The challenge of collaboration in urban design

Co-designing resilient public spaces in Chile

Gaete Cruz, M.

DOI
10.71690/abe.2025.04

Publication date
2025

Document Version
Final published version

Citation (APA)
Gaete Cruz, M. (2025). *The challenge of collaboration in urban design: Co-designing resilient public spaces in Chile*. [Dissertation (TU Delft), Delft University of Technology]. https://doi.org/10.71690/abe.2025.04

The challenge of collaboration in urban design

Co-designing resilient public spaces in Chile

Macarena Gaete-Cruz

The challenge of collaboration in urban design

Co-designing resilient public spaces in Chile

Macarena Gaete-Cruz

TOC

A+BE | Architecture and the Built Environment | TU Delft BK

25#04

Design | Sirene Ontwerpers, Véro Crickx

Cover photo | Kaukari Urban Park. Kids playing in the opening. Picture taken by the author.

Keywords | Co-design, co-design framework, public space, urban resilience, climate change, knowledge integration, collaborative design, visual methods, co-design process.

ISBN 978-94-6384-742-1
ISSN 2212-3202

TOC

The challenge of collaboration in urban design

Co-designing resilient public spaces in Chile

Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology
by the authority of the Rector Magnificus, prof.dr.ir. T.H.J.J. van der Hagen
chair of the Board for Doctorates
to be defended publicly on
Thursday 6 March 2025 at 17:30

by

Macarena GAETE-CRUZ
Master of Science in Architecture,
Pontificia Universidad Católica de Chile

TOC

This dissertation has been approved by the promotors.

Composition of the doctoral committee:

Rector Magnificus,	chairperson
Prof.dr. E.M. van Bueren	Delft University of Technology, promotor
Dr. D.K. Czischke	Delft University of Technology, promotor
Dr. A. Ersoy	Delft University of Technology, copromotor

Independent members:

Prof.dr. T.N. Broekmans	Delft University of Technology
Prof.dr. P.J. Stappers	Delft University of Technology
Dr. T. Kuzniecow Bacchin	Delft University of Technology
Prof.dr. C. Rojas Quezada	Pontificia Universidad Católica de Chile

This research was funded by the Chilean National Agency for Research and Development (ANID 2018), and partially supported by Delft University of Technology.

Preface

The starting point of the dissertation is that **co-design is much more than citizen participation**. It is undoubtedly much more than allowing others to choose the colour of the benches of the square you are designing. Co-design implies that we are able and willing to open the design conversation **with actors from diverse sectors and backgrounds at different collaborative levels throughout the cyclical design steps**. This research studies design processes, from concepts to applied cases, and the author's experiences. If collaboration continues to be a path that makes us uncomfortable, **designing design processes may be one of the most crucial contributions of designers in the future**.

The dissertation results from a **rigorously planned research process that remained open to change**. I planned to study three variables: collaboration in design, knowledge integration, and public space resilience. However, the pandemic, motherhood, and the critical timeframes for publishing four articles, among other process factors, sorted it out differently. I ended up focusing on the collaboration of actors in design processes—a topic in which I was not an expert, but to a certain extent, my supervisors were. I soon understood that **co-design as a research method is crucial to bridging the science-practice gap**. The value of living a collaborative experience while evaluating it is one of the great possibilities that Action Research through Design approaches enables. This research leaves me as an expert on co-design, a topic I will continue to develop from my experience as an urban designer, urban collaborator, landscape designer, or another of the professions I often identify with. Further research on designing for resilience is yet to be developed.

The thesis results from having one foot in academia and another in practice. After a while, I understood that **designers never design alone** and that any form of **urban design is inherently collaborative,** even though we fail to teach it as such. Directing the Kaukari Urban Park project in the Architecture firm of Teodoro Fernández L. after my graduation was, as I like to call it, undertaking a new master's degree. It is difficult for a design lover not to look for a more significant challenge to solve. Then, climate change, water, vegetation, local identity, and children's play crossed my path.

This dissertation was written in The Netherlands to speak to the world. On the way, I had to select Chilean cases to face the pandemic and motherhood without losing focus and mental health. It is a dissertation that was reported retrospectively for

Chile as a way of seeking coherence among the four published articles. I firmly believe that the **Global South is a northern construct**. Fortunately, some articles have been well-received in different settings. One has been among the most read in its scientific journals, and some have already accumulated 30 and 14 scientific references. It is notable that the Co-design Framework has been used and expanded by academics in Europe and has been analysed in literature reviews on the subject. I hope that the thesis continues to speak to the world. Focusing on a specific country ignores the fact that multiple phenomena and problems cross borders.

Opting for urban resilience responds to the search for flexibility, adaptability, and transformation, with which we must understand and design our cities. Especially if **climate change is only one of the changes that cities need to adapt to,** and we have not yet resolved how to inhabit nature. Today, I identify with nature-based solutions, water-sensitive urban design, and green infrastructure. From a conceptual standpoint, but especially from my practical experience as an urban (landscape) designer, I am convinced that **integrating social and ecological knowledge during public space co-design processes improves context-suitability**. No matter where we are, the more compelling the information and involvement are, the more suitable the design will be for a place.

As complexity grows, change is inevitable. While the foundations of academia and practice lay the specialisation of knowledge, **designing design processes may be the most crucial contribution of designers in the future**.

Acknowledgements

I'm incredibly thankful to my life partner, Diego Castro A. Without our shared parenting, none of our dissertations would be finished and printed in book form. I'm thankful for your wisdom, both within and outside the research spheres, and for always giving me an additional perspective on life. To my kids, Elena and Isma, for bearing two PhD parents. Thanks to Elena for joining the adventure at an early age. Even with its twists and turns, you became a lovely girl with a native Dutch language at school within a couple of months. Thanks to Ismael for bearing the pandemic on diapers in the multilingual setting where you grew up. And thanks to the coming baby that came to flavour the final stretch of this book, which will continue to season our lives as a family of five. Special thanks to Maria for allowing Diego and me to finish our PhDs when the *kinderopvangtoeslag* suddenly failed to support us. Thanks to my family back in Chile for bearing us being abroad. To the losses we had on the journey and the children that arrived. To my other family in Spain, who was present from the start in its unconventional but magical ways. **A PhD process is a lifetime experience; with it, all other dimensions of life also unfold**.

Thanks to those who introduced me to these topics. Teodoro Fernández L., mentor, and friend. He allowed me to lead, learn, design with him, and then teach alongside him for years at the Pontifical Catholic University of Chile. My dear Rosanna Forray and Rocio Hidalgo gave me the space to propose within the City & Mobility Laboratory. To Rocío Díaz, leading the Ministry of Housing and Urban Planning of the Atacama Region, who, with her impressive instincts and leadership, already asked me in 2015 to rebuild Copiapó "based on nature" after the flood that hit the city. To Alejandro Gutierrez, thank you for believing in my design-thinking capabilities and allowing me to experience the unprecedented and innovative CREO Antofagasta. To my team at the same organisation, thank you for your generosity in sharing your experiences about the development of the Master Plan. Your eyes shined, sharing your travel paths and the dreams spread across the community. To the School of Architecture at the Pontificia Universidad Católica de Chile for allowing me to teach while I learned. During all these years, I taught the course "Resilient Public Spaces to Climate Change" for master students with Tomás Gómez. A course that forced me to handle the conceptual sphere, challenging questions, the study of diverse cases, and experience inter-discipline in the first person. To the Management in the Built Environment Department for allowing me to coordinate a group within the Urban Re-Development Game course. A course that allowed me to experience knowledge

integration and its benefits in teaching. Thanks to Richard Sennett for writing the book “Together: The Rituals, Pleasures and Politics of Cooperation”, which I swallowed back in 2014 and may have influenced the early steps on this path.

Special thanks to my supervisory team. Each of them has undoubtedly left a mark on my PhD journey and how I developed each of the published (and unpublished) articles we worked on. Thanks to Ellen for showing me institutions, actors, arenas, and management processes. She was brief or extensive in her comments but always sharp and rigorous. No adjective was valid if arguments and conceptualisations weren’t crystal clear. No visualisations were necessary if it wasn’t essential for each written piece. Her experience and abilities always led to crucial comments. Thanks to Darinka for her substantial comments on my files. And how, with her sociologist background, she succeeded in me sharing multiple details and characteristics of the processes, the actors, and the collaborative mechanisms, giving insights into the particularities of the remote contexts I was studying. Special thanks to Aksel, who felt like a life coach throughout the process. He combined sharpness with kindness. His urban planning background made us speak the same language. So, I felt he supported most of my ideas and proposals.

Thanks to my PhD friends, of whom I will surely miss someone if I name them. To the ones with whom I know we will be friends for life. To those with whom we often had cold or warm lunch. To those with whom we spend hours chatting in the hallway or the printer’s room. To those who started their journey when I was on the final stretch of mine, I recall pleasant encounters or simple hallway laughter. To name some of you: Afua, Vale, Anne, Sara, Nina, Celine, Cynthia, Fatemeh, Lucy, Mart, Mohammad, Maarten, Bi Yue, Bo, Chi, Jeroen, Luzma, Koray, Anna, Alex, Sultan, Boram, Saskia, and many others, that due to time and distance, I’m now failing to recall. Thanks to Luzma and Ale, Pontificia Universidad Católica de Chile classmates who introduced me to TU Delft, BK, and the Delft lifestyle. Special thanks to The Hobbits Vale, Anne, Sara, and their families. Colleagues at the beginning of our journeys and companions during the twists and turns of our lives: pandemics, marriages, childbirths, and farewells. I recall a marriage in a French castle by a Maastricht hill. The Writing Retreats in Callantsoog with my dear Dutch PhD friends. My efforts to understand your casual chats. I recall enjoying lovely tiny houses, Dutch food, and cosy music. The Grassnapolsky Music Festival on the freezing winter of 2023 with Nina, Mart, Marthe, Maarten, Anna, Stefi, Wiebke, and Longmiao. Thanks to the Co-Design Reading Group. Before the pandemic with Nina, Floortje, and Marthe. After the pandemic with Sara, Tamara, Floortje, Sahar, Marta, Nina, Cigdem, and Yao, amongst others. Thanks to Las Rumberas, my Latin friends from all possible Hispanic countries. Thank you Nati, Sandra, Clau, Nicole, Lorena, Cata, Andrea, Caro, and Karina. Without you, I may have lost my mind during winter. You allowed me to

bear the distance from my Sagima friends who stayed in Chile. Thanks to Bea, Elena, Pia, José, Cristina, Heather, Suhasini, Aaron, Nati, and Cesar. To Delftactivos for all those September 18th celebrated on the Delftse Hout. Thanks to the UDMers who enlightened my days at Bouwkunde: Erwin, Karel, Yawei, Zac, and Aksel.

Thanks to the interviewees from Kaukari Urban Park in Copiapó and the two cases from Antofagasta. Thanks to the participants in the workshop hosted in Pontificia Universidad Católica de Chile. Also, thank those who participated in the Action Research through Design endeavours later in Copiapó. Special thanks to Nicole (†) for her collaborative wisdom.

TOC

Contents

List of Tables

List of Figures

TOC

Summary

Climate change impacts every region of the world, and it is estimated that 3.3 billion people will be exposed to it in the following decades. Its impacts challenge how urban systems interact with ecological ones and add to social inequalities and conflicts. Climate adaptation is the process of adjusting settlements to climate impacts, which can be done by improving urban resilience. Resilience is the ability of a system to withstand a crisis, and in cities, public spaces have been defined as a priority for improving it. They are the urban voids in which multiple infrastructures, mobility, water, biodiversity, and human life unfold, but their stakeholders are often diverse and conflicting.

Chile has a long history of climatic and geographic impacts that have shaped its cities and now faces the impacts of climate change. Its intricate and diverse geography, and the proximity to resources and economic activities have conditioned the location of human settlements. Today, cities are often located in vulnerable areas due to climatic and geographic impacts, opting for profitability rather than long-term safety. Climate change imposes new challenges on existing ones and challenges already threatened cities. To address this, the Chilean government has developed a series of national adaptation plans at national and regional levels. Yet, the pathways to implement urban resilience in Chile remain unclear.

Problem Statement. If cities are to adapt to climate change through resilient solutions, the collaboration of a wide array of actors from different sectors and backgrounds is crucial at different scales. Actors such as decision-makers, urban designers, expert professionals, citizens, and knowledge producers can contribute to design processes to improve public space resilience. However, there is an overall lack of collaboration in urban design in Chile, and little research has been carried out in such a context to date. The Chilean institutional context is challenging because public organisations tend to operate in silos, interdisciplinary urban design is an emerging phenomenon, and citizen participation is often shallow.

Knowledge gap. The research approach of this dissertation was based on the research and practical experiences of collaboration in design processes, particularly in co-design processes. Moreover, co-design studies have often focused on one-time events over the last decades. In the urban field, city-making and tactical urbanism initiatives have increasingly arisen due to their visibility, engagement, and

explorative character. However, urban design processes, particularly resilient public spaces, require the involvement of multiple actors at different stages of the process. Additionally, many scholars have stated that collaboration in design processes, especially in urban design processes, needs more conceptual and methodological clarification regarding the methods and actors involved.

The aim of this research is twofold: (1) to contribute to a further theoretical understanding of the co-design processes of resilient public spaces and (2) to provide guidelines for the collaboration of actors from diverse sectors and backgrounds in the urban design processes of resilient public spaces. The central research question in this research is: How does a collaborative approach contribute to the urban design processes of resilient public spaces in Chile?

The research consists of four empirical studies that explain the co-design processes of resilient public spaces in Chile. They examined the main barriers, the collaborative levels, the methods, and the knowledge forms integrated throughout the co-design processes. The studies answered the following questions: (1) How are barriers and enablers addressed in resilient public space co-design processes? (2) How do actors collaborate in public space design processes? (3) How do visual methods contribute to public space co-design processes? (4) What social and ecological knowledge is integrated into resilient public space co-design processes?

Research methods. The research adopted two research methods to study the co-design processes of resilient public spaces in Chile: a case study approach to explore recent processes and an Action Research through Design approach (ARtD) to design a smaller public space nested in one of the previous cases studied. The Case Study approach was based on interviews undertaken during fieldwork in 2029-2020. The ARtD approach, recently coined by scholars combining the Action Research (AR) approach with the Research through Design (RtD) approach, was used to investigate designing a public space with actors from practice. The research focused on Chile as a particular study area due to the author's experiences, the availability of information, and the proximity to multiple critical actors involved in the cases studied.

Chapter 2 answered research question 1 and investigated the barriers and enablers in three recent co-design processes of resilient public spaces in the Atacama Desert: Kaukari Urban Park, Antofagasta Seaside Park, and Seahill Pathways. The study aimed to analyse the barriers and enablers for collaboration and design in such processes. A resilience flowchart was developed for the analysis to conceptualise how barriers were addressed through transforming, adapting, and persisting mechanisms. The study revealed that flexibility on the collaboration and design

was crucial in co-designing resilient public spaces. Flexibility in the ways actors collaborated allowed new organisations and partnerships to arise. Design flexibility allowed diverse actors to influence the projects by providing valuable knowledge. It also highlighted that urban designers had a significant role in keeping the awareness of critical actors and fostering their willingness to collaborate in design.

Chapter 3 answered research question 2 and conceptualised co-design processes by bridging existing definitions of collaboration and design. The Co-Design Framework was developed by combining Arnstein's participation ladder with the design cycle steps. It was used to analyse the Kaukari Urban Park and Antofagasta Seaside Park because they were city-sized resilient parks partially implemented, and multiple actors had collaborated on their design processes. The design activities and the levels of collaboration reached by the involved actors were analysed. From the study, three co-design arenas were identified to coexist, pursuing different aims in such processes. Actor arenas are analytical units to understand institutional arrangements where such actors interact. The Strategic Arena aimed at the feasibility of the public spaces designed. The Transdisciplinary Arena integrated diverse forms of knowledge into designing context-suitable projects. The Socio-cultural Arena ensured its legitimacy while engaging crucial actors further involved in maintaining, operating, and activating the public spaces. The main contributions of this study were the development of the Co-Design Framework and the identification of the three co-design arenas. The framework clarified how diverse actors can be involved at different levels throughout co-design processes. It was estimated to be helpful as a conceptual framework for other studies and a practical tool to plan for co-design processes. Identifying the co-design arenas provided conceptual clarity to the involvement of diverse actors in influencing the projects and making them feasible and legitimate.

Chapter 4 answered research question 3 to analyse the use of Visual Collaborative Methods (VCM) throughout public space co-design processes, taking an Action Research through Design approach. Nested in the Kaukari Urban Park previously studied, the Sports Square was studied while a co-design process was carried out. The process lasted two years and allowed an immersive research experience through co-designing with actors and professionals from practice in Chile. It involved professionals based in The Netherlands and Chile and was mainly held through online modes that were only possible in a post-pandemic context. The methods studied were both analogue and digital and contributed to understanding the design steps in which they were helpful and that they changed depending on the design phases. The Co-Design Framework was expanded to differentiate the three main design phases: conceptual, embodiment, and detailing. The study suggested that VCM were helpful throughout the whole process. In the conceptual phase, they

contribute to knowledge inquiry and collective brainstorming. In the embodiment phase, they facilitate analysing and evaluating alternative solutions. In the detail phase, they integrated the technical knowledge of experienced actors. Analysing the three phases emphasised the leadership and facilitator's role of urban designers and the value of their problem-solving and solution-generation expertise.

Chapter 5 answered research question (4) and aimed to explore the diversity of knowledge integrated into co-design processes. Resilient public spaces were conceptualised as Social-Ecological Systems (SES) to frame the forms of knowledge that played a significant role in influencing urban design. This study aimed to specify further the social and ecological knowledge provided by the involved actors that were prioritised and integrated into the designs. The study provided insights into the knowledge integration mechanisms within the co-design arenas. A key finding of the study in conceptualising public spaces as SES consisted of unfolding in physical, dynamic, and institutional dimensions. This is a crucial definition for studying and designing resilient public spaces.

Research contributions. This research contributed to the theory and practice of co-designing resilient public spaces. The studies contributed to the overarching co-design and resilience theories and provided methodological contributions to co-design research and the emergent Action Research through Design approach.

The main theoretical contribution to co-design theory consists of conceptualising the Co-Design Framework by revising and combining conceptualisations of collaboration, the design cycle, and design processes. Subsequently, the three co-design arenas were identified as analytical units to understand how actors contribute to the public spaces' feasibility, context-suitability, and legitimacy. Also, the Evolutionary Resilience Framework was operationalised as a flowchart, and public spaces as Social-Ecological Systems, contributing to clarifying the knowledge systems integrated into co-design processes. Ultimately, this research contributes to operationalising co-design and bridging it with resilience theories.

The primary methodological contribution of this research is the developed Co-Design Framework, which proved valuable for analysing co-design processes in practice. The framework is also used to plan, execute, and analyse a co-design process in practice.

Guidelines for practice. Some of the main contributions of this research have been translated into guidelines for the collaborative urban design practice, mainly when aiming to improve the resilience of public spaces. These directives are pertinent to urban designers and other decision-makers involved in the design processes of resilient public spaces, such as architects, engineers, landscape architects, public

and private sector professionals, NGOs, and other non-professionals and citizens from local communities. Practice guidelines encompass the crucial conditions for co-design and the Co-Design Framework as an actionable canvas for practice. The guidelines are primarily directed at collaborative urban designers who help plan, execute, and evaluate public space co-design processes. They aim to design appropriate solutions, as well as consensus and validation.

Three conditions for the co-design processes of resilient public spaces were identified to be crucial in enabling and facilitating them: the awareness of the involved actors of the collaborative approach taken, the willingness of the involved actors to collaborate in the design, and the overall process requiring flexibility, especially of those actors involved.

The Co-Design Framework is proposed to be of use as an actionable canvas for planning such processes, a roadmap for executing them, and a frame for evaluating them. The conclusions chapter briefly presents a workshop developed and undertaken during the research to illustrate how it can be used as a canvas with diverse actors and offers an actionable protocol for practitioners and collaborative urban designers.

Reflections on research choices. This research employed two methodological approaches to analyse the co-design phenomena: the Comparative Case Study and the Action Research through Design approach. Three Comparative Case Studies were conducted. They analysed the same cases using different conceptual frameworks and focusing on different units of analysis.

The deliberate choice to analyse the processes of the urban parks using different conceptual approaches contributes to understanding the contemporary phenomenon of co-designing resilient public spaces. Although the three co-design processes studied shared some similarities, their differences provided enriching insights into the different actors and knowledge fields involved. Additionally, a significant contribution of this research was conducting a co-design process with the Action Research through Design approach while applying the Co-Design Framework for planning, executing, and analysing the co-design processes of a public space.

Focusing on the Chilean context was partly due to circumstantial factors such as the pandemic. However, it also provided an opportunity to study a geographical and institutional setting familiar to the researcher through both practical experience and academic studies before this research. The unique setting of the Atacama Desert added richness to the study, and efforts were made to ensure that the findings were both generalisable and context-specific. The discussion of the findings aims to contribute not only to theories but also to local contexts.

Recommendations for further research intend to expand and validate the findings and promote subsequent research streaming. For example, they may include testing the Co-Design Framework for analysing cases within new fields of application, such as service design, placemaking design, or different geographical contexts, as recently done by scholars from the European context (Slingerland et al., 2024). The framework can also be used to plan co-design processes in practice and further test them through the Action Research through Design approach.

A consecutive study to expand this research could consider focusing on the mechanisms by which different forms of knowledge are integrated and prioritised in design processes. This would contribute to clarifying the collaborative design methods that support them. Moreover, assessing the levels of resilience of different public spaces would enhance co-design processes and contribute to understanding their outcomes. Developing a resilience assessment framework for public spaces could help evaluate the resilience of public spaces at different levels, which could be useful for academia and practice.

Samenvatting

Klimaatverandering heeft gevolgen voor elke regio van de wereld, en naar schatting zullen 3,3 miljard mensen er de komende decennia aan worden blootgesteld. De manier waarop stedelijke systemen interacteren met ecologische systemen staat onder druk en draagt bij aan sociale ongelijkheid en conflicten. Klimaatadaptatie is het proces waarbij de fysieke leefomgeving wordt aangepast aan de klimaateffecten, onder andere door het verbeteren van stedelijke veerkracht. Veerkracht is het vermogen van een systeem om een crisis te weerstaan, en in de stad is het ontwikkelen van veerkracht in de openbare ruimte een prioriteit. Het zijn de stedelijke leegtes waarin meerdere infrastructuren, mobiliteit, water, biodiversiteit en menselijk leven zich ontvouwen, maar hun belanghebbenden zijn vaak divers en conflicterend.

Chili heeft een lange geschiedenis van klimatologische en geografische gevolgen die steden hebben gevormd en wordt nu geconfronteerd met de gevolgen van klimaatverandering. De locatie van menselijke nederzettingen wordt bepaald door een ingewikkelde en diverse geografie en de nabijheid van hulpbronnen en economische activiteiten. Tegenwoordig bevinden steden zich vaak in kwetsbare gebieden, waarbij winstgevendheid op de lange termijn meer prioriteit krijgt dan veiligheid. Klimaatverandering legt hier meer druk op. Om dit aan te pakken heeft de Chileense regering een reeks nationale aanpassingsplannen op nationaal en regionaal niveau ontwikkeld. Toch blijven de routes om stedelijke veerkracht in Chili te implementeren onduidelijk.

Probleemstelling. Als steden zich willen aanpassen aan de klimaatverandering door middel van veerkrachtige oplossingen, is de samenwerking van een breed scala aan actoren uit verschillende sectoren en achtergronden op verschillende schaalniveaus cruciaal. Actoren zoals besluitvormers, stedenbouwkundigen, deskundige professionals, burgers en kennisproducenten kunnen bijdragen aan ontwerpprocessen om de veerkracht van de openbare ruimte te verbeteren. Er is echter een gebrek aan samenwerking op het gebied van stadsontwerp in Chili, en er is tot nu toe weinig onderzoek in die context uitgevoerd. De Chileense institutionele context is uitdagend, omdat publieke organisaties de neiging hebben om in silo's te opereren, interdisciplinair stadsontwerp een opkomend fenomeen is en burgerparticipatie vaak oppervlakkig is.

Kenniskloof. De onderzoeksaanpak van dit proefschrift was gebaseerd op het onderzoek en de praktijkervaringen van samenwerking in ontwerpprocessen, met name in co-design. Bovendien hebben co-designstudies zich de afgelopen decennia vaak gericht op eenmalige gebeurtenissen. Vanwege hun zichtbaarheid, betrokkenheid en verkennend karakter, komen er steeds meer stadsmakers en tactiele stedenbouw initiatieven op. Stedelijke ontwerpprocessen, en vooral veerkrachtige openbare ruimtes, vereisen echter de betrokkenheid van meerdere actoren in verschillende stadia van het proces. Bovendien hebben veel wetenschappers verklaard dat samenwerking in ontwerpprocessen, vooral in stedelijke ontwerpprocessen, meer conceptuele en methodologische verduidelijking nodig heeft met betrekking tot de methoden en actoren.

Het doel van dit onderzoek is tweeledig: (1) bijdragen aan een verder theoretisch begrip van de co-designprocessen van veerkrachtige openbare ruimtes en (2) richtlijnen bieden voor de samenwerking van actoren uit diverse sectoren en achtergronden in de stedelijke ontwerpprocessen van veerkrachtige openbare ruimtes. De centrale onderzoeksvraag in dit onderzoek is: Hoe draagt een collaboratieve aanpak bij aan de stedelijke ontwerpprocessen van veerkrachtige openbare ruimtes in Chili?

Het onderzoek bestaat uit vier empirische studies die de co-designprocessen van veerkrachtige openbare ruimtes in Chili verder onderzoeken. Ze bekeken de belangrijkste barrières, de samenwerkingsniveaus, de methoden en de kennisvormen die in de co-designprocessen zijn geïntegreerd. De onderzoeken beantwoordden de volgende vragen: (1) Hoe worden barrières en factoren aangepakt in veerkrachtige co-designprocessen voor de openbare ruimte? (2) Hoe werken actoren samen in ontwerpprocessen van de openbare ruimte? (3) Hoe dragen visuele methoden bij aan co-designprocessen in de publieke ruimte? (4) Welke sociale en ecologische kennis wordt geïntegreerd in veerkrachtige co-designprocessen voor de openbare ruimte?

Onderzoeksmethoden. Het onderzoek hanteerde twee methoden om de co-designprocessen van veerkrachtige openbare ruimtes in Chili te bestuderen: een case study-aanpak om recente processen te verkennen en een Action Research through Design-aanpak (ARtD) om een kleinere openbare ruimte te ontwerpen die voortbouwt op de voorgaande cases. De Case Study-aanpak was gebaseerd op interviews die werden afgenomen tijdens veldwerk in 2019-2020. De ARtD-aanpak, onlangs bedacht door wetenschappers die de Action Research (AR)-aanpak combineerden met de Research through Design (RtD)-aanpak, werd gebruikt om het ontwerpen van een openbare ruimte met actoren uit de praktijk te onderzoeken. Het onderzoek richtte zich op Chili als specifiek studiegebied vanwege de ervaringen van de auteur, de beschikbaarheid van informatie tijdens de pandemie en de nabijheid van meerdere kritische actoren die bij de bestudeerde cases betrokken waren.

Hoofdstuk 2 beantwoordde onderzoeksvraag 1 en onderzocht de barrières en factoren in drie recente co-designprocessen van veerkrachtige openbare ruimtes in de Atacama-woestijn: Kaukari Urban Park, Antofagasta Seaside Park en Seahill Pathways. Het onderzoek had tot doel de barrières en factoren voor samenwerking en ontwerp in dergelijke processen te analyseren. Voor de analyse werd een veerkrachtstroomschema ontwikkeld om te conceptualiseren hoe barrières werden aangepakt door mechanismen van transformatie, aanpassing en persistentie. Uit het onderzoek bleek dat flexibiliteit in samenwerking en ontwerp cruciaal was bij het co-design van veerkrachtige openbare ruimtes. Dankzij de flexibiliteit in de manier waarop actoren samenwerkten, konden nieuwe organisaties en partnerschappen ontstaan. Door de flexibiliteit van het ontwerp konden diverse actoren de projecten beïnvloeden door waardevolle kennis aan te bieden. Het benadrukte ook dat stadsontwerpers een belangrijke rol speelden bij het behouden van het bewustzijn van kritische actoren en het bevorderen van hun bereidheid om samen te werken bij het ontwerp.

Hoofdstuk 3 beantwoordde onderzoeksvraag 2 en conceptualiseerde co-designprocessen door bestaande definities van samenwerking en ontwerp te verbinden. Het Co-Design Framework is ontwikkeld door de participatieladder van Arnstein te combineren met de ontwerpcyclusstappen. Het werd gebruikt om het Kaukari Urban Park en Antofagasta Seaside Park te analyseren, omdat het veerkrachtige parken ter grootte van een stad waren die gedeeltelijk waren geïmplementeerd en meerdere actoren hadden samengewerkt aan hun ontwerpprocessen. De ontwerpactiviteiten en de samenwerkingsniveaus die door de betrokken actoren werden bereikt, werden verder geanalyseerd. De studie identificeerde drie co-design-arena's die naast elkaar kunnen bestaan, waarbij in dergelijke processen verschillende doelen worden nagestreefd. Arena's helpen bij het begrijpen van institutionele arrangementen waar de actoren met elkaar interacteren. De Strategische Arena heeft tot doel de haalbaarheid van de ontworpen openbare ruimte te bepalen. De Transdisciplinaire Arena integreert diverse vormen van kennis in het ontwerpen van contextgeschikte projecten. De Sociaal-culturele Arena waarborgt haar legitimiteit en schakelde cruciale actoren in die verder betrokken zouden zijn bij het onderhouden, exploiteren en activeren van de openbare ruimte. De belangrijkste bijdragen van dit onderzoek waren de ontwikkeling van het Co-Design Framework en de identificatie van de drie co-designarena's. Het raamwerk verduidelijkte hoe diverse actoren op verschillende niveaus betrokken kunnen worden bij co-designprocessen. Er werd geschat dat het nuttig zou zijn als conceptueel raamwerk voor andere onderzoeken en als praktisch hulpmiddel bij het plannen van co-designprocessen. Het identificeren van de co-design-arena's zorgde voor conceptuele duidelijkheid in de betrokkenheid van diverse actoren bij het beïnvloeden van de projecten en het haalbaar en legitiem maken ervan.

Hoofdstuk 4 beantwoordde onderzoeksvraag 3 om het gebruik van Visual Collaborative Methods (VCM) tijdens co-designprocessen in de openbare ruimte te analyseren, waarbij gebruik werd gemaakt van een Action Research through Design-aanpak. Gebaseerd op het eerder onderzochte Kaukari Urban Park, werd het Sportplein bestudeerd terwijl een co-designproces werd uitgevoerd. Het proces duurde twee jaar en maakte een langdurig onderzoek mogelijk door co-design met actoren en professionals uit de praktijk in Chili. Er waren professionals uit Nederland en Chili bij betrokken en de bijeenkomst vonden voornamelijk online plaats. De onderzochte methoden waren zowel analoog als digitaal en droegen bij aan het begrijpen van de ontwerpstappen waarin ze behulpzaam waren en die veranderden afhankelijk van de ontwerpfasen. Het Co-Design Framework werd uitgebreid om de drie belangrijkste ontwerpfasen te onderscheiden: conceptueel, belichaming en detaillering. Uit het onderzoek bleek dat VCM gedurende het hele proces nuttig is. In de conceptuele fase dragen ze bij aan kennisonderzoek en collectieve brainstorming. In de uitvoeringsfase faciliteren ze het analyseren en evalueren van alternatieve oplossingen. In de detailfase integreren ze de technische kennis van ervaren actoren. Bij het analyseren van de drie fasen werd de nadruk gelegd op de leiderschaps- en facilitatorrol van stadsontwerpers en de waarde van hun expertise op het gebied van probleemoplossing en oplossingsgeneratie.

