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Urban sustainability in Barcelona: Living and learning the experience

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Abstract

This paper is a written experience of a person from Malaysia; a developing country who was given the opportunity to live and study in Barcelona; a developed metropolitan by the Mediterranean Sea in Spain. This paper is made up of three sections; 1) current characteristics of the urban planning and management 2) the sustainability and environmental approaches practiced and governed by the city 3) personal thoughts and experience overlooking the general attitude and culture of the people of Barcelona. The observation is made throughout my mobility in Barcelona and as a person living the life in the city. The observation is documented through hard evidence of photographs and local authority database and information accessible to public.

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Keywords: Urban sustainability; Barcelona

1. Introduction

This paper is written purely to share my experience as a student living and learning in the wonderful city of Barcelona. From November 2011 to November 2013, as I am pursuing my PhD in Built Environment in Faculty of Architecture, Planning Surveying at Universiti Teknologi MARA, Shah Alam, Malaysia, I was granted an Erasmus Mundus Man, Health, Environment and Biodiversity in Asia (MAHEVA) scholarship in Universitat Autonoma de Barcelona. Among the main objectives of the MAHEVA program is to support research with social and environmental themes (MAHEVA, 2011). MAHEVA programme has made it possible for 15 students from Asia including Malaysia to experience

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living and studying in various top universities in Europe. Personally, I believe many students had been sent to Spain (more than half of the grantees) to help to keep the Spanish economy going while encouraging mutual networking between Asian and European nations and universities. Universitat Autonoma de Barcelona is one of the university partners in Europe and has received the majority of the number of students allocated for Spain. Universitat Autonoma de Barcelona was ranked first in Spain on the *Quacquarelli Symonds* (QS) ranking for the year 2013/2014 and positioned at 177 in the world ranking and 79 in Europe (Universitat Autonoma de Barcelona, 2013). I was fully attached to the School of Engineering under a research group called SosteniPra which accommodates researchers in various field of industrial ecology including life cycle analysis, eco design, rainwater harvesting etc. The university and the research group I particularly work with soars high with major international journal articles in their field. The high commitment that is dedicated by its academic staff and research students in the research culture is commendable. A part of my PhD research in environmental impact assessment and urban planning is to consolidate an approach in environmental impact assessment. Approaches with the urban metabolism methods are tested with the Barcelona impact assessment and then later adapted as an environmental impact assessment in Malaysia. This part of the study is fulfilled throughout the mobility and the networking is sustained even until the mobility ends. I gathered a lot of knowledge and valuable life experience from this mobility program and would like to share my personal thoughts and collection especially regarding my research topic on urban sustainability.

1.1. Barcelona towards a city transformation

For the past two centuries, Europe has undergone a major conversion from rural to urban areas as now 80% of the European inhabitants are living in cities (Europe for Citizens Programme, 2011). Barcelona is a city in Europe by the Mediterranean Sea, with a population census of 1.6 million as of the year 2012, is the second largest metropolis in Spain after Madrid and the capital city of the region of Catalonia. Population of Barcelona is 67% of the population of the region Catalonia (Generalitat de Catalunya, 2013). Barcelona is well-known for its magnificent art nouveau architecture by Antonio Gaudi around the city such as La Sagrada Familia, Casa Btillo, Casa Mila (also known as La Padrera) and Parc Guell. Barcelona is also famous for their passionate sport fans such as the Football Club Barcelona and world class tennis. It is rich in cultural heritage and has become a major tourist destination from all over the world especially during the summer months where the beaches are flooded with people who enjoy the abundance of sunshine throughout the year.

1.2. Urban planning and management of Barcelona

The world's cities are responsible for 75% of the world's energy consumption which consists mainly of food, fuel, concrete, water supply and 80% of Greenhouse Gases emissions even though only 2.7% of the world's surface is occupied by cities (Ash et al 2008). The sounds alarming and has become the wake-up call that managing urbanization is no longer impractical but now the realistic way forward especially when sustainability is in discussion. Sustainable paths of urbanization are favourable and acceptable by the government and the public since the damaging effect is not selective. The city of Barcelona is governed by the municipality of Barcelona (Ajuntament de Barcelona). Under the Barcelona for Environment program (Barcelona per Medi Ambient), emphasis is given to support green areas, cleaning and management of waste, beaches and cycles of water, energy and environmental quality, road space and works. A transversal approach in urban planning for Barcelona is the implementation of a new urban management model which serves as an urban platform for sustainable city growth. Four main approaches are 1) optimizing urban services management and integration through urban platform model

development 2) low risk and technological trend – fiber and WIFI networks 3) efficiency - to improve cost / service delivery quality and management accounting 4) Scalable: allow to face connections growth and take advantage of internet market opportunities (Ajuntament de Barcelona, 2013).

