). It seems difficult to define high or low density, since it depends on the context - the concentration of buildings, people and activities in a particular space, influence the welfare of its inhabitants and users. Once density approaches extremes, life quality tends to deteriorate (Souami, 2011).

At city level, governance designates the combination of power, mobilization and coordination of the involved actors - social groups and institutions - which aim to accomplish, collectively, negotiated projects (Lafaille et al., 2011). The involvement of residents, associations and socio-cultural actors, from the beginning of the project development process, offers participants the opportunity to clarify their needs and point failures as well as to better understand the functioning of what is intended to be undertaken (Charlot-Valdieu & Outrequin, 2009; Lafaille et al., 2011; Lefèvre & Sabard, 2009). This is key for a long-term issue, since eco-neighbourhoods are mainly defined through technical standards for construction and energy consumption, but their sustainability depends on the behaviour of the inhabitants (Lafaille et al., 2011).

In Bologna, in Italy, a constructive cooperation between project designers and inhabitants of a sustainable neighbourhood, allowed the transformation of the neighbourhood's blueprint at residents' request (Sabard & Lefèvre, 2009). This example demonstrates how the attachment of the population to the neighbourhood is likely to make a difference and create the necessary commitment to the preservation and enhancement of spaces (d'Erm, 2009). Another example of alternative governance is the neighbourhood of Vauban, in Freiburg, Germany, where a "bottom-up" initiative has been set up, allowing population to participate in planning and construction processes (d'Erm, 2009; ARENE, 2005). One of this neighbourhood features is that it has been conceived to be able to accommodate people with disabilities. In addition, one of its schools has been designed to facilitate, if necessary, its transformation in old people care home, thus giving response to aging social problems (d'Erm, 2009).

Strategic Urban Rehabilitation in Bairro do Rego, Lisbon

The neighbourhood of Bairro do Rego is located in Lisbon. Its boundaries are clear, as they act like barriers isolating it from the rest of the city, two main thoroughfares (Lusíada avenue and Forças Armadas avenue) run respectively on the West and the North side, a railway line marks the limit on the South side and a major avenue on the East side. Its surface spreads over nearly 40 ha, host to more than 5000 residents. It is near some high attractive equipments, such as hospitals, universities and Entrecampos train station.

The district can be organised into different areas that present distinguish characteristics at both urban and social levels. Including traditional area lacking of pedestrian public spaces with some decay constructions home to an ageing population; modern and contemporary buildings on the periphery typified by more public spaces whose population is of higher socio-economic and cultural status; and 10% of social housing, with disrepair buildings.

All neighbourhood buildings have a poor energy performance, being therefore proposed generalized isolation intervention in façades, gables and roofs, as well replacement of windows. Within this ecological rehabilitation, the use of low local environment impact, recycled or recyclable materials is recommended. All pitched roofs have at least one slop with good sun exposure, on which will be placed solar and photovoltaic panels.

The construction of a cogeneration plant is also foreseen. It will be mainly fuelled by biomass, green and dry waste derived from Monsanto's forest park maintenance as well as from neighbourhoods and city green spaces. The produced thermal energy will be used to feed a district heating network and the electricity generated, together with the one produced by the photovoltaic panels installed on the central building's roof, will be enough to fulfil electricity needs of neighbourhood's urban lightning, as well as electric cars' charging stations, kiosks, the market and the pool. Furthermore, a Living Machine will be built in the front of the cogeneration plant, allowing the treatment of domestic wastewater. The water obtained from this biological treatment will be stocked in a reservoir buried in the south green area. Over that reservoir are planting reeds which treat the rainwater collected from the roof top. The storage treated water will be reused for watering, flushing cisterns and cleaning purposes.

In the market, the selling of biological and local products will be promoted and the use of packaging restricted. A restaurant will be built in a vacant lot next to the market, that will recovery the daily unsold fresh goods and cook them, preventing food waste.

To allow garbage sorting in public spaces, people will have at their disposal a sizeable number of strategically placed waste collectors, equipped with differentiated compartments.

In order to implement and facilitate non-motorized means of transport and reduce environmental and noise pollution caused by automobiles, an important intervention in road infrastructure is required. The green infrastructure is virtually non-existing, especially in its interiors, thus an improvement in green infrastructure goes together with road intervention. Therefore, it is useful do emphasize the two major interventions, the Beneficência Street will be given a pedestrian character, and all secondary streets, located in the central zone, one of the oldest and traditional areas of the

neighbourhood, will be transformed into a coexistence zone. The foreseen transformations in the remaining streets concern car lane's width reduction, which result in an increase of the sidewalks; parking's reorganization and the afforest of the introduced bicycle lanes.