Hoofdstuk 5 beantwoordde onderzoeksvraag (4) en had tot doel de diversiteit van kennis te onderzoeken die is geïntegreerd in co-designprocessen. Veerkrachtige openbare ruimtes werden geconceptualiseerd als sociaal-ecologische systemen (SES) om de vormen van kennis te kaderen die een belangrijke rol speelden bij het beïnvloeden van het stadsontwerp. Deze studie had tot doel de sociale en ecologische kennis die door de betrokken actoren werd aangeleverd en die in de ontwerpen werd geprioriteerd en geïntegreerd, verder te specificeren. Het onderzoek heeft inzicht opgeleverd in de mechanismen voor kennisintegratie binnen de co-design-arena's. Een belangrijke bevinding van het onderzoek naar het conceptualiseren van publieke ruimtes als SES bestond uit het zich ontvouwen in fysieke, dynamische en institutionele dimensies. Dit is een cruciale definitie voor het bestuderen en ontwerpen van veerkrachtige openbare ruimtes.

Onderzoeksbijdragen. Dit onderzoek heeft bijgedragen aan de theorie en praktijk van het co-designen van veerkrachtige openbare ruimtes. De onderzoeken droegen bij aan de overkoepelende co-design- en veerkrachttheorie en leverden methodologische bijdragen aan co-designonderzoek en de opkomende Action Research through Design-aanpak.

De belangrijkste theoretische bijdrage aan de co-designtheorie is het conceptualiseren van het Co-Design Framework door conceptualiseringen van samenwerking, de ontwerpcyclus en ontwerpprocessen te herzien en te

combineren. Vervolgens werden de drie co-design-arena's geïdentificeerd als analytische eenheden om te begrijpen hoe actoren bijdragen aan de haalbaarheid, contextgeschiktheid en legitimiteit van de openbare ruimte. Ook werd het Evolutionary Resilience Framework geoperationaliseerd als een stroomschema, en publieke ruimtes als sociaal-ecologische systemen, wat bijdroeg aan het verduidelijken van de kennissystemen die in co-designprocessen zijn geïntegreerd. Uiteindelijk draagt dit onderzoek bij aan het operationaliseren van co-design en de verbinding van co-design met veerkrachttheorie.

De primaire methodologische bijdrage van dit onderzoek is het ontwikkelde Co-Design Framework, dat waardevol is gebleken voor het analyseren van co-designprocessen in de praktijk. Het raamwerk wordt ook gebruikt om een co-designproces in de praktijk te plannen, uit te voeren en te analyseren.

Richtlijnen voor de praktijk. Enkele van de belangrijkste bijdragen van dit onderzoek zijn vertaald in richtlijnen voor de praktijk van collaboratief stadsontwerp, vooral met het doel de veerkracht van de openbare ruimte te verbeteren. Deze richtlijnen zijn relevant voor stadsontwerpers en andere besluitvormers die betrokken zijn bij de ontwerpprocessen van veerkrachtige openbare ruimtes, zoals architecten, ingenieurs, landschapsarchitecten, professionals uit de publieke en private sector, NGO's en andere niet-professionals en burgers uit lokale gemeenschappen. Praktijkrichtlijnen omvatten de cruciale voorwaarden voor co-design en het Co-Design Framework als bruikbaar canvas voor de praktijk. De richtlijnen zijn in de eerste plaats bedoeld voor samenwerkende stadsontwerpers die helpen bij het plannen, uitvoeren en evalueren van co-designprocessen in de openbare ruimte. Ze streven ernaar passende oplossingen te ontwerpen, evenals consensus te creëren en te valideren.

Er werd vastgesteld dat drie voorwaarden voor de co-designprocessen van veerkrachtige openbare ruimtes cruciaal zijn om deze processen mogelijk te maken en te faciliteren: het bewustzijn van de betrokken actoren van de gekozen collaboratieve aanpak, de bereidheid van de betrokken actoren om samen te werken bij het ontwerp, en de algehele proces dat flexibiliteit vereist, vooral van de betrokken actoren.

Er wordt voorgesteld dat het Co-Design Framework nuttig kan zijn als een bruikbaar canvas voor het plannen van dergelijke processen, als een routekaart voor het uitvoeren ervan, en als een raamwerk voor het evalueren ervan. Het conclusieshoofdstuk presenteert kort een workshop die tijdens het onderzoek is ontwikkeld en ondernomen om te illustreren hoe deze kan worden gebruikt als een canvas met diverse actoren en een bruikbaar protocol biedt voor praktijkmensen en samenwerkende stadsontwerpers.

Reflecties op onderzoekskeuzes. Dit onderzoek maakte gebruik van twee methodologische benaderingen om de co-design-fenomenen te analyseren: de Comparative Case Study en de Action Research through Design-aanpak. Er zijn drie vergelijkende casestudies uitgevoerd. Ze analyseerden dezelfde gevallen met behulp van verschillende conceptuele kaders en concentreerden zich op verschillende analyse-eenheden.

De bewuste keuze om de processen van de stadsparken te analyseren met behulp van verschillende conceptuele benaderingen draagt bij aan het begrip van co-design voor veerkrachtige openbare ruimtes. Hoewel de drie onderzochte co-designprocessen enige overeenkomsten vertoonden, boden hun verschillen inzicht in de betrokken actoren en kennisvelden. Daarnaast was een belangrijke bijdrage van dit onderzoek het uitvoeren van een co-designproces met de Action Research through Design-aanpak, terwijl het Co-Design Framework werd toegepast voor het plannen, uitvoeren en analyseren van de co-designprocessen van een openbare ruimte.

De focus op de Chileense context was deels te wijten aan indirecte factoren zoals de pandemie. Het bood echter ook de mogelijkheid om vóór dit onderzoek een geografische en institutionele omgeving te bestuderen die de onderzoeker kende door zowel praktische ervaring als academische studies. De unieke setting van de Atacama-woestijn droeg bij aan de rijkheid van het onderzoek en er werden pogingen gedaan om ervoor te zorgen dat de bevindingen zowel generaliseerbaar als contextspecifiek waren. De bevindingen hebben tot doel niet alleen bij te dragen aan theorieën, maar ook aan lokale contexten.

Aanbevelingen voor verder onderzoek zijn bedoeld om de bevindingen uit te breiden en te valideren en vervolgonderzoek te bevorderen, bijvoorbeeld het verder testen van het Co-Design Framework door het analyseren van cases binnen nieuwe toepassingsgebieden, zoals serviceontwerp, placemaking-ontwerp of verschillende geografische contexten, zoals onlangs gedaan door wetenschappers uit de Europese context. Het raamwerk kan ook worden gebruikt om co-designprocessen in de praktijk te plannen en verder te testen via de Action Research through Design-aanpak.

Een vervolgstudie om dit onderzoek uit te breiden zou kunnen overwegen zich te concentreren op de mechanismen waarmee verschillende vormen van kennis worden geïntegreerd en geprioriteerd in ontwerpprocessen. Dit zou bijdragen aan het verduidelijken van de collaboratieve ontwerpmethoden die deze ondersteunen. Bovendien zou het beoordelen van de mate van veerkracht van verschillende openbare ruimtes de co-designprocessen verbeteren en bijdragen aan het begrijpen van de resultaten ervan. Het ontwikkelen van een raamwerk voor de beoordeling

van de veerkracht van de openbare ruimte zou kunnen helpen de veerkracht van de openbare ruimte op verschillende niveaus te evalueren, wat nuttig zou kunnen zijn voor de academische wereld en de praktijk.

TOC

Resumen

El cambio climático afecta a todas las regiones del mundo y se estima que 3.300 millones de personas estarán expuestas a él en las próximas décadas. Sus impactos cuestionan la forma en que los sistemas urbanos interactúan con los sistemas ecológicos y aumentarán las desigualdades y los conflictos sociales. La adaptación climática es el proceso de ajuste de los asentamientos a los impactos climáticos, que puede lograrse mejorando la resiliencia urbana. La resiliencia es la capacidad de un sistema para resistir una crisis, y en las ciudades se han definido los espacios públicos como una prioridad para mejorarla. Ellos son los vacíos urbanos en los que se despliegan múltiples infraestructuras, movilidad, agua, biodiversidad y vida humana, pero sus actores suelen ser diversos y conflictivos.

Chile tiene una larga historia de impactos climáticos y geográficos que han dado forma a sus ciudades y ahora enfrenta los impactos del cambio climático. Su intrincada y diversa geografía, y la proximidad a recursos y actividades económicas han condicionado la ubicación de los asentamientos humanos. Hoy en día, las ciudades suelen estar ubicadas en zonas vulnerables debido a los impactos geográficos y climáticos, privilegiando la rentabilidad en lugar de la seguridad a largo plazo. El cambio climático impone nuevos desafíos a los existentes en las ciudades que amenazan. Para abordarlo, el gobierno chileno ha desarrollado una serie de Planes Nacionales de Adaptación a niveles nacional y regional. Sin embargo, los caminos para implementar la resiliencia urbana en Chile siguen sin ser claros y concretos.

Planteamiento del problema. Para que las ciudades se adapten al cambio climático a través de soluciones resilientes, la colaboración de una amplia gama de actores de diferentes sectores es crucial a diferentes escalas. Actores como tomadores de decisiones, diseñadores urbanos, profesionales expertos, ciudadanos y productores de conocimiento pueden contribuir en los procesos de diseño para mejorar la resiliencia de los espacios públicos. Sin embargo, existe una falta general de colaboración en el diseño urbano en Chile, y hasta la fecha se han llevado a cabo pocas investigaciones en este tema. El contexto institucional chileno es especialmente desafiante porque las organizaciones públicas tienden a operar en silos, el diseño urbano interdisciplinario es un fenómeno emergente y la participación ciudadana suele ser superficial.

Brecha de conocimiento. El enfoque de investigación se basa en la investigación y experiencias prácticas de colaboración en el diseño, particularmente en procesos de codiseño. Además, durante las últimas décadas, los estudios de codiseño suelen centrarse en actividades particulares. En el ámbito urbano, las iniciativas de urbanismo táctico y *placemaking* han aumentado debido a su visibilidad y carácter exploratorio. Sin embargo, los procesos de diseño urbano, particularmente los espacios públicos resilientes, requieren la participación de múltiples actores en diferentes etapas del proceso. Además, muchos académicos han afirmado que la colaboración en los procesos de diseño, especialmente en los procesos de diseño urbano, requiere de una mayor claridad conceptual y metodológica, especialmente con respecto a los métodos y actores involucrados.

El objetivo de esta investigación es doble: (1) contribuir a una mayor comprensión conceptual de los procesos de codiseño de espacios públicos resilientes y (2) proporcionar pautas para la colaboración de actores de diversos sectores en los procesos de diseño de espacios públicos resilientes. La pregunta central de investigación en esta investigación es: ¿Cómo contribuye un enfoque colaborativo a los procesos de diseño urbano de espacios públicos resilientes en Chile?

La investigación consta de cuatro estudios empíricos que estudian procesos de codiseño de espacios públicos resilientes en Chile. Se examinaron las principales barreras, los niveles de colaboración, los métodos utilizados y las formas de conocimiento integradas a lo largo de los procesos de codiseño. Los estudios respondieron las siguientes preguntas: (1) ¿Cómo se abordan las barreras y los facilitadores en los procesos de codiseño de espacios públicos resilientes? (2) ¿Cómo colaboran los actores en los procesos de diseño del espacio público? (3) ¿Cómo contribuyen los métodos visuales de colaboración a los procesos de codiseño del espacio público? (4) ¿Qué conocimiento social y ecológico se integra en los procesos de codiseño de espacios públicos resilientes?

Métodos de investigación. La investigación adoptó dos métodos para estudiar los procesos de codiseño de espacios públicos resilientes en Chile: un enfoque de Estudio de Caso para explorar procesos recientes y un enfoque de Investigación Acción a través del Diseño para diseñar un espacio público más pequeño ubicado al interior de uno de los casos estudiados. El enfoque del Estudio de Caso se basó en entrevistas realizadas en trabajo de campo (2019-2020). El enfoque Investigación Acción a través del Diseño, acuñado recientemente por académicos que combinan el enfoque de Investigación Acción con el enfoque de Investigación a través del Diseño, se utilizó para investigar diseñando un espacio público con actores en la práctica. La investigación se centró en Chile como un área de estudio particular debido a las experiencias del autor, la disponibilidad de información durante la pandemia, y la proximidad a múltiples actores involucrados en los casos estudiados.

El Capítulo 2 respondió a la pregunta de investigación 1, e investigó las barreras y los facilitadores en tres procesos recientes de codiseño de espacios públicos resilientes en el desierto de Atacama: el Parque Urbano Kaukari, el Parque Urbano de Borde Antofagasta y los Paseos Cerro Mar. El estudio tuvo como objetivo analizar las barreras y los facilitadores para la colaboración y el diseño en dichos procesos. Se desarrolló un diagrama de flujo de la resiliencia a fin de conceptualizar cómo se abordaron las barreras mediante mecanismos de transformación, adaptación y persistencia. El estudio reveló que la flexibilidad en la colaboración y el diseño era crucial en los procesos de codiseño de espacios públicos resilientes. La flexibilidad en la forma en que los actores colaboraron permitió que surgieran nuevas organizaciones y asociaciones necesarias. La flexibilidad del diseño permitió que diversos actores influyeran en los proyectos proporcionando conocimientos valiosos. También se destaca que los diseñadores urbanos tienen un papel crucial en mantener el compromiso de los actores críticos y fomentar su voluntad de colaborar en el diseño.

El Capítulo 3 respondió a la pregunta de investigación 2, y conceptualizó los procesos de codiseño vinculando las definiciones existentes de la colaboración y el diseño. El Marco de Codiseño se desarrolló combinando la Escalera de Participación de Arnstein con los pasos del Ciclo de Diseño. Se utilizó para analizar el Parque Urbano Kaukari y el Parque de Borde Costero de Antofagasta porque eran parques resilientes del tamaño de una ciudad que ya se encontraban parcialmente implementados y en los que múltiples actores habían colaborado en sus procesos de diseño. Se analizaron las actividades de diseño y los niveles de colaboración alcanzados por los actores involucrados. El estudio identificó tres arenas de codiseño que coexistían, persiguiendo objetivos distintos en dichos procesos. Las arenas de actores son unidades analíticas que ayudan a comprender las asociaciones institucionales donde interactúan dichos actores. La Arena Estratégica tiene como objetivo determinar la viabilidad de los espacios públicos diseñados. La Arena Transdisciplinaria integra diversas formas de conocimiento en el diseño de proyectos adecuados al contexto. La Arena Sociocultural aseguró la legitimidad en el tiempo e involucró a actores cruciales en el futuro mantenimiento, operación y activación de los espacios públicos. Las principales contribuciones de este estudio fueron el desarrollo del Marco de Codiseño y la identificación de las tres Arenas de Codiseño. El marco aclaró cómo diversos actores pueden participar en diferentes niveles a lo largo de los procesos de codiseño. Se estima que el Marco de Codiseño es útil para otros estudios, y también como una herramienta práctica para planificar procesos de codiseño. La identificación de las arenas de codiseño proporcionó claridad conceptual a la participación de diversos actores para influir en los proyectos y hacerlos más apropiados, factibles y legítimos.

El Capítulo 4 respondió a la pregunta de investigación 3 para analizar el uso de Métodos Visuales Colaborativos (MVC) en los procesos de codiseño del espacio público, adoptando un enfoque de Investigación Acción a través del Diseño. Ubicada en el Parque Urbano Kaukari previamente estudiado, la Plaza de los Deportes fue estudiada mientras se llevaba a cabo su proceso de codiseño. El proceso duró dos años y permitió una experiencia de investigación inmersiva con actores y profesionales de la práctica en Chile. Involucró a profesionales radicados en los Países Bajos y Chile, y se llevó a cabo principalmente a través de modalidades en línea que solo fueron posibles en un contexto de pandemia. Los métodos estudiados fueron tanto análogos como digitales y contribuyeron a comprender los pasos de diseño en los que se usaron durante las fases de diseño. El Marco de Codiseño se amplió para diferenciar las tres fases principales de diseño: la fase conceptual, la fase de realización y la fase de detalle. El estudio sugirió que los MVC fueron útiles durante todo el proceso. En la fase conceptual, contribuyeron a la indagación del conocimiento y a la lluvia de ideas colectiva. En la fase de realización facilitaron el análisis y la evaluación de posibles soluciones. En la fase de detalle, integraron el conocimiento técnico de actores con experiencias diferentes. El análisis de las tres fases enfatizó el papel de liderazgo y facilitador de los diseñadores urbanos y el valor de su capacidad de resolver problemas y de generar soluciones.

El Capítulo 5 respondió a la pregunta de investigación 4 y tuvo como objetivo explorar la diversidad de conocimientos integrados en los procesos de codiseño. Los espacios públicos resilientes se conceptualizaron como Sistemas Social-Ecológicos (SSE) para enmarcar las formas de conocimiento que desempeñaron un papel relevante influyendo en el diseño urbano. Este estudio tuvo como objetivo especificar aún más el conocimiento social y ecológico proporcionado por los actores y que fueron priorizados e integrados en los proyectos. El estudio proporcionó información sobre los mecanismos de integración de conocimientos en los procesos de codiseño. Un hallazgo clave del estudio al conceptualizar los espacios públicos como SSE consistió en determinar sus dimensiones físicas, dinámicas e institucionales. Esta es una definición crucial para estudiar y diseñar espacios públicos resilientes.

Contribuciones a la investigación. Esta investigación contribuyó a la teoría y la práctica del codiseño de espacios públicos resilientes. Los estudios contribuyeron a las teorías generales de codiseño y resiliencia y proporcionaron contribuciones metodológicas a la investigación de los procesos de codiseño y al enfoque emergente de Investigación Acción a través del Diseño. La principal contribución a la teoría del codiseño es la conceptualización del Marco de Codiseño revisando y combinando conceptualizaciones de colaboración y el ciclo de diseño. Posteriormente, se identificaron las tres arenas de codiseño como unidades analíticas para representar cómo los actores contribuyen a la viabilidad, la calidad

y la legitimidad de los espacios públicos. Asimismo, se operacionalizó el Marco de Resiliencia Evolutiva como diagrama de flujo, y los espacios públicos como Sistemas Socioecológicos, contribuyendo a clarificar los sistemas de conocimiento integrados en los procesos de codiseño. En última instancia, esta investigación contribuye a poner en práctica el codiseño y vincularlo con las teorías de la resiliencia. Por otra parte, la principal contribución metodológica de esta investigación es el Marco de Codiseño para analizar los procesos de codiseño en la práctica. El marco también se utiliza para planificar procesos de codiseño y como hoja de ruta al ejecutarlos.

Recomendaciones para la práctica. Algunas de las principales contribuciones de esta investigación se han traducido en recomendaciones para la práctica del diseño urbano colaborativo, principalmente cuando se busca mejorar la resiliencia de los espacios públicos. Estas directivas son pertinentes para los diseñadores urbanos y otros tomadores de decisiones involucrados en los procesos de diseño de espacios públicos resilientes, como arquitectos, ingenieros, arquitectos paisajistas, profesionales de los sectores público y privado, ONGs y otros ciudadanos y no profesionales de las comunidades locales. Las recomendaciones prácticas abarcan las condiciones cruciales para el codiseño y el Marco de Codiseño como un lienzo disponible para la práctica. Las recomendaciones están dirigidas principalmente a diseñadores urbanos colaborativos y contribuyen a planificar, ejecutar y evaluar procesos de codiseño de espacios públicos cuando su objetivo sea el de diseñar soluciones adecuadas, legítimas y viables.

Se identificaron tres condiciones para los procesos de codiseño de espacios públicos resilientes como cruciales para habilitarlos y facilitarlos: la conciencia de los actores involucrados sobre el enfoque colaborativo adoptado, la voluntad de los actores involucrados de colaborar en el diseño y el compromiso general durante el proceso. Los procesos de codiseño requieren flexibilidad, especialmente de los actores involucrados.

Se propone que el Marco de Codiseño sirve como lienzo de acción para planificar dichos procesos, como una hoja de ruta al ejecutarlos y como un marco para evaluarlos retrospectivamente. El capítulo de conclusiones presenta brevemente un taller llevado a cabo hacia el final de la investigación para ilustrar cómo se puede utilizar el marco como un lienzo para el trabajo con diversos actores, ofreciendo así un protocolo para la práctica de profesionales y diseñadores urbanos colaborativos.

Reflexiones sobre las opciones de investigación. Esta investigación empleó dos enfoques metodológicos para analizar el fenómeno del codiseño: el Estudio Comparativo de Casos y el enfoque de Investigación Acción a través del Diseño. Se realizaron tres estudios de casos analizando los mismos casos con diferentes

marcos conceptuales y centrándose en diferentes unidades de análisis. La elección deliberada de analizar los procesos de diseño de parques urbanos utilizando diferentes enfoques conceptuales contribuye a comprender el fenómeno contemporáneo del codiseño de espacios públicos resilientes en su complejidad. Aunque los tres procesos de codiseño estudiados compartieron algunas similitudes, sus diferencias proporcionaron conocimientos enriquecedores sobre los diferentes actores y campos de conocimiento involucrados. Además, una contribución significativa de esta investigación fue la de llevar a cabo un proceso de codiseño con el enfoque de Investigación Acción a través del Diseño mientras se aplicó el Marco de Codiseño para planificar, ejecutar y analizar dicho proceso de codiseño.

El foco de la investigación y sus casos en el contexto chileno se debió en parte a factores coyunturales como la pandemia. Sin embargo, brindó la oportunidad de estudiar un entorno geográfico e institucional familiar para el investigador a través de la experiencia práctica previa y los estudios académicos anteriores a esta investigación. El entorno único del Desierto de Atacama añadió riqueza mientras se hicieron esfuerzos para garantizar que los hallazgos fueran tanto generalizables, como específicos al contexto. Asimismo, la discusión de los hallazgos contribuye no sólo a la teoría sino también a los contextos locales.

Las recomendaciones para futuras investigaciones pretenden ampliar y validar los hallazgos y promover la posterior transmisión de investigaciones. Por ejemplo, futuras investigaciones pueden incluir usar el Marco de Co-Diseño para analizar casos dentro de nuevas disciplinas de aplicación, como el diseño de servicios, el placemaking, o bien en diferentes contextos geográficos, como lo hicieron recientemente académicos en el contexto europeo utilizando el Marco de Codiseño de la presente investigación (Slingerland et al., 2024). El marco también se puede utilizar para planificar procesos de codiseño en la práctica que pueden ser evaluados también a través del enfoque de Investigación Acción a través del Diseño.

Un estudio consecutivo para ampliar esta investigación podría considerar centrarse en los mecanismos mediante los cuales se integran y priorizan diferentes formas de conocimiento en los procesos de codiseño. Esto contribuiría a clarificar la función de los métodos de diseño colaborativo que los sustentan. Además, evaluar los niveles de resiliencia de diferentes espacios públicos podría mejorar los procesos de codiseño y contribuiría a comprender su influencia en los proyectos. Desarrollar un Marco de Evaluación de la Resiliencia de los espacios públicos contribuiría a evaluar la resiliencia de los espacios públicos en diferentes niveles. Ello sería útil para la academia y la práctica.

1 Introduction

1.1 Climate change adaptation in Chile and the need for collaboration in urban design

Climate change is affecting every region of the world and is taking place locally. It is estimated that 3.3 billion people will be exposed to its impacts in the next decade, and 170 countries have adopted adaptation and resilience public policies in the last decade (Calvin et al., 2023). Flooding, droughts, and heat waves have environmental impacts on urban spaces. Such impacts challenge how urban systems interact with ecological ones and add to existing social inequalities and conflicts (Carmona, 2021). Climate adaptation is the process of adjusting settlements to climate impacts (IPCC, 2014), which can be done by improving the urban resilience of cities (Meerow & Stults, 2016). Resilience is the ability of a social-ecological system to withstand stresses such as climate change (Berkes et al., 2008). Then, urban resilience is the capacity of cities to resist and change when exposed to stresses such as climate impacts (Davoudi et al., 2012). Academia and governments across the world have started promoting nature- and ecosystem-based solutions (Nesshöver, 2017; Faivre et al., 2018; Frantzeskaki, 2019; Hansen et al., 2023) to adapt cities to function like nature (Roggema et al., 2021). Public spaces have been defined as a priority for implementing urban resilience for climate change adaptation.

Chile has a long history of climatic and geographic impacts that have shaped its cities and now faces the impacts of climate change. Its intricate and diverse geography and the proximity to resources and economic activities have conditioned its location in vulnerable areas due to climatic and geographic impacts, opting for profitability rather than long-term safety (Camus. et al., 2016). According to the last census, 54% of the population is exposed (INE, 2018), 13% to at least three climate risks (Dilley, 2015), and records 1,2% GDP losses yearly (UNISDR, 2015). Climatic and geographic impacts affect ecosystems and communities throughout the country within the diverse territories of cities, including deserts, valleys, wetlands,

TOC

seaside, woodlands, fjords, and icefields. Earthquakes, river overflow and flooding, tsunamis, woodfires, and volcanic eruptions have recently hit cities from north to south (Onemi, 2020). The Chaitén volcano eruption and river overflow of the homonymous town in 2008, the earthquake and tsunami affecting central Chile in 2010, the great hill fires in Valparaíso in 2014, the river overflows in the Atacama Desert in 2015 and 2017, and the massive urban fires in Viña del Mar in 2024. The country has been catalogued as the 24th most dangerous country in the world (BEH-IFHV, 2019). Climate change imposes new challenges on existing ones and threatens cities with their impacts.

In Chile, a series of national adaptation plans have been developed, and climate change adaptation and resilience have been highlighted in public policy (National Adaptation Plan for Climate Change 2014, National Plan for Climate Change Action 2017-2022, City Adaptation Plan for Climate Change for 2018-2021). The public sector has developed such plans together with the advice of academics in several rounds (Barton et al., 2015; Barton, 2013). It was made evident that climate change could not be addressed with silo-based institutions, so different entities were created for the collaboration of the diverse parties involved (Sustainability Ministries Committee, Climate Change Inter-Ministerial Technic Team, Regional Climate Change Committees, and Climate Change Division in the Natural Environment Ministry) (MMA Chile, 2017).

In 2019, climate change adaptation became even more relevant because the Conference of the Parties (COP 2019) would be hosted in Chile. However, a few weeks before the international event, a massive social uprise started in the capital and expanded throughout the country in days. The streets hosted multiple protests, demonstrations, and riots (Somma, 2021). What was initiated by a 30 pesos (~ 30 cents) rise in the public transport fee turned into Chileans challenging political and economic constraints and making social and ecological crises evident. In all, this brought political instability and insecurity in the streets. Fast enough, the event was relocated to Madrid. This was a critical moment in the history of Chile, both as a failure to the climatic endeavour and as an underlying crisis in the economic and social stability.

Shortly after, the COVID-19 pandemic struck the country in 2020. The reduction in greenhouse gas emissions showed how much humans are responsible for climate change. While the transition to renewable energy production was on an apparent rise in the country, the development of adaptation plans and projects continued to be delayed. The right-wing government dealt with the health crisis through rigid measures to control both the disease and street security. Shortly after, a left-wing president was elected in a political twist. An academic who had participated in developing the

adaptation plans was named Minister of the country's Natural Environment Ministry. This restored hope and confirmed that the subject remained in the country's high public policy and academic spheres. Even though it would not be an easy road, efforts to improve urban resilience continued at the national and local levels.

Urban resilient measures are often implemented in the public spaces within cities. Parks and streets are the urban voids in which multiple infrastructures, mobility, water, biodiversity, and human life unfold. Urban parks, wetland restorations, naturalised riverbeds or rewild forests are public spaces for communities and biodiversity that may prevent flooding, droughts, and heatwaves (Ersoy, 2019). Yet, the institutional settings of public spaces often hamper the implementation of resilient measures because multiple functions and interests collide (Ersoy et al., 2024). In urban design processes, many complexities must be discussed and agreed upon amongst actors from diverse sectors and backgrounds. This may be done through co-design processes to improve the outcomes (Sanders and Stappers, 2008) through horizontal interactions amongst diverse participants (Manzini 2015; Mattelmäki and Sleeswijk Visser 2011). Given the Chilean situation, a collaborative approach to urban design processes may improve the chances of implementing resilient public spaces.

1.2 Illustrating the challenge of collaboration in urban design processes in Chile

Chilean growth and development have found their way through sectorial public institutions on the battlefield with private and citizen actors (Délano & Traslaviña, 1989; McPhee, 2011). Regulations and public policies for urban infrastructure development have contributed to taking control over the territory. One sector's gains often affect other sectors with a hegemony of scientific, technical, and engineering knowledge (Figueroa, 2012; Sagaris & Landon, 2017; Sagaris, 2024). The city's planning, design, and construction are fragmented, with weakened communities and excessive individualism (Tumper & Tomic, 2009). Masterplan tools were never formalised in public policy, preventing integrated urban design (Pérez Lancellotti, 2014). This has turned public attention to individual-owning family houses, promoting urban sprawl at the expense of public spaces and geographical landmarks such as rivers, wetlands, hills, and seasides (Moreno, 2018).

During the 2000s, Chile started its highway boom to address such urban sprawl. Concession intercity highways, once used to connect distant cities, soon began to be built within cities. This served as the country's economic impulse under the concession infrastructure plan (Vergara Perucich, 2019). The success attributed to infrastructures such as airports, ports, and interurban highways would inevitably encounter conflicts within the urban fabric and resistance from its multiple local actors (Allard, 2000). Following the cutting-edge Highway 5 (*Ruta* 5), built in the 19960s as an open pit highway, the Southern Vespucio highway (Autopista Vespucio Sur) was built. With it, there was also the irreversible loss of the great republican Americo Vespucio Ring Park and the fragmentation of the neighbourhoods (González Abarca, 2017). This was one of the leading public spaces in low-income neighbourhoods. Progress arrived at those neighbourhoods, destroying one of its emblematic public spaces.

An emblematic case is the Riverside North highway (*Costanera Norte*), intended to cross Santiago from east to west, connecting high-income neighbourhoods at the foothill of The Andes with middle and low-income neighbourhoods towards the international airport at the east. It was one of the most critical urban interventions of the late 20th century. One of the futuristic and utopian ideas of the 1960 Santiago Intercommunal Plan (PRIS) of the Ministry of Public Works (in charge of Juan Parrocchia) was materialised. It was one of the first cases in which authoritarian infrastructure paradigms were challenged through anti-highway revolts that lasted for five years (1997-2001) (Álvarez Rojas, 2013; Sagaris, 2014). Citizens and academia, especially those neighbouring the original layout of the highway, grouped to resist the initiative. The NIMBY effect (not in my backyard) assembled diverse academics from the School of Architecture of the Pontifical Catholic University of Chile because of its proximity to the preliminary highway layout.

