URBAN WATERFRONT SUSTAINABLE MANAGEMENT WITHIN LIFE CYCLE ANALYSIS
Case: South European Cities

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Abstract

This research develops a monitoring tool for urban plan-process based on Life Cycle Analysis by Lourenço. A special project of urban waterfront revitalization is proposed as a contribution to legitimize the LCA model. This research also proposes the influence and the success key factors of its behavior plan-process.

The model is tested through benchmarking for six waterfront cities in South Europe. Bilbao in Spain, Genoa in Italy, and Lisbon in Portugal are considered as the success projects since the urban strategy has a strong link with the urban waterfront area notified by the high intensity of the cycle for each phase. Porto and Viana do Castelo in Portugal are considered as the success projects which have a similar behavior for the action and living phase which might be due to the same project under national policy and the projects touch economic and social opportunity of the people. Aveiro in Portugal shows rupture in the beginning, followed by high intensity in the next period which has similar behavior with ideal behavior of LCA model.

This research shows the applicability of LCA Model to monitor waterfront revitalization projects and enables the discussion of conceptual issues related to the legitimizing of LCA and the present contribution. The behavior of urban waterfront area and the time dimension can be monitored and the influenced factors of the behavior can be noticed with the success key factors, those are: *Planning*: does the urban waterfront become the focus of the city planning? *Action*: does the project persistence in the design proposal? and *Living*: does the urban waterfront touch social, culture and economic of the people activities?.

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1. Introduction

Life cycle analysis (LCA) is a graphical tool to represent a succession of phases in a long period of time. The applicability of LCA urban growth area for urban expansion was introduced by Lourenço in 2003. She developed a meta-analysis for urban growth areas applied in seven urban areas of Portugal. Presented by three curves of planning, action, and living, it is a bi-dimensional graph which represents the intensity of the cycle and time period dimensions. In the development of the model, Lourenço applied it to examine the behavior of revitalization of abandon waterfront area through Lisbon Expo 98 as the big event. The model showed that the plan-process behavior of the area previously occupied by the event has been accelerated as time passes.

Nowadays, some cities compete for the quality of life which represented by green areas. It is very important in urban planning to provide public space for citizens and to get fresh air. One of the opposite properties of green area is water as a refreshing element of life in green areas and a restraint for urban function (Jormola, 1998). Some cities which are passed by rivers or have surface water resources such as lakes, have already had advantages for providing this element.

Urban waterfront in 20th century became spread all over the world especially in USA and Europe. Most of the waterfront areas are polluted areas as post-industrial era heritages as harbors and ports. Those abandoned areasnowadays, have a new perspective from the urban planners as a valuable area in urban development. Some of the urban planners reclaim that waterfront area is sandwiched between the urban fabrics and the water that it might be river, sea, or lake.

There are some succeed projects and bring the new urban images for the cities. Not only big cities and first rank cities, but also second and medium or small cities like in Spain, Italy, and Portugal, revitalize their waterfront areas. Since the remarkable results are noticed, some cities in Asia, try to do so. Unfortunately, in the development phase, some ruptures and neglected projects happened in Asian cities before the optimal profit is fruitful by citizens.

Since waterfront revitalization needs investments, it is important to keep it sustain. This project needs to be well-managed and monitored. An improvement of LCA observation to monitor the urban waterfront projects is proposed. This enables the discussion of conceptual issues related to the legitimizing of LCA and the present contribution. It is also possible to confirm that the relevant nature of this tool allows for an earlier awareness of the cycle progression anomalies.

2. Hypothesis

When the city wants to revitalize its waterfront area, it might be a new approach for the city planning. It might bring a success result, when people can enjoy the waterfront area and get the feel of waterfront city or it might be fail.The hypothesis of this research is stated to achieve the research objective. As an urban project, waterfront has the data to be portrayed in Life Cycle Analysis Graph that will be useful as a monitoring tool. As a sustain project, the waterfront plan-process should be influenced by these success key factors: *Planning*: does the urban waterfront become the focus of the city planning?

Action: does the project persistence in the design proposal?
Living: does the urban waterfront touch social, culture and economic of the people activities?

3. Theoretical Framework

Life Cycle Analysis in Urban Development

Life cycle is a graphical tool that represents a succession of phases in a long period of time. It can be a relevant tool for monitoring several areas of knowledge. The specific approach to life cycle modelling was launched in the sixties and it concerned economic production by phases. This analytical tool has now been expanded to process into several areas, namely geography, urbanism, tourism and marketing as well as civil engineering.

