Resume of Paper:

The City of the Future: What Sustainability?

Case Study: Masdar, the city in the desert

1. Introduction

The subject of the paper is related with the planning of the city, enhancing it for a future where sustainability becomes an increasingly inevitability. The aim of this paper is to perceive if there is some model or sustainability principles, according to which we can plan the city of the future in order to reach the sustainable ideal. The following inquiry question can be placed:

Is there a model of sustainable city?

The way we organize and structuralize the construction of our cities was based on the false idea of eternity, having considered the available resources as infinite. This fact was aggravated with the fast evolution and recent technological progress, imposing terrible consequences in the Environment. Although we've gain this consciousness, the global attitude hasn't changed, and even having an adjusted technological reply, it is still necessary to place it in practice. But the answers coming from the planning and the architecture have not followed the progression, that´s being faster than the capacity of an adequate reply.

2. Urbanism and Urbanity - Historical, Technological and Social evolution

Before, the city had an easily defined limit, with a clear distinction between the field and the city, between natural and constructed environments, today, when expanding our cities, these barriers broke entering in the landscape and humanizing it to the measure of our urban necessities, filling it with infrastructures that spread to meet the untied housing, offices and plants in the landscape. But there's an element without which the city cannot exist, it needs its inhabitants, and this can be the base for the definition to urbanity, which ends not settling on the physical space, but rather putting it on society. That is, as mentioned by Mumford, where the interaction and interchanging possibilities, raise the human activities to their highest potential. This interpretation meets the current reality, where the fact of being or not urban, is no longer associated to the city, or to the fact if we inhabit it or not. Since the barriers of physical distance have been broken by the technological development, we've been allowed to be part of society with a real but not physical existence. Will this not be a subversion of what is society? Is there not necessary to have physical interaction to be part of society? Are we urban? Yes, it is certain. But are we social? We are each time more individual and less social. If urbanity resides in the existence of society, without this element it ceases to exist, and it is necessary to understand to what point it will arrive, if there's no human physical interaction, and what new molds of urbanity will thus appear. The city exists with a clear and precise form, which varies depending on the cultural framings,

but that subsists when the social essence disappears. Therefore it is important to understand its evolution, its space mutations, to react to the present reality and to answer to the future necessities. At a time where it is essential to live in a sustainable way, it is urgent to reuse and to recycle the city, we cannot continue to widen the spread of our ecological footprint on the planet, abandoning existing structures to forward an urbanism that spreads like an oil spot on the landscape, no longer natural, but only naturalized.

The urban evolution starts at the moment from which urbanity exists. That is, when the population concentrations are no longer defined only by population numbers, but include the transition between the agricultural life to the urban one. In the base of this modification is the displacement of focus of attention from the community reproduction and feeding, which with the settling of communities pass as a plain one, giving space to the structuring of human interaction. Throughout the historical evolution of urbanism (Picture 2.1) we perceive that it maintained perseverance in its formalization as compact and concentrated, allowing social activities to be fulfilled inside a short physical limit. The walled city was out of order with the Industrial revolution and with the progressive attitude associated to it. An attitude that doesn't look back to past, where cities were organized in a net system that allowed independence but also benefit from the market relations they fomented amongst them, to change to a system of human concentration, supported with the aggregation of housing suburbs to saturated and congested centers. The city was overwhelmed by new technological innovations, but didn't give it time to perceive the cost-benefit relation of each one and without fulfilling its capacities to maximum. The society started demanding in the present what was intended for the future.

	Mesopotâmia civilization	Egyptian civilization	New World	Minóica civilization	Greek civilization	Roman civilization	Midlle Age	Islamic civilization	Renaissance	Baroque	Industrial Era	Garden city	Modern movement
City network					Y	Y	Y		Y			Y	
Finite city	Y		Y	Y	Y	Y	Y	Y	Y	N	N	Y	N
Self-sufficient city	Y	Y	Y			Y	Y					Y	
Conditional city					Y	Y	Y				Y/N	Y	
City with identity	Y	N		Y	Y	Y	Y	Y	Y				N
Absolute city	Y	Y		Y						Y			
City suburb											Y		Y

