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DOI
10.1007/978-3-030-73399-5_7

Publication date
2021

Document Version
Final published version

Published in
Governance of Climate Responsive Cities

Citation (APA)
Gaete Cruz, M., Ersoy, A., Czischke, D., & Van Bueren, E. (2021). How Co-design of Public Space Contributes to Strengthening Resilience: Lessons from Two Chilean Cases. In E. Peker, & A. Ataöv (Eds.), *Governance of Climate Responsive Cities* (pp. 105-125). (Urban Book Series). Springer. https://doi.org/10.1007/978-3-030-73399-5_7

Chapter 7
How Co-design of Public Space Contributes to Strengthening Resilience: Lessons from Two Chilean Cases

Macarena Gaete Cruz, Aksel Ersoy, Darinka Czischke, and Ellen Van Bueren

Abstract The implementation of adaptation measures and the improvement of urban resilience is a growing concern recently. While urban projects are encouraged to become resilient, there is an interest in the design processes that produce them. In the Latin-American context, co-design is gradually taking a central role in space production, recognizing the need for involving multiple stakeholders to achieve more integrated and inclusive designs. However, in the case of Chile, institutions are rather rigid, over-regulated, and tend to operate in silos. We investigate how the co-design of public spaces can contribute to urban resilience through a case study of two Chilean design processes. The study applies the evolutionary resilience framework (ERF) to assess urban co-design processes (Davoudi et al., Plan Pract Res 28:307–322, 2013). Barriers and enablers reported by the interviewees shed light on how the co-design processes evolved and contributed to, or hindered resilience. Co-design is seen as a preparation-building process towards climate resilience that can be furthered through persisting, adapting, or transforming collaboration and design process factors. This study operationalizes the ERF framework and proposes a flowchart to identify factors influencing urban resilience. Although the Latin-American context may differ from other places, this study provides insights to co-design processes elsewhere.

Keywords Urban resilience · Evolutionary resilience · Co-design · Transformation · Chile · Public space

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E. Peker and A. Ataöv (eds.), *Governance of Climate Responsive Cities*, The Urban Book Series, https://doi.org/10.1007/978-3-030-73399-5_7

7.1 Introduction

Cities are interdependent urban systems, with multi-scalar components of social, ecological, and technical sub-systems that go beyond their jurisdictional as well as built-up boundaries (Boelens and de Roo 2016; Ersoy and Yeoman 2020; Meerow and Stults 2016; Van Bueren et al. 2012). Climate Change and natural hazards have direct as well as indirect impacts on these sub-systems and they challenge the way we have produced our cities and public spaces (Nightingale et al. 2020). As a result, it has been recognized that the design processes to produce the built environment are complex, making it necessary to work in integrated ways at different structural levels of decision-making and expertise (Folke et al. 2009; Savaget et al. 2019). Co-design has gained relevance in the context of the increasing need to climate-proof our cities, and thus their public spaces.

In most urban areas, the specialization of functions results in a general condition of decline, neglect, and contamination which impacts human health, the quality of life, and well-being. With the accelerated urbanization, the natural landscape inside as well as outside urban areas have become more ecologically fragmented which affects the environment but also its supportive role to our society (Brink et al. 2016; Wamsler et al. 2013). Implementing climate change adaptation measures in public spaces enables us to think about how a variety of environmental, social, technical, and economic challenges can be addressed to increase the resilience of cities through collaborative processes (Castán Broto and Bulkeley 2013; Wamsler and Raggers 2018).

In recent years, there is a growing awareness to incorporate climate change adaptation measures in Latin-American cities (Krellenberg et al. 2014; Romero-Lankao and Gnatz 2013). Although most countries have developed national or metropolitan plans (Chile, Colombia, Costa Rica, and others), difficulties arise when urban adaptation is to be implemented (Barton et al. 2015; Barton 2009). In the context of Chile, this is an emerging phenomenon that has been dealt with in sectorial ways with some exceptional examples in which actors from the various institutional systems involved have collaborated to design and produce resilient public spaces (Fernández and Courard 2018; Harkness et al. 2019; Moreno 2019). Two of these exceptional cases will be analyzed in this chapter. They have in common that their co-design process became crucial for the socio-ecological solutions of public spaces. However, the implementation of co-design is not always straightforward in rigid and over-regulated institutional settings that are ill-adapted to such collaborative processes.

In this chapter, we apply the evolutionary resilience framework (ERF) to study two Chilean urban park design processes. We aim to understand how these co-design processes confronted enablers and overcame barriers through changes. The ERF framework builds on the evolutionary resilience tradition (Folke et al. 2010; Gunderson and Holling 2001; Walker et al. 2004), and defines it as a process of change (Davoudi et al. 2013) emphasizing the preparedness capacity of institutional systems through persistence, adaptation, and transformation. Specifically, we aim to understand the dimensions of persistence, adaptability, and transformability in such

co-design process-oriented cases. To do so, the enablers and barriers for collaboration and design will be analyzed for each of the cases.