One of life cycle analysis in urban area is Lourenço´s model. It is a bi-dimensional graph which represents the intensity of the cycle and time period dimensions. Time dimension is represented in the horizontal axis which means that one period T equals ten years. The intensity of the cycle is represented on the vertical axis which portrays the intensity a gained by the cycle (see figure 1).

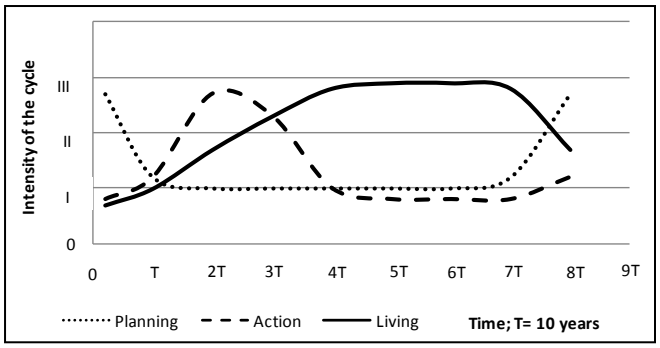


Figure 1. Ideal Behavior of a Plan-process: Lourenço´s Model (Lourenço, 2003a)

It was parameterised in three classifications: minimum (I), medium (II) and strong (III) according to the stages of a planning process s-curves on planning can also be drawn for actions and living cycles, rising from birth, then apogee culminating in decline. These three stages represent a cycle of a planning process related to actions and life-cycles, for a specific urban expansion area. This model attempts to portray the planning efforts, the investment on urbanization, public infrastructures, equipment and the participation of the population, which are parameterized at the mentioned levels (Lourenço, 2003a).

Urban Waterfront

Coastal Zone Management Act (1972) defines the term of urban waterfront or port which consists of any developed area that is densely populated and is being used for, or has been used for: urban residential, recreational, commercial, shipping, or industrial purposes. Based on the development the industrial area that supported by strong harbor, the existence of waterfront for the city is very important. However since the industrial era was declined the harbor became abandoned and polluted area. Fortunately urban planner in 20th century noticed that this area as an asset for the city.

The broader definition afterwards accommodated virtually any shoreline adjacent to urban areas on marine or great lakes water. The phrase “waterfront revitalization” then appears used in several coastal management publications due to the waterfront development in action.

Giovinazzi (2010) explained that the experiences of waterfront revitalization became the leading value of urban development. It is able to reclaim the waterfront as areas facing the water. The waterfront area is sandwiched between the urban fabric and the water body (be it river, sea, or lake) that recently becoming a central theme of planning and a paradigmatic element in policies for the transformation and regeneration of urban fabrics.

According to CZMA (1972), waterfront revitalization is a process that begins with the desires of a community to improve its waterfront. That proceeds through a series of planning steps and public review to adoption of a waterfront plan. Implementation of the plan, involves public and private actions, investment decisions, and developments (CZMA, 1972). The new urban waterfront territory nowadays can be identified at least four functional areas: public, natural, working and redeveloping (NYCDCP, 2002 in Jankovska, 2009).

Center for Cities on Water in Venice conducted ‘’The 10 Principles for the Sustainable Development of Urban Waterfronts‟. It constructed the strongest elements of the urban waterfront transformation process (Giovinazzi and Morretti, 2009). Those principles are: secure the quality of water and the environment, waterfronts are part of the existing urban fabric, the historic identity gives character, mixed use is a priority, public access is a prerequisite, planning in public private partnerships speeds the process, public participation is an element of sustainability, waterfronts are long term projects, revitalization is an ongoing process, and waterfronts profit from international networking.

Basu (2011) described the urban parameters of public space in relation to the waterfront and relationship between the waterfront public space, water body and the city by case study of Barcelona and Lisbon waterfront revitalization projects through nine parameters. Those are: urban aesthetic and architectonic quality, public amenities, physical connection and barriers, visual connections, water accessibility, safety, uses and functionalities, recreation and leisure, integration measures. There were eight spots of waterfront area in Lisbon and five spots in Barcelona. Lisbon waterfront has physical connections issue. The railway cut off and created a barrier between the city and water. However most of the projects are urban renewal plans in action and nowadays becomes attractiveplaces as touristic areas such as Belem and Terreiro do Paço. Barcelona waterfront is noticed as an excellent waterfront area. Careful planning has been considered were designed and executed in a proper fashion. Through those parameter most of Barcelona waterfront spots shows the high score.