Picture 2.1 – Systematization of urban evolution – Y (yes) N (no)

The technological evolution appears as an immediate reply to the human necessities for simplification and systematization of routine processes, and is fomented by life in society, where the sense of urbanity exists. But the technological progress has never been as fast as it is now. We stopped having an evolution that replied to the human necessities, to have one that answers to the will of scientific progress, without a purpose. This sped up process, had its consequence in the explosion of the city, that expands throughout the landscape creating a lack of organization capacity. This expansion corresponds to the lack of capacity from the city to be the focal point of attraction, putting the civilization power of control over its resources and chances at stake. But this is not the first time that we come across with the lack of control over the evolution process of the civilization. The shock between people in different degrees of development resulted in many wars, which led to the assimilation, or in extreme cases, to the extinguishing of one of the people. In situations like these, not always the people with the higher technological capacity have prevailed, making us understand, that the technological progress is neither continuous nor constant.

3. The Dream of the future - Ideals, Utopias and Reality

Since the concern with the planning of cities exists, that the main thinkers, philosophers and city planners concentrate in reaching the ideal city, containing the right urban principles for each time. In reality the ideal is confused with utopia, and in the majority of the cases, such cities remain in paper, influencing the real concretions. The interventions of Pope Sixto V in Rome and of Haussmann in Paris, that opened avenues over the existing structures, are a clear indication of the will to approach the theorizations of the city by Alberti and Palladio.

The new constructions were almost always based on quadricular plans, they were associated with movements of expansion and territorial consolidation, where the cities needed to be implanted in a short space of time and were walled, restricting its growth, but perhaps that fact was a goal, because a territorial affirmation demands that the city does not exist isolated, but in a net system. After the Industrial Revolution cities were completely free of walls, but in cases such us New York, the quadricular planning was kept to facilitate its expansion. The biggest change in the form of planning the cities is undertaken when the conscience that it cannot hold the proximity with the industry due to the raising levels of pollution, this leads planning the city as a set of zones with differentiated uses, facilitated by the use of the automobile that allows the city to enlarged itself. Recently when putting the automobile in question, the city based on the multifunctionality returns, as in the renewal interventions of the Parisian blocks, supported by specific equipment designed to become its prompt center, with the city functioning as network of small nuclei.

In terms of recent interventions it is necessary to have present that the historical set back still isn't enough to have a real analysis of the effect the carried out plans had. Even so, it interests to analyze more specifically some situations of ideal city, that are relatively recent and in some way antagonisms.

Thus being we have the materialize ideal city: Brasilia that represents the Modern Movement, on the other hand an example not carried through: Bionic Tower because it thinks the city differently than what we know, and finally an example of the city that we inhabit, thought to be transformed into ideal through the MILU program, that intends to intensify and to diversify the uses in the existing city.

3.1. Brasilia

Brasilia (Fig. 3.1) was thought as a closed plan where the image of monumentality must remain. The expansion when happening is to be made in the satellite cities, where most of the population inhabits, creating problems concerned with distance and transport cost, wish is based on road traffic, without a viable alternative. The bus station that receives the transit to and from the satellite cities is a platform where the main axes cross at, destined to be the cosmopolitan center of the city, which not knowing how to take advantage from the road convergence faded its initial function. To this contributed the lack of engagement in finishing the workmanships of the monumental axle – mostly equipments, and taking the option to build shopping malls in the adjacent areas. Even thought the foreseen equipment hasn't yet been constructed completely, even if its center has become an transports interface, even if the lake area originally destined to the public leisure has been privatized to the rich, even if the monumental scale subsists as a barrier to human fruition, the truth is that Brasilia created its space. Perhaps it's still too much of a recent experience to make a structuralized evaluation, but is important that Brasilia growth answering to the sustainability, innovating its plan at the infrastructures level (transports) and fomenting power generating from clean energy (sun, wind and biomass).

Fig.3.1. – Monumental axe of Brasilia – view the TV tower towards the miniseries.

