

Barcelona gives way to green infrastructure

Les Glòries urban transformation as a case study of citizen participation



Treball de fi de màster

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Resum

En l'actualitat, hi ha més població concentrada a les zones urbanes que a les zones rurals. Aquest procés d'urbanització ha esdevingut la modificació del paisatge i el verd a les ciutats s'ha anat fragmentant cada cop més, provocant la degradació i la pèrdua de molts serveis ecosistèmics. La gran expansió de Barcelona va ocórrer durant el Pla Cerdà a mitjan segle XIX. Cerdà va dissenyar Barcelona com una xarxa de illes on la gent podia recórrer els seus carrers i descansar en grans zones verdes, però va deixar algunes zones de la ciutat com Les Glòries sense cap planificació per la seva complexitat. En els anys posteriors, la ciutat de Barcelona s'ha convertit en una ciutat compacta, densament poblada, amb espais verds escassos i aïllats, mentre que l'espai públic ha estat dominat principalment pel cotxe.

Per fer front als problemes actuals de la ciutat de Barcelona, l'Ajuntament ha implementat diverses mesures com la política i la planificació estratègica de la infraestructura verda. Tot i que aquests plans i polítiques no s'han realitzat amb participació ciutadana, aquestes han suposat un canvi de paradigma en la planificació, així com un canvi de paradigma en el model de ciutat on s'utilitza la infraestructura verda com a mesura d'adaptació per mitigar els efectes del canvi climàtic i com a eina de planificació estratègica per reduir el trànsit de vehicles a la ciutat.

El projecte de Les Glòries ha esdevingut un referent de com un lloc planejat per al cotxe es pot convertir en un lloc per als ciutadans, a més del segon espai verd més gran de de Barcelona. La reurbanització d'aquest espai esdevindrà com a referent per a les noves polítiques i mesures de l'Ajuntament per a una Barcelona més sostenible i participativa. El projecte Les Glòries és també un referent de la participació ciutadana, ja que les associacions de veïns van participar des del principi en la planificació i el disseny d'aquest espai juntament amb els tècnics de l'Ajuntament.

Resumen

Actualmente, hay más población concentrada en áreas urbanas que en áreas rurales. Este proceso de urbanización ha modificado el paisaje y el verde en las ciudades se ha vuelto cada vez más fragmentado, lo que lleva a la degradación y pérdida de muchos servicios ecosistémicos. La gran expansión de Barcelona ocurrió durante el Plan Cerdà a mediados del siglo XIX. Cerdà diseñó Barcelona como una cuadrícula de bloques donde la gente podía caminar por sus calles y descansar en grandes áreas verdes, pero dejó algunas partes de la ciudad como Les Glòries sin ninguna planificación debido a su complejidad. En los años posteriores, la ciudad de Barcelona se ha convertido en una ciudad compacta, densamente poblada, con espacios verdes escasos y aislados, mientras que el espacio público ha sido dominado principalmente por el automóvil.

Para hacer frente a los problemas actuales de Barcelona, su Ayuntamiento ha implementado varias medidas como la política estratégica y la planificación de la infraestructura verde. Aunque no han sido realizadas con participación ciudadana, estas han supuesto un cambio de paradigma en la planificación de la ciudad, así como, un cambio de paradigma en el modelo de ciudad donde se utiliza la infraestructura verde como medida de adaptación para mitigar los efectos del cambio climático y cómo herramienta de planificación estratégica para reducir el tráfico de automóviles.

El proyecto de Les Glòries es un hito de cómo un lugar para el automóvil puede convertirse en un lugar para el peatón, además del segundo espacio verde más grande de la ciudad de Barcelona. Convirtiéndose en una referente de las nuevas políticas y medidas del ayuntamiento para una Barcelona más sostenible y participativa. El proyecto Les Glòries también es un referente de la participación ciudadana debido a que los ciudadanos y las asociaciones de vecinos participaron desde el principio en la planificación y diseño de este espacio junto con los técnicos del ayuntamiento.

Summary

Nowadays, there are more population concentrated in urban areas rather than in rural areas. This process of urbanization has altered natural processes in addition to landscape modification. The green in cities has become more and more fragmented, leading to the degradation and loss of many ecosystem services. The big expansion of Barcelona happened during the Cerdà Plan in the middle of the 19th century. Cerdà designed Barcelona as a grid of blocks where people could walk through its streets and rest in big green areas, but, left some parts of the city like Les Glòries without any planning due to its complexity. In the years thereafter, the city of Barcelona has become a compact city, densely populated, with scarce and isolated green spaces while the public space becomes mainly dominated by the car.

In order to face the current issues of Barcelona, its City Council has implemented several measures like the green infrastructure strategic policy and planning. Although they have not been done with citizen participation, this supposed a paradigm shift on the municipal city planning, as well as, a paradigm shift on Barcelona's city model where green infrastructure is being used as an adaptation measure to mitigate the effects of climate change and as a strategic planning tool for reducing car traffic.

The project of Les Glòries is a landmark of how a place planned as car-based could become pedestrian-based, in addition to the second biggest green space of the city of Barcelona. Becoming a reference for the new city council policies and measures for a more sustainable and participative Barcelona. Les Glòries project is also a referent of citizen participation due to the citizens and neighbourhood associations were from the very beginning in the planning and design of this space together with the city council technicians.

Keywords

Green infrastructure, Barcelona, Les Glòries, Citizen Participation, Sustainability in cities.

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1. Introduction

Historically, the growth of cities in the global north has occurred as a result of the population migration from rural areas to urban areas due to the industrial revolution and the improvement of the agricultural techniques (Farrell, 2017), happened in the XVIII century. Since then, a greater number of a rural population rather than urban provided a continuous supply of rural migrants to replace the labour force required in urban areas. Where, over time, advances in medicine have reduced mortality and have increased the life expectancy. Circumstances that had fostered a transition towards an urban society as a result of a rural to urban migration, the urban natural population increase and the reclassification of rural areas as urban (Farrell, 2017).

This process of urbanization, where more people are concentrated in urban areas than in rural areas, have required the expansion of the cities hinterlands in order to solve this increase of population by transforming the land uses of the peri-urban interface, from rural to urban land. This changes in response to the population and city needs suppose the alteration of natural areas, hindering lots of natural processes such as wildlife migrations, natural water flows, infiltration or pollination among others, together with the alteration of the landscape modifying the land uses for agricultural, residential, commercial and industrial purposes. The fragmentation and degradation of natural ecosystems lead to the demean and loss of the ecosystem services (MEA, 2005).

As it is said by (Calaza-Martínez, 2016) “The rapid and disproportionate urban population growth added to the massive population migration generates overpopulated cities, with low liability, basically without open and green spaces”. This generates a lack of housing or bad quality housing, no social cohesion and health problems aggravated with intensive car traffic in cities. In addition, the lack of soil permeability increases the risk of flooding and exacerbates the heat island effect.

Barcelona nowadays is the second most populated city in Spain with a registered population of 1,620,809 inhabitants (Departament d'Estadística i Difusió de Dades, 2018) and 3,665,687 (Eurostat, 2018) inhabitants taking into account its metropolitan area. Due to the morphological characteristics of its territory, the city of Barcelona has not been able to grow in size, so it has been densifying itself, becoming compact city with semi-tall buildings of 5–6 stories and mostly narrow streets having a net density of 6.6 inhabitants per km² (Departament d'Estadística i Difusió de Dades, 2018). Moreno-Garcia (1994, p.710) has shown that because of this compactness, the city of Barcelona suffers from a heat island effect, where the downtown temperatures can be ≤ 8 °C higher than the less compact areas.

Car traffic is one of the most important issues that must need to be faced in Barcelona. According to the Ecology agency of Barcelona, in 2016, the city has the highest vehicle density in Europe (Ecología Urbana de Barcelona, 2016) with 9,417.7 private vehicles per square kilometre (Departament d'Estadística i Difusió de Dades, 2018). Although the majority of the workday journeys in the city are done by foot, bicycle or public transport, the use of the private vehicles reaches 20.36 % of the total (Departament d'Estadística i Difusió de Dades, 2018), mostly with a single occupant. Even so, Barcelona dedicates between 50 % to 70 % of its public space for private vehicles mobility and parking (Ajuntament de Barcelona, 2016).

The city of Barcelona has among the highest air pollution and noise levels in Europe due to its high population and traffic density, a big proportion of diesel vehicles, low precipitation and its urban design with grey and narrow streets added to a scarcity of green spaces (Nieuwenhuijsen, et al., 2014). Only 7.1 m² of green space is available per resident in 2017 (Departament d'Estadística i Difusió de Dades, 2018) and one-third of the population did not live within the

recommended distance of 300 m to a green space ≥ 0.5 hectares (Mueller et al., 2016). The levels of air and noise pollution in the city are exceeding the thresholds set by current legislation and for the World Health Organization (WHO) (Agència de Salut Pública, 2017) causing lots of health issues and premature deaths aggravated with reduction of the Barcelona's dwellers physical activity (Mueller et al., 2016).

(Mueller et al., 2016) developed a model called Urban and TranspOrt Planning Health Impact Assessment (UTOPIA), the first health impact assessment (HIA) that quantifies the effects of multiple urban and transport planning-related exposures in a city showing the considerable impacts on inhabitants health. They estimate that 2,904 annually deaths in Barcelona could be prevented (Mueller et al., 2016). The authors consider green spaces as “an important urban and traffic management tool” (Mueller et al., 2016) for enhancing physical activity, for better citizens mental health, to mitigate the harmful environmental exposures such as air pollution, noise and heat.

To fight towards the negative impacts of urbanization is essential to renaturalize the city in different ways and scales of intervention in order to increase the city resilience and enhance its sustainability. For this reason, the green infrastructure is viewed, by many experts and governmental entities, as a good opportunity to develop ecologically sustainable cities more liable for the people that inhabit them. With this aim, the Barcelona city council would like to renaturalize the city and transform its green areas to a well-connected network of green infrastructure by the creation of green corridors as it is said in its Green and Biodiversity Strategy **“Pla del Verd i de la Biodiversitat de Barcelona 2020”** and in its Green Infrastructure Action Plan **“Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)”** for increase 1.6 km² of urban green in order to improving citizens health and city resilience (Ajuntament de Barcelona, 2018b). One of the biggest projects of green infrastructure, of this action plan, that is taking place now in Barcelona is the one in the area of Les Glòries that will introduce 100.000 m² of green surface in the city with the creation of a Les Glòries Park (Ajuntament de Barcelona, 2013). This project was produced as a result of an agreement between the neighbourhood associations and the Barcelona’s City Council called **“Compromís per Glòries”** where they establish the bases for Les Glòries urban transformation and embedding citizen participation during all the planning process and design.

The purpose of this master thesis is to:

- Examine the green infrastructure strategic policy, planning and implementation in Barcelona.
- Analyse citizen participation in Barcelona’s urban green policy and planning, and within the case study of Les Glòries Park.

In order to answer the following Research questions:

- What are the problems and challenges of urban green planning and implementation in the city? There is more than one approach or opinion about it?
- How citizen participation is embedded in green infrastructure policy, planning and implementation in Barcelona? And in Les Glòries?

The policies carried out by the City Council of Barcelona, although they have not been done with citizen participation, have a strong commitment to improving the life quality of its citizens, as well as facing climate change. Green infrastructure is being used in Barcelona as a strategic planning tool for reducing car traffic and for increasing the green space available per inhabitant in the city, providing ecological, social and public health benefits, in addition, to mitigate the effects of climate change.

The case study of Les Glòries urban transformation shows that the urban green could be more than an adaptation tool of climate change. The Glories Park will be the second largest green area in the city, used as an urban glue for unify four neighbourhoods of the city, as well as being an example of a paradigm shift in mobility based on pedestrians and public transport rather than based on the car. This project should not have been the same without citizen participation and without the great efforts made by neighbourhood associations together with the technicians of Barcelona's City Council. However, citizens had to be more interested and informed about what is happening in the city.

In the following sections of this document, were explained the methodology used in this thesis based on the review of literature, policy and planning document, web pages and news, as well as, interviews and surveys analyses. In the third chapter of this document, the theoretical concepts of urban green, green infrastructure and citizen participation were explained. In the fourth chapter, was made a brief historical review of the city of Barcelona with a special focus on the case study of Les Glòries urban transformation as an example of green infrastructure implementation in the city. In the fifth chapter were compiled all the results obtained through the methodology. In the sixth chapter, the results were discussed comparing with the theoretical concepts. And finally, in the seventh chapter, the main conclusions of this thesis were stated in addition to possible future work.

2. Methods

The methodology used for this thesis were, a review of literature, strategic policies and action plans, document, web pages and news were made. After the analysis concerning Barcelona's historical background and state of the art of its green infrastructure policy and planning, by a case study approach. This information compilation was the base for creating a questionnaire which was used to extract opinions, experiences and discourses of different actors involved in green infrastructure policy and planning, and in the project of Les Glòries Park by interviewing them. The information obtained in the interviews also was used to complement and detail the case study explanation and some other information about the review. In addition to interviews, the surveys made by the City Council of Barcelona about the Project of Les Glòries square and its surroundings were analysed in order to obtain the citizens opinions, points of view and worries about the project of Les Glòries park. These surveys were the easiest way to get the most randomly stratified sample possible with the highest number of population closer to Les Glòries. In order to understand better the results of the survey, the experience of Les Glòries viewpoint was used to collect information from its visitors about the project and to have better understanding of the results analyzed in the survey.

2.1. Interviews

Different actors implied such as city council workers, architects, researchers and neighbourhood associations, as we can see in **Table 1**, were interviewed for characterizing Barcelona's urban green, if there is more than one approach or opinion about the planning and implementation of green infrastructure in the city, analyse the citizen participation in the city green infrastructure policy and planning, and in Les Glòries park, in addition to complement the information obtained from the review. All the interviewees answered the same questions about the green and Les Glòries allowing to identify the different points of view and opinions for the same subject. The content of the interviews is reported in the **Results** chapter and the questionnaire of the interview could be seen in **Appendices**.

Table 1. People interviewed:

External Actors	City Council	Neighbourhood Associations (AVV)
<i>BCNecología</i>	<i>Àrea d'Ecología, Urbanisme i Mobilitat (Management of Les Glòries project)</i>	<i>AVV Poblenou</i>
Cynthia Echave	Rosa López	Jaume Badenes
29/4/2019	24/4/2019	9/4/2019
<i>Researcher ICTA (UAB)</i>	<i>Àrea d'Ecología, Urbana (Management of Barcelona's urban green)</i>	<i>AVV Clot-Camp de l'Arpa</i>
Francesc Baró	Coloma Rull	Miquel Catasús
2/4/2019	30/4/2019	9/4/2019

2.2. Surveys Analysis

The opinion of the citizens will be obtained from the last three surveys about the Project of Les Glòries square and its surroundings, made by Barcelona's City Council. Furthermore, the experience of Les Glòries viewpoint will be an additional tool for the following analysis and comprehension of the results of the survey.

2.2.1. Citizen's opinions

From 2013, Barcelona's City Council surveyed every year the inhabitants around the area of Les Glòries to obtain information, about the citizen's problems, worries and opinion about the neighbourhood public services and facilities, consumption and mobility habits, the project of Les Glòries square and the impacts of its urban transformation. This survey is called Survey about the Project of Les Glòries square and its surroundings. And for this thesis, were analysed the surveys made in 2016, 2017 and 2018. For each survey were interviewed 670 people, older than 18 years, from the seven neighbourhoods that surround the square. Through a stratified random sampling with a confidence level of 95.5 % (Oficina Municipal de Dades (2016), Oficina Municipal de Dades (2017) and Oficina Municipal de Dades (2018)). The tree surveys have almost the same questions and it is possible to detect any change in the citizen's opinion and habits.