In the next section, we will explain this framework and describe how we applied it to assess the co-design processes followed in our case studies. After this, we briefly introduce our cases and comment on the results of the interview analysis. Finally, we discuss how co-design processes can contribute to the future discussions of the ERF.

7.2 Applying the Evolutionary Resilience Framework to Urban Co-design

The design and the implementation of resilient adaptation interventions are challenging tasks for cities due to their complex and dynamic structures. Understanding the link between the social and ecological sub-components of cities is crucial to develop their long-term capacities, and reconfigure socio-economic and institutional paths into sustainable ones. With the increasing uncertainty of internal and external stresses, cities need to improve their preparedness to change, and therefore their resilience. There is a long list of literature dealing with how cities respond to shocks and their experience with their recovery aftermath (Bristow 2010; Christopherson et al. 2010; Davoudi et al. 2012; Hudson 2010). While the engineering-angle of resilience focuses on the ability of a system to return to a previous state or its recovery aftershocks (Fingleton et al. 2012; Rose 2004), the ecological interpretation focuses on whether cities can modify their function and structure. This allows a system to change and adapt to new circumstances (Gunderson and Holling 2001; Holling 1973). More recently, there has been an increasing interest in the evolving nature of systems that understand the world as complex, dynamic, uncertain, and unpredictable. This approach to resilience has been coined as evolutionary (Davoudi et al. 2012).

Evolutionary resilience is understood as the capacity of complex socio-ecological systems to adapt and transform in response to stresses and shocks (Carpenter et al. 2001). It also suggests that change can happen due to internal stresses with *"no proportional or linear relationship between the cause and the effects,"* and that they hardly ever return to where they used to be (Davoudi et al. 2012, p. 302). The Evolutionary Resilience Framework (ERF) defines resilience as a process of change (Davoudi et al. 2013), and emphasizes the preparedness capacity of institutional systems to change by understanding it through the processes of persistence, adaptation, and transformation. Persistence implies "*resisting disturbances*," while adaptability refers to the ability to absorb shocks "*without crossing a threshold into an undesirable and possibly irreversible trajectory*." Transformability involves "*innovating toward desirable trajectories*" through change and the creation of new structures. These three are linked to the preparedness and "*learning capacity of governing bodies*" as dependent components (Davoudi et al. 2016, p. 712). In sum, the ERF incorporates the dynamic interplay among these three components to provide

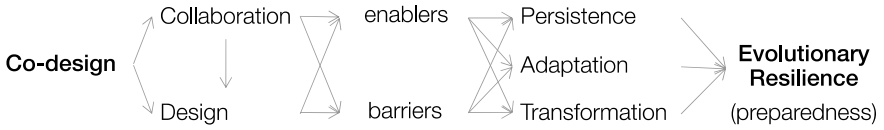

Fig. 7.1 Linking co-design to evolutionary resilience

an understanding of how complex socio-ecological systems can become more or less resilient through human action and intervention, as taking place in co-design, consisting of processes of collaboration and design and giving rise to factors enabling or obstructing persistence, adaptation, and transformation (Fig. 7.1).

The study of public spaces allows us to understand how complex socio-ecological systems shape urban spaces. Resilient and high-quality public spaces can stimulate long-term social and economic benefits for cities' green infrastructure and increase urban livability (Ersoy and Yeoman 2020). However, the unpredictable social and ecological dimensions of climate change push us to think not only about public space design solutions but also about the processes to produce them. Co-design, in this respect, aims to allow a wider variety of knowledge to be considered and analyzed by a broader group of experts and stakeholders than traditionally involved in urban design to provide more suitable and context-specific spatial designs that are better prepared for change.

Co-design originated in the encounter of participatory design (Mattelmäki et al. 2014), co-production (Parks et al. 1981), and co-creation traditions (Galvagno and Dalli 2014; Vargo and Lusch 2008). It suggested the involvement of customers, consumers in service marketing (Vargo and Lusch 2004), or users in industrial design (Sanders and Stappers 2008) in the process of developing products or services. It has over the years broadened its scope to new knowledge and application fields such as environmental studies (Djenontin and Meadow 2018; Moser 2016), urban design (Sørensen and Torfing 2018; Stelzle et al. 2017), governance and management (Ersoy 2017; Pestoff et al. 2013), architecture (Emmit and Ruikar 2013), planning (Healey et al. 2007; Webb et al. 2018) and industrial design (Koskela-huotari et al. 2013; Mattelmäki et al. 2014; Mattelmäki and Visser 2011; Sanders et al. 2010). In sum, there has been a diversification of actors involved in the design processes that have been understood as networked institutional systems (Manzini 2016; Mattelmäki et al. 2014).