Sustainable Development

Sustainable urban development has been written so

many times since the Brundtland Report (1987). It consists of three dimensions: economic, social, and environment. It has significant influence on planning and policy at the local level. Afterwards, the communities have adopted sustainability as a goal in comprehensive plans and other planning activities.

Nowadays, sustainable planning and management has diverse definitions ranging from “deep green” ecological fundamentalism to: energy conservation issues, serious principles of social equity (inter, intra-generational, and gender), environmental economics, and economic sustainability. Kammeier (2003) proposed the resume of sustainable development coped with big events management as a pragmatic manner as seriously “green” to some extent, socially equitable (at present and with regard to the near future), and economically prudent. The emphasis is on economic value added, employment effect and ‘’city image‟.

The regeneration of waterfronts was concluded by Giovinazzi and Moretti (2009), as representing an extraordinary opportunity for cohesion and for stitching the territory together. Water as a collective legacy can play a central role and become the engine for sustainable development through recreating the relationship between spaces, uses, and visions. Afterwards, it will build adialogue between spatial organization, port, and city functions and their economic and social aspects.

Benchmarking

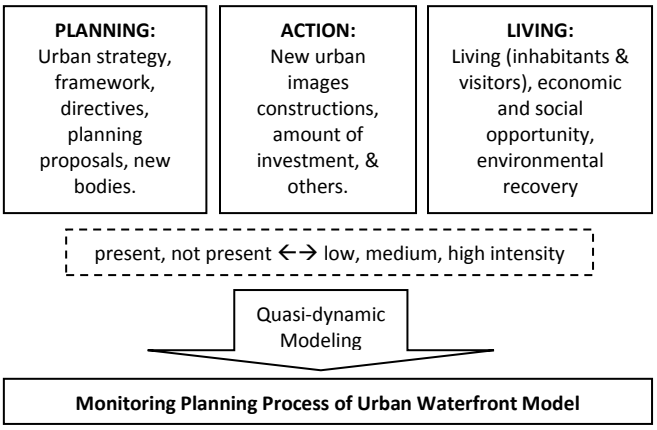
Benchmarking as a quality management and improvement technique is mostly used in industry and production processes. Deming’s management theory said that benchmarking is used to enhance quality and check its sustainability by several stages followed in order. It goes beyond just comparison and looks at the assessment of operating and management skills producing these products and services (Walleck, 1991). In the process of benchmarking, management identifies the best firms in their industries or in another industry where similar processes exist. Then they compare the results and processes of those studied (the "targets") to one's own results and processes. In this way, they learn how well the targets perform and how success the business processes.

Based on typical benchmarking methodology, two methodologies will be applied in this benchmarking application, those are: identify the problem areas and identify other places that have similar process. Since benchmarking can be applied to several areas, a range of research techniques may be required. Before embarking on comparison with others, it is essential to know the organization’s function and process, and base lining performance which can be measured. Since there is no single benchmarking process, Camp (1989) developed 12-stages approach to benchmarking, those are: select subjects, define the process, identify potential partners, identify data sources, collect data and select partners, determine the gap, establish process differences, target future performance, communicate, adjust goal, implement, review and recalibrate.

4. Methodology

The flow work for doing this thesis started with data collection and data verification. The data can be obtained from primary data directly from the city hall or raw data from statistic office. It might be obtained from secondary data mentioned by previous researches.

The data afterwards will be distinguished for each phase of planning, action, and living. Based on the plan-process framework and the flow work of the LCA model, the data will be proceded according to the factors. If it is present the intensity will be high, if it is not present the intensity will be low or medium.



Source: based on Lourenço (2003a) and Alvares (2008) revisited by author (2012)

Figure 2. The flow work of the model

Since the benchmarking methods will be used to get the best practice of success waterfront area, this thesis will analyze six cities with waterfront projects and will be examined through the LCA Model. The benchmarking analysis will inform if the LCA can be applied for that project or not. If it can be applied, the success factors can be indicated by the model as mentioned in the hypothesis.The weighting analysis recited from applied multi criteria decision analysis will support the most influenced and success key factors of the case study.