2.2.2. Citizens information

Les Glòries viewpoint was opened for the first time on the 12th of January and can be accessed every first Saturday of the month, from 10:00 a.m. to 2:00 p.m., for free. This 6 meters high viewpoint is located in the middle of the Les Glòries square, which allows showing to its visitants how the works and the transformation of the area, enabling a global vision of the space with the different main streets, la Meridiana, la Diagonal and la Gran Vía. The viewpoint receives a great influx of citizens those discusses the project, exchange thoughts and reflections with other visitors while informers explain the project and answer the questions made by the citizens.



Figures 1 & 2. Experience from Les Glòries viewpoint on the 2nd of February 2019. (Own source).

3. Theory

In the following section were explained the concepts of urban green and green infrastructure focussing on the benefits and risks of green infrastructure implementation at the urban scale. Furthermore, the social urban movements of neighbourhood associations and citizen participation are explained according to the case study of this thesis, added to some guidance for citizen participation processes in planning.

3.1. Urban green and Green Infrastructure (GI)

Barcelona's City Council (Ajuntament de Barcelona, 2013, p. 9) defined urban green as the green spaces (mostly parks and gardens) that are present in the urban fabric, which had been incorporated to transform the urban space. When this greenery is linked with natural spaces or farmland it became green infrastructure, working as a single ecological complex system offering ecological, environmental, social and economic benefits. This tangible and intangible benefits that people obtain from the ecosystem are called ecosystem services and are categorized by (MEA, 2005) as provisioning, regulating, cultural, and supporting services. Although some of the categories overlap, the supporting services are the most important because are essential for the production of all other ecosystem services, also, differ from the rest because their impacts on people are either indirect or occur over a very long time (MEA, 2005). Those ecosystem services are enhanced by ecological connectivity between the natural environment and the semi-transformed spaces that, in addition to the movement and dispersion of organisms, allow the maintenance of ecological processes and the flows that characterize them (Ajuntament de Barcelona, 2012).

The concept of Green Infrastructure (GI) was set for the first time in 1994 (Firehock, 2010), and it has been defined by a wide variety of academics and organizations, but according to (European Environmental Agency (EEA), 2011, p.6), the concept of green infrastructure has no single widely recognized definition. However, most of the definitions agree that green infrastructure is a multifunctional tool for landscape conservation through its connectivity, where green areas became a network of functional spaces that its management provides a wide range of ecosystem services, rather than isolated spaces preserved just for aesthetics.

Moreover, the definition of green infrastructure could also differ according to the scale where green infrastructure is implemented providing different benefits (European Environmental Agency (EEA), 2011). Green infrastructure at the urban scale is implemented for connecting parks and other green spaces mostly for the peoples benefit, conversely, green infrastructure at the landscape level (regional, national and transnational) is implemented for preserve and connect natural areas to benefit biodiversity and fight against habitat fragmentation. Of course, that green infrastructure at the landscape scale would also benefit people and green infrastructure at the urban scale would be beneficial for habitat preservation, reducing landscape fragmentation and enhance biodiversity. What is intended to explain is that green infrastructure is already a widely used concept that could be applied at different scales and for different purposes that could provide different benefits. In addition, the scale of green infrastructure implementation also predetermines the typology and characteristics of the green infrastructure assets those can be man-made or more natural/semi-natural (European Environmental Agency (EEA), 2011).

3.1.1. Green Infrastructure at landscape level

As humans, we depend on nature and biodiversity that supplies and provides us with lots of benefits and drives our economy (European Commission, 2018b). Meanwhile, we are forcing the earth system destroying natural ecosystems and putting under pressure their services. For this reason the EU, in 2011, had developed the **EU Biodiversity Strategy** to 2020 that “aims to stop the loss of biodiversity and ecosystem services” (European Commission, 2018a). The strategy is based in 6 targets and 20 actions to achieve these objectives by 2020.

The **EU Biodiversity Strategy** is legally protected by EU nature legislation of the Birds Directive and the Habitats Directive (European Commission, 2018b), those also creates the legal basis for Natura 2000, the nature protection areas. In order to combat isolation between the Natura 2000 areas, was developed the **EU Green Infrastructure Strategy** with the purpose of connect this areas through green infrastructure for restoring the ecosystems and its services while enabling the species to live and migrate to different habitats (European Commission, 2018b).

The **EU Green Infrastructure Strategy**, was developed under the **Target 2** of the **EU Biodiversity Strategy**: “Maintain and restore ecosystems and their services” (European Commission, 2011), that, “*By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems*” (European Commission, 2011). This target 2 is broaden by 3 actions, those are improving the knowledge of ecosystems and their services in the EU, setting priorities to restore and promote the use of green infrastructure and ensuring no net loss of biodiversity and ecosystem services (European Commission, 2011). Providing a common framework for **Mapping and Assessment of Ecosystems and their Services (MAES)**, for the restoration of ecosystems developing the **Restoration Prioritization Framework (RPF)** and for **Biodiversity-Proofing of the EU budget**.

The **EU Green Infrastructure Strategy** aims to “promote the deployment of green infrastructure in the EU in urban and rural areas” (European Commission, 2011) and is formulated as an enabling framework that provides a combination of policy signals added to technical and scientific actions that are implemented in the different existing legislations, policy instruments and funding mechanisms (European Commission, 2013). This long-term EU commitment consist in: **a)** the promotion of the Green Infrastructure in the main UE policy areas; **b)** improving the information about Green Infrastructure, strength the knowledge base and promote its innovation; **c)** improving the access to Green Infrastructure finance; and to **d)** extend the Green Infrastructure projects to a EU-level (European Commission, 2013).

In conclusion, this strategy promotes the implementation of GI in all Europe and between Europe, by the TEN-G network (European Commission, 2016a). The investment on green infrastructure becomes an integral part of spatial planning and territorial development (European Commission, 2016b) being a connector between the different natural areas allowing the species movement across them. It does not have its own legislation, but it has been integrated into the different existing legislations in which the use of green infrastructure can be useful for its purpose. Using the existing mechanisms that the policies provides (European Commission, 2013). By this way, its application is intended to be more effective and produce a greater number of benefits in a wider and more comprehensive range and fields (European Commission, 2016b).

The **EU Biodiversity Strategy** and the **EU Green Infrastructure Strategy** are made to enhance green infrastructure initiatives at national level, but a framework for GI at local level is not broadly developed yet (The Biodiversity Information System for Europe (BISE), 2015). The different financial mechanisms and knowledge that the EU offers, are good opportunities for GI implementation at national level, but these are not enough. More information must need to be spread away to the population in order to force politician to change this situation, while, scientist and researchers need to develop further the knowledge and the tools about green infrastructure, for a better assessment of the ecosystems services that GI proportionate.

3.1.2. Green Infrastructure at urban scale

For the realization of this document, it is going to take as a reference to the definition of Green infrastructure provided by the European Commission, also followed by Barcelona's City Council:

"Green infrastructure is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation. This network of green (land) and blue (water) spaces can improve environmental conditions and therefore citizens' health and quality of life. It also supports a green economy, creates job opportunities and enhances biodiversity" (European Commission (EU), 2016a).

The city of Barcelona is the case study of this thesis, so this document it is going to be focussed on green infrastructure implementation at the urban scale in order to connect parks and other city green spaces manly for peoples benefit and enhance ecosystem services in the city. Next, were shown the possible benefits and risks of the green infrastructure at an urban scale, according to Barcelona's current context.

Benefits of green infrastructure at urban scale

The investment in green infrastructure at urban scale is seen by many authorities as a successfully tested planning tool that provides environmental, economic and social benefits through the development and use of natural-based solutions while it helps to reduce dependence on 'grey' infrastructure that is usually more expensive to build and maintain European Commission (EU) (2016a) and European Environmental Agency (EEA) (2011). The green spaces must be understood as a multifunctional green infrastructure that, depending on how green spaces are, can provide many potential benefits, both for health and for environmental regulation.

In several studies carried out by ISGLOBAL, it has confirmed that green infrastructure is beneficial for people's health, since it promotes the practice of physical activity, reducing the risk of cardiovascular disease and the prevention of obesity (Mueller et al., 2016). They have also confirmed that being in contact with nature and green is beneficial for the cognitive level of children, reducing stress with adults and for pregnant women (Triguero-Mas et al., 2015). In addition, it has been scientifically confirmed that the presence of green provides psychological benefits and improvements for humans, showing that green areas in hospitals favour the recovery of patients who are in contact with the green (Chang et al., 2017).

Regarding environmental regulation, it has been shown that green and green infrastructure is beneficial for microclimatic regulation (Wang, 2016) by reducing the island's heat effect. The presence of plant mass allows the thermal balance of a microclimate to be much more beneficial than not having a stone surface. It has also been shown that the presence of green improves environmental quality, reducing levels of acoustic pollution (Wang et al., 2014) and cushioning atmospheric pollution by capturing, retaining or at least decanting particles from combustion. Due to the fact that cities have waterproofed most of the soil and urban green, the increase in green infrastructure allows to give the opportunity to breathe the soil by returning its permeability to retain water, control run-off and control the rainfall of the city. The impact of the green infrastructure on the water cycle also allows the green to act as a mitigation of climate change (Wang, 2016).

The implementation of green infrastructure at council level reinforce the character of the areas where they are located, improving its connectivity and cohesion with the rest of green spaces, minimizing its fragmentation meanwhile increasing biodiversity, working for a more ecologic coherence and nature preservation (Ribeiro and Barao, 2006, in Calaza-Martínez, 2016), allowing the creation of synergies and benefits to higher level than the local one (Davies et al., 2006, konijnendijk et al., 2004, in Calaza-Martínez, 2016).

Potential risks of green infrastructure at urban scale

Green infrastructure also has negative aspects such as allergic reactions to pollen, a feeling of insecurity in green spaces in some cases, or can damage urban infrastructure for example when a branch falls, but these are minor issues.

Gentrification is a process that takes place in a neighbourhood or in an area where is been elitizing, the first symptom is the change of the commercial fabric for one with more select products, showing that the purchasing power of its residents is raising, then the rental price also increases. Finally, gentrification can end up with a process of expelling neighbours with less purchasing power.

Sometimes green is used as an attractor of high-income people that are looking for a healthy environment to live. Green gentrification takes place when the creation of a green area is used as a tool for favouring gentrification (BCNUEJ, 2019). In addition, many cases of green gentrification were studied in North America showing that green gentrification is also a matter of environmental justice showing that green areas only benefit the health of privileged residents living in neighbourhoods that are been gentrified, excluding the most disadvantaged social classes (Cole, 2019). So the amenities and the environmental hazards are being disproportionately distributed (BCNUEJ, 2019), being the low-income people the ones that are more vulnerable to the lack of green spaces.

The Green LULUS group, led by the researcher Isabelle Anguelovski, studies the social impact by the creation of green spaces and urban parks. Anguelovski et al., (2017) had published a study that measured different gentrification indicators for 18 parks that were created in Barcelona from the 90's in order to know if the creation of municipal green spaces in Barcelona have contributed to green gentrification or, conversely, has dealt with social or racial inequalities by an environmental justice point of view. The results indicate that new parks in the old town and in the new urbanized neighbourhoods show the possibility of having experienced green gentrification (Anguelovski et al., 2017). Instead, the most low-income areas that are far from the city centre had gained residents as these areas became greener, indicating a possible concentration of vulnerable residents in these areas of the city (Anguelovski et al., 2017). Beyond the creation of these parks, there had been a very important urban transformation in these neighbourhoods. So the paper concludes that green gentrification is a complex issue, which can not only be attributed to the green space itself but is linked to a wider urban transformation process.

A lot of research has been done about how badly managed urban environmental strategies could potentiate gentrification were its main effects are suffered from the most economically vulnerable population (BCNUEJ, 2019).

3.2. Social urban movements and Citizen Participation

Social movements are a group of people from different ideology and social stratus united by a common interest. These arise when they consider that institutions, normally pressured by economic factors, do not carry out correct management of collective heritage. The concept of collective heritage is very generic and this can be considered of many types. But it can be defined as everything that the population considers as their own and that has a high value or importance for itself and its environment (Nel·lo, 2015). Social movements generally arise in cities due to a greater population density and social awareness, where the use of collective heritage generates more concerns and is more dependent on economic activities, becoming social urban movements.

The social urban movements, arise in Barcelona since the process of industrialization of the city in the nineteenth century, as a result of a set of economic, demographic and social changes. According to Nel·lo (2015), the social movements in Barcelona, from the early sixties to the present, can be grouped into; a) Neighbourhood Movements, b) Movements in Defence of the Territory and the Environment, and c) Movements of Social Innovation. Due to political, urban and social changes happened in Barcelona. According to Nel·lo (2015), there was a progressive displacement of the focus mobilizations, from the questions related to the defence of the territory towards social and political issues. Although, the focus displacement of social urban movements, these have been happening over the years depending on the motivations of these movements without implying the substitution of one problem for the other (Nel·lo, 2015).

3.2.1. Neighborhood Associations

Neighbourhood movements in Barcelona arose from the last years of Franco dictatorship until the first years of municipal democracy from 1959 to 1979, due to the struggle over land uses, the management of natural resources and place attachment (Nel·lo, 2015). Neighbourhood associations were developed as a result of neighbourhood movements, these are defined by the “**Federació d'Associacions de Veïns i Veïnes de Barcelona (FAVB)**” (Federation of Neighborhood Associations of Barcelona) as: “*Non-profit organization constituted by citizens of the neighborhoods who seek for quality solutions to collective problems and act in formulating demands for the rights to welfare and quality of life, making them participate in all stages of the Project to a large number of people, struggling for self-organization of society and taking into account as priority objectives:*”

- *Improve the quality of life of the neighbourhood*
- *Organize and defend collective interests*
- *Foster neighbourhood relations*
- *Promote the collective memory to give the neighbourhood the identity*” (FAVB, n.d)

During the local and regional institutions consolidation from 1979 to 2007, there was a reduction of neighbourhood conflict in the eighties due to the institutionalization of part of the demands of social urban movements since the advent of democratic administrations (Nel·lo, 2015). Since then, neighbourhood associations became the main channel between the citizens and the City Council. The citizens when they have a complaint or a problem in their day to day they inform to their neighbourhood associations and the neighbourhood associations to the city council. The information is given to the neighbourhood associations and then is explained to the citizens when we carry out the neighbourhood assemblies where there is an exchange of information that is beneficial for both parties. Citizenship delegates to neighbourhood associations since they have more power than a neighbour itself.

3.2.2. Citizen participation

With the situation of an economic, social and political crisis from 2007 to 2015, has raised a set of new citizen and social practices with the aim of confronting the material consequences of the crisis on the population, while trying to empower local communities and promote alternatives for social organizations (Nel·lo, 2015). On many occasions, the impulse of these initiatives is accompanied by political demands for quality decision-making processes, the demand for citizen participation and the defence of social rights. These practices have often been grouped under the concept of “social innovations” (Nel·lo, 2015).

According to Arnstein (1969), “Citizen Participation is a categorical term for citizen power”. Informing citizens should be the most important first step for citizen participation legitimization. However, if the flow of information is just from officials to citizens without any feedback, this is not citizen participation. The same happens with consultation, inviting citizens' opinions, can be a legitimate step toward their full participation. But if consultation is not combined with other modes of participation, it is not citizen participation unless citizen concerns and ideas will not be taken into account (Arnstein, 1969). Citizen participation happens when there is an exchange of information from municipal technicians to citizens as well as from the citizens to municipal technicians, apart from citizens having the power to negotiate with the city council. Citizen participation has to take place from the first stages of planning, otherwise, citizens have little opportunity to influence (Arnstein, 1969).