Co-design focuses on the benefits of collaboration and its opportunities to improve the design outcomes. Collaboration is said to improve the results by integrating relevant knowledge, values, aims, and skills into the process (Huybrechts et al. 2017; Ostrom 1996; Sanders and Stappers 2014), while also promoting shared understandings, mutual learning, empowerment, and legitimacy, while adapting and transforming the design processes and results to overcome difficulties. In the urban field, participants from the public, private, and community sectors collaborate and interact toward developing better informed context-specific urban projects (Drilling and Neuhaus 2019; Sharifi et al. 2017; Webb et al. 2018). In the case of

cities facing climate change, and other forms of socio-ecological disturbances, co-design processes can provide benefits to public space by promoting collaboration and context-specific designs. The designs integrate the available disciplinary and local knowledge (social and ecological) into spatial solutions that respond to multiple present and future needs. Since today's institutions have often been developed for regulating a particular sector or domain, often making use of particular disciplinary knowledge, co-design processes tend to challenge existing institutions and have to overcome the persistence of barriers to adaptive or transformative change.

In this study, we investigate how co-design processes of public spaces may enhance urban evolutionary resilience. Specifically, we apply the three-dimensional evolutionary resilience framework to assess urban co-design processes within complex socio-ecological systems in two cities in Chile. We aim to understand how the dimensions of persistence, adaptability, and transformability interplay in urban co-design processes and how we can use this knowledge to improve the co-design process.

We analyze the co-design process enablers and the barriers reported by the interviewees that contributed to or hindered persistence and change. The encountered enablers may persist, while the barriers may either persist to be overcome through adaptability or transformability. Collaboration in the design process, either hinders or enhances institutional resilience, while design denotes how it is embodied in the resulting projects. The previous may thus affect the overall socio-ecological systems' evolutionary resilience.

The ecological resilience in terms of preparedness of systems is thus observed in their abilities to maintain, adapt, or transform process factors regarding collaboration and design within these processes. In this sense, co-design may contribute to the preparedness of institutional systems and the design decisions produced within them. It may allow collaborative barriers to change (adapt and transform) when facing social or ecological challenges. And it may also contribute to the design solutions for public spaces to better adapt and transform when facing social or ecological challenges such as climate change.

In the next section, the cases are presented, and the data collection and analysis are explained.

7.3 Method

We aim to investigate how co-design can enhance institutional systems' preparedness and its evolutionary resilience through a retrospective case study of public space co-design processes with the ERF, as specified in the previous section. The two selected study cases are city-sized urban parks with context-specific adaptation measures to deal with water scarcity and water-related climate change risks in the deserted north of Chile. The case study approach responds to the complex, context-sensitive, and contemporary nature of the phenomena (Yin 1994).

The study builds on primary and secondary data obtained through fieldwork conducted in December 2019 and January 2020. The primary data considered twenty-seven semi-structured in-depth interviews with key participants such as the project leaders, the design contract administrators, the community leaders, and the academics involved. Secondary data included both written and graphic documents such as public reports, media publications, design plans, and images. To make the sampling comprehensive, participants were selected from the different sectors and backgrounds (Ridder 2017) such as public, private, non-profit, academia, and the community. Also, multiple disciplines and roles were considered in the selection of the interviewees. The interview protocol, consisting of semi-structured questions, was built from the co-design ERF framework. It was revised with key informant experts in the field in Chile and The Netherlands. Also, a pilot interview was conducted with one interviewee of each of the cases, and adjustments were made to better suit the framework.

The interviews aimed to gain in-depth insights into the perceptions and meanings of the process concerning the enablers and barriers. We analyzed the main enablers and barriers reported by the interviewees and position them within the ERF. During the data gathering in the field, the interviewees were asked to describe their point of view on the co-design processes with an emphasis on their role and contribution to the projects. We asked them to describe the processes and to reflect on the enablers and barriers encountered in co-design. They then explained how the encountered barriers were modified and sometimes new structures were created to overcome them. They were requested to reflect on the flexibility of the participants' attitudes in the collaborative meetings and workshops, their sense of shared understandings, their sense of influence on the project, and their satisfaction with the designed urban park. They were also asked to reflect on the stiffness or flexibility of the institutional system and how much it changed to overcome the process barriers, or what enablers were present to do so. Explicit questions regarding the social and ecological design solutions of the public spaces were also asked using a map of the projects for them to point out. For additional verification, the transcripts and recordings were shared with some of the interviewees, as well as the systematized results to check for internal consistency.

Figure 7.2 shows a flowchart that we have proposed and followed to classify the enablers and barriers in the co-design process according to their influence on resilience specified by the concepts of persistence, adaptation, and transformation. The encountered enablers may persist, while the barriers may either persist or be overcame through adaptability or transformability. In support, the analysis method consisted of four main steps (Bryman 2015). First, we organized data and transcribed the interviews. Then, we designed a coding based on the framework of the study. This coding connected the themes and variables to the interview questions with the reported barriers and enablers. Next, we went through the data in rounds of initial familiarization and in-depth coding with Atlas Ti software. A semantic and latent approach allowed us to identify conceptual patterns. Finally, we used a deductive thematic analysis to categorize relevant themes linked to the ERF framework.