The process lasted for years and underwent several changes in the layout of the highway. Residents of four neighbourhood councils in the vicinity of Cerro San Cristobal grouped and formed the *Coordinadora No a la Costanera Norte* (No to Riverside North Coordinator), a coalition to campaign against the highway project, relieving environmental and social urban values (Sagaris, 2104). The citizen coalition involved citizens from right and left wings, which was unthinkable in a highly polarised post-dictatorship country, involving middle and high-income neighbours from Providencia, Recoleta, and Independencia communes. Thus, citizens, ecologists, corporate lobbyists, and academics (architecture, transportation, and economists) contributed to the public discussions and educated themselves over time. As Lake Sagaris (2014), neighbour and leader of *Ciudad Viva* NGO (Living City) (2000 – 2010), currently an academic at the same university, recounts, "intense, honest and often difficult debates" were held to discuss environmental issues and

social needs. After years of struggle, they achieved the redefinition of the highway route, no longer dividing neighbourhoods and building it in a tunnel alongside the Mapocho riverbed. The *Coordinadora* had succeeded in protecting the cultural and heritage values of the neighbourhoods.

Yet, the new layout's consequences would imply the destruction of areas of the Mapocho riverbed. This led to a series of press releases and public statements rejecting intervening in the river ecosystem, which was to be replaced by concrete and other non-impermeable materials (Allard, 2000). The opposition was less organised this time, and road construction was imminent. Some managed to protect the cultural values of the neighbourhoods, while others failed to protect the ecological values of the riverbed.

The story of this initiative illustrates the lack of leadership and coordination of the urban public sector in the context of Chile (Allard, 2000). The list of truncated urban design processes in the country is long. Many social-ecological conflicts are concentrated, mainly in high-income neighbourhoods of the capital (Aliste & Stamm, 2015). From the completion of the remaining circumvallation of the *Vespucio Oriente* highway where, wealthy citizens organised under the *Defendamos la Ciudad* (Let's Defend the City) group managed to submerge the highway into a tunnel to maintain the republican Ring Park in *Las Condes* and *Vitacura* (Stamm, 2016). The Acceso Sur highway (South Access) connects high-income areas with the country's south (Sagaris & Landon, 2017). The case of the citizen plebiscite, which was organised after massive citizen resistance to the installation of a Crystal Lagoon project in the Intercommunal Urban Park, resulted in the dramatic rejection of such a costly initiative (Azócar, 2018). Or the contest for the *Nuevo Parque La Reina* (New La Reina Park) in which architecture firms proposed urban park projects, and the three proposals selected by the jury were voted by citizens based on the sole showcasing of the project renders (*Municipalidad de La Reina*).

These cases illustrate how stakeholders collaborate and the mechanisms (or lack thereof) with which cities are built in Chile. Two decades after the Costanera Norte construction, little progress has been made in the country's urban field. There is an absence of an integrated vision to administrate fragmented cities, and there is scarce knowledge and procedures to develop them (Sagaris & Landon, 2017). They illustrate the conflicts of urban design projects that solely respond to the needs of one particular interest and disciplinary knowledge field, in contrast to the diversity of cultural and ecological local impacts. The lack of spaces for dialogue is evident, and the hegemony of an engineering culture in developing urban infrastructures comes at the expense of cities' social, cultural, and environmental values. Despite the publication of the 20.500 Citizen Participation Law in 2011, the citizen focus

dismisses urban institutions' multi-layered and scalar levels, underestimating actors' contribution to urban design processes. With it, there is the consequent injustice of the inequalities in city construction (Greene & Mora, 2005; Stamm, 2016). As Sagaris puts it (2014), participation in urban development is "more than getting the process right". It requires new frameworks for integrating individual and collective knowledge, expertise, and skills involving actors from diverse sectors and backgrounds. Diverse forms of knowledge may be available and discussed in balanced ways upon different sectors for urban infrastructures to respond to its local ecological and social needs. In times of climate change and its recurrent impacts throughout Chile, this research studies emergent efforts to foster the collaboration of diverse actors throughout the urban design processes of recent resilient public spaces.

1.3 Research Formulation

1.3.1 Problem Statement

Urban public spaces are multifunctional, encompass various infrastructures and networks, and should be prepared for climate change impacts. They are part of cities' social and ecological systems, and multiple organisations govern them. Large-scale urban projects such as urban parks, river parks, waterfronts, wetland parks, and squares require multiple specialised knowledge from professionals, including actors from the public sector, users, and private and third-sector organisations. Many have proposed that diverse actors and knowledge backgrounds should be integrated into design processes to address climate change (Davoudi et al., 2012; IPCC, 2014; Meerow & Stults, 2016; SNPDRR 2020-2030, 2020). This should occur at different levels and time frames, dealing with multiple power levels, knowledge backgrounds, and sometimes conflicting values (Van Melik & Van Der Krabben, 2016).

Designing resilient public spaces within the Chilean institutional context is somewhat challenging because public organisations tend to operate in silos (Barton, 2013; Krellenberg & Barth, 2014; Orellana et al., 2016), citizen participation is often shallow (Delamaza, 2011; Barton et al., 2015; Lecannelier, 2015; Hernández et al., 2019; Biskupovic & Stamm, 2021), and interdisciplinary urban design is an emerging phenomenon (Aldunce et al., 2016; Krellenberg & Barth, 2014). For

example, in Chile, the Hydraulic Infrastructure Department manages river basins, the Water General Department manages water, and the Housing and Urbanism Ministry implements urban parks. As such, the urban design of a river basin urban park is unthinkable and improbable. Although urban design processes often involve multiple actors, designing resilient public spaces requires the knowledge and aims of even more public actors, disciplines, and citizens.

The institutional setting of urban design in Chile is silo-based, fragmented, and sometimes even conflicting, making it challenging to design resilient public spaces. The actors managing public spaces often have diverging aims and objectives or lack political commitment to climate adaptation (Calvin et al., 2023). **This research addresses the problem of lack of collaboration in the urban design processes of resilient public spaces in Chile**. The lack of collaboration amongst leading organisations, specialised professionals, designers, and citizens during the urban design processes often leads to a significant loss of value and a mismatch with the local context or the impossibility of implementing public space projects. As described before, an urban design process solely based on one sector and disciplinary knowledge may result in a lack of appropriation and care, difficulty of implementation, or simply a lack of adaptation to its climate, social, and urban context. Conflicting stakes, mismatched budgets, and political views often exacerbate these differences. The abovementioned adds to the existing overlapping infrastructures and lack of space, challenging the design and implementation of resilient public spaces.

1.3.2 Research Question

Designing resilient public spaces is a highly complex and context-specific process that requires combining diverse urban and ecological information and solutions into a project that improves citizens' quality of life and biodiversity. Multiple actors from different disciplines, sectors, and backgrounds must collaborate in urban design processes. Taking a collaborative approach to the urban design processes of resilient public spaces is needed in times of climate change (Biskupovic & Stamm, 2021; Biskupovic, 2021) and is critical for knowledge to influence urban design outcomes (Aldunce et al., 2016; Barton et al., 2015; Barton, 2013; Borquez et al., 2017). Diverse knowledge should be available and discussed in such urban design processes.

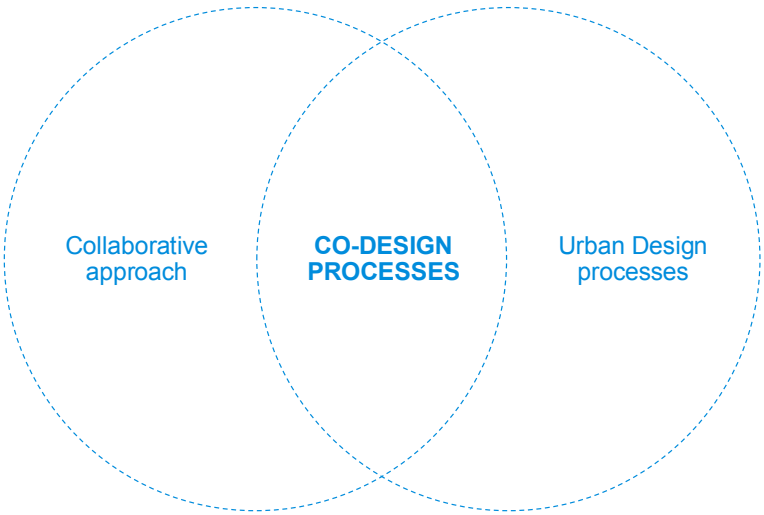

FIG. 1.1 Co-design processes as taking a collaborative approach to urban design processes.

This research explores the collaborative interactions among the involved actors throughout the urban design processes of resilient public spaces. Such urban design processes are conceptualised as co-design processes because multiple actors are involved in their design activities (Figure 1.1). Urban design is conceptualised not solely as the domain of specialised professionals but as a potentially inclusive process that engages stakeholders from different disciplines, including those lacking formal design training and experience. As such, a collaborative approach is taken to urban design processes to improve public space projects and their resilience to the climate crisis.

The research's main question is: **How does a collaborative approach contribute to the urban design processes of resilient public spaces?**

This research studies Chilean public spaces that have taken a collaborative approach to their urban design processes, focusing on their co-design mechanisms, methods, and integration of diverse knowledge.

1.3.3 Main Aim

The research aims to understand and explore the co-design processes of resilient public spaces in Chile. It is particularly interested in uncovering the mechanisms for involving actors from diverse sectors and knowledge backgrounds in urban design processes, particularly those of resilient public spaces.

1.3.4 Research Sub-questions and Objectives

This research is composed of four studies that answer the following sub-questions:

1. How are barriers and enablers addressed in resilient public space co-design processes?
2. How do actors collaborate in public space design processes?
3. How do visual methods contribute to public space co-design processes?
4. What social and ecological knowledge are integrated into resilient public space co-design processes?

The research objectives align with the research sub-questions and are elaborated on in the studies. They are the following:

1. To analyse the barriers and enablers in resilient public space co-design processes.
2. To analyse design activities and their levels of collaboration in public space urban design processes.
3. To analyse the use of visual methods throughout public space co-design processes.
4. To analyse the social and ecological forms of knowledge integrated into resilient public space co-design processes.

The research examines the co-design processes of prominent resilient public spaces in Chile and designs one in the same context. It focuses primarily on co-design processes in the Atacama Desert in northern Chile. Two cities, Copiapó and Antofagasta, share a history of controlling nature: facing desertic droughts and anticipating unexpected floodings from inland or the sea. Both settlements owe their location to mining activity and suffer the contradictions of economic growth and scarce investment to improve urban quality. While focused on exploiting the lands, societies now claim security and a higher quality of life. These seem crucial for local communities to exist and persist in such critical landscapes.

In the face of the uncertain climatic crisis, improving the resilience of public spaces requires collaborative urban design approaches across sectors and backgrounds. The first study explores the barriers and facilitators to collaboration and design (Chapter 2). In the second study, the varying degrees of collaboration in design activities are analysed through a conceptual framework, and the institutional arenas in which this occurs were defined (Chapter 3). The third study expanded the framework to analyse the use of visual collaborative methods throughout co-design processes (Chapter 4). The final study explored integrating social and ecological knowledge in such processes (Chapter 5).

1.4 Defining Public Space Resilience and Collaborative Design

This section defines the two concepts extensively used in this research: public space resilience and co-design. This positions the reader and anticipates the methodological definitions and the case selection criteria for the following four chapters.

1.4.1 Public Space Resilience

Cities need to adapt to climate change. They need to change and transform (Calvin et al., 2023). To do so, they need to improve their resilient capacities. Resilience is the ability of systems to withstand stress (Holling, 1973). In cities, the capacity to withstand climate change impacts can be addressed through resilience approaches. Solutions integrating social and ecological functions into public spaces have changed over time and have been referred to using different names, such as blue-green infrastructures (Bacchin et al., 2014), nature-based solutions (Kabisch et al., 2017), sensitive urban design (Bacchin, 2015; Wong & Brown, 2009), water-sensitive urban design (Palazzo, 2019), amongst others. These solutions require experts and design teams to integrate their knowledge and methods to design them (Barton, 2015; Berkes, 2017).

An extensive trajectory of resilience approaches within the urban domain exists (Pickett et al., 2013; Wu & Wu, 2012). Engineering resilience focuses on the system's ability to recover and return to a previous state aftershock (Fingleton et al., 2012;

Rose, 2004). There is an increasing interest in the evolving nature of systems and understanding the world's complexity, dynamics, and uncertainties. Ecological resilience defines whether cities modify functions and structures after a crisis (Gunderson & Holling, 2001). Furthermore, evolutionary resilience is the ability of social-ecological systems to persist, adapt, and transform as a process of change (Carpenter et al., 2001; Davoudi et al., 2012).

Cities have been conceptualised as complex systems (Nijhuis et al., 2016; Portugali, 2009; Roggema, 2009; Tillie, 2018) with interdependent and interrelated components. They have interdependent and multi-scalar elements and social, ecological, and technical dimensions (Van Bueren, 2009; de Roo & Boelens, 2016; Ersoy & Yeoman, 2020; Meerow & Stults, 2016). They are often conceptualised as complex and evolving Social-Ecological Systems (Berkes, 2017; Biggs et al., 2021; Folke, 2006; Ostrom, 2007). The SES concept refers to integrating humans into nature, stressing their interdependence, and highlighting their reciprocal feedback (Folke, 2006). Multiple approaches and frameworks can be used to analyse urban resilience. Particularly, the following studies will deepen the design processes of resilient public spaces as social-ecological systems.

The design of resilient public spaces is multidisciplinary and requires integrating multiple social and ecological knowledge domains and solutions into innovative and context-specific projects. It requires the involvement of multiple decision-makers, knowledge producers, and users and challenges institutional structures and regulations. To study such urban design processes, they are conceptualised as co-design processes and will be defined in the next section.

1.4.2 Collaborative Design of Public Spaces

Adapting to climate change imposes a paradigm change in urban design. Various solutions must be integrated into adapting public spaces. And their governing institutions should also be integrated in doing so (Pickett et al., 2013; Gallotti et al, 2023). Co-design approaches have been suggested to help actors integrate their knowledge and aims into the urban design process (Sandercock & Attili, 2010; E. Sanders, 2000). Co-design has been defined as processes involving multiple actors in design to improve the outcomes (Sanders and Stappers, 2008). It follows the participatory design tradition, emphasising a more horizontal approach to design processes (Manzini 2015; Mattelmäki and Sleeswijk Visser 2011; Sanders and Stappers 2008).

In urban design, the actors involved may come from different sectors (public, private, academia, non-profit, citizens) and disciplinary fields (Webb et al., 2018). As such, the collaboration of diverse actors in urban design improves the projects by integrating actors' knowledge, values, aims, and skills into the process (Huybrechts et al., 2017; Ostrom, 1996; Sanders & Stappers, 2014). Collaboration in design processes occurs in dynamic ways, with diverse interactions to integrate knowledge, values, and skills (Baibarac & Petrescu, 2019). Despite the many practical experiences and conceptualisations of co-design in urban design processes, there is still room for clarifying co-design processes and their complex evolutions (Szebeko & Tan, 2010; Watchorn et al., 2023).

Many co-design studies focus on specific activities and the use of tools and methods to foster the collaboration of designers and non-designers (McDonnell, 2018; Saad-Sulonen et al., 2018b; Sanders & Stappers, 2014). Only a few focus on the consequences of such co-design activities and how collaboration modifies the resulting designs (Bossen et al., 2016; Mc Evoy et al., 2019a; Nguyen, 2022). Moreover, more research is needed to focus on how co-design processes unfold (Saad-Sulonen et al., 2018a). A recent study on the last three decades of co-design studies reported that there is still no consensus on the steps of such a process (Ávila-Garzón & Bacca-Acosta, 2024). Most studies do not define the reported processes' precise methods, steps, and phases (Ávila-Garzón & Bacca-Acosta, 2024). This leaves space for clarifying how diverse actors can collaborate throughout design processes. This research focuses on public space co-design processes in which public, private, citizens, NGOs, and partnerships collaborate in urban design and the multiple ways to involve them.

1.5 Methodological Approaches

1.5.1 Research Design

This section explains the overarching methodological approach and the research design and introduces the studies conducted and presented in the different chapters of this dissertation. It determines the worldview, data inquiry strategies, and research methods (Creswell, 2009). First, the research design is explained, followed by the methodological choices. Finally, the cases studied are presented, and their selection is justified.

This research adopts a pragmatic philosophical worldview, emphasising pluralistic approaches to producing knowledge from a practical problem (Creswell, 2009). The research problem is rooted in the real world and studied using different research methods to analyse the consequences of actions. The research makes operational decisions to collect and analyse data and to find answers to the questions investigated (Hart, 1998).

This research explores how resilient public spaces are co-designed. To empirically understand the complexity of this contemporary phenomenon, the studies focus on the co-design processes of resilient public spaces. It adopts a research approach that derives from the nature of the research question that aims to be answered (Yin, 1994). It seeks to contribute to solving practical problems and not only theoretical dilemmas. It develops analytical frameworks and contributes insights for practical purposes (Hart, 1998). A framework is an overarching guide (Biggs et al., 2021) to identify and organise factors for understanding a phenomenon (McGinnis, 2011). Such an approach is justified due to the topic's novelty (Creswell, 2009), especially in Chile.

The research takes qualitative, descriptive, and design-oriented approaches to studying co-design processes. Three Comparative Case Study analyses focused on three public space co-design processes in Chile, which were used as case studies in three of the studies. Additionally, one Action Research study was undertaken within a practice setting. Cross-feedback between the two approaches contributed to validating and further developing the findings and their conceptual approaches.

Three Chilean co-design processes were studied and compared through case studies. This qualitative descriptive approach contributes to science by analysing retrospectively co-design processes from practice. The cases studied were city-sized urban parks under extreme climates and socially vulnerable mining cities in the Atacama Desert. The case studies (chapters 2, 3 and 5) adopted a deductive analytical approach to test a theory with data from the practice (Hart, 1998). Additionally, an Action Research through Design study was conducted within the same geographical context. The applied and design-oriented approach (chapter 4) aims to test academic knowledge in an ongoing co-design process from practice. Through this approach, a sports square co-design process was planned, implemented, and analysed. The findings of the studies aim for analytic generalisation instead of statistical (Yin, 1994). Both generalisable and context-specific findings were provided.

The research design combines two methodological approaches to answer the "how" main research question (Table 1.1). It takes descriptive knowledge and applied design approaches to contribute means-end knowledge for practice (Zwart & de Vries, 2016). This section defines the procedures for collecting, analysing, interpreting, and reporting the studies to answer the sub-questions. The research contributes scientific knowledge through three descriptive studies and one designed study.

TABLE 1.1 Brief description of the four studies.

Studies	Method, units of analysis, and cases
Chapter 2	
"Enablers and barriers for collaboration and design: An exploratory study of two public space processes in Chile". RQ1: How are barriers and enablers addressed in resilient public space co-design processes?	**Method:** Case study **Unit of analysis:** Barriers and enablers to collaboration and design. **Cases:** Kaukari Urban Park co-design process. Antofagasta Seaside Park co-design process.
Chapter 3	
"A framework for co-design: Linking the participation ladder and the design cycle". RQ2: How do actors collaborate in public space urban design processes?	**Method:** Case study **Unit of analysis:** Co-design activities. **Cases:** Kaukari Urban Park co-design process. Antofagasta Seaside Park co-design process. Sea hill pathways co-design process.
Chapter 4	
"A framework for Co-design Processes and use of Visual Collaborative methods: An Action Research through Design in Chile". RQ3: How do visual methods contribute to public space co-design processes?	**Method:** Action Research through Design **Unit of analysis:** Visual collaborative methods used. **Cases:** Slope Sport Square co-design process.
Chapter 5	
"Social-Ecological Knowledge Integration in Co-Design Processes: Lessons from two Resilient Urban Parks in Chile". RQ4: What social and ecological knowledge are integrated into resilient public space co-design processes?	**Method:** Case study **Unit of analysis:** Knowledge systems. **Cases:** Kaukari Urban Park co-design process. Antofagasta Seaside Park co-design process.

Three studies are descriptive knowledge projects (chapters 2, 3 and 5). They aim to describe the specific phenomena in the world (Zwart & de Vries, 2016), specifically co-design processes for resilience. The studies were undertaken along the well-known research cycle (de Groot, 1969) according to the following five steps. The cycle begins with an *observation* step in which literature is collected and grouped with the research question in mind. Then, *inductive* reasoning brings assumptions from previous practices for pattern recognition. Then, frameworks are formulated as proposed assumptions and explanations of the phenomena (co-design) in the *deductive* step. This sets the basis for *testing* and data gathering from the cases studied, leading to evaluating the analytical frameworks. This allows the analysis and *evaluation* to uncover how the frameworks withstand the cases.

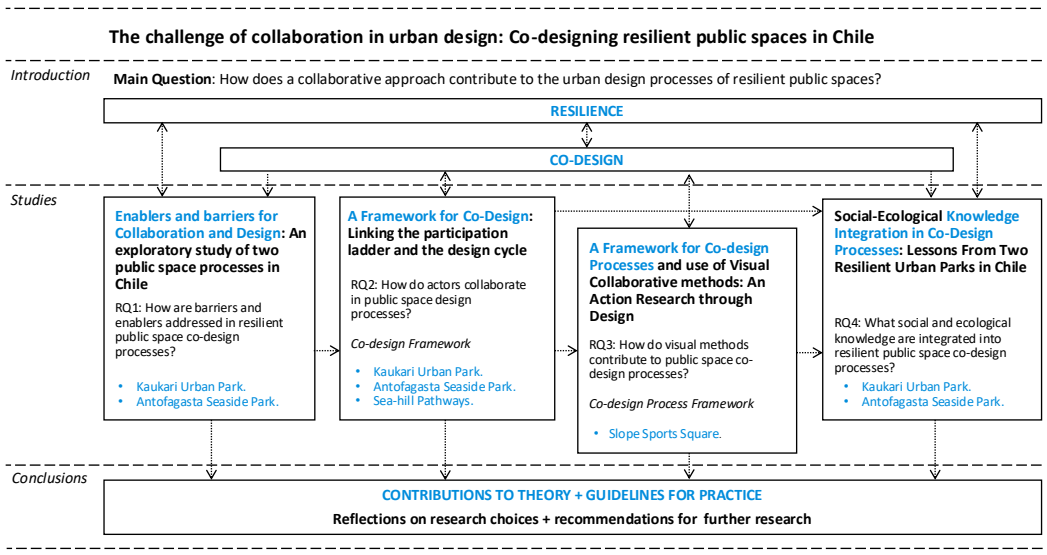

FIG. 1.2 Research Design scheme.

One of the studies can be considered a design project because it aims to produce new knowledge through design (Zwart & de Vries, 2016). This study (chapter 4) aimed to design, undertake, and evaluate a co-design process that fulfilled a set of criteria according to the conceptual framework we had developed. This allows the evaluation of the framework regarding its design requirements in a contextual setting. This study was undertaken along the well-known basic design cycle and its four steps (Cross, 2001; Jonas, 2007; Roozenburg & Eekels, 1995). The design cycle started with gathering literature and data regarding the research questions and topic through data *analysis* and complementing it with the previous studies (chapters 2 and 3). The *synthesis* of the main concepts results in the development of the analytical framework and the design of the co-design process to be conducted (chapter 4). Then, due to this study's applied character, the simulation step consisted of undertaking the co-design process formulated in a real-life setting. The co-design process was then not simulated but implemented in practice.

The Action Research through Design approach was deemed suitable for combining applied research and research through design practice (van Stijn & Lousberg, 2022). Finally, the *evaluation* step lets us know whether the co-design process satisfied the established framework and plan. This allows the analysis of how the conceptual approaches compare to the applied experience. Designers often learn about the problem while working on the solutions (Zwart & de Vries, 2016), and this is also the case for researchers studying design processes while undertaking them.

Considering that the study's subjects are co-design processes, comparing practical experiences and undertaking one of them in practice had relevant matching aspects. The studies aimed to provide both generalisable and context-specific findings.

To answer the "how" main question of the research, an alternated approach was taken to ensure that descriptive and design projects would contribute to means-end knowledge. Such knowledge aims to prescribe "how to act" if a "specific goal" aims to be achieved within a "specific context" (Zwart & de Vries, 2016). Specifically, this research aimed to provide guidelines for urban co-design processes (means) for improving resilience (end) within the context of Chile. From the studies, guidelines for practice and research were to be prescribed within the contexts of the cases and potentially elsewhere.

1.5.2 Case Study Method

Case studies are the primary research method. This choice responds to the complexity and novel nature of co-design phenomena. It expects to contribute to a deep understanding of complex and context-sensitive processes (Yin, 1994). Our applied research seeks to analyse practical problems, gather knowledge from science and practice, and develop new knowledge to provide recommendations for science and society.

Case studies are used to gain knowledge from processes that have occurred in the past. Different units of analysis were defined to answer each research question. For the first study (chapter 2), the study's enablers and barriers to collaboration and design were the focus. For the second study (chapter 3), co-design activities were used as units of analysis. For the final study (chapter 5), the units of analysis were the social and ecological knowledge integrated. These units of analysis contributed to undertaking a process-oriented approach to co-design processes.

The case studies build on primary and secondary data from the December 2019 and January 2020 fieldwork. The primary data consisted of thirty-three semi-structured in-depth interviews of key actors (Rubin & Rubin, 2012). The selection of the participants considered different sectors and backgrounds to make the sampling comprehensive (Ridder, 2017). A total amount of 35 interviews were conducted for the three cases. Secondary data included public reports, media publications, and design plans. The studies rely on multiple sources of evidence and use triangulation for accuracy. For research reliability, fieldwork and interview protocols were developed to systematise the procedures.

The cases studied and the case selection criteria

For the case studies, the object of study was defined to narrow the scope. The co-design processes of three public spaces were defined as objects of study. The projects were public spaces adapted for climate change and social and ecological functions. The studies focus on the co-design processes of three city-sized public spaces designed during the last decade in the Chilean Atacama Desert. They have been selected due to their co-design approaches and the resilience pursued. Diverse stakeholders, users, disciplines, and sectors were involved in the process. The resilient aspect implies that the projects and design solutions embody transformative approaches to future socio-ecological changes. One is in Copiapó City, while the others are in Antofagasta City.

The urban parks were selected for the case studies according to selection criteria (Table 1.2). The cases are unique because their design processes involved diverse actors and developed inter-sectorial partnerships, multidisciplinary teams, and active community associations. They represent non-conventional approaches to climate adaptation as public space infrastructures in Chile (Fernández & Courard, 2018; Moreno, 2018). The cases were selected according to the following selection criteria:

- **Recent date of design:** Public spaces designed in the last decade in Chile. This criterion is crucial because co-design and resilience are emerging paradigms in the country.

- **Public space large size:** Large-sized public spaces with the extension of the city longitudinally or in cross-section. This aspect was relevant to open the diversity of actors involved and benefited from the project. Their size suggests that their beneficiaries are all city inhabitants.

- **Climate impact addressed:** Public spaces embody resilience for climate adaptation. This was relevant to the study of interdisciplinary and innovative design approaches. The cases deal with the impact of heatwaves, river floodings, sea storms, and drought.

- **Multiple actors involved:** Diversity of actors involved in their design processes from diverse disciplines, backgrounds, and sectors (inter-sectorial partnerships, multidisciplinary teams, and engaged local organisations and communities).

- **Data availability:** Data availability and familiarity with the settings and actors. Although this criterion may raise legitimacy aspects, reaching people and accessing crucial information that would have otherwise been impossible was crucial.

TABLE 1.2 Brief description of the cases studied.

	Kaukari Urban Park	Antofagasta Seaside Park	Sea-hill Pathways
Size	60 hectares and 3,5 km. long.	35 km long.	4 hectares and 3,5 km long.
Location	Copiapó city Atacama region, Chile.	Antofagasta city Antofagasta region, Chile.	Antofagasta city Antofagasta region, Chile.
Main actors involved	Teodoro Fernández Associate Architects and Bonifacio Fernández (design leaders). Housing and Urbanism Ministry (Minvu), Public Infrastructure Ministry (MOP) Hydraulic Infrastructure Office (DOH), Municipality of Copiapó, Regional Government of Atacama, National Assets Ministry, Social Development Ministry, *Habiterra* Consultancy group and Community Organisations.	Creo Antofagasta (living lab) Teodoro Fernández Associate Architects, Urbana ED, and GSI Engineers (design leaders). Public Infrastructure Ministry (MOP), Port Infrastructure Office (DOP), Road Infrastructure Office (DV), Housing and Urbanism Ministry (Minvu), Municipality of Antofagasta, Regional Government of Antofagasta, Social Development Ministry, Chilean Army, BHP Billiton, *Urbanismo Social* NGO, Ciudad Emergente (CE), University of Antofagasta, Catholic University of the North, Industrial Association of Antofagasta (AIA), the Citizen Council (CC), the Executive Council (EC) and Community Organizations	Creo Antofagasta (living lab) Archipiélago Consultants. Housing and Urbanism Ministry and BHP Billiton company. Housing and Urbanism Ministry, Social Development Ministry, Municipality of Antofagasta, Regional Government of Antofagasta, BHP Billiton, Econsa Water Company, Adasa Water Company, Boa Mistura, Mi Parque NGO, Ciudad Emergente NGO, University of Antofagasta, Catholic University of the North, Citizen Council, Community Organizations
Timeframe studied	Pre-design planning process (2009 – 2010) Design consultancy (2011-2013) Partial implementation (2016-ongoing) Further developments of the projects (2016-ongoing)	Pre-design planning process (2012-2016) Design consultancy (2017-2022) Partial implementation (2019-2020)	Pre-design planning process (2012-2016) Design consultancy (2016-2018) Partial implementation (2016 and 2019)
Climate impacts addressed	River floodings, heat waves, and drought.	Sea storms, heat waves, and drought.	Ravine floodings, heatwave, and drought.

The three cases involve adaptation measures for public spaces aiming for context-specific solutions to connect, foster social interactions, and address water scarcity, droughts, island effects, and water-related risks in the Atacama Desert in Chile. Two are city-sized longitudinal urban parks on the Copiapó riverbed and Antofagasta seaside. The third is a multi-neighbourhood pedestrian connection from the hills to the seaside, integrating the vulnerable upper neighbourhoods and informal settlements with the lower areas where most services are located.

FIG. 1.3 Aerial view of the implemented sectors of Kaukari Urban Park (case 1) (source: Tomás Gómez).

The urban design processes of the three selected cases involved different actors. Case 1 exemplifies collaboration among two ministries, a transdisciplinary team integrating landscape and hydraulic designers, and some citizen participation endeavours. It was designed a decade ago by Teodoro Fernández Associated Architects, whose lead architect was awarded by the Architecture National Price. Half of the project has already been implemented and has significantly contributed to the city (according to the interviews undertaken in this research). It is considered a relevant adaptation project and has been studied by academia nationally and internationally (Moreno, 2018).

These projects are receiving considerable attention from academia, national government entities, and private companies because of their public-private partnerships, collaborative design approaches, and transdisciplinary development of nature-based solutions to climate change adaptation (CNDU, 2014) (Pérez Lancellotti, G., 2017; Devenin, V., 2021). The cases aim to address socio-ecological local challenges, and the leading actors fostered multiple forms of collaborative dialogues integrating knowledge throughout long-term co-design processes.