There are three ways of citizen power depending on its influence degree on decision-making (Arnstein, 1969). These are a) Partnership; when citizens are engaged in the process and can negotiate with the city council by policy boards and planning committees, meanwhile, the planning and decision-making responsibilities are shared between the citizens and the city council b) Delegated power, when in negotiations between citizens and the city council the citizens are the main decision-makers over a particular plan or program, and c) Citizen Control; when citizens have the full power to decide, but there are just a few examples of it (Arnstein, 1969).

3.2.3. Citizen participation in planning

The City Council of Barcelona is aware that democracy is more than go to vote once every four years. And that citizens must take part in political decisions by citizen participation processes. Participatory processes are defined by Barcelona's City Council as: “*A series of meetings delimited at a specific time to promote the debate and the contrast of arguments between citizens, or between them and those responsible for municipalities. A participatory process can deal with almost any topic and may affect one or more neighbourhoods and districts or the entire city*” (Decidim Barcelona, 2017).

In October 2017, Barcelona's City Council approved a new **Regulation for citizen participation** as a result of a participative process between various municipal groups, neighbourhood associations, participation bodies and citizenship. This framework defines the political participation channels; the necessary resources to carry it out and a system that must ensure the good use and efficiency of these channels. “*The current Regulation represents a strong impetus for the citizen initiative that fosters channels of direct democracy, commitment to hybrid participation between the digital and face-to-face world, which favours transparency and traceability and puts special attention in guaranteeing inclusive participation that takes into account the diversity and needs of the entire population of Barcelona*” (Decidim Barcelona, 2017).

The City Council of Barcelona conceives citizen participation as a partnership, previously described by Arnstein (1969). Where citizen participation takes place as a genuine interchange between citizens and city planners wherein municipal technicians have to be open to working with citizens, while, citizens must be active and competent in planning. According to this last definition, Godschalk (1971) calls this type of citizen participation as "*Collaborative planning*". Godschalk (1971) in Fagence (1977) were established twelve propositions that must be taken into account during citizen participation in planning. The following propositions have been classified according to whether citizen participation relies on policy and planning or in local planning:

Citizen participation in policy and planning

- *"The broader the base of citizen participation in the planning process, the more potential influence the planner and citizens can bring to bear on public policies and plans".*
- *"The broader the base of citizen participation, the more potential influence the planner can bring to bear on the social choices of the citizens, and vice versa".*
- *"The more diverse the interest represented in the planning process, the more innovative will be the proposals".*
- *"The more decentralised the client groups, the more innovation will be adopted, conversely, the more centralised and comprehensive the decision process, the fewer will be the innovations".*
- *"The more the planning process facilitates citizen participation, the more the community will be aware of the planning function as a democratic and community force".*
- *"Participatory planning, open to radical proposals, is more likely to pursue innovative solutions to community problems".*
- *"The wider the scope of planning and the longer the time horizon, the less useful (and possible) collaborative planning will be"* (Godschalk, 1971 in Fagence, 1977).

Citizen participation in local planning

- *"Local planning goals will be more congruent with community desires if discussed widely by participant groups and then communicated to the decision-making body".*
- *"A one-way flow of objectives from a central decision-making body to a planning agency will tend to under-represent the interest of some community groups".*
- *"The more public consultation techniques are used, the more the planning programme will attract public support".*
- *"The relevance of the planning function and its influence will depend upon the number of dispersed contacts established in the community"* (Godschalk, 1971 in Fagence, 1977).

4. Case study: Les Glòries in Barcelona city

In this chapter, the historical background and the urban transformations that have happened in the city of Barcelona and in the area of Les Glòries are going to be explained in order to understand the importance of this project.

4.1. Brief historical review of Barcelona's Urban Transition and Transformation

At the end of the eighteenth century, the wall that surrounded the city became an urban problem due to the increase in population density and several epidemic outbreaks. This situation forced the local government to consider a plan for expanding Barcelona that could provide more space for a growing population that demanded a better water supply and sewer system (Aibar & Bijker, 1997). Between 1854 and 1868 the Barcelona's walls were demolished and the planning proposal of the Catalan civil engineer Ildefons Cerdà was the one imposed by the Spanish Government to expand the city of Barcelona.

One of the main influences in the development of the Cerdàs Plan was the 19th hygienist theories. He identified that many of the deaths occurring in Barcelona were produced as a consequence of the city urban form. His initial plan, presented in 1856, planned the city space as a grid of blocks with an extension of 113.3 by 113.3 m² surrounded by 35 meter wide streets or big avenues from 50 to 80 m wide, those allow natural sunlight, wind and big green areas in order to optimize the living standards. Cerdà also predicted the future development of a transportation system, this is the reason why the corners of every block were cut out as a chamfer for having better visibility and favouring the vehicles to turn easier. The streets were divided into two equal parts, one for vehicles and one for pedestrians (Aibar & Bijker, 1997). However, the original plan was modified in 1859 to accomplish with the local government demands. Cerdà diminishes the wide of the streets from 35 to 20-30 m, the depth of buildings was extended to 20 m tall, and the former regular distribution of parks and gardens, which supposed to be the 50 % of the total block surface, was not made obligatory (Aibar & Bijker, 1997).

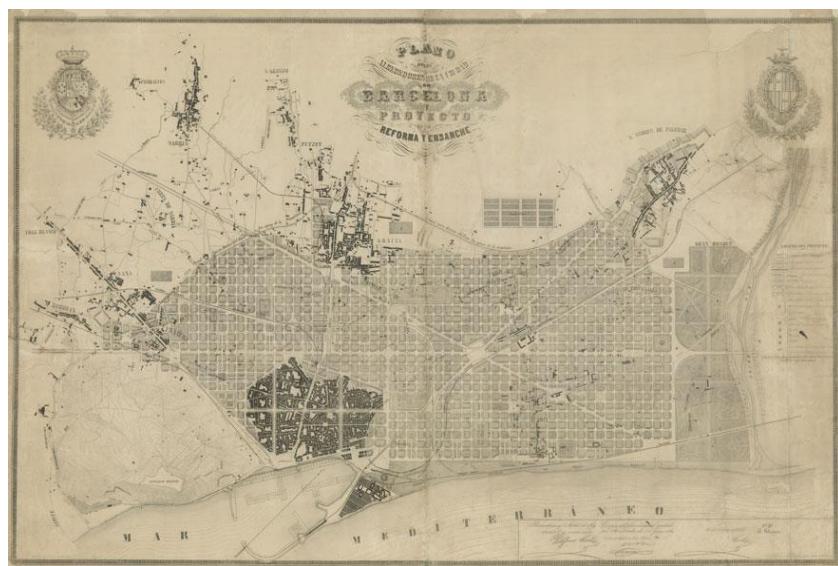


Figure 3. Barcelona's map of the Cerdàs Plan. (Arxiu Històric de la Ciutat de Barcelona, n.d)

The final Cerdà's plan, that allowed people to walk through its wide streets and rest in parks and gardens, was not carried out due to the increasingly high population growth, housing speculation and the introduction of the private vehicles. The Cerdà's building laws were mostly broken, the buildings were built in all the block sides occupying more than 80 % of the block surface while the streets became highly dominated by car traffic and occupied by parking lots, reducing the public space for the pedestrians. The priority given to the car in the coming years was coupled with the urbanization of the periphery to place the immigrants arrived from other parts of Spain, during the years 1945 and 1975, that led to an accelerated process of land occupation, repeated in 1986. The rapid development caused a lack of open spaces, infrastructures, social services and public transportation for the periphery. As a result of all of these processes, Barcelona has become a very compact city dominated by cars and with few green areas.

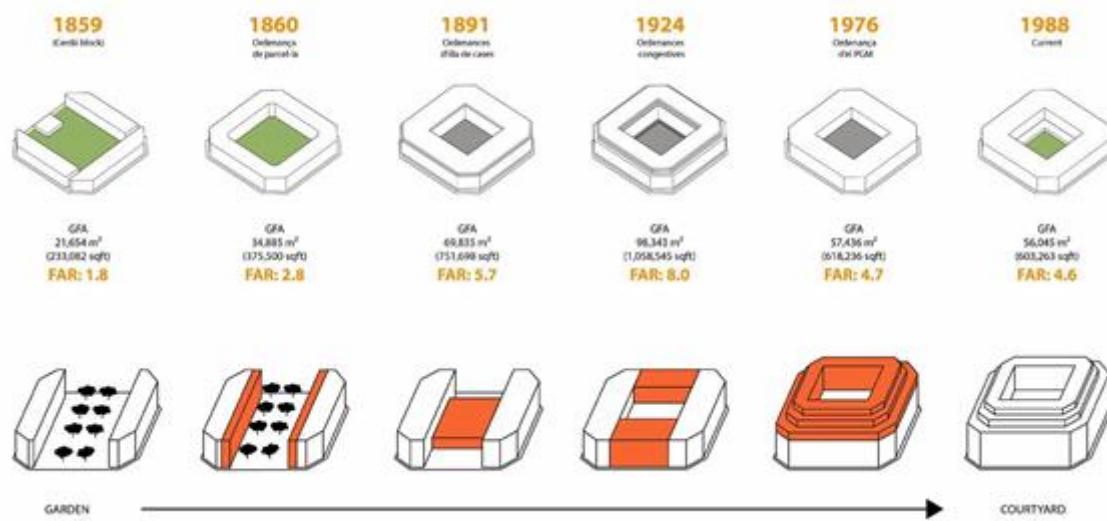


Figure 4. The gradual occupation of Cerdà's blocks (Dintorni Barcellona, 2013)

4.2. Introducing the area of Les Glòries

The area that today occupies the current Plaza de Les Glòries Catalanes has always been a place of passage rather than a stopover, as a natural way out of Barcelona (Ajuntament de Barcelona, 2014a). In the tenth century, the construction of the Rec Comtal, an irrigation canal near Barcelona, changed the physiognomy of the place transforming it into a large fertile plain of crops. The area remained almost unchanged until the 18th century when the Bourbonic troops settled in this place to bombard the city during the siege of Barcelona in 1713-1714. Once the war was won, the area was abandoned, becoming an empty urban space, a characteristic that has marked this place since then (Ajuntament de Barcelona, 2014a).

In the mid-nineteenth century, while the walls of the city were being demolished, several rail and tram lines were built across the area that hampered the development of the Cerdà's Plan for the reform and expansion of Barcelona. Cerdà imagined the Les Glòries as the future city centre where the crossing of the Gran Vía, the Meridiana and the Diagonal took place. The train tracks obliged the engineer to modify the orthogonal mesh of his plan where the square becomes a large rectangular hole of 9 hectares, turned 30 degrees with respect to the Gran Vía. This exception in the regularity of the Cerdà scheme gives an idea of the difficulties that this area of the city has always entailed (Ajuntament de Barcelona, 2014a).

At the beginning of the 20th century, many city planners and architects made several urban planning proposals that were never carried out due to the complexity of the area, its poor communication and the presence of the railway. Becoming an empty degraded space in the outskirts, lacking in all order and crossed by the train tracks (Ajuntament de Barcelona, 2014a). In 1928 it was decided to move the Fira de Bellcaire also called "Els Encants", which became a singularity of the square, along with industries and many railroads. The lack of urbanization of the area made Glories an insecure space that favours clandestine activities and crime.

Between the decades of the 30's and the 50's, the rail tracks were buried, propitiating the first major formal urban transformation of the area. At the end of the 60's, the city was totally rendered to the automobile. The area of Les Glòries was crossed by the Gran Vía connecting with the highway of Mataró, becoming the main road junction of the city. During the decade of the 70's, the car traffic continued to increase and the square presented a complex set of roads, ramps, overpasses and underground tunnels with a public park, equipped with a children's play area and an artificial stream in its surroundings. In the decade of the 90's, due to the celebration of the Barcelona 1992 Olympic Games, the old roads were substituted by a double ring that housed a parking lot and inside the ring was located a park with 2.10 hectares (Ajuntament de Barcelona, 2014a). The neighbourhood associations of the area were against the project as this allows a motorway in Les Glòries perpetuating high-density car traffic. The associations were mobilized but they do not enough support from the citizens due to the great transformations that were taking place in the city. On the other hand, the mobilizations were able to put traffic lights to stop the freeway and eliminate the elevated steps to facilitate the connection between the neighbourhoods that surrounded the ring.



Figures 5. Aerial picture of Barcelona where it could be seen the ring of Les Glòries square (red circle), in the middle east of this picture. Picture modified from (Centre Europeu Bcn, 2019).



Figures 6 & 7. Pictures of the past double ring hosted in Les Glòries square.
(EjePrime, 2018) and (Ajuntament de Barcelona, 2014d).

However, the ring allowed the extension of the Diagonal to the sea and the subsequent transformation of the 22@ district. These urban transformations required the definition of a new urban project for the area of Les Glòries that started with the opening in 1995 of the Glòries Shopping Center and the La Farinera del Clot Cultural Center or the construction of the La Torre Agbar (1999-2005) among others. “*The project of the ring was a failed attempt to integrate a road solution with green public space*” (Neighbourhood Associations). The landscape of this area of the city, which had not yet really become a square, was totally hostile for the pedestrians and had been completely dominated by the car (Ajuntament de Barcelona, 2014). The double ring was a barrier between the surrounding neighbourhoods of Clot-Camp de l’Arpa, Poblenou, Fort Pienc and Sagrada Família, as it could be seen in **Figure 8**. Moreover, the inner park of the ring did not have any utility.

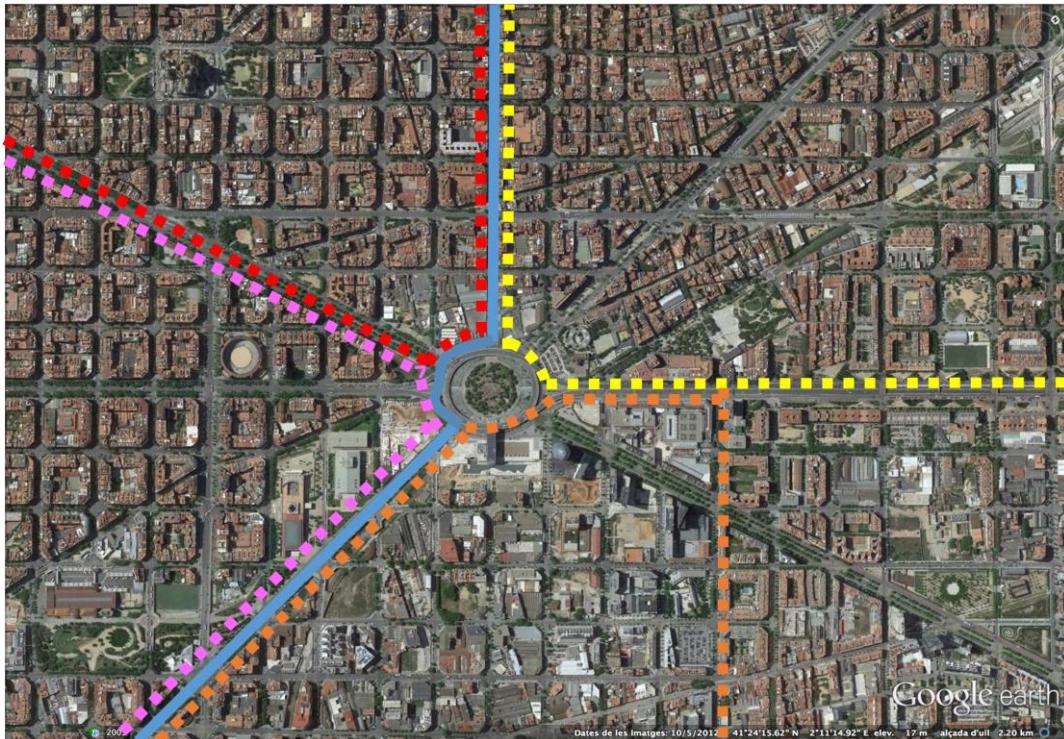


Figure 8. Aerial picture of Barcelona where it could be seen how the ring of Les Glòries square, was a barrier between the surrounding neighbourhoods of Clot-Camp de l'Arpa (yellow), Poblenou (orange), Fort Pienc (red) and Sagrada Família (pink). Picture modified from (Prat, 2014).