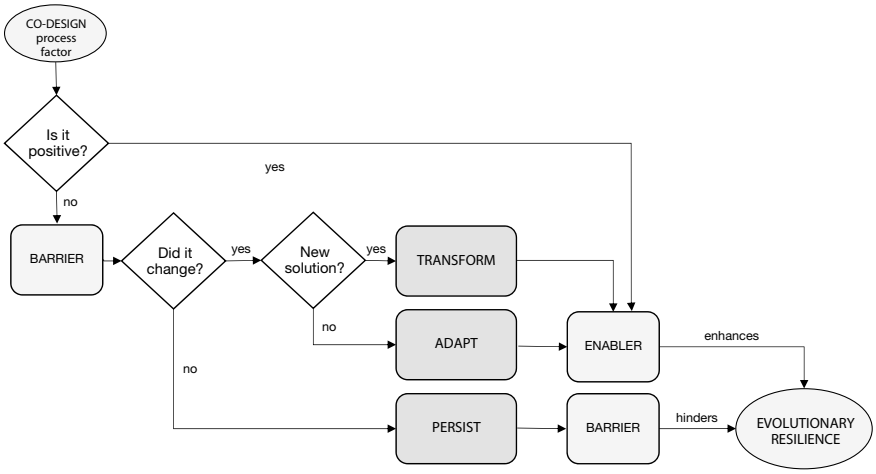

Fig. 7.2 Flowchart of process factors persisting, adapting, or transforming to influence evolutionary resilience

7.4 Cases

The study analyzed two public space design processes in-depth to understand how co-design contributed to, or hindered urban resilience. The cases were selected because they are some of the first context-specific climate change adaptation examples of co-design processes that occurred during the last decade in the Chilean context involving inter-sectorial partnerships, multidisciplinary teams, and engaged communities. These projects are receiving considerable attention from academia, national government entities, and private companies due to their public–private partnerships, collaborative approaches to design, and the transdisciplinary development of nature-based solutions to deal with climate change adaptation (CNDU 2014; Moreno 2018).

The cases are briefly described in Table 7.1. They are city-sized longitudinal urban parks for adaptation aiming for context-specific solutions to deal with water scarcity and water-related risks of climate change in the deserted north of Chile. Case 1 is an example of collaboration among two ministries, and a transdisciplinary team integrating urban landscape and hydraulic designers. It addresses flooding and mudslides through the naturalization of the riverbank, and water scarcity with low water requirement foresting and permeable pavements. Case 2 is a collaboration led by CREO Antofagasta and had strategic, transdisciplinary, and community co-design. CREO Antofagasta is a public–private-people-academia partnership NGO leading and articulating sustainable urban projects for the city. It addresses water scarcity through a landscape design with low water requirement species and the natural restoration and protection of the seaside. Both projects were led by the same urban design studio, whose chief is a renowned architect who holds the National Architecture Award.

Table 7.1 Description of the two cases

	Case 1 (Fig. 7.3) Kaukari Urban Park	Case 2 (Fig. 7.4) Antofagasta Seaside Park
Location	Copiapó city, Atacama region, Chile	Antofagasta city, Antofagasta region, Chile
Size	60 hectares. 3,5 km long	35 km long
Brief description	Public urban park in the riverbank	Public urban park along the city seaside
Climate change resilient design	Naturalization of the riverbank to adapt to flooding and mudslides. Low water requirement foresting and permeable pavements due to water scarcity	Landscape design with low water requirement species and the natural restoration and protection of the seaside. No considerations regarding sea storms or sea-level rise
Design consultancy	2011–2013 Teodoro Fernández Architecture Studio and Bonifacio Fernández Engineers	2017–2020 Teodoro Fernández Architecture Studio, Urbana ED, GSI Engineers
Main funding source	Shared budget from the Housing and Urbanism Ministry (Minvu) and the Public Infrastructure Ministry (MOP)	Shared budget from the Public Infrastructure Ministry (MOP) and BHP Billiton mining company

Fig. 7.3 Aerial view of Kaukari Urban Park in Copiapó city. (Tomás Gómez)