The graph can be drawn manually or used excel program as a tool. The justification of the intensity of the cycle for each phase did according to the representation of the factors appears in the urban plan-process that can be examined through the plan-process history of the study case. For example, for the planning phase, when the city has vision and mission, the planning proposals, and urban strategy, the intensity of the planning phase justified in the high intensity. When the city has a new urban image that most of the action plan did based on the planning proposals, the intensity of the action phase justified in the high intensity. Afterwards, in the living phase, the visitors data shows the decline curve and not much people come to joy the new urban image, the intensity of the living phase justified in the medium intensity. Through this graph, the city hall can do an assessment to find out the living problems and try to solve the problem as quick as they can to avoid dry run of the investment and infrastructure

buildings. The analysis process will be shown through table in figure 3 below.

Year	Planning	Present/not	Action	Present/not	Living	Present/not
1975						
1980						
1990	Vision & mission	V				
1995	Urban strategy	V				
	Frame-work	V				
2000			Construc-tions	V		
2005			Investments	V		
			New urban images	V	Number of visitors	-
2010					Economic opportunity	-
2015						

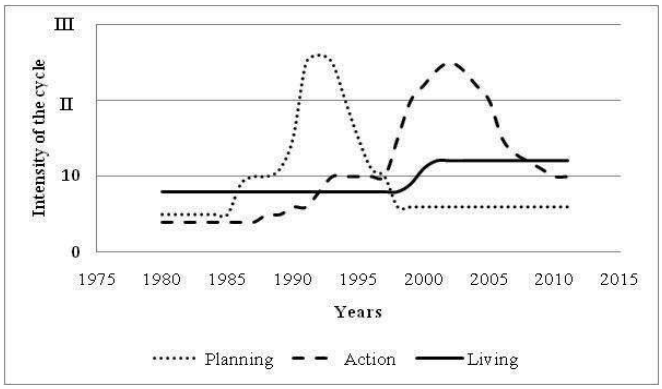


Figure 3. The example to portrayed the LCA graph

The justification process of the intensity of the cycle might become the most difficulties phase in doing the analysis. The subjectivity when justify the intensity should be minimized to see the big picture fairly to get the assessment results clearly similar to the field condition. The objective analysis can be achieved if the complete and historic data can be collected and verified. It should be done carefully in order to help researcher to understand the behavior of the city plan process during certain period that will be assessed.

5. Benchmarking of the Cases

The prospected cases that studied are the successful urban waterfront projects in the cities that have been notified in Spain, Italy, and Portugal. Most of them are second rank cities from big, medium, and small cities. Those are Bilbao in Spain, Genoa in Italy, Lisbon, Porto, Viana do Castelo, and Aveiro in Portugal (see table 1).

Table 1. The Characteristics of the Cases

No	Prospected Cases	Name of the projects	Inhabitants (2012)	Area (km^2)	Former Condition
1	Bilbao, Spain	Abandibarra & Guggenheim Museum	355.731	41	A river port for 20 km from the city to sea
2	Genoa, Italy	Centro Storico & Porto Antico	608.493	243,6	Port city overlooking 33 km of coastline
3	Lisbon, Portugal	Expo 98 – National Park	564.657	84,8	Industrial and port area on Tagus River
4	Porto, Portugal	Ribeira Waterfront	237.584	41,66	Port wine on a riverside of Douro River
5	Viana do Castelo, Portugal	Viana do Castelo Riverfront	36.544	37,04	Medium sized port at the entrance of the Lima river
6	Aveiro, Portugal	Forum Aveiro & Lagoon Revitalization	78.463	199,99	Lagoon and canal area for water trans-portation

Bilbao

Bilbao had centuries of existence and was well known as an industrial city. It is heart of industrial region of the production of metallurgy, steel industry and shipbuilding. Unfortunately by the 1970's, economic declined occurred caused the closing of industries and shipbuilding, followed by the increasing number ofunemployment and social riots, massive departure of the population, increase of brown field in the town center, especially on the river banks and left industrial and polluted buildingsRealizing this turn around points, the City Hall decided to do urban recovery. Started in 1989 when a strategic plan was adopted, they created an entity in charge of the strategic plan, composed of: ministries, port, Bilbao's rail Transports Company, and government. They proposed action plans of: urban renewal of the brown fields and of damaged districts, economic restructuration of the town, and increase of housing and green spaces. The plan-process behavior of this urban waterfront is potrayed in the figure below.