As a result of the issues produced by the double ring, as well as, the irregular situation of the Encants and some housing. There was a strong citizen claim for changing this situation. The City Council of Barcelona wrote, in 1999, a modification of the General Plan of Barcelona that perpetuates the road ring and more housing in return of building public facilities and green areas (Ajuntament de Barcelona, 2017b, p.11) that were not made (Ajuntament de Barcelona, 2007, p.2). This proposal of 1999 was not accepted by the neighbours who demanded a deep rethinking of the area in addition to its participation in the urban planning and design of the space. The city council did not meet the demands of citizens and the associations were continued to mobilize.

The area of Les Glòries stayed more than 150 years almost as an empty urban space although was planned by Cerdà as a new urban centrality where takes place the crossroad of the three main roads of the city. Despite its potential, the area reminded as an urban gap until the arrival of the car. Since then, the area of Les Glòries has been transformed into a point of access and exit from the city. Today, this area can no longer assume the role of city urban gate because the city has extended much further (Ajuntament de Barcelona, 2017b, p.12)

5. Development and analysis of results

In this chapter, has been made a revision of Barcelona's municipal planning. Then, the policies and plans related to Barcelona's urban green those are the Green and Biodiversity strategy called "***Pla del Verd i de la Biodiversitat de Barcelona 2020***" and the Green Infrastructure action plan called "***Programa d'Impuls a la Infraestructura Verda Urbana (PIVU)***" have been described and evaluated through the answers obtained by the interviews made.

In addition, the case study of Les Glòries urban transformation, previously introduced, is going to be explained in detail about the chronology of all the citizen participative processes, the agents involved and an explanation of the final layout of Les Glòries Park. Then, this project is going to be evaluated through the answers obtained by the interviewees and by the surveys.

5.1. Revision of urban sustainability policies in Barcelona

In order to have a more resilient city for the future challenges of global change and achieve long-term sustainability, it is necessary a paradigm shift on city planning, with a multidimensional approach interrelated with the different areas such as transport, waste management, water management, pollution, health, urban green, biodiversity, education, culture and economy among others. Besides to include the actor's interests and involve the citizens in urban planning. The City Council of Barcelona has been implementing these criteria since its adhesion to the Aalborg Charter in 1995, defining its local agenda 21 through the ***Citizen Commitments for Sustainability (2002-2012) and (2012-2022)*** (Ajuntament de Barcelona, 2015). These documents were the basis of the work carried out by Barcelona's municipality in the field of biodiversity with renaturalization as the priority of its local sustainability strategy.

Next, a timeline, **Figure 9**, is presented with a revision of the different municipal policies, plans and action plans developed in the last decade by the City Council of Barcelona in order to combat climate change, with a special focus on those that are going to be explained in this chapter, related to city renaturalization and to green infrastructure implementation.

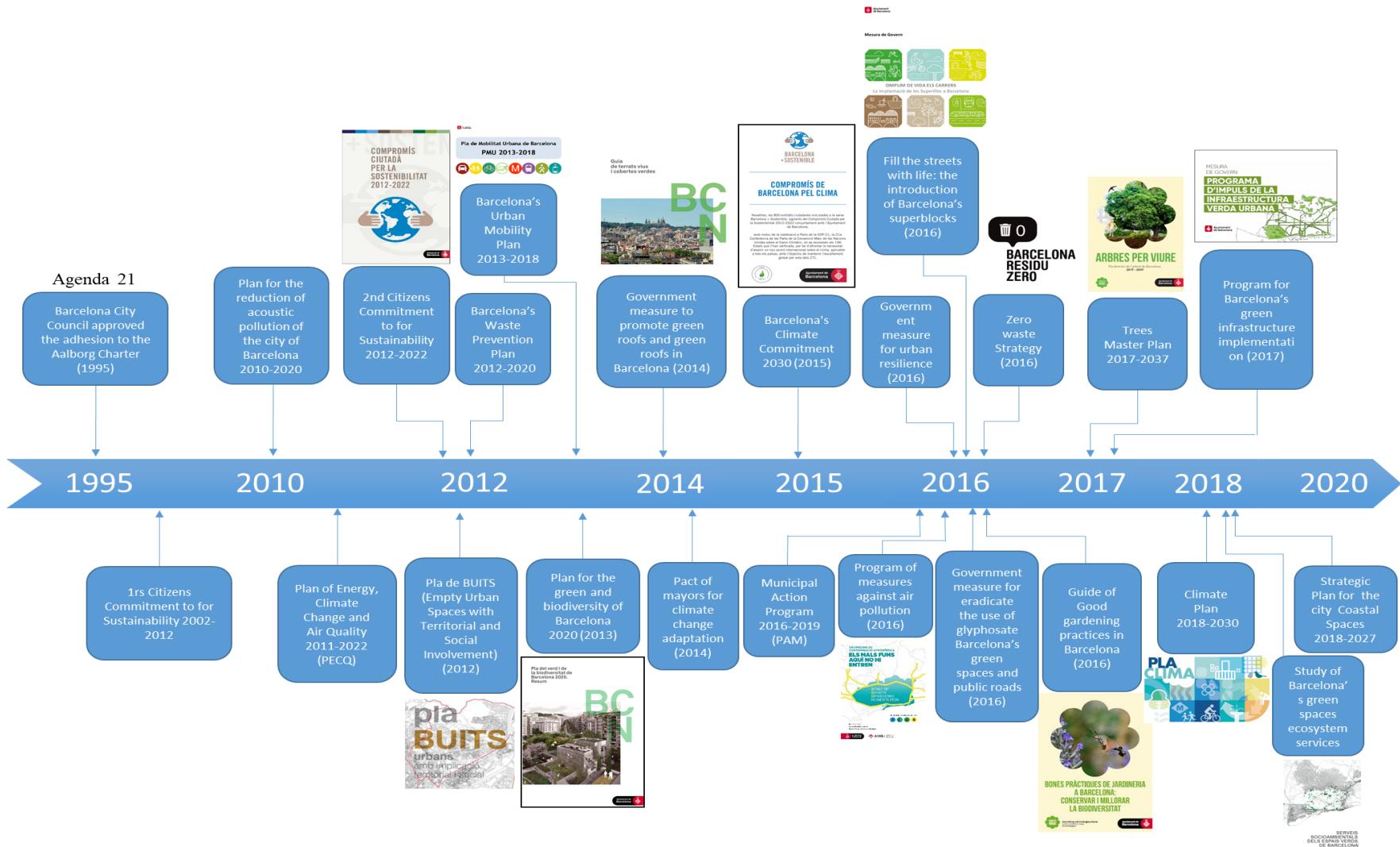


Figure 9. Timeline of the last decades Barcelona's municipal policies and plans related to climate change and green infrastructure. (Own source).

In 2015, after the celebration in Paris of the COP21, the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change. The City Council of Barcelona ratified its “*Compromís de Barcelona pel Clima 2030*” creating the “*Pla Clima*” (2018-2030) for the fulfilment of the Paris Agreement. The “*Pla Clima*” is one of the most ambitious and most pioneering plans for climate change adaptation and mitigation at the European level and globally. This document has six strategies, with its corresponding actions. The first one is the reduction of 45 %, to 2005 values, of greenhouse gas emissions in 2030 and the second one is to increase 1.6 km² of urban green. In addition, the city of Barcelona is committed to becoming carbon neutral by 2050 (Ajuntament de Barcelona, 2018b).

The “*Pla Clima*” (2018-2030) makes a revision and compiles the actions and strategies of the previous plans and documents related to climate change, as could be seen in **Figure 10**, and establishes new actions at short (2020) and long (2030) term for the compliance of its six strategies. About green infrastructure, the plan has established that by 2020 must be created a plan of urban green corridors network in a participatory way that reinforces the function of green as a measure of adaptation to the possible effects of climate change and to prioritize the actions planned in the “*Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)*” in the districts and neighbourhoods with less urban green (Ajuntament de Barcelona, 2018b).

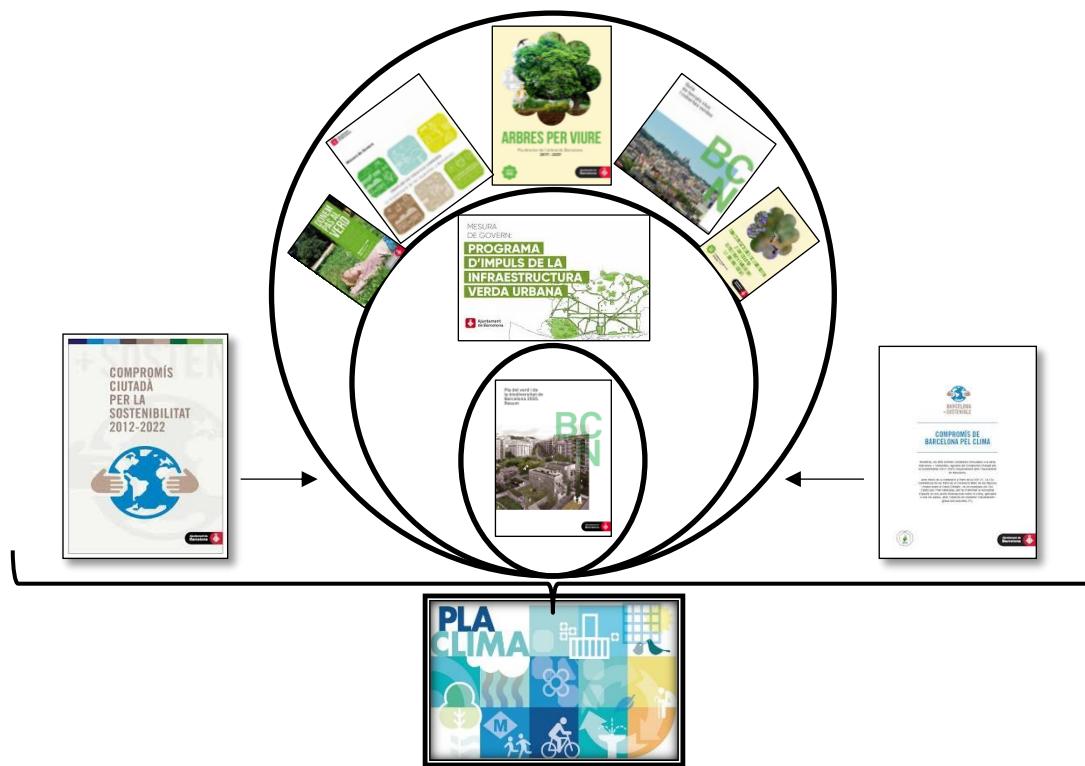


Figure 10. A diagram that shows the “*Pla Clima*” (2018-2030) as a compilation of the strategies and actions of the previous policies and plans about green infrastructure and climate change adaptation (Own source).

5.2. Green Infrastructure policy and planning in Barcelona

Parcs i Jardins de Barcelona, Institut Municipal (PIJBIM) is responsible for the management and conservation of the public green spaces and trees of the city. (Ajuntament de Barcelona, 2017c, p. 54). In 2016, the Government Commission of Barcelona's City Council declared public gardening as an essential public service (Ajuntament de Barcelona, 2019, p. 5). Then, **Parcs i Jardins** was unified with the **Gerència de Medi Ambient i Serveis Urbans** of the City Council (Rull, 2019) which its directorate **Direcció d'Espais Verds i Biodiversitat** is the responsible for the management of the municipal public green (La Vola, 2017, p. 9). All these departments belong to the **Àrea d'Ecologia, Urbanisme i Mobilitat**, which is in charge of the planning, design, execution, management, use and evaluation of public management of this green infrastructure (Ajuntament de Barcelona, 2019, p. 5). In addition, the City Council is also in charge of other related activities such as awareness campaigns or controls of invasive alien pests and species.

Barcelona's urban green and biodiversity is regulated by **Barcelona's Environment Ordinance** (La Vola, 2017, p. 9) and the most relevant planning elements that the City Council have are its Green and Biodiversity Strategy "**Pla del Verd i de la Biodiversitat de Barcelona 2020**" and its Green Infrastructure Action Plan "**Programa d'Impuls a la Infraestructura Verda Urbana (PIVU)**".

5.2.1. The Green and Biodiversity Strategy "Pla del Verd I de la Biodiversitat 2020"

The Department of Urban Ecology of the Barcelona's City Council had developed, in 2013, its own Green and Biodiversity plan called "**Pla del Verd i de la Biodiversitat de Barcelona 2020**". Following the international treaties of the **European Biodiversity Strategy to 2020** and developing the accomplishment of the first goal of the **Citizen Commitment for Sustainability (2012-2022)** for preserve and improve the natural elements of the city and its biodiversity.

The plan summarizes the main contributions of Barcelona's green and biodiversity, expressed as values, attributes, functions, and list the types of spaces that carry out these services, those are: open natural green spaces, river areas, coastal areas, woods, parks, gardens, squares, orchards, green walls, green rooftops, rafts, streets with trees and street flowerpots. Pointing out that different spaces make different contributions.

The document follows with a diagnosis of Barcelona's green and biodiversity. With a summary of the work previously carried out to preserve the city biodiversity and an analysis of its state in the year 2012. Together with an analysis about the green in the city: how is distributed in the city; its composition, structure and ecosystem services; its relation with society and health; its historical dimension and heritage; communication and environmental education; and management and conservation.

According to the plan, the city of Barcelona contains a great variety of natural spaces in less than 100 km² of the surface (Ajuntament de Barcelona, 2013), due to its geographical location. Has a natural heritage integrated by the Collserola mountain range (with 1,795 hectares in the municipal area and more than 8,000 hectares in total), the Llobregat and Besós rivers, and the Mediterranean Sea, those are the natural boundaries of the city. Within the city, a total of 53 spaces of local natural interest have been stocktaking (Ajuntament de Barcelona, 2012), where the Montjuïc Mountain, Tres Turons and Ciutadella are the most relevant spaces. In addition, the city has 1,076 hectares of public parks and gardens, 30 hectares of beaches, 30 hectares of crops, 740 hectares

of private green and trees with 153,000 units of 150 species (Ajuntament de Barcelona, 2013). Along with a large variety of autochthonous species of flora and wildlife in the urban nucleus. Barcelona has some areas of special protection such as the Collserola Natural Park that forms part of the ***Natura 2000 Network***, and the protected natural space of Montjuïc the Cliffs. There are 3 types of habitats, holm oaks, pine woods and dry meadows, which are designated as habitats to be preserved by the ***1992 Habitats Directive***. And 72 vertebrates protected by law (Ajuntament de Barcelona, 2013).

The city of Barcelona has 3,611 hectares of greenery, measured by the plan in 2009, where 50 % of the total corresponds to the Collserola Mountains, the 20 % is from private property and the 30 % (1.083,3 ha) represents the greenery in public areas strictly urban (Ajuntament de Barcelona, 2013). Being 6.84 m² of green area per inhabitant in 2009 (Ajuntament de Barcelona, 2013). Although the city has a large variety of green elements, these are scarce, bad-connected or isolated and not homogeneously spread. Moreover, those suffering from urban pressures and negative impacts such as city development, intensive usage for recreational purposes or transit.

With this strategic instrument, the city council would like to transform its green areas to a well-connected network of green infrastructure by the creation of green corridors, **Figure 10**, and identify all the available spaces in the city like roofs, terraces, balconies, walls, streets, avenues, parks and gardens, that are possible to build more green infrastructure in order to renaturalize the city.