3.2. Bionic Tower

The bionic tower (Fig.3.2)caused polemic for its total height, as well as for the way in which it was thought and it will be construct. The project draws in principles of bionic architecture, which combines of balanced forms of biology, engineering and the architecture. It is led on the simple principle that nature has already perfected more than the current techniques of construction and engineering, and thus we need only to observe and imitate nature. Thus being, sustainability happens in the correlation between the constructive model and the natural systems. When translating into the infrastructural systems the way vegetables function, we obtain much more sustainable constructions than others in height. Its compacting allows the reduction of used materials, and the constructive system allows reduction on energy expenses with climatization.

But it continues to enhance doubts on crucial project areas related to sustainability, the energy issue is not boarded, the vertical system of displacement is not explained enough and it is not known how impacts from construction can be mitigated. It fact can be alleged, that densifying the urban structure, intensifying its functions, and allowing free natural space, incurs into creating a more sustainable environment, but will this be sufficient without having concern for energy expenses and the wasteful structures a structure of these dimensions implies.

Fig.3.2. – Bionic Tower

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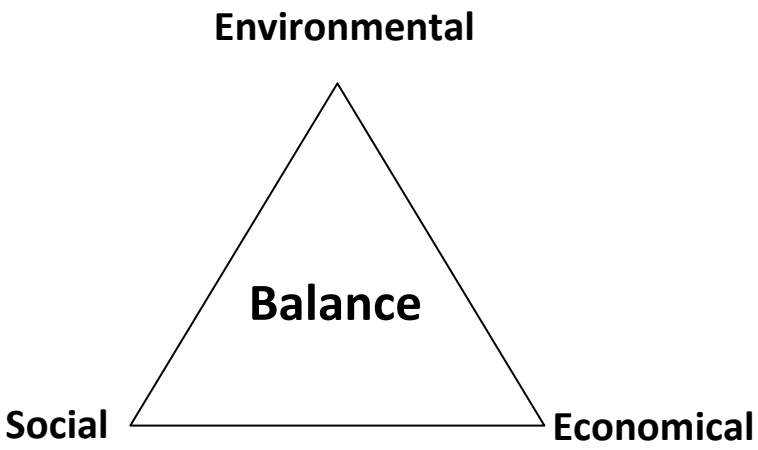
3.3. MILU

Milu means Multifunctional Intensive Land Use. It intends to promote and encourage the varied use in space and time, of a determined area, with the guarantee to construct the best possible quality environment, improving its social potentiality and reducing the ecological footprint of cities (Rees, 1996 *cit. in* Haccoû, 2007), in a global incentive to sustainable growth. The Milu is an experience on the city, but it does not answer to a specific planning, its success relies on that fact, which allows its principles to be reached in an efficient and fast way. The ideal city for a better future is carried through from within, where the historical structures give it identity and then knowledge on the current technological development is added. The Milu exists in a phase previous to the one of the city planner and architect, analyzing and making considers in the conceptual scale, which needs to be later transferred to the reality of each city. This is an option clearly against the urban expansion, concentrating society in the existing structures, but improving them, to converge with sustainability, because in this way there's a clear exploit of exiting of structures and infrastructures, controlling the use of unnecessary resources. On the other hand, the concentration allows the revitalization of the basic qualities of urbanity that lay in its ability to socialize.

4. Sources of Sustainability

Today the world-wide conscience knows that the economic growth depends on ambient quality. For that to happen, one of the beats has been the reduction of energetic necessities and the substitution of its sources from not renew sources to renewed ones. But sustainability is not guarantee only through clean energy production, it is part of quotidian in all of its ways, being necessary to inserted it in the general thought of the society. Sustainability as mentioned in the *Brundtland Report,* intends "to supply the necessities of the present generation without affecting the ability of the future generations to supply itself ". For such, it is necessary to proportionate our well-being, balancing the elements that

constitute the environment: environment, economy and society. Only by balance can we guarantee a structuralized and insured evolution.



- *economical source* is based on the requirements for a strong and durable economic growth, as in preserving its financial stability, low inflation and, and the capacity to invest and innovate.
- *environmental source* intends to guarantee the maintenance of integrity, productivity and resistance of the biological and physical systems, preserving the access to a healthful environment.
- *social source* focus on the importance to have an adjusted job, with nets of security capable to accommodate the increasing population and structural changes, by guarantying the equality and democratic participation in decision making.