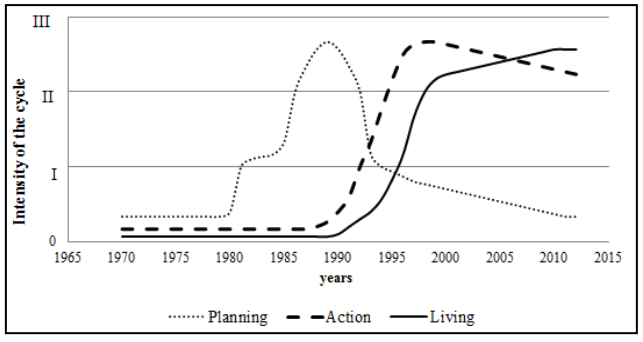


Figure 4. Bilbao urban waterfront plan-process behavior

Genoa

The City of Genoa was an important city in Italy. In the post-war years, Genoa played a pivotal role in Italian economic miracle. Together with Milan and Turin, it became a pole of the industrial triangle cities of northern Italy.It harvested poverty in the 1960's until 1970's. With area of 243,6 km^2, it became a strong steel industry

supported by the strategic location in front of thesea with its modern seaport. However in the 1980's this city faced a collapsing economic and derelict waterfront area Genoa used intensive big events as an impulse to do city regeneration. During period 1994-2000, most of the urban revitalization occurred according to the event proposals. The city did not have a comprehensive planning. Afterwards, in April 2002, the City Hall introduced "piano dellacitta", a novelty of urban planning under many points of views contained public discussion collection. The plan-process behavior of this urban waterfront is potrayed in the figure below.

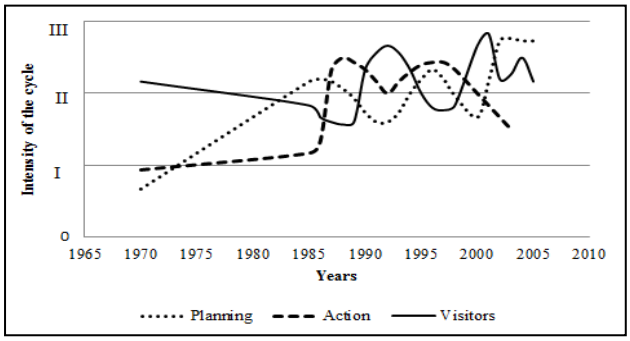
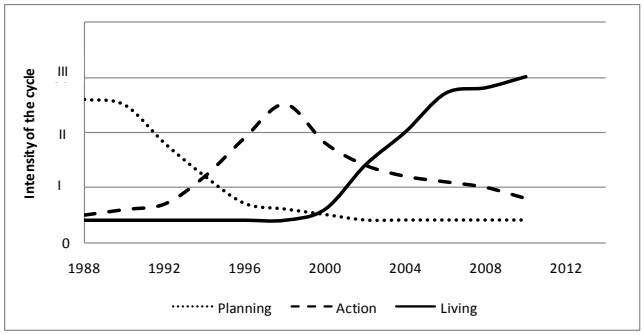


Figure 5. Genoa urban waterfront plan-process behavior

Lisbon

Lisbon is Capital City of Portugal. In the 1960's, it was industrial city with the developed port in the eastern part of the city. The population number of the city increased forward. It faced industry collapse and depopulatedin the 1980's. It was started by suburbanization era in the periphery area of Lisbon Metropolitan (Estevens, 2005).The deindustrialization era in Lisbon left an abandoned and polluted area. The surrounding had grown low cost social housing for the poor people who stayed.This area had not been planned for several years until in 1989. The City Hall decided to rebuild the area as National Park. It is a new area that can be used for people all around the world and Lisboans to live. They proposed the Strategic Plan and the Master Plan of Lisbon 1990-1993 as the new urban strategy of the city. It reflected the strategic necessity for the devolution of the river to the city,in view of the citizen's welfare and benefit of the international projection of this ''Atlantic capital of Europe". Afterwards, the City Hall competed for international event of Expo'98 with the theme of "The Oceans, a heritage for the future" to gain international attention on the waterfront revitalized area. The plan-process behavior of the urban waterfront is potrayed in the figure below.