Many studies are using Barcelona as a case study to take up a new approach on sustainability. Oliver-Sola et al 2011 has highlighted various urban fabrics including concrete sidewalks have on the urban neighborhood in terms of Global Warming Potential (GWP). Life Cycle Analysis of new development should include the most relevant urban infrastructures, i.e. buildings, streets, pipelines, etc. The impacts during operation are the most critical stage. The impacts of constructing a building may represent 15% of the total impact, whereas the operation may account for the remaining 85% of the whole impact. Therefore, it is important to consider the use stage of the urban infrastructures. Therefore, how the city is managed after it is in the use phase is the very crucial part in environmental management. Also, the city is also moving forward towards eco design where strategic actions and indicators for a neighbourhood are established and monitored including energy, water, wastes, green space, mobility and public space (Farreny et al, 2011). Ideally, high density residential development planning approach would have added to the benefit of reducing car dependency where residences are constructed closer to urban centres and public transport infrastructure with relatively low emissions intensities. The state and value of urban metabolism were assessed for influencing urban sustainability and conclude by suggesting that urban metabolism analysis, to be effective, also requires a political–ecological–theoretical framework and an understanding of power and money (Pincetl et al., 2012). With that being said, the non-environmental spectrum of the urban environment shall never be disregard in any impact assessment. The advanced movement of economic input output analysis in determining an environmental burden of a city can be seen as a very timely instance where the economic input output that occurs within a city can actually be converted into a meaningful value of Global Warming Potential (Shafie et al, 2013). Domestic industry sector supply is using input–output (I–O) analysis. Nationally- arising greenhouse gases emission were estimated by using data from the analysis. These data are amended so that GHG emissions arising outside the state can be estimated as an outcome of domestic construction activity. Therefore, the total emissions will be including the amount of those come up directly from the construction site, and also indirectly from domestic activities and international activities (Acquaye, 2009). The study is inspired by the wide application of Life Cycle Assessment (LCA) in determining environmental impacts of a product. The same idea occurs to the possibility of carrying a LCA for the community wellbeing of a township. In the assessment of industrial product, there are many inputs and outputs for its production from which environmental impacts can be estimated. Using a similar concept, this study aims to see the feasibility of LCA as an approach to analyze a town metabolism with a demand-based approach. At the design and planning level, the life cycle approach implies the recognition that each decision made in the early stages of planning has consequences for the following urban stages. Often these are not obvious or immediate, and they are only observed when the complete life cycle or the neighbourhood is examined. Through a life cycle approach, decisions can be made in a more deliberate and systematic way.

1.3. Sustainability and environmental approaches practiced and governed by the city

Reduction of environmental pollution contributes to the status of a sustainable city. Barcelona is seen to take up two primary approaches: 1) management of the source of pollution 2) involvement of the citizens through environmental awareness programme. The golden rule to sustainability is that the improved quality of the environment must surpass the immediate emergency and persist in anticipated pollution. In the case of waste, for example, putting in place a sorting and recycling system is just as essential as cleaning up the pollution at the garbage collection point or a landfill. To illustrate the management of

pollution, two main aspects that this paper would like to focus on are: city mobility and waste management.