Figure 11. Picture of the green corridors. (Ajuntament de Barcelona, 2013)

The “***Pla del Verd i de la Biodiversitat de Barcelona 2020***” proposes a model of an urban green system and a city model in which green as a real green infrastructure rather than an ornamental complement. This model is developed from two key concepts, connectivity and renaturalization, specified in two instruments:

• **Urban green corridors**, in order to connect the urban green system with peri-urban nature, for configuring a robust and functional green infrastructure network. The urban green corridors had to be considered on two scales:

- At the city scale, where green corridors became spaces of urban comfort that could be used by everybody in its everyday life and builds a basic city network that enhances the city connection and walkability (Ajuntament de Barcelona, 2013).
- At peri-urban scale, where green corridors allow the penetration of the natural systems that surround the city territory to the urban system, creating a network of natural and non-natural green infrastructure that provides more services and benefits for the urban ecosystem regulation (Ajuntament de Barcelona, 2013).

• **Opportunity spaces**, of different types and dimensions, such as unoccupied plots, roofs and balconies, which can be identified and renaturalized for revitalizing their surroundings (Ajuntament de Barcelona, 2017c, p. 18).

This long-term strategy lists 10 strategic lines and 68 actions in order to preserve and increase the green areas and the biodiversity of the city, with a more interlinked network of Green Infrastructure, that could provide environmental, social and economic services, enhancing a strong city-nature relation, in order to make a more resilient city for the future challenges of climate change (Ajuntament de Barcelona, 2013).

From the considerations and evaluations extracted from the interviewee's opinions and the review of the Green and Biodiversity Strategy "Pla del Verd i de la Biodiversitat de Barcelona 2020", the following issues can be outlined:

Problems and challenges of green infrastructure urban planning in Barcelona

Since the 90's, the City Council of Barcelona has made a very important effort to create good quality green spaces (External Actor, BCNecología). In the last ten years, an important commitment has been made to improve the green space of the city, but there are still many aspects to improve. "*Traditionally urban planning sets the soil as a green space, as a green area, but does not say how this green should be*" (External Actor, ICTA UAB). An example of this is the concrete squares, squares that are classified as green areas but does not have much green. This is a clear example of a lack of precision in urban planning where a space classified as a green area that is not really. Until now, "*the amount of green space depended much on the sensitivity of the architect or the urban planner*" (External Actor, ICTA UAB). So, the design criteria were not specified, lacking any coherence.

A pioneering strategy in Barcelona

The city of Barcelona in the recent years has been approving a series of strategies headed by the "**Pla del Verd i de la Biodiversitat de Barcelona 2020**" which marked a series of basic lines for the improvement and the increase of urban green, not only at the level of parks and gardens but also at the level of trees and other types of green. "*It was a pioneering strategy that included how to plan and design new green spaces, how should be preserved historical parks and gardens, how to manage all urban green as a whole, and how to spread and communicate all these practices. Altogether from the mixture of the biodiversity and greenery perspective*" (City Council, Management of Barcelona's urban green).

The “**Pla del Verd i de la Biodiversitat de Barcelona 2020**” is the framework for which has been promoting green infrastructure. “*This green infrastructure is a green domesticated by the humans*” (External Actor, BCNecologia) but this is functional green strategically planned to obtain as much as possible ecosystem services. “*There is the feeling that sometimes a park or garden in a city is an artificial thing that is not considered in the concept of biodiversity*” (City Council, Management of Barcelona’s urban green). The new parks in Barcelona, go beyond what a typical park is, are designed to have the maximum utility and functionality. Green infrastructure is used in Barcelona to creating spaces for recreation that at the same time enriches biodiversity enrichment and mitigates the effects of climate change. They are created as climatic refuges, with spaces of shadows and with water games that in case of heat waves, citizens can take refuge in the park.

“*This plan is not only a breakthrough in the improvement of civil society or citizenship, also establishes the long term strategy that Barcelona’s City Council will follow*” (External Actor, BCNecologia) were city council technicians must need to consider in its projects a specific criteria for choosing the species, for parks and gardens management or the introduction of criteria Sustainable at gardening among others. “*After the implementation of the “Pla del Verd i de la Biodiversitat de Barcelona 2020” some guidelines were repeated in green planning confirming good dialogue between urban planning with urban green policies and plans*” (External Actor, BCNecologia). This is because many of these criteria have been internalized by the technicians that make and execute the projects. In spite of this, “*there are still difficulties in introducing the concept of green infrastructure, even in the institutions, where it is difficult to change the name of green spaces for green infrastructure, maybe because it continues to sound as grey infrastructure*” (City Council, Management of Barcelona’s urban green). “*It is still hard to understand for some technicians that green infrastructure as a powerful, multifunctional tool that provides a large number of ecosystem services*” (External Actor, BCNecologia).

Now, with the implementation of the “**Pla del Verd i de la Biodiversitat de Barcelona 2020**” and its associated measures, together with the modification of the Urban Development Master Plan called “**Pla Director Urbanístic Metropolità**” (PDU), green planning is expected to be a much more detailed at urban planning. In the drafting of the new PDU, green planning is being incorporated into master planning so the qualification of a green area will be greater specified. It would refer to how this green area should be, what kind of vegetation should have and what services this area will offer. “*It is not yet known whether the PDU will really end up incorporating the green infrastructure as a basic infrastructure of the new urbanism of Barcelona, such as lighting, mobility among others. But there is a clear commitment to integrating the “Pla del Verd i de la Biodiversitat de Barcelona 2020” at city level*” (City Council, Management of Barcelona’s urban green).

A framework strategy for the rest of the plans related to the green in Barcelona

The “**Pla del Verd i de la Biodiversitat de Barcelona 2020**” is a very generic plan that touches all areas, so any other plan or measure related to green, regardless its typology, has been linked to this plan. On the contrary, many measures had been created to specify different scopes of this plan. An example is the “**Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)**” that has been created to precisely determine how 1.6 km² per inhabitant will be achieved in the climate plan.

Not enough monitoring of this strategy

This plan consists of 68 actions, some of them were very specific and others were very generic. During the deployment of these actions, the city council technicians realized that “*some of the actions were unnecessary and others were very effective*” (City Council, *Management of Barcelona’s urban green*). The problem is that there is no information about the implementation or the results obtained from these actions. According to the city council’s technicians, the department of urban green management has the data but this could not be published due to the elections. When the municipal elections finish, this data is supposed to be published. It is also true that many documents are not published on the internet due to a lack of time and resources for checking the format the content of the documents, but the municipality had the data.

Just expert participation on the “Pla del Verd i de la Biodiversitat de Barcelona 2020”

For the realization of this document, there was no open process of citizen participation. The participation took place internally with technicians of the house and with professionals of the world of the green like tree-growers, external companies of gardening that works for the city council, companies of environmental consultancy, universities and companies that work in projects about of fauna preservation. Therefore, a participatory session was held but with professionals convened, as explained in the plan. Once the plan was approved, a public presentation was made to the public, therefore, only information. “*It should also be taken into account that the moment in which this plan was approved was with the previous government that did not promote both the participatory processes and the government of the current mandate*” (City Council, *Management of Barcelona’s urban green*). But the municipal technicians do not think that this type of strategies at a more general scale should be done with citizen participation.

Lack of transversality in the plan

The “**Pla del Verd i de la Biodiversitat de Barcelona**” is valid until 2020. The technicians of a sub-area of Parks and Gardens of the city council that drafted this plan have realized that for the drafting of the new plan, it must be done in a shared way, but not with citizens, shared with the other institutions that work with the green. “*It must be a plan that from the beginning will be drafted with all and from all the aspects becoming a city plan that it can be promoted and deployed in a homogeneous way*” (City Council, *Management of Barcelona’s urban green*). The drafting of the new “**Pla del Verd i de la Biodiversitat**” must involve all green institutions in order to have common criteria in the city, but these plans should also engage the citizens. It is true that an expert has more knowledge about the green than a current citizen, but “*enhancing citizens on managing the green will be a good chance to increase the citizen’s interest about it, favouring the implementation of the measures to increase the green in the city*” (External Actor, *ICTA UAB*).

A huge effort on citizen information will slow down the citizen rejection to the projects for increasing the green in the city. The citizens are also part of the city and these measures are going to improve their life quality they also should be involved in it. Other associations related to the green should have more voice and also make an effort for doing information campaigns and workshops about the green. The citizens also have to make an effort to get information about the green, if there is real interest, it is easy to find information about the green.

A strategy that provides a new city model for Barcelona with green corridors and superbblocks

The actual change on Barcelona's the city model to make the city greener, freer of cars and healthier it is encountering the refusal of the people who demand more car-based mobility. There is much work to do for informing the citizens about the benefits that green infrastructure can make for climate change mitigation. The language of health is very powerful in order to raise awareness to the citizens (External Actor, *BCNecologia*), the fact of relating green to human health makes the benefits of green more explicit for citizens (External Actor, *ICTA UAB*). For example, if the citizens are informed that the trees are making a thermal impact for reducing the adverse effects during a heat wave, then the citizens will value more these trees.

Not because there is more green in the city there are reasons to continue polluting as before, these measures must be accompanied by a reduction in pollution so that these benefits can be more visible. (External Actor, *BCNecologia*). The benefits of increasing green in the city are very positive but they must be accompanied by changes in habits, especially in mobility. For this purpose, the most relevant projects carried out by the Barcelona city council to increase the green and removing space for cars are the superbblocks project and green corridors plan. By this way, the public space used by the car is recovered for the benefit of citizens and biodiversity.

In the superbblocks, the car traffic was almost eliminated, excluding residents and vehicle services. But in the green corridors, this has not been the case, they have reduced the number of car roads but the city council was not brave enough to completely eliminate the traffic in these areas (City Council, *Management of Barcelona's urban green*). In the beginning, the Superblocks project has had a strong rejection by an important part of the citizens but once the superbblocks have been implemented the residents like it. This is because people are not enough informed at the beginning. The council technicians know that the superbblocks project will greatly improve the quality of life of the citizens but are not aware that if the citizen does not become part of the project design is very easy that citizens reject the superblock, on the one hand, due to distrust and ignorance and on the other because people are very used to use the car.

5.2.2. Green Infrastructure Action Plan “Programa d’Impuls de la Infraestructura Verda Urbana (PIVU)”

In 2017, Barcelona's City Council creates the government measure called “**Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)**” to promote urban green infrastructure in the city. This measure is the concretion of the “**Pla del Verd i de la Biodiversitat de Barcelona 2020**”, it responds to the **Citizens Commitment for Sustainability 2012-22** promoting the renaturalization of the city and details how is going to reach the goal set by the “**Compromís de Barcelona pel Clima 2030**” of increasing 1.6 km² urban green, 1 m² for each inhabitant by 2030, to generate a greater city adaptation to the possible effects of climate change (Ajuntament de Barcelona, 2017c). The main objectives of this measure are to create more green infrastructure for a better citizen's health, improve the existing green infrastructure to obtain more services, engage citizens increasing the city green infrastructure and biodiversity, and monitoring and evaluate the green infrastructure (Ajuntament de Barcelona, 2017c).

The document defines the concept of green infrastructure, explains the ecosystem services that green infrastructure will provide to the city and establishes three criteria that the action plan will follow. Those are: 1) Plan the green urban spaces like a system considering its multifunctionality, by a holistic and interdisciplinary way that will contribute to increasing the variety of environmental services and its global efficiency. 2) Make green spaces more accessible for the population looking for equity, combining macro and micro planning, having green areas of

different sizes and uses closer to every household. 3) Design an aligned action plan with the different city infrastructures, to coordinate the green infrastructure planning with other urban policies such as urbanism, mobility, health, sustainability, social rights and culture among others (Ajuntament de Barcelona, 2017c). Moreover, the plan explains three indicators, two quantitative and one qualitative, used to measure the city green infrastructure based on cartographic data. The indicator about Green Public Spaces that shows those spaces that could be used by the population, the indicator of vegetation coverage detected with the Normalized Difference Vegetation Index (NDVI) that allows evaluation of vegetation gains, and the Map of the Green Infrastructure of Barcelona, will categorize the different types of green spaces in the city, in order to evaluate the overall system in terms of connectivity, complementarity of uses, population accessibility to the parks and suitability of the location of the spaces to offer socio-environmental services (Ajuntament de Barcelona, 2017c) its creation is on process.

The municipality has drawn 4 strategic lines, which set out the way forward for the implementation of the green infrastructure in the city, and 25 planned actions that have been programmed. Each of these 25 actions was detailed with the specific projects and measures that the city council will carry out within a specific time plan. Those measures that are planning projects to increase green infrastructure for accomplishing the goal of increasing 1.6 km² urban green have been programmed with its specific time plan until 2030, the surface of green space that they are going to create and its costs. The rest of the actions are planned until 2019. Below there is a brief explanation of them:

The first strategic line is to build greener infrastructure by creating new parks and public gardens, creating new green areas recovering the empty space inside the blocks, temporary greening, greening the public space, green rooftops and green walls. This actions of green infrastructure microplanning are aligned with city policies and measures such as the “**Programa d’Acció Municipal” (PAM) 2016-2019** a long-term strategic planning for the management of the city public services, the government measure called “**Pla de Buits**” where municipal empty spaces are granted, for a short period time, to public or private non-profit entities to create activities of public interest (Ajuntament de Barcelona, 2012), the government measure “**Omplir de Vida els Carrers**” (Ajuntament de Barcelona, 2015), based on the implementation of the superblocks that will return sovereignty to the pedestrian by taken out space from the cars promoting a more sustainable mobility together with the renaturalization of the city, and the **Government Measure to promote green roofs and green walls** (Ajuntament de Barcelona, 2014c).

The second strategic line is to create greater green infrastructure transforming the existing spaces to more natural-based ones. Through naturalizing the existing green spaces, increasing its biomass, preserving and improving its biodiversity, preserving and improving the city natural spaces, creating urban wildlife refuges, naturalizing ponds, preserving and managing the city natural water sources, implementing SUDS and strengthening the green spaces public management. Basically, this strategic line is based on the improvement and enrichment of the existing green spaces aligned with the **Government Measure to apply the eradication of the use of glyphosate and reduce the use of phytosanitary products in the maintenance of public gardening in the city** of 2016 in which the city council commits to manage the urban green according to the ecological gardening criteria (Ajuntament de Barcelona, 2016a), the guide of **Good gardening practices in Barcelona: preserving and improving biodiversity** of 2016, a technical instrument that establishes gardening practices to maintain the green spaces quality and creating good habitat condition for the city flora and wildlife (Ajuntament de Barcelona, 2016b), or the “**Pla Director dels Arbres” (2017-2037)** sets strategic actions for increase a 5 % of the tree cover with native and more variate species, reaching up to 30 % of the urban area covered by trees. Besides transforming the trees to a true green infrastructure that achieves the maximum connectivity with the urban and natural environment for a better adaption to the urban ecosystem and to global change (Ajuntament de Barcelona, 2017a).

The third strategic line is to share with the citizens the management of the urban green by promoting the collaboration with the citizens to increase and preserve the city green infrastructure, enhance the green infrastructure custody made by non-profit organizations like the “***Pla de Buits***”, boost ecological urban framing, promote private green, encourage the opening of non-municipal green spaces for public use and extend the knowledge about urban nature and the value of its conservation (Ajuntament de Barcelona, 2015).