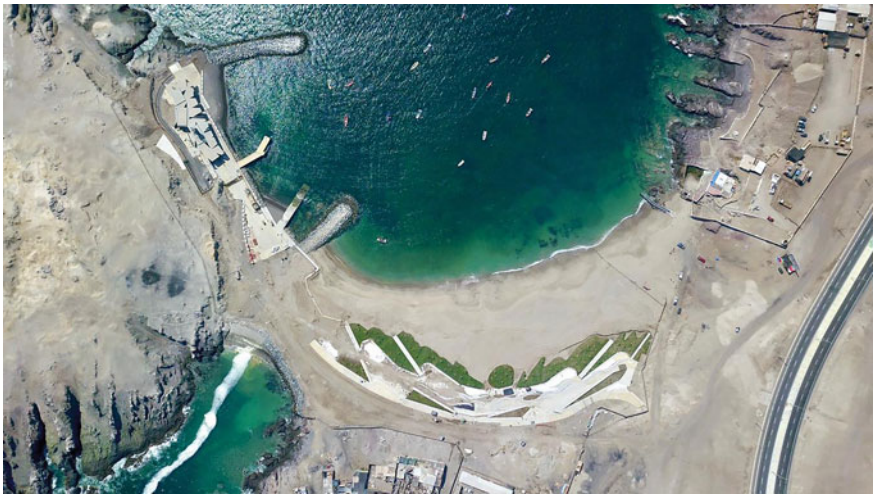

Fig. 7.4 Aerial view of Antofagasta Seaside Park in Antofagasta city. La Chimba artificial beach and fishing cove. (Nicolás Sepúlveda)

The first author of this chapter was involved partially in the two cases. We acknowledge such involvement could bring legitimacy issues but has enabled interviewees and access to data that would have been difficult otherwise. Likewise, the familiarity developed with the cities, the involved organizations, and the projects enabled valuable insights for this study (Labaree 2002).

7.5 Research Findings and Discussion

This section presents the findings of the study and discusses the implications of the ERF concepts in the co-design processes. The enablers and barriers of the processes reported by the interviewees, as well as their narratives about co-design, allowed us to analyze the main factors influencing resilience. The agglomerated results of case 1 revealed 14 enablers and 12 barriers, while case 2 revealed 21 enablers and 15 barriers. A summary of the enablers and barriers for collaboration and resilient design as identified in the interviews can be found in Table 7.2, followed by a discussion of the table. We classified the enablers and barriers according to their influence on resilience concepts of persistence, adaptation, and transformation, following the flowchart in Fig. 7.2, and identified how barriers have been overcome or removed through adaptation or transformation of the institutional or physical context of collaboration and design, thus changing the barriers into enablers. Maintained enablers were considered to enhance resilience, while barriers that had not been resolved (persisting) hindered it. Other barriers reported that were overcome through change,

Table 7.2 Collaboration and design enablers and barriers categorized according to the ERF concepts

Case 1—Kaukari Urban Park, Copiapó, Chile	Case 2—Antofagasta Seaside Park, Antofagasta, Chile
Collaboration process factors	
Persistent enablers	
• Importance of the river site for the citizens • Familiarity among the actors • Trust in the prestige of the design leader • Young actors were willing to innovate	• Importance of the seaside site for the citizens • Emerging participatory culture • Trust in the prestige of the design leader • Young actors were willing to innovate
Persistent barriers	
• Lack of participatory culture • Institutional rigidity	• Institutional rigidity • Communicational difficulties
Barriers adapted to enable	
• Stiffness of the design contract (barrier) Flexibility to change the design contract (enabler) • Stiffness of the financial procedure (barrier) The flexibility of two public entities to change the financial procedure (enabler)	• Stiffness of the design contract (barrier) Flexibility to change the design contract (enabler) • Stiffness of the public entities (barrier) The flexibility of the public entities to adapt two overlapping projects (enabler) • Stiffness of the leading organization (barrier) The flexibility of the leading entity to organize continuous multi-actor meetings
Barriers transformed to enable	
• Lack of participatory culture (barrier) It was overcome with the creation of a governance entity to influence the design and implementation processes (enabler)	• Difficulties to manage the participatory process (barrier) It was overcome with the creation of collaborative entities and multi-actor meetings (enabler)
Design process factors	
Persistent enablers	
• Compatibilized landscape architecture and hydraulic design projects • Riverbank at the heart of the valley city and culture in the desert	• Seaside at the heart of a coastal city and culture in the desert
Persistent barriers	
• Lack of control over the river water distribution and management	• Lack of design considerations regarding sea-level rise

(continued)

were classified as adapted, or transformed. These two types of changes enhanced the evolutionary resilience of their institutional systems.

Table 7.2 (continued)

Case 1—Kaukari Urban Park, Copiapó, Chile	Case 2—Antofagasta Seaside Park, Antofagasta, Chile
Barriers adapted to enable	
• Uncertainty about the hydraulic behavior of the river (barrier) Changes in the topography to increase the water capacity of the river (enabler) • A cultural vision of a green grass urban park (barrier) Flexibility to propose a low water requirement landscape design (enabler)	• Seaside accessible with cars (barrier) Flexibility to restrict car access (enabler) • Sea storm risks (barrier) Flexibility to lower the implementation costs and diminish maintenance (enabler) • Low budget for an extended project along with the city (barrier) The flexibility of the design to diminish and focalize the intervention areas (enabler)
Barriers transformed to enable	
• A multiplicity of activity requirements (barrier) It was overcome with the creation of a mixture of flexible and specialized spaces (enabler) • The park and the river were conceived as separate spaces (barrier) It was overcome with the proposal for a naturalized and accessible river (enabler)	• Rustic rocky seaside (barrier) It was overcome with the creation of an artificial beach and the habilitation of rocky areas (enabler)

7.5.1 Enablers of Collaboration and Design

Some enablers were acknowledged and maintained within the co-design processes. They contributed to the collaboration and design processes, thus contributing to evolutionary resilience. Collaborative enablers contributed to consolidate existing structures or organizations that govern and play a role in the creation, design, management, operation, of public spaces, or activate people to make use of them. Design enablers allowed the integration of the existing requirements for the climate-resilient design and the available knowledge into the projects.