1.4. City mobility

The everyday life of the city citizens is largely determined by their mobility. The day starts with school for kids and work for the adults. In a non-sustainable city, the day might start with sluggish car movement in a massive traffic jam but with a user friendly public transportation (which includes walking), the day could be less hassle. A scheduled and punctual public transportation gives confidence for the user to rely on to carry on their daily routines. In a comparative study on the financing of public transportation in European metropolitan cities (Barcelona, Madrid, Brussels, Amsterdam, Paris and Berlin), Barcelona came up highest with 41% for its citizen travelling on foot (this is followed by Paris with 34% and Madrid with 31% respectively) (European Metropolitan Transport Authority, 2010). In another study conducted by European Metropolitan Transport Authority in 2013, it has been concluded that most of the main cities achieve more than 60% of modal share for what the authority consider as "sustainable mobility" (as sum of public transport and soft modes). Amsterdam, Barcelona, Budapest, Copenhagen, Helsinki, Madrid, Paris, Stockholm, Vienna and Warsaw stand out with a rate over 70%, illustrating the very dense public transport systems irrigating the heart of those capital cities, and the deep-rooted habit of walking and/or biking in the European cities. As a resident living in Barcelona, I find Barcelona a very pedestrian-oriented city. Essential needs are within walking distance or easily around the corner. The pedestrian walkways are safe and in good condition. I was also amazed by the driver's attitude in giving way to pedestrians to cross the road at zebra crossings. This attitude serves the purpose of zebra crossing where pedestrians can cross safely. Grocery shopping which is an essential part of a resident routine can be straightforwardly done within 200-250 meters. I observe the use of wheel carts to carry the goods and facilitate the walking home part. As for public transportation, the buses in Barcelona are now equipped with an indicator to inform the users the arrival of the bus in minutes. The waiting time is displayed on the screen at the bus stops giving users the estimated time of arrival. The use of multiple-trip passes which is cheaper than one time pass encourages users to use the service. The only thing I see room of improvement is the validation process when one uses the bus, where the multiple trip card can be made into hard card with touch options which could be a lot faster instead of the inserting and punching the soft foldable card.

1.5. Waste management

How a city manages its waste management reflects its action in environmental management. Waste management entails a long and complicated process from waste generation, waste sorting and transportation and the final disposal. This important public service could inform how sustainable or livable one city is as the impact along the complete procedure of waste disposal could pose a threat to the environmental health (Shafie et al, 2012). In the Cerdanyola del Valles neighbourhood I am living in, and in fact in other parts of the city of Barcelona, a set of waste containers provided almost every 300 meters in the residential area (Figure 1).

Fig .1 . A set of waste containers in Barcelona

The yellow bin is for plastics, green bin for glass and blue bins for papers. The grey bin marked "R" is for mixed waste. The smaller brown bin is for organic material. Like other metropolitan cities in Europe, among the aim of the good waste management drive is to encourage selective waste disposal by installing the whole range of waste containers around the entire city. From my observation, these containers are fully made use of by the residents. As a person who never recycles before, I feel the urge to sort my garbage accordingly, as I feel very satisfied and happy with the least thing I can do every day for the environment. Again, the facilities that are provided are very systematic and easy to use and it is the main basis to its effectiveness. There is no unnecessary garbage outside the bins as the bins are emptied regularly. Waste collection is carried out once a day and usually during the night where the traffic is less heavy. In the UK, waste sorting has become mandatory as charges are being implemented if necessary sorting is not carried out. In Spain and Barcelona in particular such stringent measure is not yet implemented as the action is purely voluntary. From my observation, the sorting at source is working out when the residents are putting the effort to sort their garbage at source. The residents are well informed on the waste management procedure. Singhirunnusorn et al, 2012 in a waste management study concluded that the participation process was usually lacking in the project planning procedure and did not contribute enough time and resource to educate participants.

Yellow bins are meant for plastic packaging, tetra paks and other polycoat cartons and cans. This waste is taken to sorting plants where the different materials are separated by means of a combination of visual, mechanical and manual techniques. The various sorted materials are compacted, packaged and distributed to recycling facilities. Tetra paks and other polycoat cartons are used to manufacture paper bags, cardboard and aluminium sheets, chipboard, cardboard for packaging, paper towels etc. Steel cans are melted down for use in the vehicle industry. Aluminium cans are used in making bicycles, home appliances, screws, etc. And plastic packaging is made into plastic bags, street furniture, signage, clothing, boxes and other containers for non-food applications (bleach, detergents, etc.) **Green bins are for recycling glasses.** Glass collected selectively is taken to recycling plants where it is cleaned and ferrous material removed with a magnet. It is then crushed into powder (glass is selected, cleaned and crushed) and used to manufacture glass containers identical to the originals: bottles, jars, light bulbs, etc. **Blue bins are provided for papers and cardboard.** Paper and cardboard are taken to recycling plants where they are made into large balls of shredded paper. These balls are left to soak and strained to filter out the ferrous materials. The resulting pulp is dried, rolled out and stored on spools. These are distributed to paper mills, which use the pulp to make new boxes, wrapping paper, bags for the