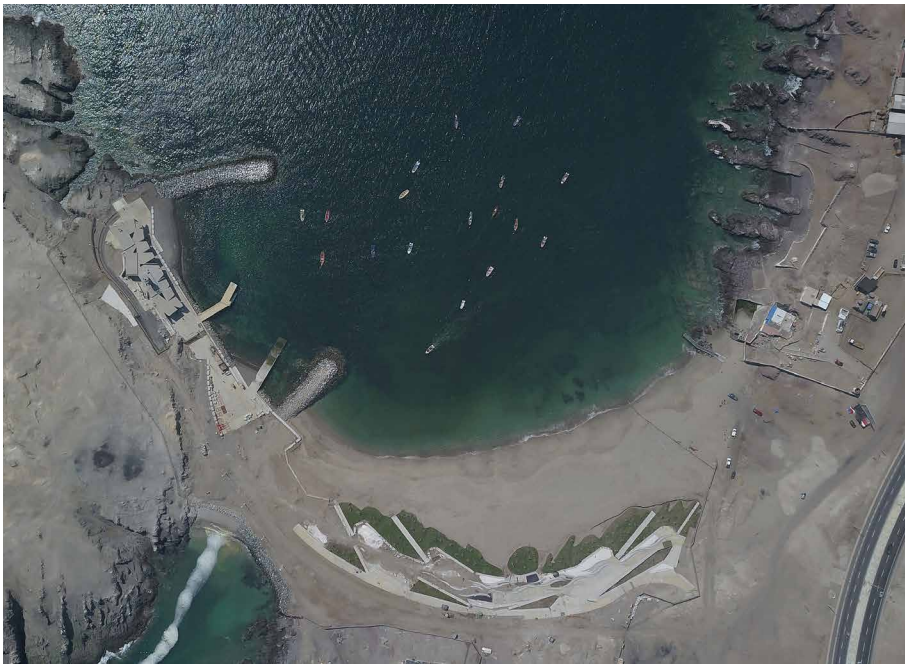

FIG. 1.4 Aerial view of La Chimba artificial beach, the first implemented sector of Antofagasta Seaside Park (case 2) (source: CREO Antofagasta NGO).

Creo Antofagasta, a public-private-people-academia living lab partnership, leads cases 2 and 3. Active citizen involvement, interdisciplinarity, and intersectoral approaches were used in the design processes. The Living Lab NGO was created with funds from an international mining corporation in the desert city of Antofagasta. It aimed to articulate the interests of diverse stakeholders and sectors involved in urban development and resilient public spaces. It supported developing a city master plan for interaction with diverse sectors in a long-term process. The plan included diverse initiatives and projects. Within five years, only a few have been designed or implemented due to difficulty building agreements and trust among the actors from different sectors and political orientations. In this research, two big-sized public space projects are studied. The Antofagasta Seaside Park and the multiple Sea-hill pathways across Antofagasta.

The involvement of diverse actors in the three design processes suggested a collaborative approach to design. Their involvement in the design processes, their influence on the projects, and the challenges they faced were considered relevant aspects further unpacked in the studies.

1.5.3 Action Research through Design Method

To gain more practical insights to inform theory, an Action Research through Design approach (ARtD) is taken to generate knowledge from practice by acting in real-life, ongoing design processes (van Stijn, 2021) to intervene in the urban environment through problem and solution definition (Buchanan, 1992). This approach combines Action Research with Research through Design methods.

An Action Research approach aims for knowledge inquiry with the active participation of the involved actors in open-ended processes where objectives and results are kept flexible (Baum et al., 2006; Bell et al., 2004). A Research through design approach aims to contribute new knowledge in the form of designs by systematically reflecting and evaluating the action of design processes (Cross, 2001; Frankel & Racine, 2010; Jonas, 2007; Roggema, 2016). We acknowledge that these two approaches pursue different aims and have different disciplinary trajectories. Still, a combined approach was appropriate to address such collaborative design-oriented research in the practice. Such an approach allowed us to act and analyse at three operational levels: in planning the design processes, in conducting the design processes to produce the outcomes of design, and finally, in reflecting upon such endeavours.

This study is carried out in six consecutive steps based on the defined design project steps. First, a literature review clarified the knowledge gap and was used to build the analytical framework. Then, the co-design process was planned using the framework. Next, the co-design process was undertaken, followed by an evaluation of the process retrospectively using the initial framework. From such analysis, both generalisable and case-specific findings were discussed.

The project designed and studied as a case

The Slope Sport Square was chosen as an object of study because it matched the conceptual scope of the applied research. This public space square was smaller than the other cases studied. Its design process was considered relevant and suitable to study because it was nested in the Kaukari Urban Park, one of the previously studied cases. It matched the location and institutional setting previously studied.

The project was an urban space meant to function as a public square with climbing and skate structures. The co-design process aimed to gather sportspeople to contribute sports requirements to the design process and foster the square's future

cooperation. Within this research, a co-design process was planned, conducted, and reflected upon. Two co-design processes were undertaken during 2020-2021, but only one of them was reported on for this research.

The co-design process occurred within a public design consultancy commissioned by the Housing and Urbanism Ministry of Chile to *Co-Diseño Urbano Consultants*. The ministry aimed to update the Kaukari Urban Park project, designed by Teodoro Fernández Associate Architects. They acknowledged the need for updated mixed sports functions in the park.

TABLE 1.3 Brief description of the project.

	Slope Sport Square
Size	2.400 square meters.
Location	Copiapó city, Atacama region, Chile.
Actors involved	*Co-Diseño Urbano* Consultants (design leaders). Housing and Urbanism Ministry (Minvu). Skate organisations (*Club Deportivo Recreativo cultural skate, Fusion Skate*), Climbing organisations (*Club de Escalada Roca Viva, Club de Montaña Atacama, Cuerpo de Socorro Andino*), Circus art organisations (*CircoOrbicular*), Other community organisations.
Timeframe studied	Pre-design planning process (2020) Design consultancy (2021-2022)

The Slope Sports Square was designed as an open public space with skating elements and a climbing wall. Various sports organisations were summoned and considered as the future end users. We involved them early as relevant actors in co-designing the space. They requested climbing and skate structures and requirements. The organisations were actively involved in all the design phases, providing expert technical knowledge and leading strategic interactions with relevant local sports actors. The co-design process also fostered the co-management and co-operation of the square.

FIG. 1.5 Aerial view of the Slope Sport Square within Kaukari Urban Park (source: Co-Diseño Urbano Consultants).

The co-design process was planned to integrate a diversity of strategic, design, and assessment professionals and the prospective users of the project. The leading actors were the ministry in charge and the design team, of which the lead author was in charge. The author of this research played a vital role as the urban designer and project manager, fostering co-design interactions using the developed conceptual framework. The author participated in the planning and development of the design consultancy. The case study for the article was selected because it could be planned and conducted in practice to evaluate the use of visual collaborative methods. The timing of the consultancy matched this study. This was a real-life rooted practice of co-designing applied research in a top-down setting and was thus not an utterly autonomous research endeavour. A co-design approach was suggested as a mode of practice amongst the involved actors, and most adhered to it.

1.6 Relevance

1.6.1 Scientific Relevance

This research investigates the complex and dynamic co-design processes of resilient public spaces. It is relevant as it links two bodies of literature that are relevant nowadays: co-design and resilience. It aims to advance means-end knowledge on relevant social and urban needs.

Resilient public spaces are often implemented as climate adaptation measures (Castán Broto & Bulkeley, 2013; Wamsler & Raggers, 2018). Many have stated the need to involve multiple actors with different knowledge backgrounds and diverging aims to do so (Baibarac & Petrescu, 2019; Huybrechts et al., 2017; Ostrom, 1996; Sanders & Stappers, 2014). While many co-design studies focus on urban and public space design, little has been said about how such an approach contributes to designing resilient public spaces. Many compare, analyse, apply, and test co-design methods and activities (Mc Evoy et al., 2019b; Mulder & Stappers, 2009; L. Sanders, 2008), but there is little knowledge on how these complex processes should take place to foster urban resilience.

To date, co-design processes are predominantly studied by analysing the collaborative interactions among the participants at one-time events interactions (McDonnell, 2018; Saad-Sulonen et al., 2018b; Sanders & Stappers, 2014). Although these studies provide valuable concepts, methods, and approaches, they do not clarify how recurrent co-design activities contribute to improving the designed outcomes designs (Bossen et al., 2016; Mc Evoy et al., 2019a; Nguyen, 2022) or clarify how co-design processes unfold (Saad-Sulonen et al., 2018a; Ávila-Garzón and Bacca-Acosta, 2024). Similarly, academics have reported the need for urban resilience guidelines for urban design practice (Meerow & Newell, 2016).

This research is relevant as it develops in-depth insights into co-designing resilient public spaces. Recent calls for more studies on co-design processes and the consequences of such approaches support this relevance (Saad-Sulonen et al., 2018a). The insights developed generate new perspectives on urban resilience and co-design. They are of value to different academic disciplines involved in studying public space co-design processes. Scholars in urbanism and landscape design will benefit from the conceptualisations of co-design processes and resilient public spaces.

1.6.2 Societal Relevance

The societal relevance of this research lies in the fact that it investigates a phenomenon of which many practitioners need more knowledge and experience. Urban and landscape designers and architects must be formally trained to collaborate (E. Sanders, 2009) and to design open-ended public space projects (Sendra & Sennet, 2020). This applies to public servants, decision-makers, stakeholders, and citizen organisations. Even worse, for designers, co-design approaches seem to challenge their projects and consider them a distraction from their core line of work and a waste of time.

Nevertheless, the climatic crisis and the need to improve the resilience of our cities are happening and require renovated approaches (Barton et al., 2015). The implementation of adaptation plans, the cross-sectorial needs to address climate change impacts, and the development of citizen participation norms and standards (Barton, 2009) challenge professionals in practice throughout the country and the world. They must move beyond conventional linear design processes to address social and climatic issues in integrated public space projects (Folke et al., 2009; Savaget et al., 2019).

The insights developed by this research generate new ways of approaching the co-design of resilient public spaces in practice. They are of value to different disciplines and institutional systems involved in public space design processes. Urban designers and architects will benefit from the contributions of this research. A renewed understanding of the co-design of resilient public spaces contributes to addressing public space projects and the impacts they seem to achieve. Insights from this research will be helpful for professionals in Chile and other world contexts.

1.7 Dissertation Outline

The dissertation is divided into six chapters: the introduction, the four studies, and the concluding chapter. The studies answer the research questions, and the last chapter articulates the main contributions.

The **first empirical study** is “How co-design of public space contributes to strengthening resilience: Lessons from two public space processes in Chile”. It aims to address how resilient public space co-design processes address barriers and enablers to collaboration and design. This study analysed the barriers and enablers for collaboration and design in three co-design processes in Chile. A flowchart is developed to analyse three cases from practice. The study and its findings are reported in Chapter 2.

The **second empirical study** is “The Co-Design Framework: Linking the Participation Ladder and the Design Cycle.” It addresses how actors collaborate in design activities throughout public space co-design processes. A literature review contributed to developing a Co-design framework, which was then used to analyse three co-design processes. This study and its findings are reported in Chapter 3.

The **third empirical study** is “The Co-design Process Framework and the Use of Visual Collaborative Methods: An Action Research through the Design Process in Chile”. This study will address how visual collaborative methods contribute to public space co-design processes. Based on the previously developed framework, the Co-design Process framework is developed. Through Action Research through Design, the framework is used to plan, conduct, and evaluate a co-design process from practice. The study and its findings are reported in Chapter 4.

The **fourth empirical study** is “Social-Ecological Knowledge Integration in Co-Design Processes: Lessons from two Resilient Urban Parks in Chile”. It aims to answer the question of what forms of social and ecological knowledge are integrated into resilient public space co-design processes. A literature review allowed us to develop a new framework based on the previous ones. The Knowledge Integration framework for Co-design processes is used to analyse two co-design processes from practice. The study and its findings are reported in Chapter 5.

The **conclusions** further explain the answer to the research questions and define the contributions of this research in Chapter 6. The research formulates frameworks and guidelines to facilitate and foster co-design processes to improve urban resilience. Both generalisable and context-specific findings are explained. Guidelines for practice and further research gained through undertaking this research are explained.

References

Aldunce, P., Bórquez, R., Adler, C., Blanco, G., & Garreaud, R. (2016). Unpacking resilience for adaptation: Incorporating practitioners' experiences through a transdisciplinary approach to the case of drought in Chile. *Sustainability (Switzerland)*, *8*(9), 1–21. https://doi.org/10.3390/su8090905

Aliste, E. & Stamm, C. (2016). Hacia una geografía de los conflictos socioambientales en Santiago de Chile: lecturas para una ecología política del territorio. Revista de Estudios Sociales.

Allard, Pablo (2002). Si el río suena ya no serán piedras lo que trae: Costanera Norte: Mitos, verdades y lecciones de una autopista urbana. ARQ (Santiago), (52), 44-49. https://dx.doi.org/10.4067/S0717-69962002005200018

Álvarez Rojas, Ana María (2013). Autopista Costanera Norte: Un análisis cri1tico desde la e1tica civica. Perspectivas: revista de trabajo social, Nº. 24, 2013, 45-68.

Azócar, V. (2018, October 18). Lavín y su polémica laguna en el Parque Padre Hurtado: Cómo nació el negocio con Crystal Lagoons. *La Tercera*. https://www.latercera.com/la-tercera-pm/noticia/lavin-polemica-laguna-parque-padre-hurtado-nacio-negocio-crystal-lagoons/365437/

Bacchin, T. K. (2015). *Performative Nature - Urban Landscape Infrastructure Design in Water Sensitive Cities*.

Bacchin, T. K., Ashley, R., Sijmons, D., Zevenbergen, C., & Van Timmeren, A. (2014). Green-blue multifunctional infrastructure : an urban landscape system design new approach. *13th International Conference on Urban Drainage, Sarawak, Malaysia, September*, 7–12.

Baibarac, C., & Petrescu, D. (2019). Co-design and urban resilience: visioning tools for commoning resilience practices. *CoDesign*, *15*(2), 91–109. https://doi.org/10.1080/15710882.2017.1399145

Barton, J., Krellenberg, K., & Harris, J. (2015). Collaborative governance and the challenges of participatory climate change adaptation planning in Santiago de Chile. *Climate and Development*, *7*(2), 175–184. https://doi.org/10.1080/17565529.2014.934773

Barton, J. R. (2009). Revisión de marcos conceptuales y análisis de enfoques metodológicos (barreras y viabilidad) para el desarrollo de una infraestructura urbana sostenible y eco-eficiente. *CEPAL: Eco-Eficiencia y Desarrollo de Infraestructura Urbana Sostenible En América Latina y El Caribe (ECLAC-ESCAP. ROA101)*, 1–86. https://www.cepal.org/ecoeficiencia/noticias/paginas/2/36162/Barton.pdf

Barton, J. R. (2013). Climate change adaptive capacity in Santiago de Chile: Creating a governance regime for sustainability planning. *International Journal of Urban and Regional Research*, *37*(6), 1916–1933. https://doi.org/10.1111/1468-2427.12033

Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. *Journal of Epidemiology and Community Health*, *60*(10), 854–857. https://doi.org/10.1136/jech.2004.028662

Bell, J., Cheney, G., Hoots, C., Kohrman, E., Schubert, J., Stidham, L., & Traynor, S. (2004). *Comparative Similarities and Differences between Action Research, Participative Research, and Participatory Action Research*.

Berkes, F. (2017). Environmental governance for the anthropocene? Social-ecological systems, resilience, and collaborative learning. *Sustainability (Switzerland)*, *9*(7). https://doi.org/10.3390/su9071232

Berkes, F., Colding, J., & Folke, C. (2008). *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press.

Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (2021). The routledge handbook of research methods for social-ecological systems. In *The Routledge Handbook of Research Methods for Social-Ecological Systems*. https://doi.org/10.4324/9781003021339

Binder, T., Brandt, E., Ehn, P., & Halse, J. (2015). Democratic design experiments: between parliament and laboratory. *CoDesign*, *11*(3–4), 152–165. https://doi.org/10.1080/15710882.2015.1081248

Biskupovic, C., & Canteros, E. (2019). Movilizando saberes ciudadanos: encontrar un lugar, construir la verdad. *Revista Austral de Ciencias Sociales*, *36*, 7–28.

Biskupovic, C., & Stamm, C. (2021). *Experiencias participativas en el Chile Actual* (C. Biskupovic & C. Stamm, Eds.). RIL Editores.

Borquez, R., Aldunce, P., & Adler, C. (2017). Resilience to climate change: from theory to practice through co-production of knowledge in Chile. *Sustainability Science*, *12*(1), 163–176. https://doi.org/10.1007/s11625-016-0400-6

Bossen, C., Dindler, C., & Iversen, O. S. (2016). Evaluation in Participatory Design: A literature survey. *ACM International Conference Proceeding Series*, *1*, 151–160. https://doi.org/10.1145/2940299.2940303

Bronfman, N. C., Castañeda, J. V., Guerrero N. F., Cisternas, P., Repetto, P. B. , Martínez, C., and Chamorro, A.. 2023. A Community Disaster Resilience Index for Chile, Sustainability 15, no. 8: 6891. https://doi.org/10.3390/su15086891

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8*(2), 5–21.

Bueren, E. Van. (2009). *Greening governance An evolutionary approach*. IOS Press under the imprint Delft University Press.

Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Ha, M. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* (P. Arias, M. Bustamante, I. Elgizouli, G. Flato, M. Howden, C. Méndez-Vallejo, J. J. Pereira, R. Pichs-Madruga, S. K. Rose, Y. Saheb, R. Sánchez Rodríguez, D. Ürge-Vorsatz, C. Xiao, N. Yassaa, J. Romero, J. Kim, E. F. Haites, Y. Jung, R. Stavins, … C. Péan, Eds.). https://doi.org/10.59327/IPCC/AR6-9789291691647

Carmona, M. (2021). *Public places, urban spaces. The dimensions or urban design* (3rd ed.). Routledge.

Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From Metaphor to Measurement: Resilience of What to What? *Ecosystems*, *4*(8), 765–781. https://doi.org/10.1007/s10021-001-0045-9

Carroll, C. L., & Huntington, P. J. (2015). Modelo de Gestión Territorial utilizado en la reconstrucción post terremoto y tsunami del 27-F en Chile. *Innovación e Investigación En Arquitectura y Territorio. Universidad de Alicante.*, *20*(January 2015), 41–45. https://doi.org/10.1111/j.2042-3306.1988.tb01451.x

Carson, Rachel (1963). Silent Spring. Boston, Houghton Mifflin.

Castán Broto, V., & Bulkeley, H. (2013). A survey of urban climate change experiments in 100 cities. *Global Environmental Change*, *23*(1), 92–102. https://doi.org/10.1016/j.gloenvcha.2012.07.005

CEPAL (2010). The Chilean earthquake of 27 February 2010: an overview. United Nations publication. 2010-191, Santiago.

CNDU. (2014). *Sistema de Planificación Urbana Integrada. Propuestas para la implementacion de la Politica Nacional de Desarrollo Urbano*.

Creswell, J. W. (2009). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). Sage Publications Sage. http://ir.obihiro.ac.jp/dspace/handle/10322/3933

Cross, N. (2001). *Designerly Ways of Knowing : Design Discipline Versus Design Science*. *17*(3), 49–55.

Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., Fünfgeld, H., McEvoy, D., & Porter, L. (2012). Resilience: A Bridging Concept or a Dead End? "Reframing" Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does it Mean in Planni. *Planning Theory and Practice*, *13*(2), 299–333. https://doi.org/10.1080/14649357.2012.677124

Davoudi, S., Zaucha, J., & Brooks, E. (2016). Evolutionary resilience and complex lagoon systems. *Integrated Environmental Assessment and Management*, *12*(4), 711–718. https://doi.org/10.1002/ieam.1823

De Groot. Adriaan. (1969) The Empirical Cycle In Science. The book Methodology.

Delamaza, G. (2011). Espacio público y participación ciudadana en la gestión pública en Chile: Límites y posibilidades. *Polis*, *10*(30), 45–75.

De Roo, G., & Boelens, L. (2016). Setting the scene: about planning and a world of change. In Spatial planning in a complex unpredictable world of change. In *Coöperatie InPlanning UA* (pp. 14–27).

Devenin, V. (2021). Collaborative community development in mining regions: The Calama Plus and Creo Antofagasta programs in Chile. Resources Policy, 70 (March 2021), 101284. DOI: http://doi.org/10.1016/j.resourpol.2018.10.009.

Dilley, M. (2015). Natural disaster hotspots: a global risk analysis. World Bank Publications.

Drain, A., & Sanders, E. B.-N. (2019). A Collaboration System Model for Planning and Evaluating Participatory Design Projects. *International Journal of Design*, *13*(3), 39–52. www.ijdesign.org

Duhau, F. (2022). Challenged tactical urbanism in Santiago de Chile, a neoliberal city (Master's thesis, UiT Norges arktiske universitet).

Ersoy, A., Brand, N., & van Bueren, E. (2024). Adapting a systems perspective for sectoral coordination: approaching flood resilience in Houston and Accra. Planning Practice & Research, 1-21.

Ersoy, A., & Yeoman, R. (2020). Reconfiguration of public space via nature-based solutions. In J. Riegler & J. Bylund (Eds.), *Unfolding Dilemmas of Urban Public Spaces. Recommendations by JPI Urban Europe's AGORA*. Urban Europe.

Faivre, N., Fritz, M., Freitas, T., De Boissezon, B., & Vandewoestijne, S. (2017). Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges. Environmental research, 159, 509-518.

Feagan, M., Matsler, M., Meerow, S., Muñoz-Erickson, T. A., Hobbins, R., Gim, C., & Miller, C. A. (2019). Redesigning knowledge systems for urban resilience. In *Environmental Science and Policy* (Vol. 101, pp. 358–363). Elsevier Ltd. https://doi.org/10.1016/j.envsci.2019.07.014

Fernández, T., & Courard, P. (2018). Parque Kaukari del Río Copiapó [Kaukari Park in Copiapó River]. *ARQ*, *2018*(99), 70–82. https://doi.org/10.4067/S0717-69962018000200070

Figueroa, Oscar (2012). Las autopistas, los desplazamientos y la movilidad: Santiago de Chile. Revista Planeo: Pontificia Universidad Católica de Chile. www.revistaplaneo.uc.cl/2012/06/01/las-autopistas-los-desplazamien-tos-y-la-movilidad-santiago-de-chile

Fingleton, B., Garretsen, H., & Martin, R. (2012). Recessionary shocks and regional employment: Evidence on the resilience of u.k. regions. *Journal of Regional Science*, *52*(1), 109–133. https://doi.org/10.1111/j.1467-9787.2011.00755.x

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change*, *16*(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*(4). https://doi.org/10.5751/ES-03610-150420

Folke, Chapin, F. S., & Olsson, P. (2009). Principles of ecosystem stewardship. Resilience-based natural resource management in a changing world. In C. Folke, F. S. Chapin, & P. Olsson (Eds.), *Springer*. Springer. https://doi.org/10.1007/978-0-387-73033-2_13

Frankel, L., & Racine, M. (2010). The Complex Field of Research: for Design, through Design, and about Design. *DRS Montreal—Design and Complexity*, 518–529.

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. Environmental Science and Policy, 93(December 2018), 101–111. https://doi.org/10.1016/j.envsci.2018.12.033

Fritz, H., Petroff, C., Catalán, P., Cienfuegos, R., Winckler, P., Kalligeris, N., Weiss, R., Barrientos, S., Meneses, G., Valderas-Bermejo, C., Ebeling, C., Papadopoulos, A., Contreras, M., Almar, R., Domínguez, J. and Synolakis, C. (2011). Field Survey of the 27 February 2010 Chile Tsunami. *Pure and Applied Geophysics* 168: 1989-2010

Gallotti, R., Sacco, P., & De Domenico, M. (2021). Complex urban systems: challenges and integrated solutions for the sustainability and resilience of cities. Complexity, 2021(1), 1782354.

Geertman, S., Dijst, M., Lyons, G., Worrell, E., Mokhtarian, P. L., Kwan, M.-P., Brunner, P., Perrels, A., Rosales Carreón, J., Thomson, G., Urge-Vorsatz, D., Davoudi, S., Lenz, B., Ribeiro, A. P., Zeyringer, M., Helbich, M., Holtslag, A. A. M., Newman, P., Harmsen, R., & Böcker, L. (2017). Exploring urban metabolism—Towards an interdisciplinary perspective. *Resources, Conservation and Recycling*, *132*(September 2017), 190–203. https://doi.org/10.1016/j.resconrec.2017.09.014

Geddes, S. P. (1968). Cities In Evolution. An Introduction To The Town Planning Movement And The Study Of Civics. Ernest Benn Limited; First American Edition.

González Abarca, Valentina (2017). Segregación ocasionada por las autopistas urbanas: el caso de la comuna de Lo Espejo en Santiago de Chile. Espacio y Sociedad, n°1, pp. 114-121.

Greene, Margarita y Mora, Rodrigo (2005). Las autopistas urbanas concesionadas, una nueva forma de segregación. Revista ARQ, n°60, pp. 56-58.

Gunderson, L. H., & Holling, C. S. (2001). *Panarchy: understanding transformations in human and natural systems*. Island press.

Hansen, R., Bush, J., Pribadi, D. O., & Giannotti, E. (2023). Planning and maintaining nature-based solutions: lessons for foresight and sustainable care from Berlin, Jakarta, Melbourne, and Santiago de Chile. In Nature-Based Solutions for Cities (pp. 215-240). Edward Elgar Publishing.

Harkness, A., Ramirez, A., Rihm, A., Orellana, A., Lefevre, B., Robertson, C., Davis, D., Slack, E., Valenzuela, E., Vera, F., Astaburuaga, F., Rojas, F., Carvalho, G., Cienfuegos, I., Robinson, J., Ducci, J., Munoz, J. C., Bresciani, L. E., Valenzuela, L., … Ortega, S. (2019). *Construyendo Gobernanza Metropolitana* (F. Rojas, F. Vera, & C. Robertson, Eds.). Banco Interamericano de Desarrollo BID.

Hart, C. (1998). Doing a Literature Review: Releasing the Social Science Research Imagination (SAGE Study Skills Series). In *Doing a Literature Review*.

Hernández, J., Fuentes, M., & Ríos, M. (2019). *En qué va la gestión participativa local? Análisis e implementación de mecanismos de participación ciudadana en la gestión pública local chilena.* RIL Editores.

Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, *4*, 1–23. https://www.jstor.org/stable/2096802 REFERENCES Linked

Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory Design, Co-Design and the public realm. *CoDesign*, *13*(3), 148–159. https://doi.org/10.1080/15710882.2017.1355006

INE (2018). Síntesis de Resultados Censo 2017. Institutio Nacional de Estadísticas de Chile, Santiago.

IPCC. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)].rmany), Ismail Elgizouli (Sudan), . *IPCC, Geneva, Switzerland: Kristin Seyboth (USA)*, 151. https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_Front_matters.pdf

Jirón, P., Imilán, W. A., Lange, C., & Mansilla, P. (2021). Placebo urban interventions: Observing smart city narratives in Santiago de Chile. Urban Studies, 58(3), 601-620.

Jonas, W. (2007). Research through DESIGN through research. *Kybernetes*, *36*(9/10), 1362–1380. https://doi.org/10.1108/03684920710827355

Kabisch, N., Korn, H., Stadler, J., & Bonn, A. (2017). *Theory and Practice of Urban Sustainability Transitions. Nature-based Solutions to Climate Change Adaptation in Urban Areas*. https://doi.org/10.1007/978-3-319-56091-5_3

Krellenberg, K., & Barth, K. (2014). Inter- and transdisciplinary research for planning climate change adaptation responses: The example of Santiago de Chile. *Interdisciplinary Science Reviews*, *39*(4), 360–375. https://doi.org/10.1179/0308018814Z.00000000097

Lama, J., & Tironi, M. (2019). Distributing obligations, performing publics: Responsible Citizens in Post-Disaster Engagement. *Qualitative Sociology*, *41*(1), 1–23.

Lecannelier, L. (2015). Del conflicto a la oportunidad: Participación ciudadana en el desarrollo urbano. *Urbano*, 14–19. http://revistas.ubiobio.cl/index.php/RU/article/view/455

Lupien, P. (2015). Mechanisms for popular participation and discursive constructions of citizenship. *Citizenship Studies*, *19*(3–4), 367–383.

Lynch, Kevin (1960). The image of the city. The MIT Press.

Manzini, E., & Rizzo, F. (2011). Small projects/large changes: Participatory design as an open participated process. *CoDesign*, *7*(3–4), 199–215. https://doi.org/10.1080/15710882.2011.630472

Mc Evoy, S., Van de Ven, F. H. M., Santander, A. G., & Slinger, J. H. (2019a). The influence of context on the use and added value of Planning Support Systems in workshops: An exploratory case study of climate adaptation planning in Guayaquil, Ecuador. *Computers, Environment and Urban Systems*, *77*, 101353. https://doi.org/10.1016/j.compenvurbsys.2019.101353

Mc Evoy, S., Van de Ven, F. H. M., Santander, A. G., & Slinger, J. H. (2019b). The influence of context on the use and added value of Planning Support Systems in workshops: An exploratory case study of climate adaptation planning in Guayaquil, Ecuador. *Computers, Environment and Urban Systems*, *77*, 101353. https://doi.org/10.1016/j.compenvurbsys.2019.101353

McDonnell, J. (2018). Design roulette: A close examination of collaborative decision-making in design from the perspective of framing. *Design Studies*, *57*, 75–92. https://doi.org/10.1016/j.destud.2018.03.001

McHarg, Ian (1969). Design with Nature. American Museum of Natural History.