Some enablers were recognized by the interviewees to have been of benefit to collaboration throughout the processes. In both cases, young professionals working for the main organizations were involved, who were young idealists aiming for innovation. They often knew each other and were willing to actively collaborate. The landscape architect for both of the cases had a nationally recognized and respected track record, so the process was somehow smoothed because everyone knew the results would be made context-specific and of good quality. Particularly in case 1, the main design disciplines (hydraulic engineering and urban landscape architecture) were led by two academics that were at the same time, twin brothers. This resulted in successful transdisciplinary collaboration. They had also been professors of some of the involved civil servants on the different public entities, and this smoothened the co-design process. In case 2, an emerging participatory culture was beneficial to collaboration in design. The leading NGO Creo Antofagasta was created to raise

collaboration among public and private entities, and a couple of community organizations emerged with time. This allowed collaboration, but communication and management difficulties were confronted in leading the process.

Some enablers reported by the interviewees were also of benefit to the designs. For both cases, the project sites are central natural landmarks (riverbank and seaside) within the cities. All citizens are beneficiaries of the future public spaces, this summoned them to support the designs. Additionally, in case 1, the two main designs, landscape architecture and hydraulic design were reported to be compatibilized in transdisciplinary ways due to the collaboration that occurred between the teams.

7.5.2 Barriers for Collaboration and Design

The barriers that persist throughout the co-design processes tend to hinder the resilience of a system in terms of its adaptive and transformative capacities. Most reported barriers for collaboration were present in both cases. The main differences regarded citizen involvement: in case 1 there was a lack of it, in case 2 it was a complex emerging process. In both cases, a participatory culture barely existed in the early days of the projects due to the recent national political history. For case 1 this was to the detriment of the participation of the community, so their involvement was mainly informative and somehow shallow. In case 2, over the years a collaborative culture was developed, achieving a much more mature and consistent collaborative institutional system, with new emerging community organizations and professionals. Nevertheless, in this case, some of the interviewees reported a lack of consistent communication throughout the process that led to a certain discomfort and mistrust toward the leading organization. Moreover, the Executive Council (a strategic consulting entity created for the process) was denounced to have become an informative, rather than consulting and genuinely participative entity. Furthermore, the interviewees reported a rigidity of national institutions in both cases. They commented on the excessive regulations and overall stiff management culture. For example, the public bodies were mandated to coordinate their actions, but their instruments and regulations were not designed to do so. This resulted in somehow linear, segregated, and autonomous projects instead of well-attuned ones. Another example of the institutional stiffness was the fact that the seaside in Antofagasta was managed by the Chilean Army, an entity with no formal command or interest in its development. This limited not only the use of the seaside area, but also, its strategic planning.

The barriers to design were different in both cases. For case 1, the lack of control over the river water distribution and management was a barrier that the design had to deal with and could not be influenced or modified. This made the naturalized river solution indispensable to overcome drier seasons. In case 2, the lack of design solutions to respond to the sea-level rise as a climate change risk was not considered at all, thus hindering the urban park's resilience.

7.5.3 Barriers Adapted, Turning into Enablers

The flexibility with which barriers faced are modified is considered a process of adaptation. Co-design contributes to the adaptation of the institutional systems by changing organizations or their roles to different duties regarding the needs of public spaces. Co-design contributes to the adaptation of design when the raised awareness of the unpredictable may condition the integration of flexible spaces where the social uses and ecological functions may change.

In both cases, the design contract was adapted to allow the integration of additional design square meters to allow for such future flexibility. The design contract deadlines were extended, but only in case 2, this was followed by a budget extension. Also, an extra project was incorporated into the design assignments in both cases. These extensions strategically promoted the early construction of the projects that could have lasted years otherwise. Additionally, in case 2 the leading public entity (Public Infrastructure Ministry) had two overlapping projects on the same seaside site: the urban park and the project for a seaside avenue. The conflicting planning and budget claims were solved by attuning both projects and sharing their building costs, giving more room for other investments in the region. Likewise, the construction budget of case 1 combined contributions from two ministries, a rather unusual arrangement for the Chilean context, allowing shared resilience investments. Furthermore, in case 2, the lack of a participatory culture was handled by CREO Antofagasta NGO through the continuous management of crucial actors for the project progress (public, private, academic, citizen), and joint meetings were organized among them. This allowed a shared understanding about the seaside uses and values, supported by a collaborative analysis of the opportunities and risks that were raised during the meetings. These shared understandings set the tone of the project and influenced the design. They also influenced all the actors' views on the seaside site, leading to the support of these shared understandings by all the involved organizations.