Figure 4.1 – Environmental equilibrium

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To reach sustainable development we must explore models that better analyze these relations, guaranteeing the present and future human needs, even without knowing which they will be. These difficulties quantification, which allows the goals to be verified and acknowledged for the way in wish they were carried. We cannot forget that sustainability functions on a global scale, being restrained if there's no agreement to attain the same end (OECD, 2001: 55). Standing out is the importance of the work done by international organizations (EU, OCDE, UN, etc.) in delineating of the main goals and in monitoring its correct completion in the necessary time frame.

Sustainability is most critical in points of human concentration, where the environment is subject to more challenges in the way to find its break-even point. Cities are essential elements in reaching sustainability, because if it's not to obtain in the urban centers, it's globally convicted to failure, putting the survival of the human species on the line.

4.1. Planning the Sustainable City: Challenges for an urban sustainability

The fact is that the city continues to be an enormous region of attractiveness, even if the reasons that lead to this are different in accordance with the context where they are presented. By creating situations of human concentration the city allows saving a number of resources: space, energy, and infrastructures, those of transport, sanitation or equipment. The city is created and necessary by sustainability principles, and is fundamental to remember this fact.

Sustainability answering to a set of factors becomes contextualized, and the work that has been developed for its understanding and spreading, tries to refine the methods of its application and monitoring, so that it has a joust analytical comparison of the reached goals. One becomes forced to create a quantitative base of scientific support that allows taking concrete decisions on politics and environmental management on urban situations. The most common option is the use of indicators, even so if they generate conflicts because of their typological diversity that can be applied to each situation, being difficult to keep the degree of objectiveness, relevance and significance of each indicator in relation to the intended information. One of the recurrent problems is the subjectiveness of the public opinion, but that also it can be looked as the possibility to express reality, without having a cultural imposition of supposed needs. This dichotomy between indicators of subjective and objective origin has the advantage to synthesize the information, identifying the parameters and variables in diagnosis that in disclose become more important and significant.

The urban model of Harris and Ulmann (*The Nature of Cities*, 1945) defends that the metropolises, as they keep growing develop other centers, allowing the decentralization and specialization of its functions, creating cities with diverse nucleus. This reality can be transposed to the cities as elements of a structuralized network, with different levels of attractiveness, which corresponds to a hierarchy. The structuring of the cities in network subsisted since antiquity, as a legacy to which we forgot the motivations. Cities of controlled dimensions are easier to manage and to defend, and guarantee the resources for its subsistence in the neighborhoods. On the other hand, when keeping the distance in between cities the available resources are potentiated. The basic functions exist in all the cities, but when increasing the population the functional access will also be bigger, becoming specialized, or accumulating as in the great metropolis. In this case we try to make it to function with differentiated and interrelated nuclei, not centering the functions in only one point which would overload infrastructures not generating sustainable growth. The application of the Milu can be a reference in the creation of these new centers.

But the city to be sustainable needs to reduce the resources that it spends and wastefulness's that produces, being fundamental to implement reduction politics of reusing and recycling. Also, we must not forget that the city is a set of buildings, where each one must answer ecologically to the basic requirements of being right, economically viable, socially just and culturally accepted (Impactus 10,

2007: 20)). The buildings must be sustainable, and to certify their environmental quality, specialized programs have been created. In Portugal we are trying to implement the LiderA program, that "through a set of criteria structuralized in areas and sources of analysis, allows the draftsperson to percept in fact, the benefits of applying measures, in qualitative or quantitative terms, of such form that the building can contribute continuously for sustainability." (Pinheiro, 2006: 222).

5. City of the future - Reality? The Masdar case

The Masdar project (Fig.5.1) intends to create a completely ecological city, based in a sustainable development that intends to reach null energy wastefulness - carbon zero, with a continuous exploitation of the used energies and the elimination of wastefulness, since all its garbage is recycled or will be transformed into composites. Its goal is that all the energy used is from renewed sources using to its advantage the potentiality of the desert-like zone where it is inserted. The intension is to create a mixed city of high density and uses, but that it keeps the building line low, because as Foster (project's architect) himself defends this fundamental factor to assure the low impact of the city and to guarantee a good social and commercial interaction in the community (*cit. in* Siakavellas, 2008).