Mc Phee, Bernardita. (2011) Planificación territorial y crecimiento urbano en Santiago Metropolitano. Revista Planeo: Pontifica Universidad Católica de Chile. http://revistaplaneo.uc.cl/2011/12/06/planificacion-territori-al-y-crecimiento-urbano-en-santiago-metropolitano

Meerow, S., & Newell, J. P. (2016). Urban resilience for whom, what, when, where, and why? *Urban Geography*, *3638*(July), 1–21. https://doi.org/10.1080/02723638.2016.1206395

Meerow, S., & Newell, J. P. (2017). Spatial planning for multifunctional green infrastructure: Growing resilience in Detroit. *Landscape and Urban Planning*, *159*, 62–75. https://doi.org/10.1016/j.landurbplan.2016.10.005

Meerow, S., & Stults, M. (2016). Comparing conceptualizations of urban climate resilience in theory and practice. *Sustainability (Switzerland)*, *8*(7), 1–16. https://doi.org/10.3390/su8070701

MMA Chile. (2017). *Plan de Accion Nacional de Cambio Climatico 2017-2022*.
Moreno, O. (2018). Contain, restore, connect: landscape as infrastructure. *ARQ*, *2018*(99), 83–85.
Moreno, Osvaldo. (2018). Contener, restaurar, conectar: el paisaje como infraestructura. *ARQ (Santiago)*, (99), 85-86. https://dx.doi.org/10.4067/S0717-69962018000200070
Mostafavi, M., & Doherty, G. (2010). Ecological urbanism. Frankfurt: Lars Müller.
Mulder, I., & Stappers, P. J. (2009). Co-creating in practice: Results and challenges. *2009 IEEE International Technology Management Conference, ICE 2009*. https://doi.org/10.1109/ITMC.2009.7461369
Municipalidad de La Reina, (2024, August). Concurso Nuevo Parque La Reina, Municipalidad de La Reina. https://nuevoparquelareina.cl/
Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., ... & Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. Science of the total environment, 579, 1215-1227.
Nguyen, Q. (2022). Evaluation in Participatory Design-The Whys and the Nots. *ACM International Conference Proceeding Series*, *2*, 161–166. https://doi.org/10.1145/3537797.3537828
Nijhuis, S., Stolk, E., & Hoekstra, M. (2016). Teaching urbanism: the Delft approach. *Proceedings of the Institution of Civil Engineers - Urban Design and Planning*, *170*(3), 96–106. https://doi.org/10.1680/jurdp.16.00013
Olmsted, F. L. (1997). Civilizing American Cities: Writings On City Landscapes. Hachette Books.
ONEMI (2020). Strategic National Plan for the Disaster Risk Reduction 2020-2030, Government of Chile.
Orellana, A., Arenas, F., Marshall, C., & Rivera, A. (2016). Resistance to metropolitan institutionality and planning in Chile. *Planning Practice and Research*, *31*(4), 435–451. https://doi.org/10.1080/02697459.2016.1196535
Ostrom, E. (1996). Crossing the Great Divide: Coproduction, Synergy, and Development. *World Development*, *24*(6), 1073–1087. https://doi.org/10.1016/0305-750X(96)00023-X
Ostrom, E. (2007). Sustainable Social-Ecological Systems: An Impossibility? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.997834
Palazzo, E. (2019). From water sensitive to floodable: defining adaptive urban design for water resilient cities. *Journal of Urban Design*, *24*(1), 137–157. https://doi.org/10.1080/13574809.2018.1511972
Peñafiel, R. (2015). La criminalization de la participation citoyenne par des democraties participatives. *Revue Qebeciuse de Droit International*, 247–271.
Pérez Lancellotti, Gino (2014). El Plan Maestro como instrumento de diseño urbano: potencialidades y limitantes. El caso de la ciudad de Antofagasta. Revista AUS, núm. 15, enero-junio, 2014, pp. 16-21.
Pickett, S. T., Cadenasso, M. L., & McGrath, B. (Eds.). (2013). Resilience in ecology and urban design: Linking theory and practice for sustainable cities (Vol. 3). Springer Science & Business Media.
Portugali, J. (2009). Complexity Theories of Cities : *Criticism*, *2005*, 1–14.
Ridder, H. G. (2017). The theory contribution of case study research designs. *Business Research*, *10*(2), 281–305. https://doi.org/10.1007/s40685-017-0045-z
Roggema, R. (2009). Adaptation to climate change: A spatial challenge. *Adaptation to Climate Change: A Spatial Challenge*, 1–360. https://doi.org/10.1007/978-1-4020-9359-3
Roggema, R. (2016). Research by Design: Proposition for a Methodological Approach. *Urban Science*, *1*(1), 2. https://doi.org/10.3390/urbansci1010002
Roggema, R., Tillie, N., Keeffe, G., & Yan, W. (2021). Nature-based deployment strategies for multiple paces of change: The case of oimachi, japan. *Urban Planning*, *6*(2), 143–161. https://doi.org/10.17645/up.v6i2.3779
Rojas M., P. Aldunce, L. Farías, H. González, P.A. Marquet, J., (2019). Evidencia científica y cambio climático en Chile: Resúmen ejecutivo para tomadores de decisiones. Santiago, Comité científico COP 25.
Rossi, Aldo (1966) The architecture of the city. The MIT Press.
Rose, A. (2004). Defining and measuring economic resilience to disasters. *Disaster Prevention and Management: An International Journal*, *13*(4), 307–314. https://doi.org/10.1108/09653560410556528
Roozenburg, N. F. M., & Eekels, J. (1995). *Product Design: Fundamentals and Methods* (1st ed.). John Wiley & Sons.
Rubin, H. J. and Rubin, I.S. (2012) Qualitative Interviewing: The Art of Hearing Data. 3rd Edition, Sage Publications, Thousand Oaks.

Saad-Sulonen, J., Eriksson, E., Halskov, K., Karasti, H., & Vines, J. (2018a). Editorial. Unfolding participation over time in the design of IT. *CoDesign*, *14*(1), 1–3. https://doi.org/10.1080/15710882.2018.1426981

Saad-Sulonen, J., Eriksson, E., Halskov, K., Karasti, H., & Vines, J. (2018b). Unfolding participation over time: temporal lenses in participatory design. *CoDesign*, *14*(1), 4–16. https://doi.org/10.1080/15710882.2018.1426773

Sagaris, L. (2014). Citizens' Anti-highway Revolt in Post-Pinochet Chile: Catalyzing Innovation in Transport Planning. *Planning Practice & Research*, *29*(3), 268–286. https://doi.org/10.1080/02697459.2014.929840

Sagaris, Lake, & Landon, Paulette. (2017). Autopistas, ciudadanía y democratización: la Costanera Norte y el Acceso Sur, Santiago de Chile (1997-2007). EURE (Santiago), 43(128), 127-151. https://dx.doi.org/10.4067/S0250-71612017000100006

Sandercock, L., & Attili, G. (2010). Digital ethnography as planning praxis: An experiment with film as social research, community engagement and policy dialogue. *Planning Theory and Practice*, *11*(1), 23–45. https://doi.org/10.1080/14649350903538012

Sanders, E. (2000). Generative Tools for CoDesigning. In S. A. R. Scrivener, L. J. Ball, & A. Woodcock (Eds.), *Collaborative Design. Proceedings of CoDesign 2000*. Springer.

Sanders, E. (2009). Exploring co-creation on a large scale. Designing for new healthcare environments. In P. J. Stappers (Ed.), *Designing for, with and from user experience. Symposium proceedings* (pp. 10–26). https://doi.org/http://doi.acm.org/10.1145/347642.347802

Sanders, E., & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. *CoDesign*, *10*(1), 5–14. https://doi.org/10.1080/15710882.2014.888183

Sanders, L. (2008). An evolving map of design practice and design research. *Interactions*, *15.6*(November+December), 13–17.

Savaget, P., Geissdoerfer, M., Kharrazi, A., & Evans, S. (2019). The theoretical foundations of sociotechnical systems change for sustainability: A systematic literature review. *Journal of Cleaner Production*, *206*, 878–892. https://doi.org/10.1016/j.jclepro.2018.09.208

Sendra, P., & Sennet, R. (2020). *Designing disorder. Experiments and disruptions in the city*. Verso.

Silva, M. M., & Costa, J. P. (2016). Flood Adaptation Measures Applicable in the Design of Urban Public Spaces: Proposal for a Conceptual Framework. Water (Switzerland), 8(7). https://doi.org/10.3390/w8070284

Slingerland, G., Mulder, I., & Jaskiewicz, T. (2019). Join the park! Exploring opportunities to lower the participation divide in park communities. ACM International Conference Proceeding Series, 131–135. https://doi.org/10.1145/3328320.3328382

Somma, N. M. (2021) Power cages and the October 2019 uprising in Chile, Social Identities, 27:5, 579-592, DOI: 10.1080/13504630.2021.1931092

Spirn, A. W. (1984). The Granite Garden: Urban Nature and Human Design. New York: Basic Books.

Spirn, A. W. (1985). Urban Nature and Human Design: Renewing the Great Tradition. Journal of Planning Education and Research, 5: 1.

Stamm, Caroline (2016). Conflictos, autopistas urbanas y discursos sobre la (in)justicia en Santiago de Chile. *Revista do Programa de Pós-Graduação em Geografia e do Departamento de Geografia da UFES*, 22(1), 88-99.

Tillie, N. (2018). *Synergetic Urban Landscape Planning in Rotterdam. Liveable Low-Carbon Cities*. Technique University of Delft.

Tironi, M. (2010). Redefiniendo la participación, redibujando lo ciudadano: El plan de participación ciudadana del PRES Constitución. *Arquitecturas Del Sur*, 52–65.

Trumper, R. & Tomic, P. (2009). The Chilean Way to Modernity: Private Roads, Fast Cars, Neoliberal Bodies. In: Conley, J. (2009). *Car Troubles: Critical Studies of Automobility and Auto-Mobility* (A.T. McLaren, Ed.) (1st ed.). Routledge. https://doi.org/10.4324/9781315570846

Ubilla-Bravo, Gerardo. (2020). Relaciones de poder entre los actores del periurbano en torno al Plan Regulador Comunal: analizando la gobernanza territorial. *Cuadernos de Geografía: Revista Colombiana de Geografía*, 29(2), 455-472. https://doi.org/10.15446/rcdg.v29n2.75249

UNDRR (2020). The Sendai Framework and the SDGs. United Nations Office for Disaster Risk Reduction (UNDRR).

UNISDR (2015). Global Assessment Report on Disaster Risk Reduction.

Ureta, S. (2017). A very public mess: Problematizing the participative turn in energy policy in Chile. *Energy Research & Social Science*, *29*, 127–134.
Van Melik, R., & Van Der Krabben, E. (2016). Co-production of public space: Policy translations from New York City to the Netherlands. *Town Planning Review*, *87*(2), 139–158. https://doi.org/10.3828/tpr.2016.12
van Stijn, A. (2021). Guidance in the application of Research through Design: the example of developing circular building components. *Interventionist Research Methods*, *2021*.
van Stijn, A., & Lousberg, L. H. M. J. (2022). Approaching Research through Design in the field of Architecture and the Built Environment: Relating to the history, key theories and discourse. In L. H. M. J. Lousberg, P. Chan, & J. Heintz (Eds.), *Interventionist Research Methods*. Taylor & Francis.
Vergara Perucich, F. (2019). Urban Design Under Neoliberalism: Theorising from Santiago, Chile (1st ed.). Routledge. https://doi.org/10.4324/9780429203268
Waldheim, Charles (2016). Landscape as urbanism. A General Theory. Princeton, New Jersey: Princeton University Press.
Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, *9*(2). https://doi.org/10.5751/ES-00650-090205
Wamsler, C., & Raggers, S. (2018). Principles for supporting city–citizen commoning for climate adaptation: From adaptation governance to sustainable transformation. *Environmental Science and Policy*, *85*(March), 81–89. https://doi.org/10.1016/j.envsci.2018.03.021
Watchorn, V., Tucker, R., Hitch, D., Frawley, P. (2023). Co-design in the context of universal design: An Australian case study exploring the role of people with disabilities in the design of public buildings, The Design Journal. DOI: 10.1080/14606925.2023.2264652
Wong, T. H. F., & Brown, R. R. (2009). The water sensitive city: Principles for practice. *Water Science and Technology*, *60*(3), 673–682. https://doi.org/10.2166/wst.2009.436
Wu, J., & Wu, T. (2012). Ecological resilience as a foundation for urban design and sustainability. In Resilience in ecology and urban design: Linking theory and practice for sustainable cities (pp. 211-229). Dordrecht: Springer Netherlands.
Yin, R. K. (1994). Case study research and applications: Design and methods. In T. Oak (Ed.), *Sage Publications* (2nd ed.). SAGE Publications. https://doi.org/10.1016/j.jada.2010.09.005
Zwart, S. D., & de Vries, M. J. (2016). *Methodological Classification of Innovative Engineering Projects*. https://doi.org/10.1007/978-3-319-33717-3_13

2 Enablers and barriers for collaboration and design

An exploratory study of two public space processes in Chile

The content of this chapter was published in: **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. Ataov (Eds.), *Governance of climate responsive cities* (pp. 105–125). The Urban Books Series Springer, https://doi.org/10.1007/978-3-030-73399-5_7.**

Note: This chapter was renamed for the purpose of this book but was originally published as "How co-design of public space contributes to strengthening resilience: Lessons from two Chilean cases".

ABSTRACT

The implementation of adaptation measures and the improvement of urban resilience have been a growing concern recently. While urban projects are encouraged to become resilient, there is an interest in the design processes that produce them. In Latin America, co-design is gradually taking a central role in space production, recognising the need to involve multiple stakeholders to achieve more integrated and inclusive designs. However, in the case of Chile, institutions are relatively 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 operationalises the ERF framework and proposes a flowchart to identify factors influencing urban resilience. Although the Latin-American context may differ, this study provides insights into co-design processes elsewhere.

2.1 Introduction

Cities are socio-ecological systems with multi-scalar components and sub-systems that go beyond their jurisdictional and physical boundaries (Boelens & de Roo, 2016; Ersoy & Yeoman, 2020; Meerow & Stults, 2016; Van Bueren van Bohemen, Itard, & Visscher, 2012). Climate Change and natural hazards directly and indirectly impact these sub-systems and challenge how we have developed cities and public spaces (Nightingale et al., 2019). As a result, it has been recognised that the design processes to produce the built environment are complex, making it necessary to collaborate and integrate different decision-making and expertise levels (Folke, Chapin, & Olsson, 2009; Savaget, Geissdoerfer, Kharrazi, & Evans, 2019; Ersoy & Yeoman, 2020). Co-design has gained relevance in the increasing need to climate-proof our cities and, thus, their public spaces.

In most urban areas, the specialisation of functions results in a general condition of decline and contamination, impacting human quality of life and health (Ersoy & Yeoman, 2020). With urbanisation, the ecological landscape has become ecologically fragmented, affecting the environment and our society (Brink et al., 2016; Wamsler, Brink, & Rivera, 2013; Ersoy & Yeoman, 2020). Implementing climate change adaptation measures in public spaces enables us to think about how various environmental, social, and economic challenges can be addressed to increase the resilience of cities through collaborative processes (Castán Broto & Bulkeley, 2013; Wamsler & Raggers, 2018).

In recent years, there has been a growing awareness of the need 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 & Courard, 2018; Harkness et al. 2019; Moreno 2019). Two of these

exceptional cases will be analysed in this chapter. They have in common that their co-design process became crucial for the socio-ecological solutions of public spaces. However, implementing co-design is not always straightforward in rigid and over-regulated institutional settings that are ill-adapted to such collaborative processes.

This chapter applies 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 & Holling, 2001; Walker et al., 2004) and defines it as a process of change (Davoudi et al., 2013) emphasising the preparedness capacity of institutional systems through persistence, adaptation, and transformation. Specifically, we aim to understand the dimensions of persistence, adaptability, and transformability in co-design process-oriented cases. To do so, the enablers and barriers to collaboration and design will be analysed for each case.

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 future discussions of the ERF.

2.2 Background: Applying the Evolutionary Resilience Framework to Urban Co-Design

The design and implementation of resilient adaptation interventions are challenging tasks for cities due to their complex and dynamic structures. Understanding the link between cities' social and ecological sub-components is crucial to developing their long-term capacities and reconfiguring socioeconomic 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. A long list of literature deals 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 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). It emphasises the preparedness capacity of institutional systems to change by understanding it through 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 creating 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 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 (Figure 2.1).

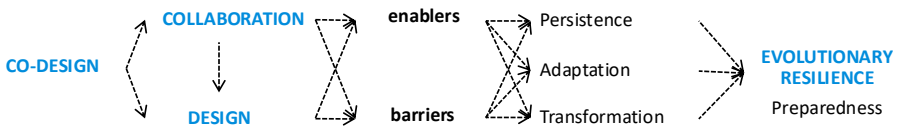

FIG. 2.1 Linking co-design to evolutionary resilience.

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 & 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. In this respect, co-design aims to allow a wider variety of knowledge to be considered and analysed by a broader group of experts and stakeholders than traditionally involved in urban design to provide more suitable and context-specific spatial designs 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 & Dalli, 2014; Vargo & Lusch, 2008). It suggested the involvement of customers, consumers in service marketing (Vargo & Lusch, 2004), or users in industrial design (Sanders & Stappers, 2008) in developing products or services. It has, over the years broadened its scope to new knowledge and application fields such as environmental studies (Djenontin & Meadow, 2018; Moser, 2016), urban design (Sørensen & Torfing, 2018; Stelzle et al., 2017), governance and management (Ersoy, 2017; Pestoff et al., 2013), architecture (Emmit & Ruikar, 2013), planning (Healey et al., 2007; Webb et al., 2018) and industrial design (Koskela-Huotari et al. 2013; Mattelmäki et al., 2014; Mattelmäki & Visser, 2011; Sanders et al., 2010). In sum, there has been a diversification of actors involved in the design processes understood as networked institutional systems (Manzini 2016; Mattelmäki et al. 2014).

Co-design focuses on the benefits of collaboration and its opportunities to improve 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. Public, private, and community participants collaborate and interact in the urban field to develop 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 to regulate 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 them.

We analyse 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 persist to be overcome through adaptability or transformability. Collaboration in the design process 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 systems' preparedness 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. It may also contribute to designing solutions for public spaces to better adapt and transform when facing social or ecological challenges such as climate change.

The following section presents the cases and explains the data collection and analysis.

2.3 Method: A case study of three co-design processes

We aim to investigate how co-design can enhance institutional systems' preparedness and 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 from December 2019 and January 2020 fieldwork. 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 written and graphic documents such as public reports, media publications, design plans, and images. To make the sampling comprehensive, participants were selected from different sectors and backgrounds (Ridder 2017),

such as public, private, non-profit, academia, and the community. Also, multiple disciplines and roles were considered when selecting the interviewees. The interview protocol, consisting of semi-structured questions, was built from the co-design ERF framework. Key informant experts in Chile and the Netherlands revised it. Also, a pilot interview was conducted with one interviewee in each case, and adjustments were made to suit the framework better.

The interviews aimed to gain in-depth insights into the perceptions and meanings of the process concerning the enablers and barriers. We analysed the primary enablers and barriers reported by the interviewees and positioned 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, emphasising 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 barriers encountered were modified and that, 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 understanding, 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 public spaces' social and ecological design solutions 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 interviewees, and the systematised results were used to check for internal consistency.

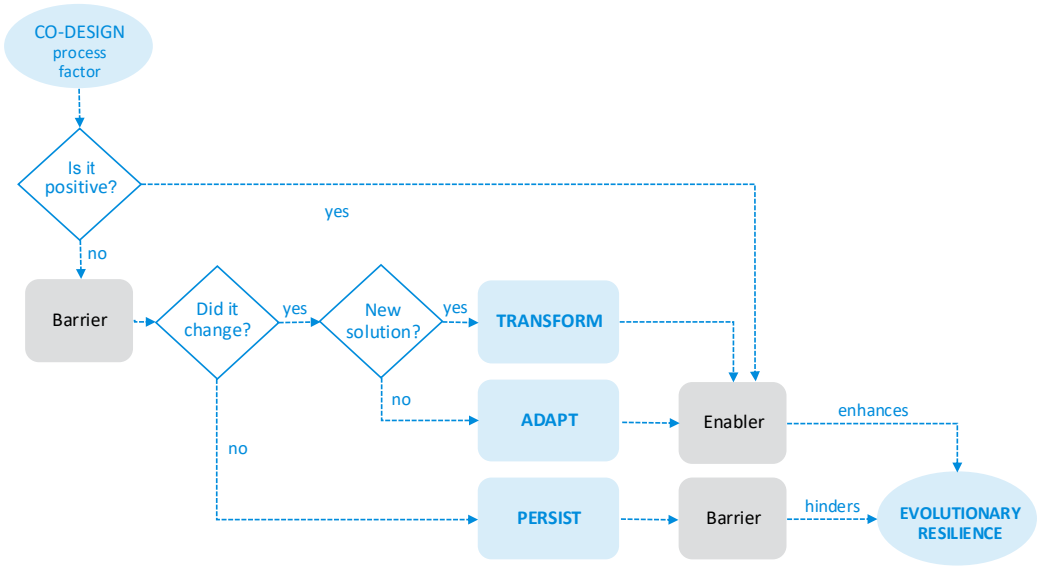

FIG. 2.2 Flowchart of process factors persisting, adapting, or transforming to influence evolutionary resilience.

Figure 2.2 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 persist or be overcome 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 reviewed the data in rounds of initial familiarisation 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 categorise relevant themes linked to the ERF framework.

2.3.1 Cases: Two public space co-design processes

The study analysed two public space design processes 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 during the last decade in the Chilean context. They occurred

TOC

within complex socio-ecological institutional systems and involved inter-sectorial partnerships, multidisciplinary teams, and engaged communities. These projects are receiving considerable attention from academia, national government entities, and private companies because of their public-private partnerships, collaborative approaches to design, and the transdisciplinary development of nature-based solutions to climate change adaptation (CNDU, 2014; Moreno, 2018).

TABLE 2.1 Description of the two cases.

	Case 1 – Kaukari Urban Park	Case 2 – Antofagasta Seaside Park
Location	Copiapó city, Atacama region, Chile.	Antofagasta city, Antofagasta region, Chile.
Size	60 hectares. 3,5 kilometers long.	35 kilometers 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.

The cases are briefly described in Table 2.1. 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 naturalisation of the riverbank, as well as 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 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 with the National Architecture Award.

FIG. 2.3 Aerial view of Kaukari Urban Park in Copiapó city. (Photo Credit: Tomás Gómez).

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, familiarity with the cities, the involved organizations, and the projects enabled valuable insights for this study (Labaree, 2002).

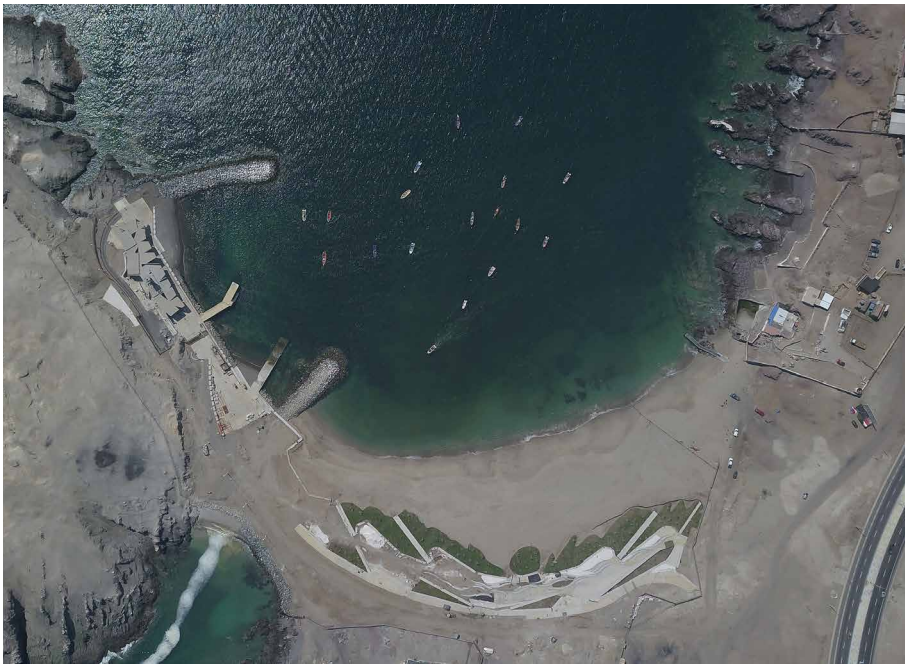

FIG. 2.4 Aerial view of Antofagasta Seaside Park in Antofagasta: La Chimba artificial beach and fishing cove. (Photo Credit: Nicolás Sepúlveda).

2.4 Results and discussions: Barriers and enablers for collaboration and design

This section presents the study's findings and discusses the implications of the ERF concepts in the co-design processes. The enablers and barriers of the processes reported by the interviewees and their narratives about co-design allowed us to analyse 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 2.2, 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 Figure 2.2, 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 were classified as adapted or transformed. These two types of changes enhanced the evolutionary resilience of their institutional systems.

TABLE 2.2 Collaboration and design enablers and barriers are categorised 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 quality of the design leader. – Young actors were willing to innovate.	– Importance of the seaside site for the citizens. – Emerging participatory culture. – Trust in the quality 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.

>>>

TABLE 2.2 Collaboration and design enablers and barriers are categorised according to the ERF concepts.

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).

2.4.1 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 resilience. Collaborative enablers contributed to consolidating existing structures or organisations that govern and play a role in the creation, design, management, and operation of public spaces or activating people to use them. Design enablers allowed the integration of the existing requirements for climate-resilient design and the available knowledge into the projects.

The interviewees recognised some enablers that have benefitted collaboration throughout the processes. In both cases, young professionals working for leading organisations were involved and were young idealists aiming for innovation. They often knew each other and were willing to collaborate actively. The landscape architect for both cases had a nationally recognised 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 who 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 in the different public entities, and this smoothened the co-design process. In case 2, an emerging participatory culture benefited from collaboration in design. The leading NGO Creo Antofagasta was created to raise collaboration among public and private entities, and a couple of community organisations emerged with time. This allowed collaboration, but communication and management difficulties were confronted in leading the process.

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

2.4.2 Barriers to 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 to 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, a collaborative culture was developed over the years, achieving a much more mature and consistent collaborative institutional system with new emerging community organisations and professionals. Nevertheless, in this case, some interviewees reported a lack of consistent communication throughout the process that led to a certain discomfort and mistrust towards the leading organisation. 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 institutional stiffness was 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 naturalised 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.

2.4.3 Barriers adapted and 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 organisations 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.

2.4.4 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 2.3 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 towards context-specific adaptation measures for public space.	– Social resilience was enhanced through the designed project, while low ecological considerations with regards to context-specific water adaptation measures. – The project responds mainly to social requirements, but not to some relevant climate change's ecological threats.

Table 2.3 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.

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 towards 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 towards 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.

2.5 Conclusions

The design processes that produce our built environments are complex and require involving actors at diverse levels of decision-making and expertise (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 to analyze our 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 may contribute to, or hinder, 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 combine multiple ecological and social requirements into 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 towards 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, and how co-design may ensure collaborative design, operation, activation, and use of public spaces to better adapt to socio-ecological challenges. Additionally, studies on the social learning approach to the ERF may allow for the assessment of institutional preparedness towards evolutionary resilience.

References

Barton, J. R., Krellenberg, K., & Harris, J. (2015). Collaborative governance and the challenges of participatory climate change adaptation planning in Santiago de Chile. *Climate and Development*, *7*(2), 175–184.

Barton, J. R. (2009). Revisión de marcos conceptuales y análisis de enfoques metodológicos (barreras y viabilidad) para el desarrollo de una infraestructura urbana sostenible y eco-eficiente. *CEPAL: Eco-Eficiencia y Desarrollo de Infraestructura Urbana Sostenible En América Latina y El Caribe (ECLAC-ESCAP. ROA101)*, 1–86. Retrieved from https://www.cepal.org/ecoeficiencia/noticias/paginas/2/36162/Barton.pdf

Boelens, L., & de Roo, G. (2016). Planning of undefined becoming: First encounters of planners beyond the plan. *Planning Theory*, *15*(1), 42–67.

Brink, E., Aalders, T., Ádám, D., Feller, R., Henselek, Y., Hoffmann, A., … Wamsler, C. (2016). Cascades of green: A review of ecosystem-based adaptation in urban areas. *Global Environmental Change*, *36*, 111–123.

Bristow, G. (2010). Resilient regions: re-'place'ing regional competitiveness. *Cambridge Journal of Regions, Economy and Society*, *3*(1), 153–167.

Bryman, A. (2015). The nature and process of social research. *Social Research Method*, 3–16.

Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From Metaphor to Measurement: Resilience of What to What? *Ecosystems*, *4*(8), 765–781.

Castán Broto, V., & Bulkeley, H. (2013). A survey of urban climate change experiments in 100 cities. *Global Environmental Change*, *23*(1), 92–102.

Christopherson, S., Michie, J., & Tyler, P. (2010). Regional resilience: Theoretical and empirical perspectives. *Cambridge Journal of Regions, Economy and Society*, *3*(1), 3–10.

CNDU. (2014). *Sistema de Planificación Urbana Integrada. Propuestas para la implementacion de la Politica Nacional de Desarrollo Urbano*. Santiago de Chile.

Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary Resilience and Strategies for Climate Adaptation. *Planning Practice and Research*, *28*(3), 307–322.

Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., … Porter, L. (2012). Resilience: A Bridging Concept or a Dead End? "Reframing" Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does it Mean in Planni. *Planning Theory and Practice*, *13*(2), 299–333.

Davoudi, S., Zaucha, J., & Brooks, E. (2016). Evolutionary resilience and complex lagoon systems. *Integrated Environmental Assessment and Management*, *12*(4), 711–718.

Djenontin, I. N. S., & Meadow, A. M. (2018). The art of co-production of knowledge in environmental sciences and management: lessons from international practice. *Environmental Management*, *61*(6), 885–903.

Drilling, M., & Neuhaus, F. (2019). The Fragile Body in the Functional City: An Editorial. *Urban Planning*, *4*(2), 1.

Emmit, S., & Ruikar, K. (2013). *Collaborative Design Management*. New York: Routledge.

Ersoy, A. (Ed.). (2017). *The impact of co-production. From community engagement to social justice*. Bristol: Policy Press. Connected Communities - Creating a new knowledge landscape.

Ersoy, A., & Yeoman, R. (2020). Reconfiguration of public space via nature-based solutions. In J. Riegler & J. Bylund (Eds.), *Unfolding Dilemmas of Urban Public Spaces. Recommendations by JPI Urban Europe's AGORA*. Riga: Urban Europe.

Fernández, T., & Courard, P. (2018). Parque Kaukari del Río Copiapó. *ARQ*, *2018*(99), 70–82.

Fingleton, B., Garretsen, H., & Martin, R. (2012). Recessionary shocks and regional employment: Evidence on the resilience of u.k. regions. *Journal of Regional Science*, *52*(1), 109–133.

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*(4).

Folke, Chapin, F. S., & Olsson, P. (2009). *Principles of ecosystem stewardship. Resilience-based natural resource management in a changing world*. (C Folke, F. S. Chapin, & P. Olsson, Eds.), *Springer*. New York: Springer.