In case 1, the uncertainty about the hydraulic behavior of the desert river was handled by making changes in the topography to increase the water capacity of the river. Also, the cultural vision for a green grass urban park was assessed by the design team. They had the flexibility to propose a scarce water landscape design that nevertheless maintained the green image, but which was adapted to sustain in the desertic environment. In case 2 the seaside used to be accessible by cars. This was sensed by the community as an old habit with a detrimental effect on the ecological environment. The design was adapted to organize and restrict car access along the park. Also, the available budget was considered too low for the extended urban park project that run alongside the city. The design of the park was simplified and diminished to focus the intervention areas and lower the building costs. The low budget also conditioned the building costs to diminish the maintenance budget when facing storm sea risks. This allowed the project to leave space for future modifications and transformations.

In both cases, co-design played the role in adapting the existing collaborative interactions and in the development of design solutions to remain open and aware of the unpredictable and of the need to embrace changing circumstances.

7.5.4 Barriers Transformed into Enablers

The innovative creation of new structures when facing barriers in co-design can be understood as a transformation. Co-design contributes to resilience by allowing new associations, partnerships, and emerging organizations to play a role in the development and governance of public spaces. Co-design contributes to the transformation of the design because new innovative solutions may emerge, and future innovations may be promoted. For both cases, co-design succeeded in enabling collaboration and design, with openness for emerging organizations, meetings, partnerships, and design solutions as a result.

The main transformations or innovative solutions emerged from conflicts encountered through the co-design processes. In case 2, the variety of collaborative entities created throughout the process demonstrates transformation and innovation. Entities were created to stimulate the emerging collaborative culture. First, the main articulator and convenor, CREO Antofagasta NGO was created, followed by the creation of the Executive Council for strategic shared decision-making, and the Citizen Council for civil representation. These organizations facilitated the many multi-actor meetings throughout the process with the involvement of public, private, academic, non-profit, and community participants. In contrast, for case 1, the lack of a citizen participatory culture was countered by the early creation of the Governance entity, which aimed to socially manage and activate the implemented areas of Kaukari Urban Park and to play a role in the areas to be implemented. This organization allowed collaborative decision-making, as well as contributed to the activation of the public space.

Some barriers were recognized by the interviewees to have been transformed to the benefit of the design. For case 1 there were many activity requirements to be considered by the project (civil, cultural, recreational, sports, among others). This barrier was overcome with the creation of flexible and specialized spaces throughout the park in the river. Additionally, the park and the river, normally conceived as independent urban spaces in Chile, were designed together with the design proposal for a naturalized and accessible river. Similarly, the rustic rocky seaside was seen as a barrier for the urban park design. This was overcome with the creation of one artificial beach and the habilitation of rocky swimming areas.

Table 7.3 presents an assessment of the overall contribution of co-design, in terms of the collaborative process and design processes, to the evolutionary resilience of the urban parks in the two cases. Both collaborative processes seem to have contributed to resilience challenging the actors involved to come up with context-specific design solutions and new institutional arrangements.

Table 7.3 Assessing the evolutionary resilience of the two cases

Case 1—Kaukari Urban Park Copiapó, Chile	Case 2—Antofagasta Seaside Park Antofagasta, Chile
Collaboration	
• Some forms of resilience developed throughout the process through collaboration • The creation of the Governance entity might indicate later efforts to stimulate collaboration, and thus enhance resilience	• A high system's resilience is observed in collaboration dealing with the complexities of shared knowledge and decision-making within diverse participants • The creation of multiple entities shows collaborative intentions, yet some communication problems remain unsolved
Design	
• High resilience of the project concerning social and ecological aspects. The design decisions merge social and ecological solutions toward context-specific adaptation measures for public space	• Social resilience was enhanced through the designed project, while low ecological considerations with regard to context-specific water adaptation measures • The project responds mainly to social requirements, but not to some relevant climate change's ecological threats

Case 1 presented an ongoing process of resilience building through the collaborative involvement of multiple organizations in the design, management, and increased use of the urban park project. Some forms of resilience were made possible through transdisciplinary design solutions and flexible (and transformable) public spaces. In case 1 the collaboration seems to have been focused on the two involved public bodies and the two main design firms involved in the project for the riverbank park. These participants have shared understandings, and have developed collaborative interactions throughout the process. This seems to have influenced the project: the design responded to the social and ecological requirements that emerged from the process and merged solutions toward context-specific adaptation measures for public space. This can be observed in the naturalized riverbank that is accessible to visitors but also serves as a biodiverse ecological corridor. This rather new design solution for the country indicates that the project would be prepared to address multiple values of public space, as brought up by the participants in the process, and was prepared to accommodate the effects of a changing climate by adopting nature-based solutions that can mitigate the effects of drought and heavy rainfall. The institutional system resilience was being developed in February 2020, when the case study ended. At that time, interviewees expected that the Governance entity would help to enhance the institutional system's resilience by allowing for shared decision-making among its collaborators and channeling citizen requirements.

