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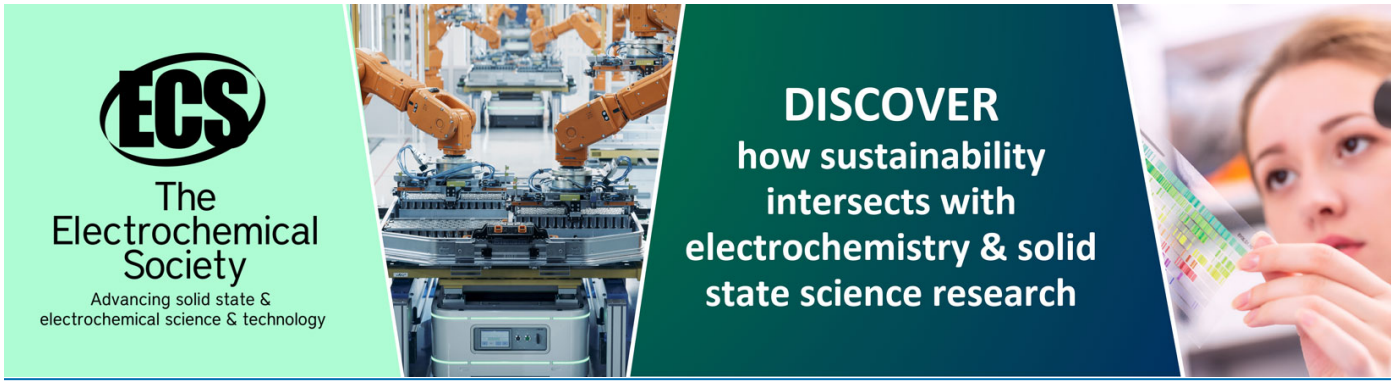

The fourth generation of urban projects to tackle climate change: a typological proposal

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Abstract. Climate change is the major challenge of our humanity and the relationship between climate change and cities has received increasing scholarly attention from governance, urban planning and infrastructure perspectives. However, the scale of the urban project, understood as the operationalization of climate change actions, has been neglected. The current three generations of urban projects are revisited (modern city, morphologic articulation, large urban projects) and a fourth-generation within the context of climate change is identified as missing; it combines adaptation and mitigation strategies for urban projects. While adaptation strategies are oriented to minimizing the negative impact of climate change on rising sea-levels, floods and rivers' changes through green and blue infrastructures, mitigation strategies are twofold: one oriented to minimizing CO2 gas emissions and the other to reducing the risks of deterioration of natural systems due to human intervention or natural causes. Integrating the four generations, a typology of a 2x2 matrix of urban projects is drawn up. The four quadrants of types of urban projects are explained and accompanied by examples. Potential and desirable shifts between the quadrants are discussed to understand how changes are needed to advance to develop this new generation of urban projects. The paper contributes to expanding our understanding of urban projects in the context of climate change with heuristics purposes for researchers, practitioners and academia, and to prepare public policy makers to encourage the debate of climate change actions of adaptation and mitigation that should be materialized on an urban project scale. Future research may empirically test the typology in different contexts of development.

1. Introduction

The Paris Agreement, adopted in 2015 by most of the Parties (COP21), marks out climate change goals through limiting global warming to well below 2 degrees, preferably to 1.5 degrees Celsius [1]. Cities are acknowledged as responsible for the emissions of 71 to 76% of anthropogenic greenhouse gas (GHG) emissions and concentrate between 67 to 76% of total energy demand [2, 3] The most recent projections of the United Nations show a growing proportion of the world population living in urban areas that is estimated to reach 60% by 2030 and 68% by 2050, and was at 55.3% in 2018 [4]. In this scenario, human activities are contributing to global warming and cities are both accountable and likely to be called on to tackle this global "Grand Challenge" [5]. As the scope of climate change is so vast and has a long-term impact for future generations, it is necessary to reach an operational level of concrete actions at the urban development level for all possible scales of intervention in cities.

Prior research on climate change and cities is based upon scientific evidence on global statistics about urban population growth, cities' size, temperatures, sea levels, risks of floods, and greenhouse gas emissions (GHG). Special attention has been given to the research that investigates the vulnerability of cities and their capacities to adapt to climate change, however, the approaches are usually global at the scale of cities, territories or countries. In this line, rapid progress has been made in measuring these vulnerabilities through multi-risk models that support public policies and decisions [6–10]. Thus, the scale of the analysis is mainly on macro, territorial or sectorial, institutional or governance planning levels while the scale of the more specific site or projects has been neglected.