Galvagno, M., & Dalli, D. (2014). Theory of value co-creation: A systematic literature review. *Managing Service Quality*, *24*(6), 643–683.
Gunderson, L. H., & Holling, C. S. (2001). *Panarchy: understanding transformations in human and natural systems*. Island press.
Harkness, A., Ramirez, A., Rihm, A., Orellana, A., Lefevre, B., Robertson, C., … Ortega, S. (2019). *Construyendo Gobernanza Metropolitana*. (F. Rojas, F. Vera, & C. Robertson, Eds.). Santiago de Chile: Banco Interamericano de Desarrollo BID.
Healey, P., Richardson, T., Tewdwr-jones, M., Reeves, D., & Needham, B. (2007). *Urban Complexity and Spatial Strategies Towards a relational planning for our times Policy and Planning in a World of Difference*.
Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, *4*, 1–23. Retrieved from https://www.jstor.org/stable/2096802
Hudson, R. (2010). Resilient regions in an uncertain world: wishful thinking or a practical reality? *Cambridge Journal of Regions, Economy and Society*, *3*(1), 11–25.
Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory Design, Co-Design and the public realm. *CoDesign*, *13*(3), 148–159.
Koskela-Huotari, K., Friedrich, P., & Isomursu, M. (2013, June). Jungle of "co". In *Proceedings of the Naples Forum on Service* (pp. 18-21).
Krellenberg, K., Jordán, R., Rehner, J., Schwarz, A., Infante, B., Barth, K., & Pérez, A. (2014). Adaptation to climate change in megacities of Latin America. *Economic Commission for Latin America and the Caribbean (ECLAC)*, 98.
Labaree, R. (2002). The risk of 'going observationalist': negotiating the hidden dilemmas of being an insider participant observer. *Qualitative Research*, *2*(1), 97–122.
Manzini, E. (2016). Design Culture and Dialogic Design. *Massachusetts Institute of Technology*, *32*(1), 52–59.
Mattelmäki, T., Vaajakallio, K., & Kosinen, I. (2014). What Happened to Empathic Design? *Design Issues, MIT.*, *30*(1), 67–77.
Mattelmäki, T., & Visser, F. S. (2011). Lost in Co-X. *Proceedings of the IASDR2011*.
Meerow, S., & Stults, M. (2016). Comparing conceptualizations of urban climate resilience in theory and practice. *Sustainability (Switzerland)*, *8*(7), 1–16.
Moreno, O. (2018). Contain, restore, connect: landscape as infrastructure. *ARQ*, *2018*(99), 83–85.
Moreno, O. (2019). Infraestructura verde urbana. Estrategias de planificación y diseño del paisaje para la resiliencia y adaptabilidad socioecológica de ciudades regionales en Chile. El caso de Llanquihue. In F. Sciaraffia, S. Kumar Biswas, T. Nideroest, & H. Zander (Eds.), *From the South. Global perspectives on landscape and territory* (1rst Editi, pp. 82–91). Santiago de Chile: Universidad del Desarrollo.
Moser, S. C. (2016). Can science on transformation transform science? Lessons from co-design. *Current Opinion in Environmental Sustainability*, *20*, 106–115.
Nightingale, A. J., Eriksen, S., Taylor, M., Forsyth, T., Pelling, M., Newsham, A., … Whitfield, S. (2019). Beyond Technical Fixes: climate solutions and the great derangement. *Climate and Development*, *0*(0), 1–10.
Ostrom, E. (1996). Crossing the Great Divide: Coproduction, Synergy, and Development. *World Development*, *24*(6), 1073–1087.
Parks, R. B., Baker, P. C., Kiser, L., Oakerson, R., Ostrom, E., Ostrom, V., … Wilson, R. (1981). Consumers As Coproducers of Public Services: Some Economic and Institutional Considerations. *Policy Studies Journal*, *9*(7), 1001–1011.
Pestoff, V., Brandsen, T., & Verscheure, B. (Eds.). (2013). *New Public Governance, the Third Sector, and Co-Production* (1st ed.). New York: Routledge.
Ridder, H. G. (2017). The theory contribution of case study research designs. *Business Research*, *10*(2), 281–305.
Romero-Lankao, P., & Gnatz, D. M. (2013). Exploring urban transformations in Latin America. *Current Opinion in Environmental Sustainability*, *5*(3–4), 358–367.
Rose, A. (2004). Defining and measuring economic resilience to disasters. *Disaster Prevention and Management: An International Journal*, *13*(4), 307–314.
Sanders, E, & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(1), 5–18.
Sanders, E, & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. *CoDesign*, *10*(1), 5–14.

Sanders, E., Brandt, E., & Binder, T. (2010). A Framework for Organizing the Tools and Techniques of Participatory Design. In *PDC 2010 Proceedings*. Sydney, Australia. Retrieved from http://portal.acm.org/dl.cfm

Savaget, P., Geissdoerfer, M., Kharrazi, A., & Evans, S. (2019). The theoretical foundations of sociotechnical systems change for sustainability: A systematic literature review. *Journal of Cleaner Production*, *206*, 878–892.

Sharifi, A., Chelleri, L., Fox-Lent, C., Grafakos, S., Pathak, M., Olazabal, M., … Yamagata, Y. (2017). Conceptualizing dimensions and characteristics of urban resilience: Insights from a co-design process. *Sustainability (Switzerland)*, *9*(6), 1–20.

Sørensen, E., & Torfing, J. (2018). Co-initiation of Collaborative Innovation in Urban Spaces. *Urban Affairs Review*, *54*(2), 388–418.

Stelzle, B., Jannack, A., & Noennig, J. R. (2017). ScienceDirect ScienceDirect ScienceDirect Co-Design and Co-Decision : Co-Design and Co-Decision : Decision Making on Collaborative Design Platforms Decision Making on Collaborative Design Platforms b. *Procedia Computer Science*, *112*, 2435–2444.

Van Bueren, E., van Bohemen, H., Itard, L., & Visscher, H. (Eds.). (2012). *Sustainable Urban Environments. An Ecosystem Approach*. Springer.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, *68*(1), 1–17.

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science*, *36*(1), 1–10.

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, *9*(2).

Wamsler, C., Brink, E., & Rivera, C. (2013). Planning for climate change in urban areas: From theory to practice. *Journal of Cleaner Production*, *50*, 68–81.

Wamsler, C., & Raggers, S. (2018). Principles for supporting city–citizen commoning for climate adaptation: From adaptation governance to sustainable transformation. *Environmental Science and Policy*, *85*(March), 81–89.

Webb, R., Bai, X., Smith, M. S., Costanza, R., Griggs, D., Moglia, M., … Thomson, G. (2018). Sustainable urban systems: Co-design and framing for transformation. *Ambio*, *47*(1), 57–77.

Yin, R. K. (1994). *Case study research and applications: Design and methods*. (T. Oak, Ed.), *Sage Publications* (2nd ed.). London New Dehli: SAGE Publications.

TOC

3 The Co-design framework

Linking the participation ladder and the design cycle

The content of this chapter was published in: **Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022). Towards a framework for Urban Landscape Co-design: Linking the participation ladder and the design cycle. *The CoDesign Journal: The International of Cocreation in Design and the Arts.***

Note: This chapter was renamed for the purpose of this book.

ABSTRACT

With the increasing social and ecological pressures on urban settlements, re-thinking how we produce them becomes a growing concern. Due to the diversity of actors across sectors and backgrounds involved in design processes, collaboration is of utmost importance. Co-design can thus play a crucial role in integrating aims and knowledge as an evolving institutional process toward feasible, suitable, and legitimate projects. While many studies on co-design focus on one-time activities, little attention is paid to conceptualising how such processes occur, involving several actors in dynamic participatory ways. We propose a framework for urban landscape co-design and suggest that collaboration is achieved at many levels within different design steps in the process. Analysing three Chilean public space co-design processes through the lens of our framework, we highlight the intrinsic diversity of such an approach. This study posits that three co-design arenas interact (strategic, transdisciplinary, and socio-cultural) according to their main aims to enable, inform, and legitimise the projects accordingly. Our framework contributes to conceptualising co-design and may also be helpful in planning and developing other processes in academia and practice.

3.1 Background: A framework for public space co-design

3.1.1 Co-design: More than just collaboration in design

Co-design refers to the collaboration of multiple actors in the design process to improve the outcomes (E Sanders & Stappers, 2008). It follows the participatory design tradition, emphasising collaboration in design processes (Manzini, 2015; Mattelmäki & Visser, 2011; E Sanders & Stappers, 2008). In recent years, it has been said to contribute to solving complex problems (Manzini, 2015) while improving the outcomes' legitimacy, context-specificity, innovativeness, feasibility, and, ultimately, their sustainability and resilience (Baibarac & Petrescu, 2019; Gaete Cruz, Ersoy, Czischke, & van Bueren, 2021; Hansen et al., 2019; Lang et al., 2012; Manzini, 2015; Mulder, 2015; Munthe-Kaas, 2015; Palmås & von Busch, 2015). Specifically in urban design, actors come from multiple sectors (public, private, academia, non-profit, community) and knowledge backgrounds (strategic, transdisciplinary, socio-cultural) (Webb et al., 2018). Such collaborative and democratic processes (Huybrechts & Teli, 2020) deal with the diverging aims and knowledge of the involved actors (Baibarac & Petrescu, 2019; Huybrechts, Benesch, & Geib, 2017; Ostrom, 1996, 2007; E Sanders & Stappers, 2014) and may require deliberation, negotiation, or other problem-solving forms (Castro, 2021). Collaboration, thus, occurs in dynamic multi-sectorial ways and in transdisciplinary teams, integrating formal and informal knowledge, values, and skills (Baibarac & Petrescu, 2019). Such complexity of co-design is not always approached and is much less conceptualised in academia and practice. With this article, we contribute toward conceptualising and evaluating co-design processes (Szebeko & Tan, 2010).

Many studies have focused on co-design moments (McDonnell, 2018; Saad-Sulonen, Eriksson, Halskov, Karasti, & Vines, 2018) and the use of tools and methods to facilitate horizontal interactions and shared understandings amongst the diverse participants (E Sanders & Stappers, 2014; Sanders, 2014; L. Sanders, 2008). Some have attempted to map tools and methods (Gaete Cruz, Ersoy, Czischke, & van Bueren, 2022; E Sanders & Stappers, 2008; L. Sanders, 2008). Others have conceptualised the levels of collaboration or the factors influencing it (Drain & Sanders, 2019). However, little attention has been paid to conceptualising how co-design processes occur, mainly how actors collaborate in design steps to pursue diverse aims.

Recent studies have suggested that more process-oriented conceptualisations of co-design have yet to be developed (Gaete Cruz et al., 2021; Halskov & Hansen, 2015; Huybrechts et al., 2017; Koskela-Huotari, Friedrich, & Isomursu, 2013; Manzini, 2015; Manzini & Rizzo, 2011). Some suggest that collaboration and design are open and dynamic processes that evolve through multiple timeframes and episodes (Andersen, Danholt, Halskov, Hansen, & Lauritsen, 2015; Huybrechts et al., 2017; Poderi, Bettega, Capaccioli, & D'Andrea, 2018). At the same time, others have developed process-oriented approaches to conceptualise how co-design unfolds over time (Saad-Sulonen et al., 2018). The question remains: how can we conceptualise the complex dynamic processes of collaboration in the design process? Moreover, how do urban landscape co-design processes take place while integrating diverse actors and aims? Furthermore, how can we analyse such dynamic, collaborative design processes?

To help answer these questions, we developed a twofold framework for urban co-design and applied it to the study of three Chilean public space co-design processes. In our framework, we reinterpret Arnstein's participation ladder (1969) and link it with the design cycle steps (Jonas, 2007; Roozenburg & Eekels, 1995). Bridging these two bodies of literature is novel and allows us to envision three coexisting co-design arenas. The latter may be the main contribution of this study.

3.1.2 When the ladder of participation meets collaboration

Arnstein's ladder (1969) is often used to assess citizen participation in design (Andersen et al., 2015). Although, the metaphor of the ladder is relatively static, limiting, and represents a continuum that does not fully apply to processes that change through time while diverse actors are involved in different ways (Andersen et al., 2015; Bowen et al., 2013; Collins & Ison, 2009; Greenhalgh et al., 2019). The duality between a leading actor and users' participation is somewhat restrictive if we aim to analyse network configurations within the urban. Following the Scandinavian and Dutch participatory design traditions, this has been a significant shift in participatory and collaborative design literature (Mattelmäki and Sleeswijk Visser, 2011). The opportunities to address design from a more horizontal perspective, with multiple actors collaborating and experimenting, may be considered an additional step on the ladder. Such design traditions have highlighted the challenges and opportunities of pursuing more balanced power dynamics amongst diverse actors, not only users or citizens (Lee, 2008). Their involvement cannot merely be considered from a top-down or bottom-up perspective but as a collective social learning process (Collins & Ison, 2009). In doing so, collaborative dynamics can be understood simultaneously as bottom-up, top-down, and peer-to-peer across conventional design boundaries (Koskela-Huotari et al., 2013; Manzini, 2015).

TABLE 3.1 Proposed ladder of collaboration.

Collaboration	
Recurrent shared decision-making that builds long-lasting partnerships.	High participation (Brysch, et al., 2021 *IN PRESS*), Institutioning (Huybrechts et al., 2017), social innovation and intense collaboration (Manzini, 2015), infrastructuring (Björgvinsson, Ehn, & Hillgren, 2012), social learning (Reed et al., 2010), partnership (Arnstein, 1969).
Participation	
Involvement in the decision-making of some elements or partial issues of the project.	Mutual learning (Björgvinsson et al., 2010), horizontal collaboration (Manzini, 2015), functional participation (Pretty, 1995), placation (Arnstein, 1969).
Consultation	
Contribution of information (knowledge, values) to the process. An advisory level without shared decision-making.	Information feedback (Connor, 1988), participation by consultation (Pretty, 1995), consultation (Arnstein, 1969).
Information	
Communication about the process and the project. One-way flow of information to report or raise awareness.	No collaboration (Manzini, 2015), passive participation (Pretty, 1995), education (Connor, 1988), informing (Arnstein, 1969).

In this study, we adhere to the evolution of the ladder and reinterpret it to conceptualise co-design. We define four levels of collaboration, disregarding the extremes in Arnstein's ladder. We propose four steps of the ladder to assess the level of collaboration in co-design: information, consultation, participation, and collaboration (Table 3.1). The lower levels of 'information' and 'consultation' stimulate the involvement of actors with an expert orientation, but they are understood as building blocks for collaboration. The higher levels of 'participation' and 'collaboration' allow the genuine involvement of the actors in decision-making. The first establishes temporary involvements, while the latter establishes permanent ones. A higher level of collaboration promotes partnership building, which can only be achieved in the long term. This way, the lower levels, 'manipulation' and 'therapy', were not considered forms of genuine collaboration and are understood to respond to the provocativeness of the publication of the ladder (Connor, 1988). Similarly, the higher levels of 'citizen control' and 'delegated power' are not considered forms of collaboration (Gofen, 2015; Pretty, 1995) and may not even be feasible (or desirable) when designing urban public spaces.

Our ladder then specifies collaboration but does not explain its effects on the design processes. In the following section, we analyse how collaboration relates to the concept of design by understanding the design cycle.

3.1.3 When collaboration meets the design cycle

Co-design is about the collaboration between actors and how diverse knowledge, values, aims, and skills are integrated to influence the design outcomes (Ostrom, 1996; E Sanders & Stappers, 2008). Design is "a trial-and-error process that consists of a sequence of empirical cycles, in which the knowledge of the problem and the solution increases spirally" (Roozenburg & Eekels, 1995, p. 88). The dynamics in design processes have often been conceptualised as design cycles that establish the processes' repeated design steps and phases (Hansen et al., 2019; Jonas, 2007; Roozenburg & Eekels, 1995). The basic design cycle distinguishes five steps (Roozenburg & Eekels, 1995) that match the success criteria for design (Sanders, 2006) and the evolution pattern and microcycle of design (Jonas, 2007). We combined such cyclical approaches to define four design steps: research, analysis, projection, and selection (Table 3.2).

TABLE 3.2 TProposed design steps.

Research	
Gathering of relevant knowledge and values to inform the project.	Research (Van de Ven et al., 2016), investigating, informing, and communication design (Manzini, 2015), research (Jonas, 2007), data gathering (Preece, Sharp, & Rogers, 2001).
Analysis	
Analysis and synthesis of information, main criteria, or requirements for the project.	Analysis (Jonas, 2007; Roozenburg & Eekels, 1995; Van de Ven et al., 2016), exploration (Van de Ven et al., 2016), triggering and enhancing (Manzini, 2015), analysis and establishing requirements (Preece et al., 2001), synthesis (criteria) (Roozenburg & Eekels, 1995).
Projection	
Designing the project or ideating possible solutions or aspects of it.	Simulation (Roozenburg & Eekels, 1995), designing alternatives (Preece et al., 2001), variation and projection (Jonas, 2007), visioning, scenario and strategic design (Manzini, 2015), testing (Van de Ven et al., 2016).
Selection	
Evaluation and decision-making of the most convenient option. This step often leads to a new design cycle.	Evaluation and decision (Roozenburg & Eekels, 1995; Van de Ven et al., 2016), selection and synthesis (Jonas, 2007), evaluating (Preece et al., 2001).

In urban co-design processes, searching and analysing relevant information and requirements may be as crucial as designing possible solutions and defining the most appropriate one. In this sense, a collaborative approach to the design steps may foster different co-design dynamics that clarify the co-design approach. Collaboration in research and analysis may foster more context-specific projects while promoting shared understandings and, ultimately, social learning (Gaete-Cruz et al., 2021). Collaborative approaches to projection and selection may ensure consensus-building, legitimising the outcomes (Gaete-Cruz et al., 2021).

3.1.4 The Co-design Framework: Linking the ladder and the cycle

To better understand how the different levels of collaboration occur in the different design steps of co-design processes, we developed a framework that linked the proposed collaborative ladder with a cyclical approach to design. In such a way, various co-design moments can be mapped and analysed in the co-design landscape. For instance, while some co-design processes may foster higher levels of collaboration in the initial steps, others may promote them in the latter ones. However, both may be considered co-design processes.

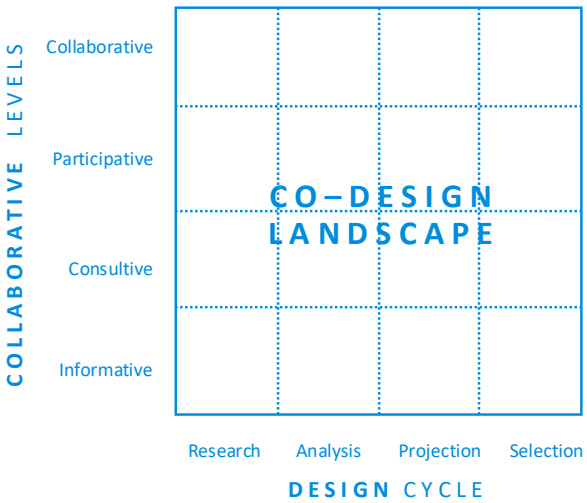

FIG. 3.1 Co-design framework: collaborative levels on the Y-axis and the design cycle steps on the X-axis.

Integrating diverse knowledge and skills during the 'research' and 'analysis' steps promotes shared understandings and learning that may contribute to more context-specific designs. Similarly, collaboration on the 'analysis' and 'projection' steps allows prioritising criteria and the generation of solutions to be consensual and legitimate. This prepares the ground for shared selection and decision-making involving higher institutional willingness and commitment. In this sense, on the lower levels of collaboration, an expert mindset prevails from the leading actors who aim to design while engaging with others. Moreover, higher collaboration levels aim for genuine negotiations and shared decision-making towards reciprocally designing with others. In sum, we understand co-design as a process in which diverse actors may interact at several collaborative levels within specific steps of the design cycle. Various co-design moments may occur in such processes to foster more context-

TOC

specific, legitimate, and feasible urban design projects (Gaete-Cruz et al., 2021). This study uses the twofold framework to map and analyse the co-design activities of three public space co-design processes in the Atacama Desert.

3.2 Method: The study of two co-design processes

3.2.1 Methodological approach

This study aims to contribute an in-depth understanding of complex and contemporary phenomena such as public space co-designing. We undertook a comparative case study based on primary and secondary data from fieldwork conducted in December 2019 and January 2020. The primary data consisted of thirty-three semi-structured in-depth interviews of key participants. Their selection considered including different sectors and backgrounds to make the sampling comprehensive (Ridder, 2017). Secondary data included public reports, media publications, and design plans. We triangulated data from the interviews, documents, and observations on site.

The interviewees were asked to describe the co-design processes, identify the actors involved, and describe the relevant activities. We aimed to gain in-depth insights into their perceptions. The data analysis consisted of four main steps (Bryman, 2015). First, we organised and transcribed the data. Then, we designed a coding based on the interview questions. Next, we coded the data in-depth with Atlas Ti software. Finally, we undertook a thematic analysis. The explanatory results helped us answer the research question and classify data into our proposed framework.

The first author of this study was partially involved in the process of the three cases. We acknowledge that such involvement might bring legitimacy issues to the study but has enabled access to data and interviews that would have been difficult to obtain otherwise. Similarly, familiarity with the cities, actors, and territories enabled valuable insights for this study (Labaree, 2002).

3.2.2 Cases: Three public space co-design processes

We analysed three public space co-design processes in depth (Table 3.3). The cases were selected as innovative co-design processes in the last decade in the Chilean institutional context. In Chile, organisations tend to operate in silos (Barton, 2013; Krellenberg et al., 2014; Orellana, Arenas, Marshall, & Rivera, 2016), and citizen participation is relatively shallow (Barton, Krellenberg, & Harris, 2015; Lecannelier, 2015), and interdisciplinary design is an emerging phenomenon (Aldunce, Bórquez, Adler, Blanco, & Garreaud, 2016; Gaete Cruz et al., 2021; Krellenberg & Barth, 2014). In this context, the institutional settings of the cases involved inter-sectorial partnerships, multidisciplinary teams, and active community associations. The cases are receiving considerable local attention due to their collaborative and resilient design approaches (CNDU, 2014; Moreno, 2018).

The three cases consist of adaptation measures on public spaces aiming for context-specific solutions to connect, foster social interactions, and deal with water scarcity, droughts, island effects, and water-related risks in the Atacama Desert in Chile. Two are city-sized longitudinal urban parks on the Copiapó riverbed and Antofagasta city's seaside. The third case is a multi-neighbourhood pedestrian connection from the hills to the seaside within the city, integrating the vulnerable upper neighbourhoods and informal settlements with the lower areas where most services are located.

The three selected cases were designed involving different actors. Case 1 exemplifies collaboration among two ministries, a transdisciplinary team integrating landscape and hydraulic designers, and some citizen participation endeavours. Cases 2 and 3 are led by Creo Antofagasta, a public-private-people-academia living lab partnership (Steen & van Bueren, 2018), and active citizen involvement in interdisciplinarity and intersectoral approaches to the design processes. While the involvement of diverse actors in each of the three cases demonstrates their collaborative approach to design, the relative level of their involvement varies widely depending on their respective contributions and influence on the projects designed.

The public sector led Kaukari Urban Park (c1), and the design teams took a prominent role in strategic and transdisciplinary design decision-making. This allowed for innovative transdisciplinary design solutions, which is unusual in the Latin American context (Barton et al., 2015). This twofold leadership also allowed the park's construction to occur soon after its design in 2015 and 2018. However, the community actors had an early involvement, which generated a rather conventional approach to social uses and spaces as an urban park for the city.

TABLE 3.3 Description of the cases and the actors involved.

Case	Case 1 Kaukari Urban Park (c1)	Case 2 Antofagasta Seaside Park (c2)	Case 3 Antofagasta Sea-hill Pathways (c3)
Location	Copiapó city, Chile.	Antofagasta city, Chile.	Antofagasta city, Chile.
Size	60 ha. 3,5 km.	35 km long.	4 ha. 3,5 – 2 km.
Project type	Urban Park in a naturalised riverbank.	Urban Park along the seaside.	Pedestrian pathways connecting the hill to the seaside.
Design consultancy	2011 – 2013. Teodoro Fernández Architecture Studio and Bonifacio Fernández.	2017 – 2020. Teodoro Fernández Architecture Studio, Urbana ED, GSI Engineers.	2017 – 2018. Nicole Rochette and Associate Architects, Creo Antofagasta.
The main funding sources for implementation	Housing and Urbanism Ministry and Public Infrastructure Ministry.	Public Infrastructure Ministry and BHP Billiton company.	Housing and Urbanism Ministry and BHP Billiton company.
Main actors involved	Housing and Urbanism Ministry, Public Infrastructure Ministry, Municipality of Copiapó, Regional Government of Atacama, National Assets Ministry, Social Development Ministry, Teodoro Fernández Associate Architects, Habiterra Consultancy, Community Organisations.	Public Infrastructure Ministry (Port Infrastructure Office, Road Infrastructure Office), Housing and Urbanism Ministry, Municipality of Antofagasta, Regional Government of Antofagasta, Social Development Ministry, Chilean Army, Teodoro Fernández Associate Architects, BHP Billiton, Creo Antofagasta NGO, Urbanismo Social NGO, University of Antofagasta, Catholic University of the North, Citizen Council, Community Organizations.	Housing and Urbanism Ministry, Social Development Ministry, Municipality of Antofagasta, Regional Government of Antofagasta, BHP Billiton, Econsa Water Company, Adasa Water Company, Boa Mistura, Creo Antofagasta NGO, Mi Parque NGO, Ciudad Emergente NGO, University of Antofagasta, Catholic University of the North, Citizen Council, Community Organizations.

For cases 2 and 3, Creo Antofagasta NGO leads the process's strategic, transdisciplinary, and socio-cultural interactions. This resulted in both opportunities and difficulties in legitimising the process through the years. Both the Citizen Council (representing citizens) and the Regional Industries Association (representing the private sector) had a positive impression of the initial leading role but reported a lack of communication and missed opportunities for collaboration leading to distrust in some of the later phases.

The Seaside Urban Park (c2) had several multi-actor meetings in the early phase that promoted shared understandings and empowerment, resulting in a context-specific seaside park. However, various citizen (citizen council), private (Regional Industries Association), public (municipality), and third-sector (*Urbanismo Social* NGO) actors reported that the lack of communication in some of the design phases discredited the process.

The Sea Hill Pathways (c3) design process lasted much longer than the previous case. The initial socio-cultural interactions with the neighbourhoods addressed a wider variety of problems than the project could solve, so other projects and activation initiatives emerged within the neighbourhoods, such as participative paintings, green recycling waste disposals, and cleaning of illegal dumpsites. This resulted in a much less consistent and coherent co-design process. The final design ended up somewhat disconnected from the local aims and interactions in the urban neighbourhoods. In this case, the local public sector, which should have played a strategic role at a local level, failed to deal with the regulatory limitations and opted to remain a technical actor.

In the three cases, citizens provided formal and informal knowledge and values that conditioned the public space designs. In case 1, some neighbourhood associations, school representatives, and students were informed and consulted in traditional meetings. While on the other two cases, local actors, citizen organisations, neighbourhood associations, and the 'citizen council' were involved in strategic and technical co-design activities.

The private sector and academia did not participate in case 1. However, they played an essential strategic role in cases 2 and 3 as the Executive Committee members approved budgets and reviewed the progress of the consultancy stages. They also provided valuable socio-cultural knowledge that influenced the designs. An example of this was acknowledging botanical and animal areas to be protected in the seaside park project.

3.3 Results: The three co-design processes mapped in the CD framework

The Co-Design framework was used to classify and map the co-design activities reported by the interviewees for the three urban co-design processes (Figure 3.2). First, we positioned the activities according to the actors' collaboration level in specific design steps of the cycle. Activities aimed at gathering information were classified as 'consulting research' (lower left). Meetings to share the development of the projects were mapped as 'informative decision-making' (lower right). Likewise, meetings aiming to develop the projects were mapped as 'collaborative projection and decision-making' (upper right) because they were roundtables in which the actors regularly contributed (the design or the technical teams). Recurring meetings to gather information to condition the projects were classified as 'collaborative research activities' (upper left). Some activities were placed in one position, while others comprehended more than one.

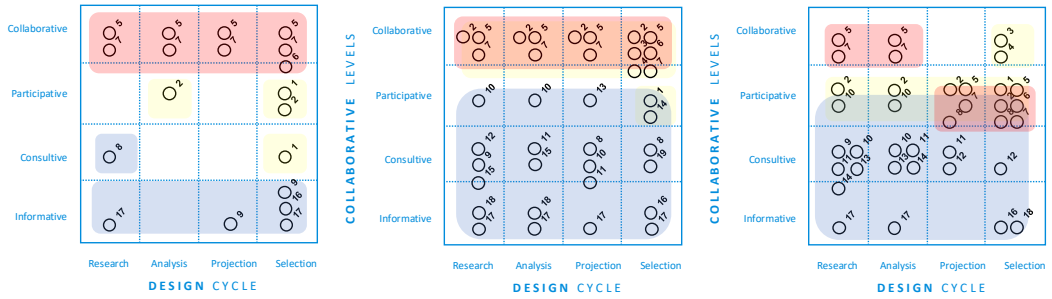

FIG. 3.2 Co-design framework for cases 1, 2, and 3 accordingly. Activities (numbers) and arenas: strategic (yellow), transdisciplinary (red), and socio-cultural (blue).

The diverse activities suggest that not purely design-oriented acts, decisions, and interactions were made but also ones aiming to enable cutting-edge projects, increasing their feasibility, and strengthening their local suitability and legitimacy (Table 3.4). The diverse activities were grouped according to their primary aims: feasibility, context-suitability, and legitimacy of the projects. This allowed the identification of three coexisting co-design arenas: the strategic, the transdisciplinary, and the socio-cultural design arenas. This suggested that co-design could consider not merely technical design acts but also strategic, transdisciplinary, and socio-cultural ones.

TOC

TABLE 3.4 Activities reported by the interviewees are organised according to the main pursued aim.

	Case 1 Kaukari Urban Park (c1)	Case 2 Antofagasta Seaside Park (c2)	Case 3 Antofagasta Sea-hill Pathways (c3)
Strategic activities			
1	Strategic national level meetings	Strategic national level meetings	Strategic national level meetings
2	Strategic local government meetings	Strategic local government meetings	Strategic local government meetings
3		Executive council	Executive council
4		Operative Comitee finance meetings	Operative Comitee finance meetings
Transdisciplinary activities			
5	Technical meetings	Technical meetings	Technical meetings
6	Technical aproval meetings	Technical aproval meetings	Technical aproval meetings
7	Design meetings	Design meetings	Design meetings
Cultural activities			
8	Citizen participatory meetings	Design workshops (2017)	Design workshops of partial project (square) (2015)
9	Public participatory hearings	Citizen participatory meetings (2013)	Citizen participatory meetings
10		Seaside multi-actor roundtables (2013, 2017).	Multiple-neighborhood meetings (2014 - 2019)
11		Tactical urbanism initiatives on site (Gran malón La Chimba, Vive tu borde costero) (2017)	Neighborhood meetings (2014 - 2019)
12		Activation initiatives on site (Juegos del Mar, Beach cleaning, Vive tu borde costero) (2016-2019)	Tactical urbanism initiatives on site (Participative facade paintings, participative tree planting)
13		Seaside pavement design contest (2016)	Activation initiatives on site (Gran Malón)
14		Seaside pavement contest - general public voting (2016)	Citizen Foums - Sustainability and neigborhoods
15		Citizen Foums	
General public activities			
16	Project expositions on public spaces and buildings	Project expositions on public spaces and buildings	Project expositions on public spaces and buildings
17	Media publications	Media publications	Media publications
18		Seminario Concurso de borde costero (publico general)	Inauguraciones de proyectos parciales (Plaza Antonio Rendic, Plaza La Cantera)
19		Opening of partial projects (La Chimba Beach)	

In the following sections, we focus on the results of each case, analysing the co-design activities and arenas we observed to have interacted in such a process.

TOC

3.3.1 Kaukari Urban Park co-design process

Kaukari Urban Park is an interesting integrated project regarding transdisciplinary design solutions and inter-sectorial implementation. The public space project integrated social and ecological elements in the riverbed along the city, addressing flooding and fluctuating river flows. The design process was transdisciplinary, and such an integrated approach was also adopted by the public entities that committed to financing and implementing the project together. Both collaborative approaches were relatively rare in the Chilean context.

We recognised strategic activities in which participative analysis and decision-making were achieved through the process. This was the case of inter-sectorial public interactions. Even the design team was involved to ensure that the ambitious and rather cutting-edge project was feasible, both budget and regulatory wise.

Conversely, trans-discipline was accomplished within the design teams in permanent collaboration with the main involved public parties. A great diversity of formal pieces of knowledge and professional practitioners were involved in the project regarding the design of the project's social, technical and ecological elements. At the same time, the inputs from the community were rather generic. The project seems to have resulted from knowledge co-production and multiple discipline interactions towards defining both the problems and solutions. The close work of the urban landscape design team with the hydraulic engineers toward a riverbed urban park design is of great relevance.