Case 2 seems to have made use of the "potential transformative opportunities which emerge from change" (Davoudi et al. 2013, p. 307) and started to prepare for a shift toward collaboration at an institutional system level. The actors collaborating in case 2 dealt with the complexities of shared knowledge and decision-making, and the involvement of diverse entities and professionals with some communication

problems. The design decisions suggest that only some resilience was accomplished through the integration of flexible spaces and low water-demand vegetation in the urban park design. The design decisions seem to have successfully incorporated the shared knowledge and understandings developed in the multi-actor meetings, nevertheless, climate change adaptation measures for sea-level rise and heavy rainfall weren't explicitly incorporated into the project nor in the interviewees' responses, even though these are well-known climate change threats nowadays. This suggests that the project responded mainly to the social requirements collaboratively agreed to by the actors involved, who only considered climate change effects to traditional park design and management, but were unaware of the impact of sea-level rise on this park.

7.6 Conclusions

The design processes that produce our built environments are complex and require the involvement of diverse levels of decision-making and expertise in integrated ways (Folke et al. 2009). Addressing climate change challenges in public spaces enables us to think about how a variety of environmental, social, and economic measures can be implemented to increase the resilience of cities.

There is a growing awareness of the need to implement climate change adaptation measures in cities. The unpredictable dimensions of climate change push us to reimagine not only the urban solutions but also the processes to design them. The emerging phenomenon of co-design has become crucial for the future of public spaces. Co-design, in this respect, allows a wider variety of knowledge to produce better informed context-specific social and ecological solutions that need to be supported by matching institutions. However, co-design is not common in a rigid, over-regulated, and non-participatory institutional setting as in Chile.

In this chapter, we applied a co-design perspective, consisting of an interrelation between collaboration and design processes, to the ERF framework to analyze two Chilean urban park cases. The framework defines resilience as a process of change (Davoudi et al. 2013) and emphasizes the preparedness of institutional systems, characterizing change through persistence, adaptation, and transformation.

We have investigated how co-design processes contributed to, or hindered, urban evolutionary resilience. We aimed to understand how co-design contributes to evolutionary resilience looking at the enablers and barriers to it in the process. While some barriers persisted, hindering resilience, others were overcome with change through adaptation or transformation. In this respect, the collaborative approach to the design process contributed to improving the institutional systems supporting more resilient design decisions. Collaboration barriers either persisted, or were adapted or transformed, when facing socio-ecological challenges, and the design solutions allowed public spaces to better persist, adapt, or transform, thus improving their resilience. The cases studied show institutional efforts to promote and sustain collaboration in the design processes of two urban parks in two cities of the Atacama Desert. In

both cases, the institutional systems allowed diverse forms of collaboration, and new organizations were created to represent and provide multiple ecological and social requirements to the design processes. Collaboration in the design decision-making processes seems to have happened at strategic, technical, and social respects in different levels. These complex collaborations seem to have informed and contributed to the designs, influencing the projects that resulted from them. The stiffness or flexibility with which the institutional settings overcome barriers and enablers of design and collaboration defines the evolutionary resilience of the projects and the processes to design them. Accordingly, co-design for climate change is a preparation-building process that can be furthered by overcoming the persisting barriers and enhancing the persisting, adapted, or transformed enablers.

The flowchart of enabling and hindering process factors offers a complementary understanding of evolutionary resilience and highlights the human action and intention embedded within institutional systems. In sum, the research presented in this chapter sheds light on the contribution of co-design to urban resilience, which is complicated due to the complexity of both concepts. By operationalizing and connecting both, this study makes a modest contribution to the understanding of the relationship between them.

While focused on the Latin-American context, this study provides valuable insights for urban public space production processes elsewhere. Our understanding of co-design contributing to resilience may help to develop collaborative and resilient institutional arrangements in practice. It may help researchers analyze and assess urban co-design processes to inform policymaking toward resilience. It may also help designers and practitioners to better manage and design urban co-design processes while enhancing evolutionary resilience. As citizens, public servants, and practitioners continue to learn how collaborative design enhances resilience, we might be able to promote more prepared institutional systems and public spaces.

Further research could explore ways in which co-design ensures the climate-proofing and livability of public spaces. Also how co-design may ensure collaborative design, operation, activation, and usage of public spaces to better adapt to socio-ecological challenges though the involvement of strategic, technical al social actors to the process. Additionally, studies on the social learning approach to the ERF and co-design may allow for the assessment of institutional systems' preparedness towards evolutionary resilience.

Acknowledgements This study has been supported by the Chilean National ANID Grant.

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