An internal line of small electric buses will ensure the link between Entrecampos station and Espanha Square with several stops within the neighbourhood, all located less than 200 meters from any dwelling. Some parking places will be devoted to electric car-sharing activity and it will also be created a system of car-pulling. Also, bicycle parking areas will be strategically placed all over the neighbourhood.

During the design of the project and its implementation, the residents associations should be consulted in order to better meet the needs and expectations of inhabitants as well as to provide explanations on the applied procedures and choices made, so they can easily be adopted by population.

Throughout the work, local firms will be hired. Moreover, unemployed people of the neighbourhood will have the opportunity to integrate the work teams under a social inclusion program to be implemented. Besides, the maintenance of green areas is likely to be dealt by the locals, a form of social integration of unemployed residents, which also aims to develop and instil in the minds of users, values such as respect for the work of others. In terms of sustainability, this maintenance should be made regarding the environment, without using pesticides or toxic products and by using the organic compound obtained by recycling organic domestic waste, generated by residents.

The market will gain dynamism thanks to sustainable educational activities, which intend to improve social and intergenerational relations and promote social ties and social cohesion. It is intended that the market becomes itself a new centrality, the neighbourhood sustainable centre, a space for learning and sharing.

On the northern part of the neighbourhood, near the school, the pedestrian area in Nuno Gonçalves' Square will be increased, by eliminating the central lanes, forcing vehicles to circumvent it. Across the plaza area, the surface will be levelled at the sidewalk height, with only a visual separation between the pedestrian and bicycle area and the car lanes. The existing urban furniture will be kept and complemented by a parking structure for bicycles and the needed equipment for a playground and a kiosk with terrace. In addition, more trees will be planted to provide shade to the space.

The transformation of a plaza located under a viaduct will give visibility to some hidden structures. The square is crossed by a road dividing it into two parts, both receiving different treatment - the southern part, homing the sport centre and the children's playground, will profit from the expansion of its green area, while the north side will remain mineral. This area, which currently hosts a post office, will benefit from a coffee structure with terrace, and local artists will be able to take advantage of this space to exhibit their artworks which can be exposed both in the square, and on the viaduct itself. To overcome the gap between the square and the surrounding street some stairs will be created that will also serve as seating. This square allows the integration of the swimming pool, now hidden behind the flyover.

An unoccupied and empty public space will be transformed into a basketball street court, framed by two gables, which will be covered by urban art or graffiti.

The vacant land south of the neighbourhood will be transformed into a large garden area with native flora, fruit trees and aromatic shrubs. Footpaths and cycle tracks will allow crossing the green area. The urban gardens created there by the inhabitants will be maintained and new ones will be create, along which composting units will allow the recovery of organic waste. The compound thus obtained, will be used in the maintenance of green spaces. To increase the comfort of the users of this green space, a sound barrier will be placed along the railway line. Events like "Outjazz" can help in the promotion and dissemination of this consequent area, and thus increase its visibility and its potential as a leisure area of the city.

Conclusion

All these interventions are mainly aimed at improving the environmental energy performance of the neighbourhood and increase its dynamism and attractiveness, decreasing isolation and encouraging social ties and the establishment of a younger population, thus countering the aging population and illiteracy issue. Two other relevant objectives of this intervention are to bring back the traditional commerce that used to characterize this neighbourhood as well as to encourage smooth modes of displacement, improving, in general, the quality of life of residents.

This dissertation aims to understand which are the key issues related to sustainable neighbourhoods construction and, throughout the analysis of different case studies, highlight some solutions to each of these questions (geographic localization, resources management, biodiversity, mobility and governance) and transpose them into rehabilitation. Moreover it is intended to justify the relevance of the intervention to the scale of the neighbourhood and the importance of rehabilitation in the current context.

Working at the district scale present some limitations, due to the fact that it must integrate a wider urban strategy. However, the district scale allows to respond to all sustainable issues while creating a better commitment from residents. Thanks to the experiences made in building sustainable neighbourhood, we have now enough knowledge to transpose it to rehabilitation. As urban rehabilitation is, currently, the most adequate way to reduce the negative impact of our cities in environment, whilst preserving its heritage. However, it is not the most efficient way, as it hinders putting in practice bioclimatic principles.

Ultimately, it is considered that the process of urban rehabilitation requires a multi-scale and multi-actor approach. Despite the identified limitations at the neighbourhood's scale, the exercise performed in the Rego's Neighbourhood allowed to understand that the neighbourhood is an interesting starting point, especially for constituting a spatial unit able to capture the attention of the local community for an active involvement in identifying alternative models of development, a topic that deserves more visibility.

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