The fourth strategic line is to study, plan and monitor the green infrastructure by thinking green infrastructure as a whole system, find existing green spaces in the city that its percentage of green could be increased, finalize the study of Barcelona’s urban green ecosystem services for all the city. This action was partially accomplished in 2018 by Barcelona Regional with the “***Estudi dels Serveis Socioambientals dels Espais Verds de Barcelona***” (Study of the ecosystem services of Barcelona’s green spaces) that will enhance the creation of an information tool about green infrastructure, the green and biodiversity (Ajuntament de Barcelona, 2018a). This last action expects the development of an information system about green infrastructure, green and biodiversity through a data bank, indicators and associated cartography. Including all the information said before about the urban green indicators, the green infrastructure map and many others, to constitute the map of the biodiversity of Barcelona. Once this tool will be developed, it will be used for green infrastructure, green and biodiversity assessment and planning, political action and public information.

From the considerations and evaluations extracted from the interviewees opinions and the review of Green Infrastructure Action Plan “Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)” the following issues on the GI policies can be outlined:

Problems and challenges of green infrastructure implementation in Barcelona

According to all the interviewees, the green in Barcelona is scarce compared to other cities, especially in northern Europe and “it is difficult to scrub green in the city” (City Council, Management of Barcelona’s urban green). But this does not mean that it cannot be created greener. Barcelona is a city where it is difficult to expand the green but has opportunities to do it. The green in Barcelona is mainly on a small scale, starts from the plants that may be on balconies, street trees, those are very abundant in Barcelona, counting more than 120 trees per 1,000 inhabitants (Ajuntament de Barcelona, 2017a), small corners and conquered spaces such as the inner island courtyards, to promenades and avenues. In addition, other shapes of green are being promoted such as urban gardens, green walls and green roofs. In spite of this, “the city of Barcelona does not have large quantities of green spaces and large parks, apart from the Horta Labyrinth and the Ciutadella Park that are from the beginning of last century, and of the parks created in the years after the end of the Franco dictatorship, in 1980” (City Council, Management of Barcelona’s urban green). These are few compared to other northern European cities.

Although the city is much built, the green in Barcelona must continue to increase to meet the objective set in the Climate Plan to grow 1.6 km² of green in the city by 2030. “In a city as dense as Barcelona, the creation of large green spaces becomes a very complex task since unused plots within the city are scarce and highly demanded to make public facilities or social housing” (External Actor, BCNecologia). Although municipal facilities, as well as houses and other buildings, can also incorporate green through a green roof, a green wall and vegetation on the balconies.

Leaving aside the empty spaces in the city, the Superblocks project has great potential to release a large amount of public space occupied by the car to transform it into a more green space for pedestrians. “*The pacification of public space is not something new, and it is done in many places around the world, but in the case of Barcelona with one of the highest density population in Europe, it would become a reference exemplifying that a dense city can also be very green*” (External Actor, BCNecologia). With the pacification of the streets as an excuse to increase green, it would considerably reduce the car traffic, thus reducing the main city issues such as air and noise pollution.

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In the superblocks, the car traffic was almost eliminated, excluding residents and vehicle services. But “*in the green corridors, this has not been the case, they have reduced the number of car roads but the city council was not brave enough to completely eliminate the traffic in these areas*” (City Council, Management of Barcelona’s urban green). In the beginning, the Superblocks project has had a strong rejection by an important part of the citizens but once the superblocks have been implemented the residents like it. This is because people are not enough informed at the beginning. The council technicians know that the superblocks project will greatly improve the quality of life of the citizens but are not aware that if the citizen does not become part of the project design is very easy that citizens reject the superblock, on the one hand, due to distrust and ignorance and on the other because people are very used to use the car.

The process of naturalizing the city is much more complex than it seems.

The initial objective of this action plan was to list all the possible spaces and projects that were possible to increase the green surface of the city. Many of those could not be done but instead, other opportunities were emerging. “*This means that the city council does not work well planned or that soon appear spaces that had not been previously planned. The process of increasing green in the city is much more complex than it seems*” (City Council, Management of Barcelona’s urban green).

The “***Programa d’Impuls a la Infraestructura Verda Urbana (PIVU)***” “ *is about taking advantage of all possible spaces and corners, recovering planning spaces that were classified as green spaces but which have been built, others that have not been built but have never been landscaped like the Sants Square*” (City Council, Management of Barcelona’s urban green). The city council is working to identify and include them on planning.

In Addition, “*the green of Barcelona is not only a matter of square meters but is also a matter of the quality of this space*” (External Actor, BCNecologia). The lack of resources for manage the green has affected its quality, but since green was declared an essential public service, public management of green could be restored to provide more staff and resources. Besides, “*it is moving towards naturalization to protect and preserve the green spaces and gardens that are most historic and emblematic of the city, such as the Horta Labyrinth or the Ciutadella Park, to preserve the urban green that has a massive influx of citizens, and to leave landscaped natural parks such as Collserola to evolve in a more natural way*” (City Council, *Management of Barcelona's urban green*). The naturalization of these spaces implies more biodiversity of native flora and fauna, improving quality and natural wealth. With more responsible, respectful and sustainable management, less harmful to the environment and less expensive, it allows positive feedback to invest more in the naturalization and to increase the green spaces of the city. “*Barcelona has taken some good steps by establishing criteria of gardening and the choice of native species to promote a good balance in the city's habitat*” (External Actor, ICTA UAB).

However, these measures of naturalization such as transforming lawns into natural meadows or grassland, installing structures to provide biodiversity shelters like insects hotels, naturalization of rafts where chemical use is being eliminated for more natural management with aquatic plants, among others, “*must be accompanied by citizen information campaigns in order not to confuse naturalization with abandonment*” (City Council, *Management of Barcelona's urban green*). For example, lawns requires so much management and water consumption are changed for a flower meadow that is more biodiverse and requires management and water consumption, the problem is that some months per year there are not flowers and becomes ugly. So at this moment is necessary to explain to the citizens that is important to respect the natural cycle of these flowers and that it will bloom soon again.

No citizen participation on drafting the action plan

According to the “***Programa d'Impuls a la Infraestructura Verda Urbana (PIVU)***”, its third strategic line is about sharing with the citizens the management of the urban green by promoting the collaboration with the citizens to increase and preserve the city green infrastructure. But nevertheless, this action plan has been elaborated without any open process of citizen participation. “*One way to engage citizens on taking care of the green is with citizen participation at planning if this initiatives more people would be interested in green co-management. But in this case, maybe is a job more for sociologists rather than biologists. Making closer the understanding of green infrastructure as a living space is essential for the citizen in order to appreciate the green*” (External Actor, BCNecologia).

More effort from the city council is still needed to engage the citizens in taking care of the green.

The City Council of Barcelona is boosting diverse projects involving citizen participation and co-responsibility to improve and increase the green of the city. Such as the Barcelona + Sustainable Map, Bioblitz Barcelona, or the promotion of knowledge for harvesting and horticultural practice in the city. The “***Pla Buits***”, a public contest where entities presented proposals to manage empty spaces of the city or the urban public gardens was also a good tool for engaging citizens on taking care of the urban green. “*Taking care of the green is one way that the citizens have for been conscious of the value of the green and start a closer relationship with it*” (External Actor, BCNecologia).

However, Barcelona's City Council is receiving more and more requests from the citizens and public entities that want to participate in the management of urban green. Although the city council is carrying out various projects to involve these proposals, they had found that this is more complex than it seems. There are many legal and administrative obstacles to enhance the co-management of urban green. Time is necessary to change laws and simplify bureaucracy. It is unfortunate that bureaucracy is an impediment to carrying out these proposals. But the deployment of this measure emerges the need to remove these barriers. Although there are legal and bureaucratic obstacles, it is very positive that there is a great interest by the citizens to co-manage the urban green. Perhaps, "*the city council, which is very clear about the way in which green management is done, and is very careful about the money invested, at the same time, is reluctant to co-manage the green because is afraid of possible bad practices that can damage the urban green*" (External Actor, BCNecología).

There is still a lot of work to do

According to the action plan "***Programa d'Impuls a la Infraestructura Verda Urbana (PIVU)***" there is a ratio of 7.1 m² urban green per inhabitant (2017 values). "*There are many ways of counting the green and for this ratio has only accounted for the green managed by the city council*" (City Council, *Management of Barcelona's urban green*). The municipality said that the city of Barcelona has more green than the reflected in the ratio of this action plan, because there is green managed by other institutions, private green, green of other public entities those are not the city council, there is even green from the cemeteries, which is municipal green but is not managed by them. Therefore, the municipality said that is still working to measure and identify all the green of the city.

Much work has been done on the collection and treatment of data for making the indicators and maps referred in this measure. But it is a very difficult and expensive work that requires a high level of precision that demands a large collection of data and more studies. All these indexes and indicators should be updated over time to identify changes or improvements. Added to the challenge of quantifying ecosystem services that involve the monitoring, evaluation, monitoring and use of models. These will also depend on political aim and funding.

5.3. The process of Les Glòries urban transformation: From the square that never was to the second biggest park of Barcelona.

Although the transformation of the Plaça de Les Glòries and its surroundings has always been a constant demand for the residents of the area. It was not until 2003 when the City Council of Barcelona sat down to talk with the neighbourhood associations of Clot-Camp de l'Arpa, Poblenou, Fort Pienc and Sagrada Família to review the planning of 1999. Then was set up a **Monitoring Commission** for the urban transformation of the Plaça de Les Glòries formed by neighbourhood associations, local entities, local technical advisors, municipal technicians, political groups and city council councillor (Ajuntament de Barcelona, 2014b). There were two years of preliminary works until was set up the 17th of November of 2005 the **Working Group** formed by neighbourhood associations, local entities, local technical advisors and municipal technicians (Ajuntament de Barcelona, 2014b). Which were tasked by the **Monitoring Committee** to debate technically the proposal for the “*Modificació del Planejament de la Plaça de les Glòries i el seu entorn*”. According to the neighbourhood associations “there were three years of hard work and negotiations” where was decided how to draw the “*Modificació del Planejament de la Plaça de les Glòries i el seu entorn*”, reaching a consensus for this emblematic space of the city (Ajuntament de Barcelona, 2014a).

5.3.1. “Compromís per Glòries”: An agreement between the citizens and the city council

At 2007, simultaneously to the obligatory participative process of the general planning modification, there was a debate between the neighbourhood associations and the city council to discuss the future development of the square. After hard negotiation between the neighbourhood associations and Barcelona's City Council, they reach a consensus about how Les Glòries should be. The accorded proposals were recorded in the document “**Compromís per Glòries**” that was signed the 20th of March of 2007. The “**Compromís per Glòries**” is a political agreement between the neighbourhood associations and the city council also ratified by several political parties to make sure that the changes in political terms did not affect the project. According to the neighbourhood associations, this agreement was a good tool to push the city council to fulfil its compromise. For example, “*the previous city mayor wanted to change some parts of the project but thanks to the “Compromís per Glòries” this did not happen*” (Neighbourhood Associations).

This was never done before in the city

This type of compromise was the first time that was done in the city. The neighbourhood associations believe that the reason why politicians acceded to sing up the “**Compromís per Glòries**” was because Les Glòries was always a mediatic space of the city that affects four neighbourhoods of the city and was a way of obtaining votes for the elections. And that the politicians that signed up the “**Compromís per Glòries**” were not conscious enough of what they signed.

The “Compromís per Glòries” states how Les Glòries must be

The “**Compromís per Glòries**”, states the objectives and the project concretion (Ajuntament de Barcelona, 2017b). The car traffic will be underground recovering the space for the pedestrians were only the public transport will be able to circulate. By this way, it is intended to recover the maximum amount of public space to create a large green area, where around, it there will build public facilities such as a residence for the elderly, schools and a health care centre as well as public and private housing. It is most relevant aspects were the complete elimination of the road ring, a flat park without traffic and with the maximum green surface, the burial of the Gran Vía, an integrated model of mobility and the construction of public facilities and public housing (Ajuntament de Barcelona, 2007). This document specified in detail all the actions to carry out in a reasonable time of execution, the different time phases to execute them and their approximate cost. According to the “**Compromís per Glòries**”, all the works had to be finished in 2013 but are still in process, however, the neighbourhood associations were aware that this deadline would not be fulfilled.

The “Compromís per Glòries” a commitment for citizen participation

Moreover, the agreement states that neighbourhood associations will be engaged during all the planning process and will take part in the project design from the beginning (Ajuntament de Barcelona, 2007). In addition to incorporate specific participation processes, as well as a report that includes the actions carried out of all the projects that will be developed in Les Glòries (Ajuntament de Barcelona, 2007, p.6). According to the “**Compromís per Glòries**” any decision about the project has to be previously consulted with the citizen by participative processes. Once the participation process was finished, the neighbourhood associations together with the municipal technicians must need to be reunited frequently in the **Working Group** and with the municipal councillor in the **Monitoring Committee**.

The **Monitoring Committee** and the **Working Groups** have been meeting over the years and still meet in order to continue to work with the coordination and impulse of Les Glòries project. The **Working Groups** meetings were made every month and a half and when it's necessary, to talk about specific topics like housing, green, public facilities, mobility or environment (Ajuntament de Barcelona, 2014b). In this meeting, the municipal technicians explain to the neighbourhood associations its technical proposals that are discussed with them. Then, later on, the **Monitoring Committee** that is reunited every three months, to ensure the development of the project (Ajuntament de Barcelona, 2014b). Then, the members of the **Working Groups** together with politicians and municipal councillors can discuss these proposals. Meanwhile, the neighbourhood associations have had time to study the proposal and can better argue and discuss its point of view about the proposal and make alternatives. The final decisions were made by the city council but the citizens and the neighbourhood associations had the right to be consulted and to be able to express their opinions from the very beginning of the project. Participation has been made from the planning decisions as well as in the projects themselves, such as the park, the tunnels, the public facilities and housing. Although Les Glòries project is one of the longest in time, has always been done together with the neighbours. This project is a referent in the city because was the first big city project that has been closely monitored by its neighbours. According to the neighbourhood associations, the “**Compromís per Glòries**” was great to shield the project and ensure the execution of the agreed and ensure citizen participation during all the project processes.

5.3.2. The contest of Les Glòries square

The “**Compromís per Glòries**” set how the area of Les Glòries must be and which elements should have, but its distribution in the space was not clear. For this reason, Barcelona’s City Council organized, in September of 2013, the contest of Les Glòries square, called “**Concurs de Projectes Restringit per al Projecte Urbà de l’Espai Lliure de la Plaça de les Glòries Catalanes de la Ciutat de Barcelona**”. The terms and conditions of the contest were agreed and written by Barcelona’s City Council together with the neighbourhood associations.

Neighbourhood associations also members of the jury

Were presented 200 teams in the contest, those the technicians of Barcelona’s City Council selected 10 of them, according to their experience and merits. Then they have three months and 20.000€ each for creating their proposals and a model. The 10 proposals were presented anonymously during a three-day participatory Citizen Conferences “**Jornades Ciutadanes del Concurs de Projectes Restringit per al Projecte Urbà de l’Espai Lliure de la Plaça de les Glòries Catalanes de la Ciutat de Barcelona**”, organized by the City Council. During this Citizen Conferences, any citizen interested could see the proposals and said its ideas and concerns about the square, giving first-hand information to the design teams and made first-hand assessments. These comments were collected by the jury of the contest formed by its president Jaime Lerner Architect, urban planner, former president of the International Union of Architects and former mayor of Curitiba. “*It was sought that the president was not from Barcelona, in order to not be influenced and that was sensitive to the ideas of public space*” (City Council, *Management of Les Glòries project*). In addition, the jury was formed by 11 architects and 2 representatives of the neighbourhood associations. This is unusual, it was the first time that representatives of a neighbourhood association were part of the jury of a contest like that, who also helped to draft the rules of the contest.