Source: Lourenço (2010)

Figure 6. Nation's Park Plan-Process Behavior in Lisbon

Porto

Porto is the second largest city in Portugal. It has 237.584 inhabitants, in around 41, 66 km^2. For many years, the city became a center of industry, trading, andcultural activities. It is concentrated on the River Douro bank which became thebackbone activities of the city (Porto Vivo, 2005). By the time, the city facedgoing up and down of economic situation and people left the city.Realizing the situation, the City Hall decided to do urban renewal for thecity of Porto included the riverbank. It was POLIS Program; aphysical and environmental upgrading program (Landeiro et.al, 2006). Focusingon waterfronts and adjacent areas, the program was targeting interventions onpublic open spaces, and valorization of environmental criteria which had beenintroduced in several waterfront cities in entire Portugal.The plan-process behavior of this urban waterfront is potrayed in the figure below.

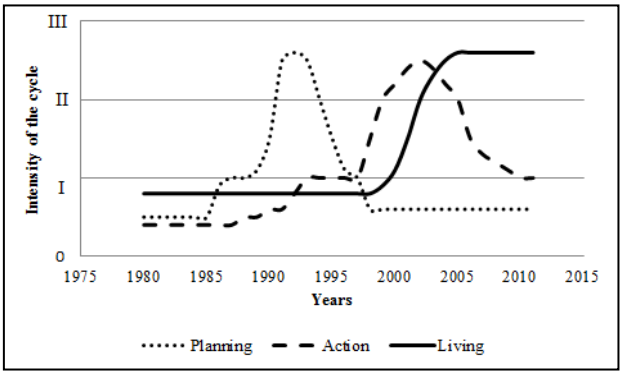


Figure 7. Porto urban waterfront plan-process behavior

Viana do Castelo

Viana do Castelo is a small medium-sized city in Portugal with 36.554inhabitants, in around 37,04 km^2 area. Viana's landscape is beautiful. It has river front and mountain area, enriched with historical city. In previous time, it was a harbor city with shipping and fish canning industry. In the 1980's, this city faced industrial crisis. It is left the harbor area poorly as a parking lot.The City Hall realized this situation and prepared a new master plan for the city in 1995 (Mullin, et.al., 1996). They proposed the revitalization of riverfront area as the most important project. It was difficult since the city does not have any authority to the harbor. However, in 2000, Viana do Castelo succeeded became the pilot project of POLIS Program, a

revitalization of urban areas project through Portugal to provide public and green area. The project consists of the strategic plan proposals arrangement and the execution. The plan-process behavior of this urban waterfront is potrayed in figure below.

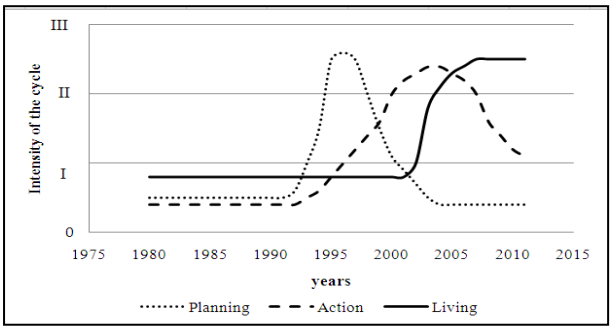


Figure 8. Viana do Castelo urban waterfront plan-process behavior

Aveiro

Aveiro is a capital of Aveiro municipality situated in south of Porto. It has 78.463 inhabitants on 199,9 km^2 area. The development of the city is based on the navigability conditions of the canals in the lagoon. Aveiro has special morphology, surrounded by salt-flats, beaches and lagoons and dominated by the Central Canal running through town. It gives a huge social, economic, and environment diversity for the city.In the past, there were 109 active quays used by people in Aveiro to support their living. Nowadays, there are only 37 quays left (Alves, et.al., 2000). These quays had their historic and cultural importance of the city that needs to be conserved as part of Aveiro River Revitalization. The plan-process behavior of urban waterfront is potrayed in figure below.

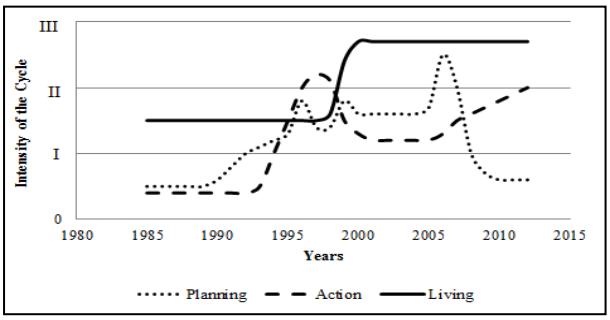


Figure 9. Aveiro urban waterfront plan-process behavior

6. Research Results

For Bilbao case in Spain, the waterfront project is successfully done. It is notified by higher intensity of plan-process during period 1985-2005 (see figure 4). The waterfront area becomes the most important spot in the city planning. The huge anchor of a flagship project which was built in this area, supported by the accessibility to the area, is fruitfully taken by the citizens and the visitors.