Regarding the involvement of citizens and the community, this process was rather conventionally approached. Activities opened for non-conventional actors only achieved informing and consulting levels of collaboration in research and analysis. This was the norm within the rather conventional top-down institutional setting. This may explain that although transdisciplinary and collaborative, the design solution failed to capture existing specific local social requirements such as specific sports or cultural activities. Despite this, the project designed considers defined spaces and undefined ones, so it is somewhat adaptable to emergent social and ecological conditions (Gaete Cruz et al., 2021).

All interviewees expressed that the project was context-specific and valued by the community because the project was implemented in recent years, and two crucial floodings have already occurred since then. However, this sense of local suitability was developed over the years after.

The many involved disciplines and professionals, especially urban landscape and hydraulic designers prove the design's transdisciplinary approach. The joint funding and implementation amongst public parties result from strategic collaboration, and Kaukari Urban Park's co-design process illustrates a transdisciplinary and strategic collaborative approach.

3.3.2 Antofagasta Seaside Park co-design process

Antofagasta Seaside Park was promoted by a living-lab NGO (Creo Antofagasta) that partnered with actors from diverse sectors and backgrounds such as the public, private, citizen, third sector and academia. Such a collaborative approach blurred the boundaries of design within a wide variety of stakeholder decision-making settings. We recognise an innovative, collaborative approach to strategic, transdisciplinary, and socio-cultural design-decision multi-actor activities.

Much public inter-sectorial dialogue was fostered in this process, and the implementation was planned with public and private funding sources. These resulted from a long-term strategic relationship-building process with other relevant public and private actors led by the NGO.

On the other hand, the project was developed by a design consortium of architects, urban landscape designers, engineers, and process managers. The leading urban designer might have taken the lead in fostering and facilitating collaboration throughout the design process. Also, before the formal design consultancy started, the consortium received vast amounts of formal and non-formal knowledge and analysis collected and synthesised in the previous phase. This significantly influenced the project and complementary activities on site (tactic urbanism, activation initiatives, seminars, pavement contests, sea sports festivals).

The previous may have also promoted the socio-cultural legitimacy of the ambitious city-sized proposal. Early activities allowed community organisations and academics to participate in design. Multi-actor round tables achieved a participative research and analysis level in which the involved interviewees valued as genuine, eye-opening, and trust-building. Nevertheless, some community members reported that effective communication with the transdisciplinary arena was lost in the later stages of the process, leading to confusion and mistrust. Anyhow, the pavement contest activities allowed the community to design and vote for an iconic pavement pattern for the main pathways of the project. This allowed participative design variation and selection, even though only for one element of the general urban park design. The

design was then technically adapted into a feasible pavement design. This initiative achieved a participative design analysis, projection, and selection, but only for one area of the general project.

We acknowledge that extensive collaborative activities were promoted throughout the design process of case 3, which may have made everyone uncomfortable or out of their comfort zone. Nevertheless, this may have prepared the ground for genuine collaborative accomplishments, raising awareness and willingness throughout the process. Some private and citizen interviewees reported a lack of fluent communication from the strategic and transdisciplinary arenas, which raised trust issues within the socio-cultural arena. This highlights that co-design is a long-term building process that should be taken care of regularly.

3.3.3 Sea Hill Pathways co-design process

The Seahill Pathways project aimed to ensure pedestrian mobility connections from the hill to the sea in Antofagasta. The project has its origin in an intense local community collaboration promoted and facilitated by Creo Antofagasta NGO. However, the lack of involvement of strategic actors towards the end resulted in its non-feasibility.

The project emerged from a local community collaboration endeavour which was both intensive and extensive. The initial focus was somewhat open and helped identify connectivity, safety, and local hygiene problems. At a certain point, citizen collaborative interactions took their journey fostering other neighbourhood needs (waste collection days, on-site activation initiatives) and initiatives (water treatment plants, sports square re-design, participative façade paintings). Activities like the design workshops for a small square and the participatory façade painting allowed for high community involvement. These two initiatives achieved a participative design projection and selection, but only for an area of the general pathway. Due to the deprived character of the neighbourhoods and the lack of public investment in the area, these moments were highly valued by the local communities. They acted as trust-building milestones fostering their willingness to participate in the long-lasting process.

The project mainly proposed the implementation of pavements, accessible crossings, urban forestry, vegetation, and urban furniture. The focus on connection was mainly addressed within the urban landscape design team of the leading NGO. As such, there was no extensive co-production of knowledge or transdisciplinary

approaches. Surprisingly, the design team even expressed that they did not see how interacting with the community would contribute to the development of the process. So the project's development proceeded rather conventionally but incorporated some ecological aspects such as water treatment and urban forestry that can be highlighted due to their innovativeness within the context.

It is important to note that despite the intense local collaboration and some of the projects already designed, they were unfeasible. Such unfeasibility responded to their high costs per square meter, the lack of political will to prioritise them, and the lack of willingness from the local government to mandate the unemployment of informal occupations on the sidewalk. The previous forced the project to be revised again to lower costs, raise awareness, and adapt to everyone's expectations.

Despite the extensive community collaboration, the designed project was reported to be unfeasible due to the lack of involvement of relevant strategic public parties. This case highlights the importance of collaborative interactions to ensure permanent communication and feedback through long-term processes.

3.4 Discussions: The interacting co-design arenas

A collaborative approach to several design steps was taken throughout the studied processes. Nevertheless, their trajectories were different and not always aimed for or achieved long-lasting partnerships within the institutional systems. Case 1 shows high collaboration within the transdisciplinary design team, promoting more strategic collaborations from the public parties to financing and implementing the project. Case 2 has early transversal collaborative activities with actors of all sectors and backgrounds that contributed to aligning the visions for the city and generated shared understandings of the seaside area. Such an approach prepared the way for such an ambitious design project and set the collaborative tone for the following phases, even with some miscommunication reported at some point. Case 3 had a conventional design process, but the early community relationship was built through diverse innovative activities that allowed the emergence of other complementary initiatives and projects. All three cases can be considered co-design processes, and their activities were worth analysing with the framework.

The activities reported for each case pursued different aims that suggest the co-existence of three co-design arenas. An arena is a helpful analytical unit for understanding sequential or simultaneous institutional arrangements (Ostrom, 2007) as social spaces where participants interact, exchange, and make decisions (Björgvinsson, Ehn, & Hillgren, 2010). This study suggests that three arenas interact in co-design processes according to their main activities, actors, interactions, and aims as the strategic, transdisciplinary, and socio-cultural co-design. The strategic arena aims for the feasibility of the project and the transdisciplinary one for its context-specificity and integration. Moreover, the socio-cultural arena aims for the legitimacy of the designs. Integrating a wide diversity of actors during the design process may contribute to public space feasibility, context-specificity, and legitimacy. Accordingly, activities in which higher levels of collaboration are fostered in the later steps of the design cycle may promote the aims of the design arenas (Figure 3.3). Identifying the co-design arenas unravels the complexity that lies within such processes.

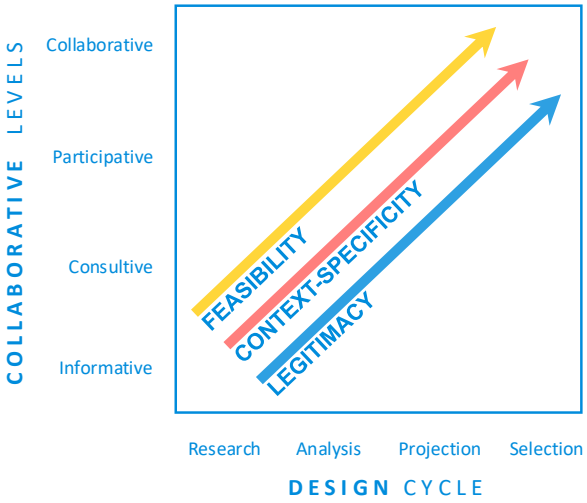

FIG. 3.3 Aims pursued by the design arenas in the framework and how to foster their achievement.

The strategic co-design arena aims for the feasibility of the projects and their implementation. It may have a less direct influence on the contents of the design decisions and strategies. The feasibility of a project is mainly related to budget availability, regulatory viability, and political aims. This arena may have a say in prioritising, promoting, and approving the project at several stages. In many cases, such feasibility actions will be influenced highly by socio-cultural and ecological values that may become legitimate. In this sense, the strategic arena may be linked

TOC

to the socio-cultural one: the first may benefit or exploit the emerging values of the second. In some other cases, acknowledging this arena may even allow the emergence of new complementary initiatives. This is the case of the pavement contest, some activation initiatives in case 2, and the early design of a sports square in case 3. The strategic character often positions this arena in the consultation and participation levels of the framework throughout the design steps. When this is not the case, projects may not be feasible, and delays may occur.

The transdisciplinary co-design arena integrates the actors' knowledge, values, and aims into the design processes and seeks context-specific integrated solutions. In the three cases studied, this arena achieved high levels of collaboration among the leading organisations and the design teams influencing design decision-making. This arena is relevant because it influences both problem definition and solution provision. An essential aim of the arena is to generate shared understandings and knowledge co-production. In this sense, the broad themes or aspects regarded as relevant will highly influence the elements designed. For example, if the sea level rise had been explicitly considered a relevant risk in case 2, the ecological focus would not only have been on conservation and safeguarding public investment. Similarly, if case 1 had acknowledged existing cultural and sports community organisations, the project could have specialised functional spaces. It should be noticed that transdisciplinary interactions often integrate formal and informal knowledge and sometimes diverging values to match the requirements of the projects. Efforts should be made to widen the social and ecological scopes of the initial analysis if seeking context-specificity, local-suitability, and integrated solutions that are open for change.

The socio-cultural co-design arena promotes the involvement and empowerment of non-conventional actors towards legitimising the designs. In the cases studied, the socio-cultural activities involved end-users and the community in providing values and shared understandings that influenced the projects and empowered them. This arena achieved informing and consulting levels of collaboration in the research and analysis design steps in some activities (public hearings, citizen forums, and conventional citizen meetings). Other activities achieved higher collaborative interactions (design workshops, placemaking activities on-site). Efforts should be made to identify socio-cultural and ecological values to legitimise the projects and empower new initiatives and the co-operation of the designed public spaces. Case 1 and 2, as city-sized projects, aimed to capture a wide variety of existing values and provide responses to existing needs. The mismatch of values, needs and solutions were detrimental in case 3. The socio-cultural arena plays a role in providing values to the transdisciplinary arena, and in doing so, it may legitimise the designs. A legitimate urban landscape design (and design process) may allow the empowerment of non-conventional actors and all the benefits that may arise.

The three arenas are interwoven in co-design processes. Their distinction is conceptual, and efforts should be made to ensure integration. In this sense, we identify them to highlight the importance of fostering cross-feedbacks. We emphasise that isolating them may be harmful to co-design processes. Case 3 illustrates how the lack of involvement in the strategic arena may undermine the overall feasibility of a project. Case 1 illustrates how not addressing the socio-cultural arena might result in a lack of acceptance from the wider community. We stress that overlaps should be promoted for actors to feel part of, and be willing to contribute to, co-design processes. The actors in leading positions (public parties, design teams, NGOs, or even citizens) can foster linkages amongst the arenas by acting as facilitators. In many co-design processes, the transdisciplinary arena may take the leading role, so its willingness and availability to collaborate with others will largely condition the achievement of the main co-design aims (feasibility, context-specificity, legitimacy).

We believe that actors are not fixed to specific arenas, and they can belong to more than one arena or may shift throughout the process. Participants might also interact in different arenas (pursuing different aims) in different co-design processes. This was the case of some local sports organisations playing a strategic role within case 2 and a socio-cultural one in case 3. In the first case, they pushed for the implementation and appropriateness of the project. At the same time, they mainly contributed with social values and technical concerns to the early conceptual designs in the latter. Actors are not fixed to specific arenas, and their evolving roles within different arenas might be somewhat desirable in long-term approaches. A flexible and evolutionary approach to design may be essential in such collaborative settings (Gaete Cruz et al., 2021).

We found that the three cases achieved collaboration within several design steps of the process. However, such a collaborative approach to design sometimes failed to build or sustain long-lasting partnerships within their institutional systems. The transdisciplinary arenas achieved higher collaborative levels on the several design steps due to the compromises made by the design teams to collaborate and provide integrated solutions. The strategic and socio-cultural arenas were often involved in consulting and informing levels during early research and analysis steps. Cases 2 and 3 reveal some creative and innovative activities to involve various actors early in the process: forums, tactical urbanism, placemaking, contests, and workshops, amongst others. Despite these co-design activities, the three processes show a critical gap between the transdisciplinary and socio-cultural arenas that may have prevented genuine, long-lasting legitimacy and empowerment towards the joint operation of the public spaces. We conclude that the three cases can be considered urban co-design processes, even though their trajectories differed.

The framework is helpful to visualise the activities and arenas intervening in complex dynamic urban co-design processes. It enabled us to illustrate the three co-design processes, highlighting their differences and similarities. While co-design is often seen as a horizontal collaborative process, this study demonstrates that interacting arenas and dynamic forms of collaboration in design may coexist and evolve. Rather than a ladder or a cycle, the framework defines a landscape in which co-design unfolds. Co-design processes might want to move up the staircase of co-design if pursuing higher degrees of feasibility, context-specificity and legitimacy.

3.5 Conclusions

In this study, we developed a twofold framework to understand how urban landscape co-design processes occur. We took the ladder of participation as a starting point and proposed four collaboration levels. We then combined the ladder of collaboration with the design cycle steps. This allowed us to conceptualise diverse possible interactions within the co-design landscape, which may contribute to clarifying and measuring it (Szebeko & Tan, 2010). We tested the framework by analysing three urban co-design processes in Chile.

The study suggests that co-design processes host transdisciplinary design activities and strategic and socio-cultural actions. According to their actors, interactions, and aims, three arenas—the strategic, transdisciplinary, and socio-cultural arenas—were found to have interacted in such co-design processes.

The framework contributes to illustrating different co-design processes. We argue that unfolding co-design processes using the framework helps visualise the complex dynamics that occur and allows their comparison and eventual evaluation. It should be noted, though, that identifying the three co-design arenas aims to explicitly express their interactive coexistence, not their segregation. If a co-design approach is taken, the interaction amongst the arenas should be fostered and ensured.

This study contributed to conceptualising and analysing urban landscape co-design while giving insights to theory based on real-life practices. Although developed for the urban landscape, the framework contributes to conceptualising the general phenomena of co-design not as a mere horizontal process but rather a dynamic and evolving one. In this sense, co-design processes may have different trajectories

and may fail or succeed in developing long-lasting collaboration (Gaete-Cruz et al., 2022). More process-oriented studies should aim for conceptual clarifications of co-design, embracing its non-linearity and blurry boundaries. The co-design framework may contribute in this direction, yet, further studies are necessary.

Although framed in the Latin American context, the study may contribute to geographical diversity. The cases studied may be valuable examples for other cities to foster urban landscape co-design processes. The framework and the co-design arenas, although conceptual contributions, may provide guidelines for the design of such processes in practice. In doing so, design leaders might be able to use the framework to define activities to involve diverse actors to pursue different aims. In such a way, the framework may be helpful to plan and design further processes in practice or even action research endeavours.

Conceptualising co-design as a phase of co-production may contribute to position collaboration within long-lasting processes. For instance, the framework could clarify how co-design occurs in the different consecutive phases of design. It may also contribute to analysing how collaboration during the design phase contributes to collaboration in the operation phase. In doing so, issues of power, politics, and social justice may be addressed, contributing to understanding the social implications of fostering collaboration early in the process. Similarly, the influence of the context (cultural, geographical, political, spatial) in urban co-production processes may call for further research. In this sense, the barriers and enablers for genuine collaboration may open new purposes, activities, methods, and social endeavours.

This study clarified how various actors collaborate in specific design steps, yet more process-oriented studies are needed to understand how they contribute to and influence design outcomes. Further research should question how co-design improves urban design by integrating diverging knowledge, values, and aims, by analysing specific co-design tools and methods concerning the aims pursued and the achievements accomplished. The influence of the involved actors on context-specificity, defining design criteria, and providing solutions are yet to be understood.

In contested times of social, cultural, ecological, and political change and uncertainty, co-design may provide answers that are possible, consensual, adaptable, and transformable for inevitable change. Deepening the knowledge of co-design processes' complex and evolutionary dynamics may allow the shift from mere collaborative activities to genuine, long-lasting institutional change. However, this requires flexibility, willingness, and social commitment (Gaete Cruz et al., 2021; 2022). This study aimed to contribute conceptual clarity for both academia and practice.

References

Aldunce, P., Bórquez, R., Adler, C., Blanco, G., & Garreaud, R. (2016). Unpacking resilience for adaptation: Incorporating practitioners' experiences through a transdisciplinary approach to the case of drought in Chile. Sustainability (Switzerland), 8(9), 1–21. https://doi.org/10.3390/su8090905

Andersen, L. B., Danholt, P., Halskov, K., Hansen, N. B., & Lauritsen, P. (2015). Participation as a matter of concern in participatory design. CoDesign, 11(3–4), 250–261. https://doi.org/10.1080/15710882.2015.1081246

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. Journal of the American Planning Association, 35(4), 216–224. https://doi.org/10.1080/01944366908977225

Baibarac, C., & Petrescu, D. (2019). Co-design and urban resilience: visioning tools for commoning resilience practices. CoDesign, 15(2), 91–109. https://doi.org/10.1080/15710882.2017.1399145

Barton, J., Krellenberg, K., & Harris, J. (2015). Collaborative governance and the challenges of participatory climate change adaptation planning in Santiago de Chile. Climate and Development, 7(2), 175–184. https://doi.org/10.1080/17565529.2014.934773

Barton, J. R. (2013). Climate change adaptive capacity in Santiago de Chile: Creating a governance regime for sustainability planning. International Journal of Urban and Regional Research, 37(6), 1916–1933. https://doi.org/10.1111/1468-2427.12033

Björgvinsson, E., Ehn, P., & Hillgren, P.-A. (2012). Design Things and Design Thinking: Contemporary Participatory Design Challenges. Design Issues, 28(3), 101–116. https://doi.org/10.1162/desi_a_00165

Björgvinsson, E., Ehn, P., & Hillgren, P. A. (2010). Participatory design and "democratizing innovation." ACM International Conference Proceeding Series, (Ehn 1988), 41–50. https://doi.org/10.1145/1900441.1900448

Bowen, S., McSeveny, K., Lockley, E., Wolstenholme, D., Cobb, M., & Dearden, A. (2013). How was it for you? Experiences of participatory design in the UK health service. CoDesign. Taylor & Francis. https://doi.org/10.1080/15710882.2013.846384

Bryman, A. (2015). The nature and process of social research. Social Research Method, 3–16.

Castro, D. (2021). Argumentation and Persistent Disagreement. Informal Logic, 41(2), 245–280. https://doi.org/10.22329/IL.V41I2.5580

CNDU. (2014). Sistema de Planificación Urbana Integrada. Propuestas para la implementacion de la Politica Nacional de Desarrollo Urbano. Santiago de Chile.

Collins, K., & Ison, R. (2009). Jumping off Arnstein's ladder: Social learning as a new policy paradigm for climate change adaptation. Environmental Policy and Governance, 19(6), 358–373. https://doi.org/10.1002/eet.523

Connor, D. M. (1988). Multi-Sector Involvement Vital to Giving Programs. National Civic Preview, 77(3), 249–257. Retrieved from http://geog.sdsu.edu/People/Pages/jankowski/public_html/web780/Connor_1988.pdf

Drain, A., & Sanders, E. B. N. (2019). A collaboration system model for planning and evaluating participatory design projects. International Journal of Design, 13(3), 39–52.

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. Ataov (Eds.), Governance of Climate Responsive Cities. Springer.

Gaete-Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022). A framework for Co-Design Processes and the use of Visual Collaborative Methods: An Action Research through Design in The Atacama Desert. [Co-Creation and the City: Arts-Based Methods and Participatory Approaches in Urban Planning]." Urban Planning Journal 7 (3): 363–378. doi:10.17645/up. v7i3.5349.

Gofen, A. (2015). Citizens' Entrepreneurial Role in Public Service Provision. Public Management Review, 17(3), 404–424. https://doi.org/10.1080/14719037.2013.822533

Greenhalgh, T., Hinton, L., Finlay, T., Macfarlane, A., Fahy, N., Clyde, B., & Chant, A. (2019). Frameworks for supporting patient and public involvement in research: Systematic review and co-design pilot. Health Expectations, 22(4), 785–801. https://doi.org/10.1111/hex.12888

Halskov, K., & Hansen, N. B. (2015). The diversity of participatory design research practice at PDC 2002-2012. International Journal of Human-Computer Studies, 74, 81–92. https://doi.org/10.1016/j.ijhcs.2014.09.003

Hansen, N. B., Dindler, C., Halskov, K., Iversen, O. S., Bossen, C., Basballe, D. A., & Schouten, B. (2019). How participatory design works: Mechanisms and effects. In OZCHI'19: Proceedings of the 31st Australian Conference on Human-Computer-Interaction. Fremantle, Australia. https://doi.org/https://doi.org/10.1145/3369457.3369460

Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory Design, Co-Design and the public realm. CoDesign, 13(3), 148–159. https://doi.org/10.1080/15710882.2017.1355006

Huybrechts, L., & Teli, M. (2020). The Politics of Co-Design. CoDesign, 16(1), 1–2. https://doi.org/10.1080/15710882.2020.1728150

Jonas, W. (2007). Research through DESIGN through research. Kybernetes, 36(9/10), 1362–1380. https://doi.org/10.1108/03684920710827355

Koskela-huotari, K., Friedrich, P., & Isomursu, M. (2013). Jungle of " Co " Jungle of " Co ," (June).

Krellenberg, K., & Barth, K. (2014). Inter- and transdisciplinary research for planning climate change adaptation responses: The example of Santiago de Chile. Interdisciplinary Science Reviews, 39(4), 360–375. https://doi.org/10.1179/0308018814Z.00000000097

Krellenberg, K., Jordán, R., Rehner, J., Schwarz, A., Infante, B., Barth, K., & Pérez, A. (2014). Adaptation to climate change in megacities of Latin America. Economic Commission for Latin America and the Caribbean (ECLAC), 98.

Labaree, R. (2002). The risk of 'going observationalist': negotiating the hidden dilemmas of being an insider participant observer. Qualitative Research, 2(1), 97–122. https://doi.org/https://doi.org/10.1177/1468794102002001641

Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., … Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. Sustainability Science, 7(SUPPL. 1), 25–43. https://doi.org/10.1007/s11625-011-0149-x

Lecannelier, L. (2015). Del conflicto a la oportunidad: Participación ciudadana en el desarrollo urbano. Urbano, 14–19. Retrieved from http://revistas.ubiobio.cl/index.php/RU/article/view/455

Lee, Y. (2008). Design participation tactics : the challenges and new roles for designers in the co-design process, 0882. https://doi.org/10.1080/15710880701875613

Manzini, E. (2015). Design, when everybody designs : an introduction to design for social innovation. Cambridge, Massachusetts: MIT Press.

Manzini, E., & Rizzo, F. (2011). Small projects/large changes: Participatory design as an open participated process. CoDesign, 7(3–4), 199–215. https://doi.org/10.1080/15710882.2011.630472

Mattelmäki, T., & Visser, F. S. (2011). Lost in Co-X. Proceedings of the IASDR2011.

McDonnell, J. (2018). Design roulette: A close examination of collaborative decision-making in design from the perspective of framing. Design Studies, 57, 75–92. https://doi.org/10.1016/j.destud.2018.03.001

Moreno, O. (2018). Contain, restore, connect: landscape as infrastructure. ARQ, 2018(99), 83–85.

Mulder, I. (2015). Opening up: Towards a sociable smart city. Citizen's Right to the Digital City: Urban Interfaces, Activism, and Placemaking, 161–173. https://doi.org/10.1007/978-981-287-919-6_9

Munthe-Kaas, P. (2015). Agonism and co-design of urban spaces. Urban Research and Practice, 8(2), 218–237. https://doi.org/10.1080/17535069.2015.1050207

Orellana, A., Arenas, F., Marshall, C., & Rivera, A. (2016). Resistance to metropolitan institutionality and planning in Chile. Planning Practice and Research, 31(4), 435–451. https://doi.org/10.1080/02697459.2016.1196535

Ostrom, E. (1996). Crossing the Great Divide: Coproduction, Synergy, and Development. World Development, 24(6), 1073–1087. https://doi.org/10.1016/0305-750X(96)00023-X

Ostrom, E. (2007). Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework. In P. A. Sabatier (Ed.), Theories of the Policy Process (p. 21). Colorado: Westview Press. https://doi.org/10.1081/E-EPAP2-120041405

Palmås, K., & von Busch, O. (2015). Quasi-Quisling: co-design and the assembly of collaborateurs. CoDesign, 11(3–4), 236–249. https://doi.org/10.1080/15710882.2015.1081247

Poderi, G., Bettega, M., Capaccioli, A., & D'Andrea, V. (2018). Disentangling participation through time and interaction spaces–the case of IT design for energy demand management. CoDesign, 14(1), 45–59. https://doi.org/10.1080/15710882.2017.1416145

Preece, J., Sharp, H., & Rogers, I. (2001). Interaction design: Beyond human-computer interaction. Universal Access in the Information Society. Wiley. https://doi.org/10.1007/s10209-004-0102-1

Pretty, J. N. (1995). Participatory learning for sustainable agriculture. World Development, 23(8), 1247–1263. https://doi.org/10.1016/0305-750X(95)00046-F
Reed, M. S., Evely, A. C., Cundill, G., Fazey, I., Glass, J., Laing, A., … Stringer, L. C. (2010). What is social learning? Ecology and Society, 15(4). https://doi.org/10.5751/ES-03564-1504r01
Ridder, H. G. (2017). The theory contribution of case study research designs. Business Research, 10(2), 281–305. https://doi.org/10.1007/s40685-017-0045-z
Roozenburg, N. F. M., & Eekels, J. (1995). Product Design: Fundamentals and Methods. John Wiley & Sons.
Saad-Sulonen, J., Eriksson, E., Halskov, K., Karasti, H., & Vines, J. (2018). Unfolding participation over time: temporal lenses in participatory design. CoDesign, 14(1), 4–16. https://doi.org/10.1080/15710882.2018.1426773
Sanders, E, & Stappers, P. J. (2008). Co-creation and the new landscapes of design. CoDesign, 4(1), 5–18. https://doi.org/10.1080/15710880701875068
Sanders, E, & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. CoDesign, 10(1), 5–14. https://doi.org/10.1080/15710882.2014.888183
Sanders, Elizabeth. (2006). Design Research in 2006. Design Research Quarterly, 1(September), 1–25.
Sanders, Elizabeth. (2014). Perspectives on Participation in Design. Wer Gestaltet Die Gestaltung? https://doi.org/10.14361/transcript.9783839420386.65
Sanders, L. (2008). An evolving map of design practice and design research. Interactions, 15.6(November+December), 13–17.
Steen, K., & van Bueren, E. (2018). The Defining Characteristics of Urban Living Labs. Technology Innovation Management Review, 7(7), 21–33. https://doi.org/10.22215/timreview/1088
Szebeko, D., & Tan, L. (2010). Co-designing for society. Australasian Medical Journal, 3(9), 580–590. https://doi.org/10.4066/AMJ.2010.378
Van de Ven, F. H. M., Snep, R. P. H., Koole, S., Brolsma, R., Van der Brugge, R., Spijker, J., & Vergroesen, T. (2016). Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders. Environmental Science and Policy, 66, 427–436. https://doi.org/10.1016/j.envsci.2016.06.010
Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. Journal of Marketing, 68(1), 1–17. https://doi.org/10.1509/jmkg.68.1.1.24036
Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. Journal of the Academy of Marketing Science, 36(1), 1–10. https://doi.org/10.1007/s11747-007-0069-6
Webb, R., Bai, X., Smith, M. S., Costanza, R., Griggs, D., Moglia, M., … Thomson, G. (2018). Sustainable urban systems: Co-design and framing for transformation. Ambio, 47(1), 57–77. https://doi.org/10.1007/s13280-017-0934-6

4 The Co-design Process framework and the use of Visual Collaborative Methods

An Action Research through Design process in Chile

The content of this chapter was published in: **Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022). A Framework for Co-Design Processes and the use of Visual Collaborative Methods: An Action Research through Design in Chile.** ***Urban Planning Journal,*** **7(3).**

ABSTRACT

With the urgency to adapt cities to social and ecological pressures, co-design has become essential to legitimise transformations by involving citizens and other stakeholders in the design process. Public spaces remain at the heart of this transformation due to their accessibility for citizens and capacity to accommodate urban functions. However, urban landscape design is a complex task for people who are not used to it. Visual collaborative methods (VCMs) are often used to facilitate expression and ideation early in design, offering an arts-based language in which actors can communicate. We developed a co-design process framework to analyse how VCMs contribute to collaboration in urban processes throughout the three commonly distinguished design phases: conceptual, embodiment, and detail. We participated in a co-design process in the Atacama Desert in Chile, adopting an action research through design approach in planning, undertaking and reflecting in

practice. We found that VCMs are useful to facilitate collaboration throughout the process in design cycles. The variety of VCMs used were able to foster co-design in a rather non-participatory context and influenced the design outcomes. The framework recognized co-design trajectories such as the early fuzziness and the ascendent co-design trajectory throughout the process. The co-design process framework aims for conceptual clarification and may be helpful in planning and undertaking such processes in practice. We conclude that urban co-design should be planned and analysed as a long-term process of interwoven collaborative trajectories.

4.1 Introduction

Urban design and planning practices have a long tradition of dealing with change and uncertainties (Healey, 1992; Jupp & Inch, 2012; Sanders & Stappers, 2008). Collaborative approaches have emerged as ways to cope with such complexities while dealing with power inequities towards more resilient, legitimate, context-specific, and feasible outcomes (Enserink et al., 2003; Gaete Cruz et al., 2021; Palmås & von Busch, 2015; Smaniotto Costa et al., 2020). Such approaches aim for democratic, deliberative, and participative approaches following debates such as the communicative turn in planning (Healey, 1992), the cross of the great divide (Ostrom, 1996; Parks et al., 1981), and the emergence of new languages and landscapes of design (Sanders, 2000; Sanders & Stappers, 2008). They represent a shift towards involving a more comprehensive range of actors and incorporating formal and experiential knowledge in dialogue and design (Sandercock & Attili, 2010; Sanders, 2000). Scholars have given special attention to new methods to initiate dialogue, awaken imaginaries, and facilitate collective knowledge co-production (Carpenter et al., 2021; Ersoy, 2017; Mattelmäki et al., 2014; Sanders et al., 2010; Sanders & Stappers, 2008).

Co-design is a term that is often used for participation in design processes where collective creativity is fostered involving users as sources of knowledge (Sanders & Stappers, 2008). The term acknowledges the diversity of stakeholders involved in design processes (Smaniotto Costa et al., 2020) while emphasising a need for active collaboration in urban design (Van de Ven et al., 2016). Tools and methods have been used to represent urban complexity for participants to visualise the diverse natural and human layers of urban spaces (Baibarac & Petrescu, 2017; Hooimeijer & Maring, 2018; Van de Ven et al., 2016). Yet public space governance is often contested and deals with multiple converging and confronting aims and requirements

(Van Melik & Van Der Krabben, 2016). This is the case in multiscale and multi-dimensional settings where co-design unfolds in various institutional frames or arenas (Gaete Cruz et al., 2022; Huybrechts et al., 2017). Moreover, in urban co-design processes, participants should feel comfortable expressing their points of view and being flexible to change their minds (Gaete Cruz et al., 2021). In collective decision-making settings, participants should be available to deliberate or negotiate when necessary (Castro, 2021). This may not be the case when actors come from diverse sectors and backgrounds or are unacquainted with design practice (Enserink et al., 2003). But when some forms of collaboration are achieved in urban design processes, outcomes are more likely to be more appropriate and locally suitable (Ersoy & Yeoman, 2020; Smaniotto Costa et al., 2020).