According to the scales of urban projects, that is the operationalization of actions at an urban scale, in their daily routine practitioners apply territorial, city and place scales. Furthermore, over time, three generations of urban projects are identified for the 1960s, 1970s and 1980s [11]. However, these generations respond to historical realities that have been surpassed by the current global challenge of climate change. On the other hand, linking climate change strategies and urban projects in the scales of territory, city and neighbourhood is still unexplored.

In the light of the new reality and time pressure, the article provides a framework that integrates urban projects as usual and a new generation of urban projects for climate change. We explore the main strategies for climate change through urban projects, which are mitigation and adaptation actions, creating a typology, a 2x2 matrix of urban projects to guide researchers, practitioners, and academia in understanding the operative urban level of intervention to deal with climate change.

Why is it desirable to expand the generations or urban projects and create a typology of urban projects? First, the proposal provides an overview of broad historical understanding of urban projects that update prior frameworks. Second, it is useful for understanding the complexity of climate change actions at an urban scale for assessment purposes. The framework explicates the range of urban projects alternatives and their linkages, especially towards absorbing mitigation into adaptation for climate change. Third, the typology enables the allocation of resources based upon the level of impact of urban projects on climate change.

The article's structure is as follows. After the introduction, in a second section a literature review on urban projects as usual is synthesized to then advance in the new context of climate change and urban projects through the strategies of mitigation and adaptation. The third section provides the theoretical typology of urban project called fourth generation and the final section presents the main conclusions.

2. Literature review

2.1. Urban project: from a crisis to generations

According to several scholars, the urban project concept is not a recent invention [12, 13] and various positions coexist regarding the milestones or phases of its development, de Solà-Morales and Portas being influential theorists.

De Solà-Morales identifies the urban project as an intervention tool to project the modern city inspired by the classic themes of civil architecture that at the end of the 20th century evolved into urban center projects. Originally influenced by Scandinavian contributions, the urban center adopts the character of an outstanding specific project through civil architecture and monuments. Advancing in its development, de Solà-Morales warns that from the International Congress of Modern Architecture (CIAM) of 1929 and the successive ones until 1935, the discussion of the scale of analysis (housing, neighbourhood, city as a whole and even region) evidences opposing visions of how to methodologically approach the projection of the city, originating the fragmentation between an architectural and urban vision of the city that exists today [14]. The modern character of the urban project is specified through three significant contributions: a) the organic approach of the city of Van Eesteren who promotes the

vision of the urban body in resistance to the position of Le Corbusier, b) the rationalist approach of Martin who tries to reconcile the modern message with the cultural and social environment and c) the classical Mediterranean cultural tradition of Quaroni who tries to reconcile the city and architecture.

Instead, Portas proposes a temporal categorization of urban projects insofar as they have passed through three generations [11]. A first generation emerged in the 1960s whose objective was to reflect the modern city on large scale through unitary architectural projects. The second generation coincides with the oil crisis of the '70s where the intervention is redirected to a smaller scale in the already existing fabric of the city, favouring the typology, language, collective space under a delimiting morphological articulation, once again giving prominence to the architect (eg Aldo Rossi, De Carlo, Solà-Morales, Bohigas, Portzamparc, Ungers, Siza and the general model IBA Berlin - International Building Exhibition Berlin) and promoting collective public spaces such as squares, corners or parks. Also, in the decade in the 1980s, progress is made towards urban projects that share innovation approaches and solutions that integrate mobility systems as a formalizing instrument, proposals for new factories and industrial buildings or the new transformation of urban spaces (e.g. the urban renewal of Barcelona for the Olympics 1992). Finally, unlike the first two generations, the third emphasizes the programme that responds to development opportunities and execution processes and works under a new planning context. Furthermore, this generation is characterized by a larger scale of intervention, called “large urban projects”, associated with strategic planning and a new centrality that are exported from Europe to Latin America. Discussions on the evolution and empirical applications in Latin American and international cases that broaden the view of the generations of urban projects can be found in Etulian & Biffis [13], Szajnberg & Luna [15] y Padilla-Llano [16], without omitting the “urban acupuncture” approach by Jaime Lerner [17] that is outlined below.

Both in Europe and Latin America, faced with the scarcity of resources as a consequence of the crisis of the 70s, the architect and mayor of Curitiba, Jaime Lerner, proposes to tackle the problem of the city through the logic of "urban acupuncture", proposing public facilities in interstitial spaces and urban mobility through more efficient public transport that discourages the use of private vehicles. This logic is incorporated into the thinking of de Solà-Morales who gives greater importance to the scale of intervention of the urban project over the size of the operation.