For Genoa case in Italy, the waterfront becomes one of the focuses of the city planning in the beginning when the city hall decided to do city revitalization. Supported by the big events proposed, the waterfront area becomes one of the attractive areas in the city afterwards. However, the city planning has not put the waterfront development in an integrated city planning. The city redevelopment mostly has done due to the big events (see figure 5). The big events brought the city to the high intensity of urban plan-process including the waterfront area.

For Lisbon case, the city successfully got its new urban image in waterfront area. Nowadays, when tourists visit Lisbon, they can enjoy the waterfront area in several spots by the easier access because of the public transport improvement. The remarkable waterfront area revitalization which has strong linkage with urban planning for the city is in the national park due to the big event. The position of Lisbon as capital city is an advantage to deal with this project in order to be the representative of the country. For that reason, there is no doubt when Lisbon reaches the high intensity level of the cycle during period 1988-2004 (see figure 6).

For the medium sized cities in Portugal, the waterfront revitalization hasbeen assessed on three cities with different type of waterfront area. Porto based on the river development which supported the industry area,Viana do Castelo based on harbor revitalization, and Aveiro based onenvironment and revitalization of the lagoon (see figure 7 and 8).The behavior of Porto and Viana do Castelohas the similar pattern,especially the action curves. It might due to the national program of waterfront revitalization in Portugal. It happened in Aveiro for Lagoon revitalization. The differentiation between Aveiro and those two cities is the focus of the project. Aveiro put environment as the focus at the beginning. That cause some ruptures happened. Fortunately, the city hall also revitalized one of the waterfront area spot as a commercial activity that brought sustainability.

The life cycle analysis with bi-dimensional graphic can inform the anomaly behavior of the urban development of the waterfront areas. It has been tested on six waterfront cities, big cities, medium sized cities, and small cities. Through the meta-analysis data, the intensity of each phase can be examined and confirms its level; if it is in the high level, reaches success phase; or in the medium level, informs the decreasing alert or progressing level as in the development stage. The benchmarking analysis also shows the factors influenced for each phase of Lourenço's model can perform the behavior of the urban waterfront.

Those factors afterwards are tested through the weighting analysis for every phase. A resume of reciprocal analysis for planning, action, and living can be seen in the table 2.

Table 2. Weighting Resume for Each Phase

	Phase	Maximum Intensity	Bilbao	Genoa	Lisbon	Porto	Viana do Castelo	Aveiro
1	Planning	9	9	8	9	8	7	7
2	Action	6	6	6	6	6	6	4
3	Living	15	12	12	11	12	11	11

The highest score goes to the big cities with the strong link between the urban planning and waterfront development. As the result, nowadays, those cities are famous as waterfront city not only among the citizens but also the tourists. Compared with the last two cities (Viana do Castelo and Aveiro) which needed to put more investment and gain the new urban image surround the waterfront areas, the intensity of the cycle is less than the bigger cities.

This analysis also confirms for the success keys factors proposed in the hypothesis those are: Planning: the urban waterfront becomes the focus of the city planning, Action: the project persistence in the design proposal, Living: the urban waterfront touches people culture & economic activities; to achieve a sustain waterfront management.

7. Conclusion

This research shows the applicability of LCA Model to monitor waterfront revitalization projects and enables the discussion of conceptual issues related to the legitimizing of LCA and the present contribution. The benchmarking of six selected cities showed that Bilbao, Genoa, and Lisbon are considered as the success projects since the urban strategy has a strong link with the urban waterfront area through flagship projects and big events, Porto and Viana do Castelo are considered as the success projects which have a similar behavior for the action and living phase, which might be due to the same project under national policy, Aveiro project showed rupture in the beginning but a high intensity in the next period, which might be due to the project focus of Polis Litoral for the environment focus which a smart investment did afterward to put an anchor in front of the waterfront area.

The behavior of urban waterfront area and the time dimension can be monitored through LCA model which allows a better understanding of the behavior plan-process of the city and a special project such as waterfront revitalization. This success analysis might be due to the data provided in each case study which almost complete supported by the number of previous researchers who performed their researches in the case studies.

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