Fig.5.1. – Aerial view over Masdar

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The city, planned to lodge about 50 000 inhabitants, will become one of the strategically centers of Abu Dhabi (mother city), but free of automobiles. The connections with the adjacent city, airport and localities are assured by surface metropolitan. In the interior, the distribution of the economic and commercial regions in several nuclei guarantees that no resident is more than what 200m from a point of transport or service, being able to displace itself by foot or bicycle, even so, the circulation is also assured by an electric and automatic network of individual covered carts in a system that spreads throughout the city in a configuration similar one of an electric micron-chip. Without cars, the planning for the public urban space demands a particular care. The passages and patios are shaded, straight and lengthy, in many cases accompanied by water canals that help to minimize the effect of the heat from the desert.

Masdar is drawn in two squares of different dimensions that will correspond to the construction phases the project is divided in. The alignments of the city, following the North-South direction, are thought to minimize the harness of the desert by allowing in the cool breezes of the sea to the north. With minimizing function to save the city from the desert sands and hot summer breezes walls are constructed, but they also serve as intelligent structure that concentrates the energy, environmental and recycling functions of the city. In the exterior of the walls technology photovoltaic fields are placed

and turbines for production of aeolian energy are installed. There's also an exterior green belt with palm plantation created so it can be the raw material for the bio-fuel and minimize the harsh climate.

The question that should be placed is whether Masdar is the city of the future that reaches the so desired sustainability, or if it is a utopian vision. Masdar cannot be looked at as a normal city, because it is a controlled one, both in dimension, as in number of inhabitants, as in the enterprise type. And as it is still being materialized, it must be looked at and analyzed as concept, one from which we can learn.

6. Conclusion

In the beginning of this paper the question whether there was a model of sustainable city was placed. I think that the reply must be no, a model does not exist, but considering context to the implantation place may be a form of approach to the planning of sustainable cities. The city has to answer to the well-being needs of its inhabitants, and for such to happen it needs to answer to the environmental conditions of the place, to the lacks and desires of its population and be economically viable in the reality where it exists.

But it lacks to educate the populations to have conscience on the necessity to reach sustainability, making it understood in its diverse dimensions. Regretfully for the majority of the population the question of sustainability is not seen as crucial to guarantee the quality of its environment. Cities as Dubai continue to be constructed and they attract us as if they were a "paradise". We live in an age of technological revolution that must use its advantages to get sustainability, the motor force of the future. But this transition really needs a solid educational base, and Masdar, constructed in the desert, can serve as example of what it is possible to reach, when removing the technology from paper into reality, allowing us to know their real potentialities. This lesson of context must be applied, using to advantage the ideas and technological innovations of Masdar but adapting them to the specific reality of each case, similarity to what was initiated by MILU, but accenting the technological capacities that assure a bigger sustainability at the energy level. The future is in working from our cities, since it is in them, that we find cultural and historical references that justify today's society, and this identification is fundamental for a structuralized evolution.

Mega cities mainly in the developing countries seem impossible to control, with huge dimensions and population numbers and offers of ambient quality inexistent or doubtful. But when looked closely we perceive that they function as independent but related *clusters*, and having this conscience, we realize that mega city is made of a diversified set of identities, that we must structuralize in future interventions. we already saw its more easy to control a small cities and therefore the first step must be to face the mega city as a set of small "cities" with centers that created their space and function independently from one another. These strategies meet the need to intensify and multiply the uses of land, presented in Milu, as strategy to fortify sustainability in our cities. But these interventions lack in the global structures of the city that would allow an accentuated reduction of resources needed to the city life. On the other hand, it is necessary that each new intervention, building or piece of city that

comes to be reorganized, renewed or added, contain all the technology and innovations that individually allow it to be sustainable. But the city also needs to search for sustainability as an whole, rethink its basic infrastructures (energy, transports, water and waste management) in order for it to function more efficient and sustainably.

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