Although some researchers emphasize that around the urban project there is some confusion in terms of temporality and scale of intervention of the city [18], a definition of urban project widely spread among urban planners such as Joan Busquets, Miguel Domingo, Antonio Font and José Luis Gómez [19] among others, is expressed by Manuel de Solà-Morales:

> “Urban Project is to start from the geography of the given city, from its requests and suggestions, and to introduce with the architecture, elements of language that shape the place. Urban Project is to rely more on the complexity of the work to be done than on the rational simplification of the urban structure. It is also to work inductively, generalizing the particular, the strategic, the local, the generative and the model” [14].

Finally, de Solà-Morales also defined five constitutive elements of urban projects: these a) represent interventions at the territorial scale level that impact beyond their own limits; b) involve multi-functional projects where users, objectives, time rhythms coexist, and also perceptual orientations from the visual; c) they are a response that operates at an intermediate scale but can be implemented in a short time horizon; d) they express an intentionality in institutional planning in terms of offering an architecture for the city with an ordering purpose; and e) they are financed with public funds and contain collective uses of the programme, in this way "projecting the place is (...) the main method (...) of Urban Projects" [14].

2.2. Strategies for climate change: mitigation and adaptation

Mitigation and adaptation are the two major strategies cities have used to combat climate change. There are two types of mitigation strategies: one focuses on reducing GHG and is primarily focused on waste disposal schemes, renewable energy generation, and public transportation on a city scale; the other is a risk mitigation approach as the result of natural system degradation due to human intervention (anthropic) or for natural origins. Adaptation plans, on the other hand, are focusing on improving green and blue infrastructure to mitigate the detrimental effects of climate change on rising sea levels, floods, and river changes.

Separate analysis dominates the literature [20–25], despite the fact that the concept that both are "sides of the same coin" has gained traction in recent years, particularly after the Paris Agreement [1].

This compartmentalization has manifested itself not only in terms of the global agenda [26] but also in the agenda of developing countries influenced by a marked stimulus towards mitigation translated into resource allocation [22] and a lower level of development of adaptation plans [27]. This would be the product of the disputed effectiveness of decades of negotiations on GHG emissions, which further stress future adaptation. If GHG emissions are not able to be reduced to meet global warming goals (foreseen according to the Paris Agreement of 2015), adaptation efforts will be associated with greater uncertainty, costs and challenges [27–29].

On the other hand, although mitigation and adaptation are deliberate responses to face climate change, they offer differences that are related to their objectives, time to reap their benefits, implementation scales, sectors involved, the degree of dependency on economic reality, built environments, policy development and level of governance [20, 22, 30]. Also, at the planning level, it is observed that the mitigation and adaptation integration process shifted from a national-level analysis [23, 31, 32] to a more local one in the early 2000s [33]. However, that the real experiences of mitigation actions could well precede the formality of the climate action plans, these being a general framework [34]. Additionally, the exploration of the interactive link between mitigation and adaptation has advanced in terms of identifying various forms of relationships such as co-benefit, synergy, conflict and exchange [22, 35]. Although in the literature, authors tend to confuse the interrelationships of co-benefits and synergies, they show singularities [31]. Indeed, co-benefit or mutual benefit “is the more common term and is defined as an additional positive adaptation (mitigation) effect that can be achieved from a planning and/or policy measure aimed at improving mitigation (adaptation)” [29]. Instead, synergy occurs when the interaction between mitigation and adaptation actions generates superior benefits compared to if they had been executed in isolation [35].

Despite the incipient research that addresses the interactions between mitigation and adaptation, it is found that applied research mainly considers the reality of Europe, North America and Oceania and limited case studies in southern countries [36, 37]. Likewise, the views in these studies are focused on a macro or territorial, sectoral, institutional or governance planning level, while the scale of the more specific place or projects is usually neglected.

3. Theoretical proposal: typology of urban projects for climate change

Considering the relationship between cities and climate change scenario, strategies of mitigation and adaptation and the current development of urban projects, the Portas’ [11] urban project generations are expanded by adding a fourth generation. Based upon Perez-Lancellotti & Ziede (2020), we introduced a more sophisticated framework, depicted in Figure 1. The fourth generation’s main features are its orientation to tackle climate change through both strategies and respect of the constitutive elements exposed by de Solà-Morales [14].