construction industry, stationery, and even toilet paper. **Organic waste is assigned to brown bins.** Organic residues are waste materials of plant and/or animal origin such as food scraps and garden trimmings, which decompose biologically. They make up a third of the waste generated in homes which is a highly significant amount. Organic waste and clippings from pruning done around the city are taken to the eco parks, where they are turned into either compost or biogas. The better-quality organic waste is used to obtain compost, which can be used as an organic fertilizer in farming and gardening or as a soil structuring agent when restoring degraded areas. The rest is used to generate biogas, a renewable energy source that can generate electricity. **General household waste is to put in grey containers.** General household waste refers to all waste unsorted before collection. This waste is taken to the eco parks, where various processes are employed to sort out the paper/cardboard, containers, glass and other materials, in order to incorporate them into the recycling process. Non-recyclable waste is dumped in landfills or incinerated. Ideally, these latter options should serve only for waste that cannot be reused or recycled, but the limitations of the existing collection and treatment methods mean that some potentially reusable and recyclable waste cannot be sorted. Two sets of additional bin that attracts my attention is the establishment of unwanted clothing bin and recycled oil bin (refer Figure 2 and Figure 3). Normally, one would just pour used oil in the sink where the oil would harden in the pipeline and cause blocking after some time. The oil will also eventually get in the wastewater system where the separation could be an extra burden for the treatment system. With the establishment of the used oil bin, used oil can now be discarded safely. Users need to store the used oil in a plastic bottle and send it to the bin. I see such a high potential to install these used oil bins in urban settlements in Malaysia. Malaysian cuisines are rich in oil and fats and I could imagine how much used oils have gone done the drains and the pipelines without active treatment. Local authorities should really consider this establishment at strategic places within a neighbourhood. I strongly suggest the Perbadanan Putrajaya to take up this plan as their recycling collection day is already in place and is receiving very good feedback from the residents.

Fig. 2. Used oil recycling bin where the used oil can be recycled in a plastic bottle

The most interesting addition to the set of waste containers is the collection bin for unwanted and unused clothes. Shirts, jackets, shoes, and bedsheets can be given up for donation. Barcelona has four seasons and with the change the season, there will be clothing that will be unsuitable for a particular season and some would opt for charity or donation. Fast pace in fashion too cause fashion lovers keep up with the current trend and they will have a bunch of unwanted or rarely used clothing at the end of a season. The ‘humana’ bin is provided with shelter to prevent rain and shine from destroying the clothes. All the clothes must be

put in a plastic bag, tied up and placed in the bin. This establishment could potentially put a stop to wastage and the needful can fully make use the donated items.

Fig. 3. A bin where unwanted clothing can be donated to the needful

Another project that is still under development is the one stop recycling centre called Punt Verd (green point) where all recyclable items can be taken to this point even in large quantities and sizes. The drop off centres are already provided in some major areas of the city and are now expanding to encourage more people to recycle.

2. Conclusion

The significant remarks that can be made on what is keeping the city as it is are; 1) the public participation which comes internally with their attitude and culture towards human and environment 2) the governing mechanism which implement the written framework into action. I have a strong feeling that generally their people are genuinely concern about humanity and the environment. They look friendly on the outside and have very nice attitude towards others and their surroundings. Responsible people clean away their dog's poop, throw away garbage sensibly and respect the pedestrians and other road users. Designated parking space for the less able is also not misused as they are considerate to other road users. They are also helpful and polite to others especially to children, women and the elderly. This sort of attitude and mentality is seen to be nurtured in their lifestyle from the very young age. With this kind of attitude, any governing mechanism towards sustainability is easier to be put in place. The people seem naturally acceptable to action plans that could benefit them and their future generation. The government needs to put the people interest always on top and the flow will occur naturally. The people constantly seek for improvement in the governing body by voicing out their dissatisfaction via set of procedures and sometimes through calm manifestation. These two central remarks uphold the sustainability in place because effective governance requires the continuous support from the community which set any environmental directive or plan in motion. The most valuable lesson I learn from this mobility is every decision or action plan that is introduced for a city, the success always depends on the behaviour of the society. The city governance can always come up with a big ambitious goal, but if the people are not responding and cooperate to the plan, the action will not work out.

The Malaysian people are yet to see that a sustainable and livable city shall benefit the current and future society. We are what the governance body is. If we could care just a little more and be just a little

bit less selfish towards the environment, we could make a difference. I see very high potential in our society where our religion teaches us to be and do good and our culture taught us to be modest and kind. That is an excellent combination towards a change of attitude. With the mass media and social media, the society is well informed at the moment and we might just need a kick start to get the action running. I would start off by stopping at the zebra crossing for pedestrians, hoping not to be honked by the car behind and the confused pedestrians doubting whether or not they should cross. With the knowledge and experience that I have gained, I hope to make a difference, no matter how small to contribute to a healthier mentality and attitude towards humanity and sustainability.

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