The interviewees said that the proposals were very different, some very green, some very hard, and others half hard and half green. Some of the teams proposed to build in the middle of the square, violating the “**Compromís per Glòries**”, and some of the members of the jury were in favour of that, in order to fill the gaps of the square and densify the city. The neighbourhood associations state that not all the members of the jury were in favour of making a park in Les Glòries. But in the end, the winning proposal was the one that puts the green in the first place. “*The result of the contest would not have come out the same if they had not been to the court. Was good to include a member of the neighbourhood associations in the jury not only for the experience as a member of the neighbourhood associations but also as neighbours that could bring their reality as people who walk and use this space every day. Helping to understand the reality of this space to the architects who did not have this day-to-day perspective*” (Neighbourhood Associations).

The winning proposal was the one that provided the greatest green space being a park rather than a square

The winning proposal was the one called “**Canòpia Urbana**” made by the UTE from Agence Ter studio architects in collaboration with the landscape architect Ana Coello de Llobet. This proposal was the greener, the less monumental and the one more in accordance with the citizen’s needs, according to the neighbourhood association requirements. “**Canòpia Urbana**” design conceives Les Glòries as a green hub for Barcelona’s green corridor network following the “**Pla del Verd i de la Biodiversitat de Barcelona 2020**” creating a 130.000 m² park with a huge variety autochthonous species, incorporating the old water infrastructure of the Rec Comtal added to a public transport mobility hub that incorporates the connection of the city tram lines with the continuation of the Diagonal avenue just for pedestrians and cyclists and strengthening the public transport connections with the metro and bus lines. Also, placing public facilities and housing according to the “**Compromís per Glòries**”, although the execution of housing, public facilities and the tunnel is made by others.

The winning proposal “**Canòpia Urbana**” transforms the area of Les Glòries from a space called square, that never was because was totally car-based, to a pedestrian park that finally unifies the four neighbourhoods of the area. According to the interviewees, the winning proposal was the one that provided the greatest green space being a park rather than a square. “*There was discussion also among the architecture professionals and the municipal technicians if being a park would not create a barrier rather than being a square. At the end it is a park that is also very walkable and open, it is possible to cross it wherever it wants because there is no barrier, and the most delicate parts, where there is more activity such as the children's park and dogs and the “Gran Clariana” are closed at night*” (City Council, *Management of Les Glòries project*). According to the municipality, it is not very normal to make a park like that.

How a project could be a paradigm shift of Barcelona’s city model

“*Les Glòries was a city space that deserved to be built up once and for all*” (External actor, BCNecología). From the Cerdà’s plan, this space was a black hole that really made a great fragmentation in the city, which, moreover, was an unsafe and an unfeasible place. It was a time that Les Glòries became a permeable space at the pedestrian level that could be walkable without any infrastructure that would slow the passage, and becoming a space as the rest of the city. Car traffic generated a very heavy margination between the nearby neighbourhoods.

The park of Les Glòries has to be a claim for creating more green areas, in addition to unlocking all the projects of big green areas such as the Marina, the coastline project, or the one in La Sagrera. “In Barcelona, there should be more parks and green areas of large dimensions such as the “**Canópia Urbana**” of Les Glòries that is very necessary for the city and is the green that really impacts and makes the difference” (City Council, *Management of Barcelona’s urban green*). When Les Glòries Park and the works were finished and consolidated, Les Glòries will become one of the central points of Barcelona that will have its own character and more activity than it has now. The idea of Barcelona is that there are different points of activity, Les Glòries can be an interesting point of the city for decentralizing its activity.

Les Glòries will be an emblematic transformation and a reference not only of the green but also of sustainable mobility, in this sense, what was once an urban freeway now it is buried getting free space for citizens, as well as a meeting point and a place for leisure. “*Les Glòries project is an example of how a park could also be a superblock. Barcelona’s municipality has to succeed on less than 30 % of the Barcelona streets has to be for car traffic and the rest dedicated to making green streets*” (City Council, *Management of Les Glòries project*).

5.3.3. The final layout of Les Glòries Park

In 2017, of the “*PGM a la Plaça de les Glòries i el seu entorn*” was modified by the “*MPGM per a l’ordenació de la Plaça de les Glòries*” this was the modification of the general plan to adjust the new way of organizing the space that is now in force. This last modification incorporates the technical project of the “*Canòpia Urbana*” designed within the architects, the municipal technicians and the neighbourhood associations, also including the proposals and reflections done in the *Participative sessions on the Glòries Square project and its environment* during the years 2015 and 2016.



Figure 12. Park of Les Glòries design. (Ajuntament de Barcelona, 2018c)

This modification includes better integration of the 1.012 new households and new public facilities within or closer to the park, the update of the project and the reintroduction of the Rec Comtal. With regard to mobility, this project expects a car traffic reduction in the square burying the Gran Via and redirecting traffic to the surrounding streets. While a public transport interchange will be created with the new tram station that connects the existing tram lines, bus lines, the metro, and the bike lanes.

The park of Les Glòries

According to the “**MPGM per a l’ordenació de la Plaça de les Glòries**” project program and the City Council Les Glòries Park is going to be finished by 2025. The project of the park was divided into 4 phases due to the complexity of the whole project. The first phase was finished in March of this year and is already opened to the public. It consists of big grass esplanade called “Gran Clariana”, a playground area for children, a sports area, a park for dogs and the park guardhouse, as can be seen in **Figure 5**. The area of the top was not possible to do at this moment due to is a private property with different buildings, it has been agreed to preserve and rehabilitate the Súcre Factory and the Paraigües Factory to be public facilities and the Rec Comtal will pass through there. The owners will be expropriated in return for a new space in the nearby Castillejos Street. The area in the middle, that cars still cross, will be done when the tunnel works were completed and it becomes operational in the year 2021 according to the municipality. The top-down area was not made waiting for the tramway connection that was politically approved in January 2019.



Figure 13. First phase of Les Glòries Park. (Ajuntament de Barcelona, 2018d).

The first phase of the park was opened on the 6th of April. That contains biodiversity nodes, a sports area, a children's area, a huge grassland area called “Gran Clariana” and a park for dogs. It is a park not only for stays but also for activities and easy crossing. Apart from finally unify the four neighbourhoods of the area of Les Glòries, which further encourages mobility on foot and public transport.

“*In this park, the concepts of green infrastructure and ecosystem services are very present*” (External Actor, BCNecología). The architects really wanted to create a powerful thermal regulation area, with trees, the biodiversity areas and recreational areas also for social cohesion and leisure. Moreover the “Rec Comtal” an old blue infrastructure is also recovered for climate regulation. The more vegetation more water consumption is required. Although the vegetation is adapted to the Mediterranean climate at the end it is also necessary to have certain water irrigation. “*The park’s project is linked to sustainability, the treatment of rainwater and the native vegetation species, creating pleasant spaces*” (External Actor, ICTA UAB). Now there is one phase of the park but when all the phases of the park will be finished the green will be extended to all sides of Les Glòries.

However, this project could also entail negative impacts if citizens and the city council do not make proper management of this space. The good maintenance of the park and avoid vandalism would be essential for keeping the park of Les Glòries as it is now. As being the second biggest green area in the city, the use of Les Glòries Park will be so intense no just for the residents of the area and Barcelona's citizens also could be a tourist attraction due to is next to the Agbar tower and is near to Sagrada Família. In addition, in Les Glòries there are a lot of hotels, so could be potentially affected by touristification, the reason why it is important to regulate tourism in the city.

Although Les Glòries will become a big green space, it is not enough for what is required in the city. *"Now, with the first phase of the park completed, it can be seen a green area with lots of potential but at the moment there is no any housing and just a public facility build so when the project of Les Glòries will be finished al all there will be more green in Les Glòries but also will be more buildings so the space will be a bit reduced as it is now"* (Neighbourhood Associations).

Another point of the "**Compromís per Glòries**" that was not achieved yet is that the Les Glòries Park must have an environmental measurement unit in order to measure the levels of atmospheric pollution. This system will allow informing the citizens if the levels of pollution established by WHO are being met or not.

Affordable housing in Les Glòries

Apart from air pollution, affordable housing is another of the most important issues that need to be solved in Barcelona. The prices of housing were highly increased in the last three years producing a process of gentrification spread in the whole city. The neighbours of Les Glòries are worried about if the urbanization of Les Glòries will rise the housing prices of the area. For that reason, both the city council and the neighbourhood associations take chance on public rental housing. According to all the interviewees, building public housing is the way that the city council has to stop this possible speculative real estate effect. Inevitably, a space that was once an urban freeway, which becomes a green space with public facilities and services around, obviously will attract real estate speculation and will surely have an impact on the real estate market.

The "**Compromís per Glòries**" states that at least 50 % of the dwellings that will be built as a result of the urbanization of Les Glòries must have some type of protection, but this is not happening. Neighbourhood associations emphasize that there have been certain irregularities in the residential buildings that are wanted to be built in the area of Les Glòries. There was made the first housing contest Illa glories, where the rent of the apartment will be according to the income, but this is not happening as it is was agreed with the city council. The municipality said that is not fulfilling the terms agreed because it is necessary to expropriate some private property to make the north part of Les Glòries Park. The city council agreed with the owners to give them another space close to Les Glòries that was previously for affordable housing.

The challenge of the city council, as in the other urban areas of the city that have been redeveloped recently, must try to curb this speculation. *"In Barcelona, there is only 2 % of public housing due to Barcelona's City Council has made a bad policy of public land, given public land to private developers as payment of the infrastructures that were made, mostly during the Olympic games. At that time the municipality pays less but now the citizens are suffering the consequences"* (City Council, Management of Les Glòries project). The City Council of Barcelona is a pioneer in trying to control this speculative process by applying recently a new regulation in which 30 % of new homes will have to be sheltered housing. But this is not enough, it is also needed a price regulation of housing at the state level.

The tunnel of Les Glòries

The “**Compromís per Glòries**” “was a double-edged sword. On the one hand, the citizens associations were lucky of sign up this compromise to oblige to the city council to keep their promise and do not change the project, but on the other hand, it is very inflexible because what has agreed 12 years ago now would not be the same” (City Council, Management of *Les Glòries* project). The tunnel is an example of that. Mobility has changed a lot in the past years. When the “**Compromís per Glòries**” was signed, the private car mobility was a priority so with the tunnels the cars will still enter to the city but underground, also favouring car traffic, remaining the pollution and all the issues related to the car.

In this mandate the construction of the tunnel was questioned, the city council proposes to the citizens associations to make the tunnel section just in *Les Glòries* and the rest in the surface, by that way, the car traffic will be slowed down with the traffic light but conversely, there will be a part of the area that remains separated by the car traffic. The perfect solution cannot always be achieved, the Gran Via is a through traffic way that at the moment is not possible to cut it. The tunnel will end up in the Poblenou Promenade transforming all the area to a superblock mainly for pedestrians. The citizens associations propose that one of the three lanes of each direction of the Gran Via tunnel should be only for intercity buses to enhance public transport and reduce the car traffic.

According to the municipality, the tunnel of *Les Glòries* is one of the most expensive and complex works that have been done in Barcelona. Is frustrating that a city that is trying to reduce the car, at the same time, is doing a huge infrastructure related to the car traffic. But was the only way to obtain the second biggest green area in the inner city that once and of all unifies the neighbourhoods of the area. This fact shows that is necessary a change on mobility, to drastically reduce the number of cars that circulate not only for *Les Glòries* but also those that circulate around Barcelona.

Public Facilities of *Les Glòries*

About the public facilities that *Les Glòries* would have according to the “**Compromís per Glòries**”, all the public facilities at city level like the Encants market, the museum of the design and the Agbar tower were made, but just one public facility a district level was made, a kitten garden. The rest of the public facilities at the district level such as a residence for the elderly and two health care centres were not done yet. The city council said that “*the project is made but there is not enough money to do it due to the high costs of the tunnel*” (City Council, Management of *Les Glòries* project). Conversely, the neighbourhood association argue that “*if the public facilities at the city level, those have more costs were made, why not about the ones at district level those are less expensive and more necessary for the citizens*” (Neighbourhood Associations).

5.3.4. General satisfaction with the participatory processes

In general, there is satisfaction with the fulfilment of the “**Compromís per Glòries**” but there are things that need to be improved. With participation, the project took more time but in the long run, it is more stable. “*People make the project if it was their own, then it is something that people invested their time and expectations. And if they see that someone is destroying they will do something about it*” (City Council, Management of Les Glòries project). “*If the projects are only made from one point of view, they do not work, this is the reason why it is necessary for being carried out the projects with participatory processes*” (External Actor, BCNecologia). The people that participates on citizen participation processes must need to be open on understanding difficulties, seeing future challenges, accepting changes, changing things and not looking at projects from a point of view anchored in the past.

The projects like Les Glòries that last so long in time are even more complex because there is an evolution of both, the technician for managing the evolution of the project, and the citizen to understand this process. The citizen, when are in a group of citizen participation, must park the individual problems to go to the collective level for the benefit the citizenship for making participation work. “*Citizens also have to understand that municipal technicians are also people, and sometimes neighbourhood associations do not see them that way. It is necessary to work more on mutual empathy*” (City Council, Management of Les Glòries project). The technicians must understand more the requests of the neighbourhood associations that usually are more from the point of view of the use, of the function, while the neighbourhood associations had to understand that there are legal, technical, temporary and economic limits that condition the projects.

If neighbourhood associations are well informed, the understanding with technicians is improved and better proposals were produced. For this reason, the City Council of Barcelona has paid a technician chosen by the neighbourhood associations to advise and help them to interpret the plans and understand better proposals of Les Glòries projects. Sometimes the technicians speak in technical language and the citizens do not understand them, the technicians have to make an effort so that the citizens understand them.

“*The majority of the representatives of the neighbourhood associations are old retired men*” (City Council, Management of Les Glòries project). That is why the city council has carried out other participatory processes with schools and sometimes a company has been hired to carry out more thematic participatory processes just for women or for the elderly. From the neighbourhood associations, “*this is seen as a way to spend public funds*” (Neighbourhood Associations). It is difficult for all sectors of society to be represented in a participatory process. It is necessary to make participation more attractive to citizens.

It is very difficult that everyone is been informed because sometimes people do not matter. Although citizens delegates to neighbourhood associations since they have more power than a neighbour and have a more direct communication channel with the administration, it is also people's responsibility for been informed and be aware of what is happening in the process. “*For promoting a more active and participatory society it is necessary a change of peoples attitude, as citizens, they have to stop complaining and stay and participate in this type of processes*” (External Actor, BCNecologia). It's true that not everyone has time to participate but an effort must be made to get people involved in the decisions of their city.

5.3.5. The citizens' perceptions: Surveys Analyses

After the analysis of the three surveys, there are no significant changes in the survey questionnaire, so it is possible to draw general conclusions from the three of them. Also, the answers of the three surveys were quite similar, verifying that there are no significant changes in neighbours opinions over the years.

In general, the citizens surveyed agree that the neighbourhood has improved and it will be better in the future. The citizen's claim that the works will finish soon, the housing gets worst, the neighbourhood security and the public facilities were maintained while the public transport and the commercial activities were improved. The citizens go to Les Glòries mostly in its leisure time for shopping or going to the parks. There are good public transport facilities, the reason why is the transportation mode mostly used by the citizens, but this has to be improved with new bus lines and more affluence of busses. The majority of the citizens agree that tourism has to be further developed in the area.

About Les Glòries urban project, citizens think that the main challenges will be on road traffic. This is the issue that generates more contradictory opinions, one part of the population states that this project will not solve the road traffic meanwhile there is another part of the population that states the opposite. Citizens manly agree that the project will create more public space for the people and will increase the urban green. However, there is big uncertainty about the improvements or non-improvements provided by this project.

The citizens agree that the urbanization of Les Glòries will be beneficial due to the creation of a huge park, a better connection between neighbourhoods and the reduction on pollution, but they are not concern about the new neighbourhood facilities and housing that are going to be built.