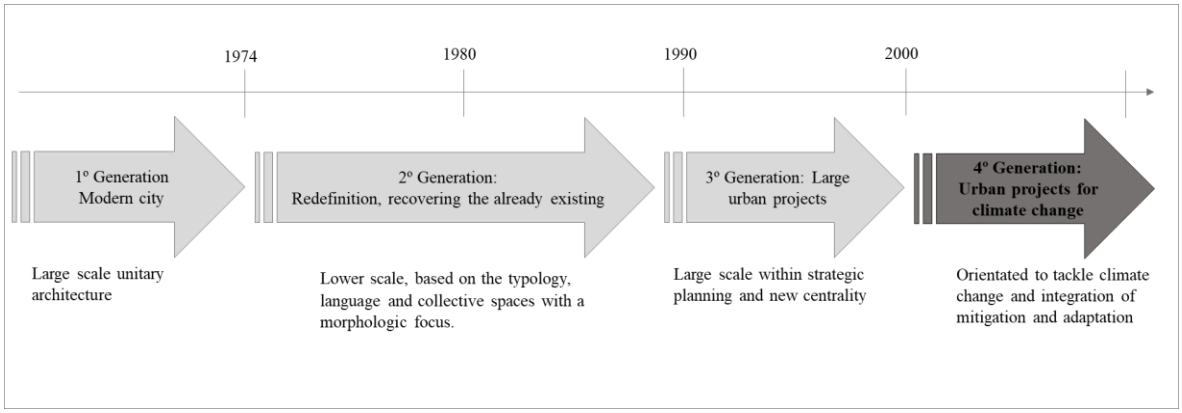

Figure 1. Four generations of urban projects; Source: own elaboration

Second, the relationships between the strategies can be seen in Figure 2 where the arrows indicate direct or indirect impacts towards climate change. Urban mitigation projects seek to address the reduction of GHG (1) with a direct effect on global warming (e.g. electric public transport, use of renewable energies, waste treatment) (2) and the mitigation of the natural risks of extreme events (3) influences climate change but indirectly through adaptation projects (4). For a natural risk mitigation project, e.g. grey infrastructures, channels, tidal containment walls, alluvial water decanting pools, docks, to have a positive impact on climate change, it must go through or become part of an adaptation project (5).

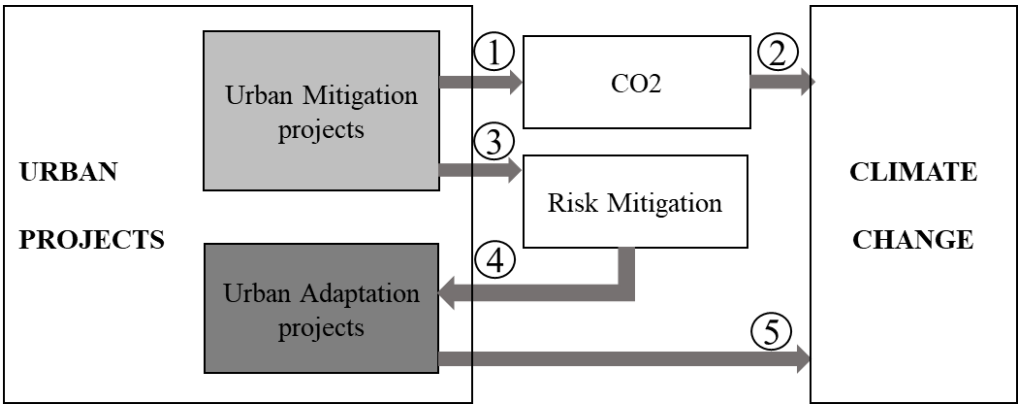

Figure 2. Urban projects for climate changem, Source: own elaboration and based on Perez-Lancellotti & Ziede [38]

Combining the proposal of the fourth generations of urban projects and the strategies available for cities to tackle climate change, a matrix of 2x2 urban project is built and drawn in Figure 3 explained below.

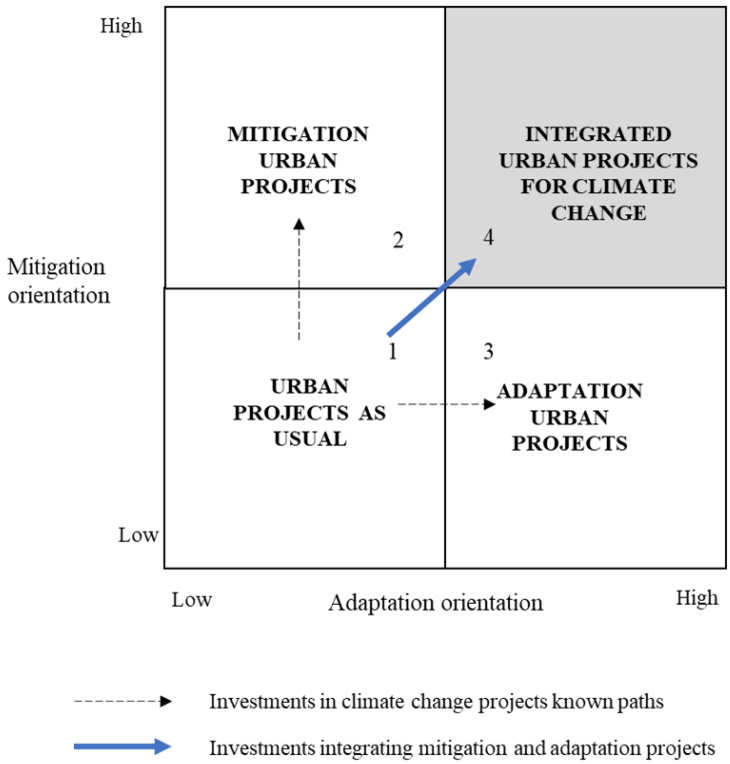

Figure 3. The matrix of urban projects, Source: own elaboration.

The matrix of project types works by combining the two strategies of mitigation and adaptation and a theoretical continuum of development. Thus, the axis moves from a low level to high levels of development for the strategies of mitigation and adaptation, creating the distinction through four quadrants. Quadrant 1 is characterized by a low orientation towards both mitigation and adaptation. It brings together projects as usual, that are defined in the three generations expressed by Portas [11]. Unpretentious classical projects to tackle climate change fall into this group and can adopt different orientations or respond to diverse or sectoral needs. Quadrant 2 represents a strong orientation towards mitigation without adaptation while Quadrant 3 has a strong orientation towards adaptation without mitigation. Quadrants 2 and 3 bring together mitigation and adaptation initiatives in a compartmentalized way and respond to local policy decisions that could respond to other levels of local, regional or national planning. Both represent deliberate responses to addressing the climate change phenomenon. Examples of Quadrant 2 are urban mobility projects such as public transport powered by clean energy, green infrastructure projects such as parks, tree planting and public spaces, and the mitigating heat islands. In the case of Quadrant 3, examples are found in New York with Manhattan's storm defences, in Venice's barriers ('Mose' system) that regulate high tide waters, in the system of Curitiba's urban parks with the natural lagoons controlling the rising of waters by effect of the rains, in Barcelona's Besòs river park and in London's Thames Barrier that can close off the Thames River in the eastern part of the city. Finally, in Quadrant 4, we have integrated urban projects for climate change that have a strong orientation in both strategies and constitute the most innovative or advanced mode of urban projects. First it is intentionally designed to deal with climate change and second it takes on the criticisms of compartmentalization. Examples of this quadrant can be found in those that were originally born as climate change adaptation projects that in a second stage incorporate elements that also allow them to exercise the role of mitigation through the creation of green infrastructure or the use of clean energy such as the Maeslantkering storm surge barrier in the Netherlands that protects vast urban areas including Rotterdam's port and includes green areas.

Additionally, it is possible to glimpse potential movements between the quadrants that have associated investment flows. In effect, what is expected is that a series of projects such as the usual ones incorporate actions or measures aimed at climate change, making the shift from Quadrant 1 to Quadrants 2 and 3 possible depending on the chosen policy. Although the foregoing is an important advance, a greater challenge would be to shift Quadrants 2 and 3 towards 4 where synergies could have a stronger positive impact on the climate change problem.

4. Conclusions

The article develops a framework that integrates the strategies of mitigation and adaptation in the context of cities and climate change, focusing on the micro level of urban projects. The model enriches the contribution of the generations of urban projects, creating a fourth generation of urban projects to face climate change, addresses the relationships between mitigation and adaptation strategies and develops a typology of urban projects that account for the need to transit towards integrating projects. The constructed typology of urban projects accounts for the classic dichotomy between mitigation and adaptation but introduces the possibility of a continuum. Depending on the orientation towards a mitigation or adaptation strategy and two levels of high and low development, four types of urban projects emerge, reflected in quadrants. This typology in a 2x2 matrix, maintains the classic urban project, the urban project focused on mitigation, the urban project focused on adaptation and the fourth-generation urban project called integrator for climate change. The possibility of movement between quadrants was also offered, especially the transit towards the last quadrant. This model is useful to understand the complexity of the relationship between city and small-scale climate change, which must be empirically verified in future studies together with reviewing which factors could be facilitating or preventing integration.

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