Table 2. In relation to the following aspects, what will be the main benefits of the project of Les Glòries?

	2016	2017	2018
Urban park of large dimensions	67.8 %	60.6 %	73.6 %
Improvement of the connection between Neighbourhoods	46.4 %	44.6 %	49.4 %
Neighbourhood facilities availability	30.1 %	28.4 %	36 %
Noise Reduction	35.2 %	40.1 %	45.2 %
New housing and neighbours	19.7 %	20.3 %	25.4 %
Others	0.4 %	0.6 %	0.1 %
Any	3 %	4.6 %	0.4 %
Does not know	0.1 %	0.1 %	4 %

Results: Number of respondents who have answered each option by dividing among the total number of respondents to whom the question has been formulated, in %. (Oficina Municipal de Dades 2016, 2017, 2018).

The majority of the surveyed citizens manly agree that the project will improve the connection between the neighbourhoods, the environmental conditions, the social relations and the

commercial activities, but they don't see clearly that the project will decentralize the touristic offer of the city.

Table 3. Which would be the impact of Les Glòries project?

	2016	2017	2018
Will promote environmental improvements	71.6 %	71.6 %	80.4 %
Will improve the connexion between near areas	80.9 %	78.1 %	83.1 %
Will promote social improvements	68.8 %	63.9 %	71.6 %
Will contribute economic activities	67.6 %	64.8 %	67.6 %
Will decentralize the tourist offer of the city	46.3 %	46.4 %	50.1 %

Results: Number of respondents who have answered each option by dividing among the total number of respondents to whom the question has been formulated, in %. (Oficina Municipal de Dades 2016, 2017, 2018).

The majority of the people surveyed, look to the internet or ask the citizens information office in order to obtain information about the project rather than get information from the neighbourhood associations. This fact shows the lack of connection between the neighbours and their representatives, the neighbourhood associations, those are the most implied in the project.

The answers to this survey reveal that citizens are just worried about the present, not having long term vision. Respondents positively value the increase in green areas but are not aware of the positive benefits that green infrastructure could do for reducing pollution or improving its life quality.

6. Discussion of results

In this chapter, the findings of this thesis are going to be discussed regarding the theory chapter.

6.1. Barcelona's GI policies and plans for a more sustainable urban city model

In spite of all its limitations due to its high population density and compactness, Barcelona is becoming a benchmark of city renaturalization at state and European level, demonstrating that a compact city can also have good quality green spaces and functional green infrastructure.

The “*Pla del Verd i de la Biodiversitat de Barcelona 2020*” has been an innovative and baseline strategy that allowed the development of measures to increase the green in the city. It is true that this plan has some deficiencies but the experience obtained in this first edition will be useful for not causing the same mistakes than in the past and draft the new plan with all the departments of the municipality and other public administrations. Also, more economic and personal resources are needed for the deployment of actions and wider dissemination of the results obtained. It is necessary to learn from the mistakes and keep innovating.

Not because there is greener in the city there are reasons to continue polluting as before, the benefits of increasing green in the city are very positive but they must be accompanied by changes in habits, especially in mobility (Rueda, 2018). The case of Barcelona is a clear example of how society has sacrificed a certain life quality provided by the green, in exchange for being able to use the car to go everywhere. For this purpose, green infrastructure is being used in Barcelona as a strategic planning tool to reduce private vehicle traffic and to increase the available green space per resident (European Environmental Agency (EEA), 2011). The most relevant projects carried out by the Barcelona city council to increase the green, as well as, removing space for cars are the Superblocks and Green Corridors. By this way, the public space used by the car is recovered for the benefit of citizens and biodiversity, in addition to a more sustainable Barcelona with more green and less pollution.

The concept of Superblocks entails a paradigm shift in Barcelona's city model (Rueda, 2018) removing space of the cars for a more sustainable transportation mode, especially for pedestrians, bikes and public transport. If superblocks were deployed in the whole city it would be a real change in the city. The problems are the constraints from the car lobby and the objections of some citizens that want to go by car everywhere. The actual change on Barcelona's the city model to make the city greener, freer of cars and healthier it is encountering the refusal of the people who demand more car-based mobility. Society as a whole only gives importance to things when those are translated at economic values or if it can directly affect them.

6.2. Green infrastructure as an infrastructure of the city

The green infrastructure allows humans to create spaces for recreation as well as for biodiversity enrichment and climate change adaptation. The green proportionate greater permeability to the city, capturing water for the vegetation and decreasing the risk of flooding, for climate regulation (Wang, 2016), reducing pollution and increasing biodiversity, a place to stay that favours social relations, as well as benefits of physical activity (Mueller et al., 2016), reduction of stress, better cognitive level of the children as many more health benefits.

The increase in green also affects local biodiversity, the introduction of more quantity and variety of autochthonous species improves the quality and relationships of the city's ecosystem. These plant and animal species are introduced by humans, and the good balance between all three will provide a good state of health for this habitat. Obviously, the effect of urban green will not be the same, nor does it seek to have the same effect that a green corridor in a natural system, but thinking at ecosystem level this vegetation has a very important role for allowing humans to live in the cities. In addition to the ecological, social and public health benefits, the implementation of green infrastructure will favour better city connectivity, sustainable mobility, local food production, circular economy or diminishing house energy consumption such as many other benefits that will enhance the reduction of greenhouse gas emissions for climate change mitigation (European Commission (EU), 2016).

Due to the important benefits that green infrastructure could provide to the city. I suggest that green infrastructure can become an infrastructure of the city, such as lighting, streets or sewers, because after all the green infrastructure performs a service and this requires conditions, dimensions and space. The difference is that the green infrastructure is constituted by living beings and therefore not only it has to be dimensioned and calculated but also must be taken with more care. Green infrastructure has to be driven, maintained and preserved, in addition to requiring tracking its link with biodiversity.

To avoid gentrification and green gentrification in Barcelona the city council must build more public housing and create green urban areas in all the city according to environmental justice and equity criteria greening the city (BCNUEJ, 2019), in compliance with the citizen's needs. The fact that this gentrifies or not, will be based on the planning and management criteria that will be made of this space. Therefore the risk is not the fact of increasing the green, if not the criteria that are behind it (Anguelovski et al., 2017). There must be a certain balance and a justification that the spaces are really planned and dimensioned according to the needs of each place, in harmony with the population that inhabits it, and with the uses of the place rather than been planned for economy speculation.

6.3. The benefits of citizen participation in green infrastructure planning

The present green infrastructure strategies, policies should engage more the citizens and doing the new uploads of this municipal planning together with citizen participation will be a way to do it. It is true that an expert has more knowledge about the green than a current citizen, but I think that enhancing citizens on managing the green will be a good chance to increase the citizen's interest about it, favouring the implementation of the measures to increase the green in the city. A huge effort on citizen information will slow down the citizen rejection to the projects for increasing the green in the city. The citizens are also part of the city and these measures are going to improve their life quality they also should be involved in it. Other associations related to the green should have more voice and also make an effort for doing information campaigns and workshops about the green. The citizens also have to make an effort to get information about the green, if there is real interest, it is easy to find information about the green.

If the projects are only made from one point of view, they do not work, this is the reason why it is necessary for being carried out the projects with participatory processes (Arnstein, 1969). Citizen participation must be open to understanding difficulties, seeing future challenges, accepting changes, changing things and not looking at projects from a point of view anchored in the past. There is nothing better than the collaboration of the users and that they feel the space as their own that defends that it stays and continues with its function (Godschalk, 1971). Not messing it up is everyone's business.

Results show that both neighbourhood associations and city council technicians have very similar views even though they do not realize it (both say that green is to be increased, reducing pollution through a significant decrease in private car traffic, increase in public housing). While citizens have a vision farther from the two because of lack of interest. All in all, there are too many times that there is a confrontation between the technicians and the neighbourhood associations and this is never good to come to a conclusion. It is necessary to listen to each other more.

Neighbourhood associations push as far as they can and the technicians would like the process were faster than they are. It is necessary to go for greater bureaucracy agility and faster modification of the legislation, those are the main barriers for the implantation of these new measures like the citizen participation or the co-management of the green.

Some technicians distrust citizen participation in some cases. For technicians, sometimes the processes of citizen participation are also harsh because it must be combined with all the other tasks they perform. Technicians are poorly prepared to handle participatory processes, they need support in terms of how to better disseminate and transmit information to the public (Fagence, 1977), how to listen better and how to include better the citizens in these participative processes. It is also true that citizens have to make a greater effort and have a greater interest in being informed of what is happening in their environment. Increased knowledge, effort and empathy, both on the part of citizens and by administration technicians, which is very beneficial for participatory processes, in which more concrete, realistic and applicable proposals can be reached (Godschalk, 1971).

It is recommended that the citizens involved in the participatory processes were being informed in advance and, if required, have advisors to make it easier to understand and assimilate the information received. On the other hand, they do not have to see the city council as someone to fight with, if not as someone who can provide a closer and more realistic vision of the space or project in the discussion. The technicians must leave their comfort area for being more open to the coherent proposals of citizens, whenever it is viable and feasible to include them.

Discussing and arguing things is always weaker and requires more time, but on the contrary, it allows for a more exhaustive analysis of the situation and the generation of more specific, adequate and lasting proposals over time. A participatory process is a process of continuous learning between the three parts, the citizens, the neighbourhood associations and the city council.

7. Conclusions

Before examining the Barcelona's green infrastructure municipal policies and plans it has been concluded that these policies have been a step forward in order to increase the green in the city. They are innovative measures at the city level that have laid the foundations for a renaturalization process in which all aspects related to green are involved. In order for these policies and plans to be more effective, the city council must make a more important effort to inform and involve more citizens in the care and planning of urban green areas and the green infrastructure of the city.

The city council of Barcelona have many ways for increasing the green in the city, but removing public space occupied by the cars by doing Superblocks and Green Corridors will be the best option that the municipality has to considerable increase in the ratio of green in the city per inhabitant, in addition, to reducing car traffic and its consequent pollution. The majority of Barcelona's dwellers are not conscious enough about the issues of living in a highly compact city with scarce green spaces and mostly dominated by the car, maybe, because they sacrifice its welfare in exchange of the comfort of going by car to any place they want although there are other alternatives. Consequently, in most cases, these people are against Superblocks and Green Corridors

Projects like the one in Les Glòries are a good example to show to these people the benefits that green infrastructure could provide to them and to the city, as well as, how removing space for the cars could allow the unification of the city, the creation of needed public facilities and social cohesion as many other. The project of Les Glòries park has to be an example that in Barcelona is still possible to make parks of big dimensions and this should be used as a reference for the people to claiming for creating more green areas, in addition to unlocking all the projects of big green areas like the one in La Sagrera that are still to be done in the city of Barcelona.

Regarding citizen participation in Barcelona's green infrastructure planning, the results have shown that in Barcelona citizen participation does not occur at policy and planning level but happens at the local planning level and in specific projects such as the Superblocks project or the case of study of this thesis, the project of Les Glòries urban transformation.

Barcelona has a long history of social urban movements, although, citizen participation was not usual, and few processes that had been done so far were more to inform the citizen rather than to listen to their ideas and incorporate them into urban planning. So Barcelona's dwellers are not familiar and are not used to citizen participation processes. Until the last four years, when Barcelona's City Council enhanced citizen participation in planning.

Citizen participation must be in all stages of urban planning, but above all, in plans and projects that will entail a major urban transformation of the city. Citizens must participate in planning and design processes from the beginning in order to have a feeling of belonging. Citizen participation has to be partnership between city council technicians and citizens who were both open to work together and to properly discuss the proposals and reach an agreement. So, citizen participation in planning must be a co-creation process among the different actors involved. However, in many cases, it is necessary for citizens to be informed in advance or having an external support for having a good planning comprehension for discussing the proposals with the experts, otherwise participation might be very poor. In addition, it is necessary to take into account that citizen participation is a complicated process since everyone must have to be aware of it and all interest must be involved. It is a complicated process but clearly, participation must be encouraged.

The citizen participation process like the one in Les Glòries never was done before in the city. The “*Comprimís per Glòries*” was an example that a big and main project in the city can be carried out with citizen participation among neighbourhood associations and the city council. This is a way for the people of being more identified with its environment and make them more engaged with the project. In addition, a project carried out with citizen participation is a more durable project over time. However, the participation processes done until now in Barcelona must need to be improved for including all the perspectives of the society, like woman, man, children, elderly, disabled and much more. The participation process is better when all types of actors intervene.

Further research will be necessary for following the future processes of green infrastructure implementation in the city of Barcelona and for following the next phases of Les Glòries Park and the other projects of the area like the tunnel of les Glòries, the unification of the tramlines in Les Glòries and the building of public facilities and public housing. Once the project of Les Glòries urban transformation will be finally finished, as well as, Barcelona's city council will improve the indicator and create the Map of the Green Infrastructure of Barcelona. Would be nice to use these tools for calculating the benefits that the green infrastructure of this park will proportionate to Barcelona's dwellers and for the ecosystem of the city

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Appendices

Questionnaire of the interviews

0. Introduce yourself and explain the link between your institution and the urban green? And/or with Les Glories

About the green:

1. What is the situation of Barcelona's urban green?

- What are the problems and challenges?
- What are the benefits of greening the city? (Climate Plan for the year 2030 to increase 1.6 km² of green in the city)
- What are the negative effects of GI implantation? (Speculation / Gentrification)?
- Green infrastructure is the solution to face the challenges of climate change?

2. Evaluation of policies and plans about the green.

- What mechanisms/strategies are available to address these problems? Brief description of the policies about the green in Barcelona
- Do you think that institutions like (UUNN, EU, Spanish State, Generalitat de Catalunya) have influenced the development of these mechanisms/strategies/ policies?
- What is the awareness of the people and citizen participation in the development of these strategies and policies of naturalization of the city? Are enough information campaigns done? Do you think they have been effective?
- Monitoring of these policies and plans. For example, in the Program for the promotion of Green Infrastructure and the Climate Plan, are there monitoring indicators? In what state of creation/development are they?
- Expectations of the execution of the objectives of these policies and plans? (Is there a lot of difference between the role and practice?) Lack of precision in implantation?

3. Assessment of green planning.

- Have there been changes in green planning in recent years?
- Do you think that green planning has become an essential part of city planning? IV as a basic infrastructure of the new urbanism of BCN, such as lighting, mobility?
- Which are the strengths and weaknesses? (More systematic or structural vision?)

4. How citizens participate in the city green planning? Who participates, how does it participate and in what moments (design, co-creation, information)? How do you value this participation?

- Participation in policy and planning
- How it is possible to improve citizen participation?

More specifically about Les Glòries:

5. A brief explanation of the project (focus on the park) and Chronology of the participative processes. Level of participation (who has participated / in what moments).

- Contribution of citizen participation to this planning?
- The repercussion of the “Compromís per Glòries”
- What could be improved from the planning process in relation to citizen participation?
Proposals to improve and involve more citizens and participatory processes

6. Evaluation of the project (Benefits / urban impacts / mobility / social / deficiencies / conflicts) and Evaluation of the process (Design / execution / conflicts)

- Are you satisfied with the project? Are the agreed proposals fulfilled?
- Positive and negative impacts of the project (Economic, tourist, gentrification ...)
- Level of citizen information about the project. Suggestions for improvement
- Do you consider that there has been an active involvement of citizens?

7. How do you imagine the Glories in 10 years (Do you think these will be the final works?). I Barcelona? City model display. (Car, change of habits?) Do you imagine Les Glories as the new centre of the city, as Cerdà planned?

The answers of the interviews were recorded in an mp3 file and were transcribed in a document file.

These are in Catalan and Spanish, if someone is interested to get this information do not hesitate to contact me by the following mail: ariadna.baro@gmail.com