While many participatory methods are said to facilitate collaboration, there are different interpretations of the use of visual collaborative methods (VCMs). For example, some studies have focused on their use to communicate and exchange design ideas (Rose, 2014), initiate dialogue, or communicate experiential knowledge (Sanders, 2008; Sanders & Stappers, 2008). Some argue that the visual language is conventionally used by urban professionals and can thus serve as an additional language in which non-designer actors can communicate and collaborate (Sanders, 2009). Many studies focus on the use of VCMs in the early stages of design. However, more conceptual clarification is needed to understand how such methods facilitate collaboration throughout the design phases. The question remains of how VCMs can facilitate collaboration in the urban landscape design process in practice. This study explores the potential of VCMs as modes of collaborative knowledge inquiry, analysis, projection, and selection throughout the design processes.

In the next section, we propose a framework to conceptualise the use of VCMs in the co-design process. Then we present the case we studied and explain the methodological approach we adopted to act and reflect on practice. The results section defines the VCMs used in the co-design process and maps them in the framework. We define the contributions of VCMs in co-design processes and clarify the complexity of such practice.

4.2 Background: Visual Collaborative Methods and building the Co-Design framework

4.2.1 The use of Visual Collaborative Methods in Co-Design Processes

Co-design brings designers, citizens, and people not trained in design to collaborate in design processes (Sanders & Stappers, 2008). Co-design initially focused on users as sources of experiential knowledge and has evolved towards new forms of diverse stakeholder involvement (Mattelmäki & Visser, 2011; Sanders & Stappers, 2008). In doing so, actors intervene in design processes in diverse ways, from sources of practical expertise, speakers of their aims, and collaborators in creativity, exploration, and learning (Mattelmäki et al., 2014; Mattelmäki & Visser, 2011). Such ways require integrating diverse (and sometimes contradicting) knowledge, values, aims, and skills. For the actors to effectively collaborate, they should feel comfortable expressing points of view, be willing to develop shared understandings, and have some knowledge on the subject (Metze, 2020). Urban actors often come from diverse sectors (public, private, academia, non-profit, community), have different backgrounds (formal or informal expertise), and pursue specific aims (strategic, transdisciplinary, socio-cultural; Gaete Cruz et al., 2022). Co-design occurs in dynamic, multi-layered, and multi-sectorial ways in transdisciplinary teams integrating formal and informal expertise (Baibarac & Petrescu, 2019; Gaete Cruz et al., 2022).

We understand urban co-design as the collaborative approach to urban design acts that involve diverse strategic, transdisciplinary, and socio-cultural actors aiming for more context-specific, legitimate, and feasible outcomes (Gaete Cruz et al., in press). Yet, despite the often recognised legitimate contributions of collaboration, bringing actors together raises many practical challenges (Switzer, 2018). They might not always understand the urban spaces and interactions to analyse and design them, which may lead to misunderstandings, conflicts, mistrust, or even the end of an involvement. In this sense, applied research studies may clarify co-design in practice.

Urban design professionals conventionally use visual language to communicate their projects. Visual representations can put information in front of others' eyes (Whyte et al., 2017) and are sometimes more effective than words (Tufte, 1997).

Yet communicating with non-experienced designers is not always straightforward, and fostering collaboration involves a lot of challenges (Sanders, 2009). Collaborative processes often use visual methods to facilitate knowledge production, brainstorming, the development of shared understandings, and the engagement of the participants (Carpenter et al., 2021; Enserink et al., 2003). Different forms of VCMs are used in co-design processes to foster communication and exchange ideas by offering an additional language in which actors can communicate (Mattelmäki et al., 2014; Sanders, 2009). And while urban designers communicate through plans, diagrams, and renders, they conventionally do so to communicate for construction or persuade in a one-way direction (Sanders, 2009).

The use of visual methods is often studied in practice because it is in their use that the main challenges and contributions can be observed. In recent years a wide variety of such methods have been studied (posters, reports, videos, storyboards, card sets, animations, pictures, diagrams, sketches, amongst others; Sleeswijk-Visser, 2009). Many studies have attempted systematisation towards conceptual clarification, yet the approaches vary widely and sometimes follow different lines of argument or theoretical traditions. Some have highlighted the value of open-ended dialogue approaches of participatory visual methods in community-based research (Switzer, 2018). Others recognise arts-based methods as knowledge co-production devices for social justice (Carpenter et al., 2021; Metze, 2020). Worth mentioning is the academic work by Elizabeth Sanders, who spent years developing an approach for the use of methods in co-design processes and proposed a map to classify design research tools concerning user participation and research (Sanders, 2006; Sanders et al., 2010; Sanders & Stappers, 2014). Although the conceptual approaches are interesting, they often fail to capture the collaborative dynamics in urban design processes. It has been said that the contributions of such visual methods need to be clarified (Carpenter et al., 2021).

In this study, we understand VCMs as methods that use visual language as a tool for collaboration in design practice. We recognise that such language is useful for the inquiry and communication of information and promotes stakeholders' engagement (Pocock et al., 2016). While some study arts-based methods to interpret personal expressions (Carpenter et al., 2021; Switzer, 2018), we aim to explore how they are boundary-spanning (Whyte et al., 2017) and prompt collaboration in design (Switzer, 2018) to set a complementary language in which everyone can actively intervene. VCMs can use a range of visual representations, from conventional urban design tools to analytical ones and even more art-based and ethnographic forms. Their value relies not only on their capacity to ignite personal expressions but to do so with others in design acts. Visual language is used to depict aspects of reality, communicate and translate information, and prompt dialogue (Metze, 2020), but

most importantly, to foster ideation and creation. In working with VCMs, it is content and form that is important (Switzer, 2018), but also how collaboration is achieved in its use (Gaete Cruz et al., 2022). So, while some of the VCMs in this study are relatively conventional, their open-ended content creation approach matters to co-design. In this study, we understand VCMs as those using visual language as a tool for collaboration in the design steps of research, analysis, ideation, and decision-making throughout co-design processes.

4.2.2 Expanding the Co-Design Framework

In a previous study, we developed a co-design framework offering a landscape in which the different design steps could occur in diverse levels of collaboration (Gaete Cruz et al., 2022). The framework builds on reinterpretations of the ladder of participation (Arnstein, 1969) and the design cycle (Jonas, 2007; Roozenburg & Eekels, 1995; Zwart & de Vries, 2016). We defined the levels of collaboration and the design actions of co-design. We distinguish four design actions that occur throughout urban design processes: research, analysis, projection and selection. A collaborative research approach might allow for knowledge co-production, allowing for better-informed outcomes. The collaborative analysis and synthesis of information might result in shared understandings and social learning. Accordingly, the shared projection and ideation of solutions, or part of the solutions, might improve the sense of participation. At the same time, a collaborative evaluation, prioritisation and selection of design solutions might most likely result in legitimising the outcomes. If these steps involve other actors, then different collaborative levels can be observed as: informative, consultive, participative, and long-term collaborative (Gaete Cruz et al., in press).

The design concept is commonly referred to as the process and the end result (Zwart & de Vries, 2016). Design has also been conceptualised as a timeline in which design solutions, through repetitive design cycles, evolve increasingly from one phase to another one. Some have coined that three main design phases are recognised: the conceptual, the embodiment and the detail phases (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). In the conceptual phase, the problem is defined, and conceptual solutions are ideated. In the embodiment phase, a preliminary design is selected amongst possible spatial layouts, functional displays, and material propositions for further development. The final design phase determines specific aspects and documents the project to be built according to technical requirements, regulations and evaluations. We extended the co-design framework into the three design phases, as shown in Figure 4.1.

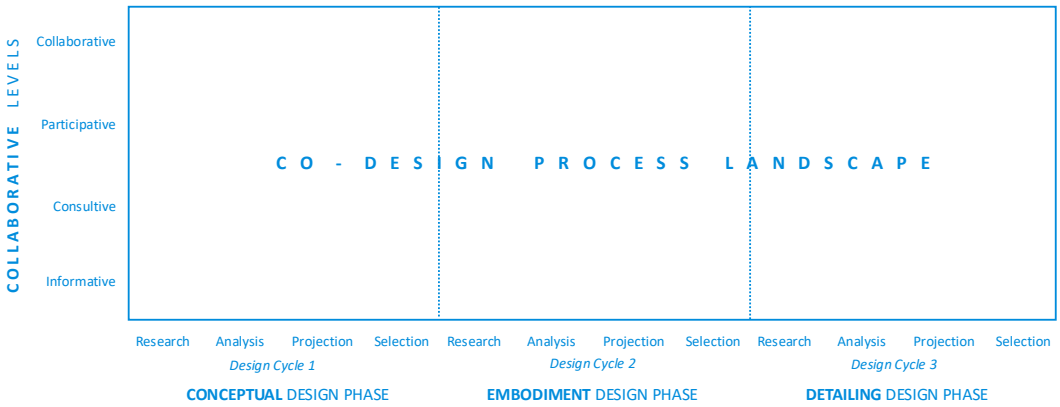

FIG. 4.1 Framework for the urban co-design process. Levels of collaboration on the Y-axis and the design acts throughout the design phases on the X-axis.

We adhere to the process-oriented approaches that simultaneously conceptualise design as cyclical and linear (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). We incorporated the linear approach in the co-design framework by emphasising that the design steps occur in a cyclical iterative way towards the development of solutions throughout the three design phases. This allows us to map and analyse the use of VCMs and how they facilitate a diversity of design actions throughout the process. Accordingly, actors may go back and forth between the steps and repeat the whole cycle several times throughout the process. We argue that such methods may facilitate collaborative research, analysis, projection, and decision-making throughout the conceptual, embodiment, and detailing design phases.

4.3 Method: Action Research through Design to undertake a co-design process

4.3.1 Description of the co-design process from practice

We conducted a case study of a public space co-design process while acting in practice. This occurred in the context of a public design consultancy commissioned by the Housing and Urbanism Ministry of Chile to Co-Diseño Urbano Consultants. The ministry aimed to update the Kaukari Urban Park project designed by Teodoro Fernández Associate Architects in 2012 in the Atacama Region. They acknowledged the need for updated mixed sports functions in the park.

The Slope Sports Square was designed as an open public space with skating elements and a climbing wall as shown in Figure 4.2. Various sports organisations were summoned as the future end-users, and some had played a role in requesting such structures. We involved them early in the process as relevant actors aiming to co-design the space to prepare the grounds for future co-management and co-operation. They were actively involved throughout the embodiment and the detailing phases providing expert technical knowledge and even leading strategic interactions with relevant local sports actors.

FIG. 4.2 Work-in-progress visualisation of the Slope Sports Square. Source: Courtesy of Co-Diseño Urbano Consultants.

The first author participated in the planning and development of the design consultancy. The case study for the article was selected because we could plan the process and act in practice. This allowed us to evaluate the use of VCMs. The Kaukari Urban Park co-design process had also previously been studied by the authors, and the timing of the consultancy matched this study. It is important to note that the co-design approach was suggested as a mode of practice amongst the involved actors. This was a real-life rooted practice of co-design applied research in a rather top-down setting, and was thus not a completely autonomous research endeavor. This article evaluates such processes of planning and interacting in practice.

The co-design process planned to integrate a diversity of strategic, design, and assessment professionals, and the prospective users of the project. The leading actors were the ministry in charge and the design team of which the lead author was in charge. The first author played the urban designer and project manager role fostering co-design interactions.

4.3.2 Acting and Reflecting on the Design Practice

This study was planned, conducted, and reflected upon a co-design process undertaken from 2020 to 2022. The lead author of this study was involved in the design team and was able to plan and undertake the co-design process. Such an approach allowed us to act and analyse at three operational levels: in planning the design processes, in conducting the design processes to produce the design outcome, and finally, in reflecting upon such endeavours. The steps taken in these levels are detailed in Table 4.1. This article reflects mainly on the use of the multiple VCMs that facilitated the co-design process.

TABLE 4.1 ARtD steps were undertaken to plan, conduct, and reflect upon the co-design process.

Operational Levels	Approach
Planning	AR approach to the collaboration of actors
	RtD approach to the design of objectives
Conducting design	AR approach to collaboration with actors
	RtD approach to the outcomes and objectives
Reflecting	AR approach to collaboration and the process
	RtD approach to evaluate the design and outcomes

This study took an action research through design (ARtD) methodological approach to generate knowledge from practice by acting in an actual ongoing design process (van Stijn, 2022), aiming to intervene in the urban environment through problem and solution definition (Buchanan, 1992). This approach combines action research with research through design methods. Action research aims for knowledge inquiry with active participation from stakeholders in open-ended processes with flexible objectives (Baum et al., 2006; Bell et al., 2004). Research through design supports the research inquiry process where new design knowledge is generated through the action and reflection in design (Cross, 2001; Frankel & Racine, 2010; Jonas, 2007; Roggema, 2016). We acknowledge these two approaches pursue different aims and have different disciplinary trajectories, but a combined approach was appropriate to address such collaborative design-oriented research in practice.

The co-design processes ran from November 2020 until April 2022. Given the global pandemic, the process was mainly conducted in an online format. With such challenging circumstances, the process benefited from digital tools in which visual language played an important role in facilitating collaboration and design.

This study's first author was personally involved in practice with an ARtD approach. She managed the designteam within the public design consultancy team. This allowed her to plan the process's co-design moments and undertake such endeavours with a collaborative and flexible mindset. Due to her expertise as an urban designer in broad innovative and multi-actor urban development processes, she was able to focus mainly on how collaboration amongst the diverse actors contributed to the design process and their resulting outcomes. We acknowledge that the involvement of researchers in practice may raise legitimacy issues, but such an applied approach deepens the conceptual reflections while operating in practice (van Stijn & Lousberg, 2022). To avoid personal or professional bias, the results were shared with certain involved actors for feedback and verification through interviews at the end of the process.

4.4 Results and Discussions: Mapping Visual Collaborative Methods in the Co-Design framework

This study explores the contribution of VCMs as modes of collaborative knowledge inquiry, analysis, projection, and decision-making in design processes. First, we define the methods we used and then map them regarding their collaboration level in design steps throughout the phases. The results showed that even though most VCMs were planned for the early phases, their use was maintained throughout the whole process. The framework helps conceptualise the use of VCMs and visualise the co-design trajectories within such a process.

4.4.1 Visual Collaborative Methods used in the co-design process

The variety of VCMs are explained in Table 4.2 and some are shown in Figure 4.3. They are described according to the moment when they were used, the actors involved, the level of collaboration in design steps, and their main contributions.

TABLE 4.2 VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
1	Interest and power matrix of actors	Conceptual phase. The matrix was used as a visual tool for dialogue and to sketch during the interviews with key actors to identify and classify a wider variety of actors that could be relevant to the design process and the operation of the square.	The interviewees belonged to public organisations, sports associations, local NGOs, and sportspeople. The facilitator of the citizen participation (socially-oriented expertise) within the design team leads this process.	Consultive research of actors and participative analysis of their position in the matrix.	This VCM allowed to identify and consequently summon relevant sports associations and organisations operating in the city.
2	Exercise booklets for experience registration	Conceptual phase. Pre-designed booklets (experience journals) for participants to fill in during their spare time while enjoying their sports in the park. The booklet layout addressed some specific aspects of the sports experiences, ideas and aims of the sportspeople for the square.	Diverse sportspeople filled in the booklets (skate, climb, circus art, parkour, running, walkers, cycling, football, basketball, Zumba dance, boxing, and cross-fit).	Participative research of sports experiences. Members of the design team then systematised the booklets.	These booklets allowed for a shared understanding of the sports practices' feelings, experiences, and functional dynamics amongst the involved actors. These notions were then incorporated into the public space designed.
3	Sports experience and conditions matrix. (Booklet's workshop)	Conceptual phase. This interactive board (Miro online platform) was used in the meeting where the analysis and results of the Exercise booklets were presented, discussed and further systematised. The interactive board was filled in during the meeting integrating the discussed issues. In a focus group setting, the conversation tackled the sport's needs, everyday needs, and the conditions of an inclusive and public urban space.	The actors summoned to the meeting were the sportspeople, the design team, and the public servants of the ministry in charge.	Informative and consultive analysis towards the participative systematisation of the results.	The meeting aimed and contributed to finding converging issues amongst the sports, developing shared understandings about the sports activities, and empowering the collective use of the future space.

>>>

TABLE 4.2 VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
4	Online post-its board in the Co-design workshop	Conceptual phase during the Co-design Workshop with the skaters, climbers, and circus art performers. The workshop was initiated by sharing the requirements of the sports gathered during the process. This was done on a digital board (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	Since the requirements of the sports had been discussed beforehand, the collected information was informed and consulted.	This method allowed the confirmation of the collected information and the development of a shared understanding of each sport's collective needs and specific requirements. There were no further discussions in this respect.
5	Live sketching in the park and site architectural plans (Co-design workshop)	Conceptual phase in the Co-design Workshop. The workshop followed with the live digital sketching of the lead author on a digital plan of the park and site (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	This method aimed to communicate and explain the urban park design criteria and the site's spatial and budget limitations (informative analysis).	This method helped set a collective understanding of the project's main design criteria and limitations. This allowed the levelling of expectations of the participants. This was useful for the next step of the co-design process, in which the groups had to develop a spatial layout for the square.
6	Live collective sketching of spatial layouts (Co-design workshop)	Conceptual phase in the Co-design Workshop with the skaters, climbers and circus art performers. The workshop followed with the collective sketching of possible layouts of the square using arrows and lines in smaller mixed groups on a digital plan of the site (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	This method allowed a participative analysis and projection of spatial layout sketches.	This method allowed a collective layout building forcing participants to think spatially and encouraging them to comprehend the implications of a shared public space. In this exercise, new spatial ideas were raised for the project.

>>>

TABLE 4.2 VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
7	Diagrams, plans, and renders (Revision meetings)	Conceptual phase, embodiment phase, and detailing phase. Multiple diagrams, plans, and renders were used throughout the process to communicate the project's development in formal revision meetings.	These revision meetings were held with the design team at the ministry's request. The ministry had the final decision in approving the project.	In these meetings, visual representations were used to inform the analysis of the design team, consult about the projection, and decide collaboratively on the design for its further development.	Even though these visual tools are rather conventional in this design field, we highlight the collaborative approach with which they were used to communicate the analysis and ideation, allowing for collective decision-making.
8	Sketching in social media visuals * (WhatsApp exchange).	Conceptual phase, embodiment phase, and detailing phase. The photography and videos from social media (Instagram, YouTube) were used throughout the process to share knowledge and understanding regarding skating and climbing sports.	The design team and the sportspeople participated in this reiterative exchange of sketched visuals.	Pictures and videos were used to inform and analyse the sports practice, spaces and construction details.	Even though these visual tools were not envisioned in the planning process, they contributed to sharing knowledge in a twofold direction between the design team and the most active sportspeople.
9	Sketching in details and sections *	Conceptual phase, embodiment phase, and detailing phase. The sections and details were used to share technical knowledge and verify that the project met the skate and climbing-specific requirements.	The design team and the sportspeople exchanged sketched sections and details.	Sections and details were used to ideate and select better solutions for the specific sports building solutions in a participative way.	The early exchange of architectural sections and building details amongst the design team and the most active sportspeople allowed the development of construction solutions to implement the sports structures and elements such as the climbing wall, the ramps, protections, and sliding elements.

>>>

TOC

TABLE 4.2 VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
10	Work-in-progress renders in social media *	Embodiment phase. Some work-in-progress renders were posted on the Kaukari Urban Park's social media, which raised many controversial public opinions.	The ministry in charge, various skaters and citizens, especially some sportspeople who had dropped the co-design process.	The WIP 3D models and renders were posted online to inform the ongoing design project.	The public exposure of draft images generated much public confusion. The images were not finished and had technical detail mistakes that gave a confusing message to the skating community. They were work-in-progress drafts far from being ready to publish.
11	Plans and renders *	Detailing phase. The project plans and images were presented to skate organisations that demanded participation in the process (even though they had voluntarily dropped off earlier).	Involved parties were the design team, the ministry in charge, and skating organizations who had dropped the co-design process earlier.	The design team presented the project to skaters. The ministry allowed the skaters to suggest changes in the project.	The main contribution of this unplanned exchange was the acknowledgement that more beginners' skating spaces could enhance the training vocation of such a public square. Since the ministry was in charge of approving the project, the suggestions had to be taken into account.
12	Photographs in a report *	Detailing phase. The skate organisations developed a report in which, through photography and written notes, they expressed their suggestions for new beginners' structures in the square. They requested lower skating structures such as ramps and sliding rails.	The skate organisations developed a report and submitted it to the ministry. The design team received the report and integrated the suggested beginner elements.	The visual report aimed to inform and consult about some project changes. It was a bottom-up way of proposing alternative structures for the inclusion of a beginners' area in the sports square.	This non foreseen report helped clarify the skate organisations' requests and allowed the design team to integrate the beginners' training space. Even though it did not allow for true collaboration toward design, the report format did add to the specificity of the requests with the use of visual images and notes.

>>>

TABLE 4.2 VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
13	Sketches in a printed architectural layout *	Detailing phase. The design team insisted on verifying the modified design proposal (implementating the beginners' area) with the local skate organisations. This was just accomplished after months. The architectural layout printed plan was used to explain the process, but the ministry was also willing to allow new changes to the whole project even though the consultancy was about to finish.	The skate organisations, the ministry, and the design team.	The meeting aimed to consult and verify how the project had incorporated the beginners' area. Nevertheless, the meeting resulted in a participative projection and modification of the overall layout of the square without an active participation of the design team.	The participants were allowed to sketch the printed plan and develop changes to the project without dialogue between the design team and the skaters. This resulted in somehow a prejudice to the final project. The lack of dialogue may have resulted in missed opportunities and overall sense of miscommunication.
14	Sketching in sections and details *	Towards the end of the process, in the detailing phase, the technical revisors changed, so new professionals arrived and requested a series of detailing and layout changes that had to be addressed by the design team.	The ministry professionals in charge of the technical approval of the project and the design team.	Such interactions started with a participative analysis but resulted in consultive projection and informative decision-making.	Such an approach is common when one actor (ministry) has the control over the process. In this case, some parties within the ministry felt uncomfortable with the top-down attitudes of others at the end of the process.

*Note: Methods with * were not part of the initial plan.*

VCMs were combined with either verbal or written forms of communication to explain and use them. This was the case in the report (12), in which the visual requests were further explained in the text. Also, during the live sketching (6), the design strategies and site limitations were explained verbally to the participants. Accordingly, a variety of verbal and written forms complemented the multiple VCMs.

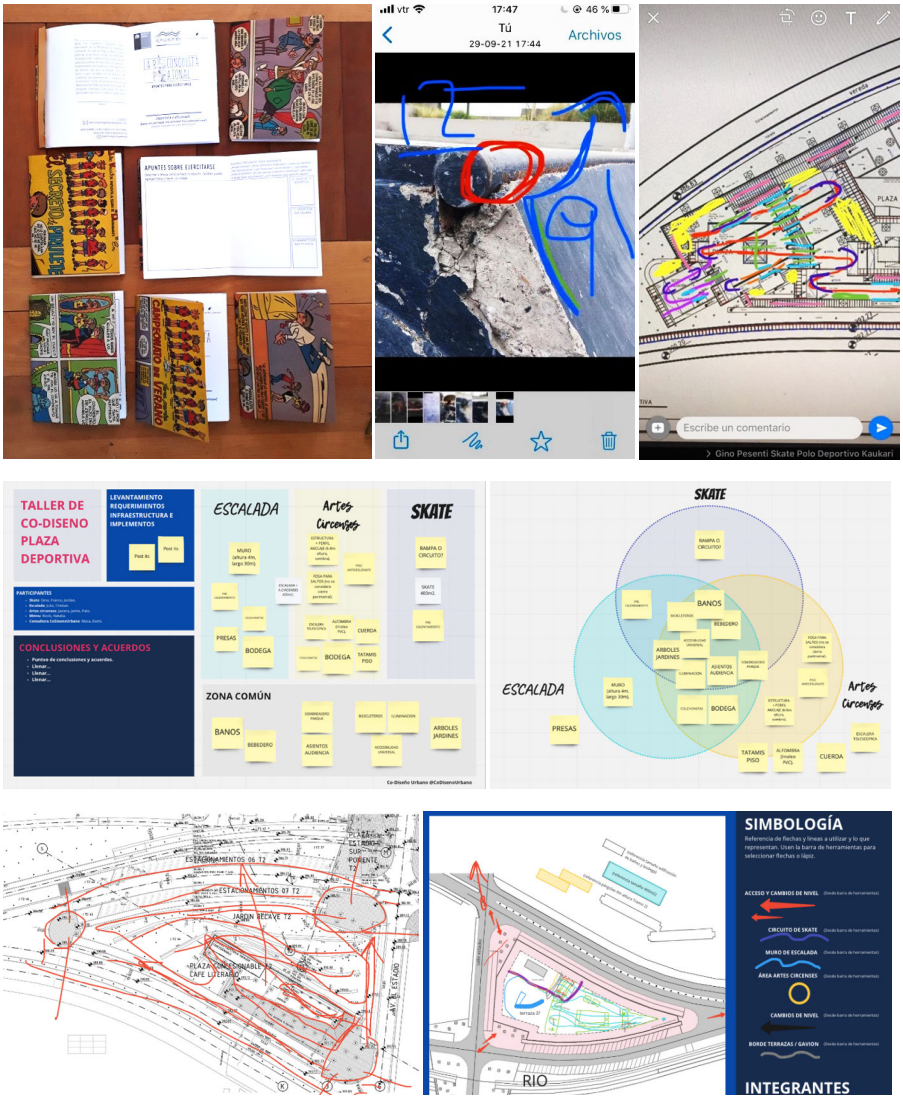

FIG. 4.3 Some VCMs used: Exercise booklets (2), boards of sports requirements (4), live sketching plans (5), spatial layout exercises (6), and sketched visuals (8). Source: Courtesy of Co-Diseño Urbano Consultants.

It is worth noting that most VCMs were digital as meetings and interactions were held online due to the pandemic. Despite this, participants seem to have felt comfortable communicating, learning and using digital tools. This probably worked out because most of them are younger than 40 years old and had already worked remotely during the previous year. Also, digital meetings allowed more

TOC

people to be present and available, and a couple of actors noted this during the process. Additionally, a couple of in-person meetings were held without a successful attendance rate. Also, occasionally, hard-copy booklets and plans were used as non-digital devices for people to fill in or sketch. In this sense, the VCMs studied are both digital and hard-copy.

4.4.2 Mapping the Visual Collaborative Methods in the Co-Design Framework

The VCMs used in the process were mapped in the urban co-design framework as shown in Figure 4.4. Within the co-design landscape, VCMs were placed according to the level of collaboration achieved by the involved actors in the design actions. In such a way, methods aiming for knowledge inquiry were classified as “consulting research,” methods to present design solutions were mapped as “informative projection,” and methods aiming to generate new solutions in collaboration through time were mapped as “participative projection and decision-making.”

Some VCMs were placed in one position, while others in more than one. The numbers in Figure 4.4 refer to the methods described in Table 4.2. For example, the actor matrix (1) was used as a consulting device during the interviews and a participative analytical tool in consecutive meetings. In other cases, more than one VCM was used in a meeting. This is the case of the co-design workshop during the conceptual phase, which consisted of three methods (4, 5, 6). The first (4) consisted of a presentation of the sports requirements collected and compiled using digital diagrams. Then the context-specific opportunities and limitations of the site and the projects were presented by the urban designer through live online sketches of architectural plans of the site and surroundings (5). Finally, the collaborative development of spatial layouts for the square with digital sketches and symbols on a site plan (6). The workshop lasted two and a half hours, ranged from informative to participative levels, and operated in three design steps: research, analysis, and projection. This explains that the use of VCMs sometimes concentrate at one point, while others draw a trajectory within the co-design landscape.

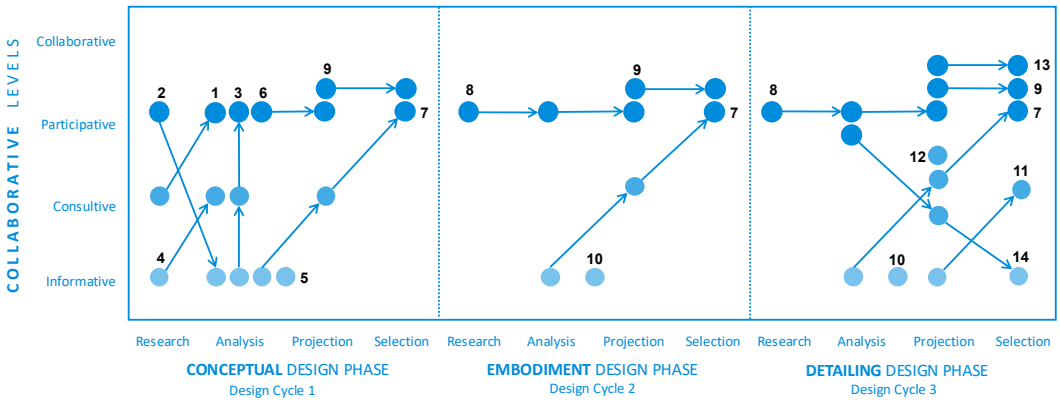

FIG. 4.4 Mapping the use of VCMs in the co-design process framework. Collaborative levels on the Y-axis and the design cycle and phases on the X-axis.

The fuzziness in the conceptual phase has been said to foster shared understandings and the empowerment of the participants (Sanders, 2005; Sanders & Stappers, 2008). The initial plan even considered some arts-based VCMs in the early phase to elicit experiences and foster knowledge-sharing of the participants. Those methods aimed for participants to communicate, feel comfortable, and provide personal knowledge, aims, and values that could then be considered, prioritised, and integrated into the designed outcomes. Most of the VCMs planned for the conceptual phase allowed shared pre-design and exploratory solutions (Sanders, 2014), as was explicitly requested in the design consultancy. Yet, new collaborative and design needs emerged in the following phases, so new VCMs were incorporated.

A selected group of sportspeople were involved in the early shared understandings to define the requirements of the sports and analyse the opportunities and limitations of the site. However, due to the high specificity of the designs and the lack of national sports regulations for climbing and skate structures, a more permanent technical collaboration was required and sustained in the following design phases. Other visual methods were used in a twofold direction for knowledge exchange, brokerage and design. This was the case in which conventional technical visuals that communicated the project were then used as tools for collaboration. Throughout the process, we used conventional visual tools that were at hand. This was possible because one of the skaters was trained and had professional experience in technical drafting, supporting collaboration even in detailing technical specifications.

The shared understandings and sports requirements were integrated in the spatial layouts and preliminary construction solutions during the embodiment phase. As illustrated in Figure 4.4, the VCMs in this phase reflect the co-design interactions within the transdisciplinary design arena (Gaete Cruz et al., 2022). Such methods allowed collaboration in the revision meetings (7) and sketching in images, videos, plans, and details (8, 9) exchanged weekly using WhatsApp, Instagram, or Zoom meetings.

During the detailing phase, the most specialised decisions are made, and this is the last collaborative phase of the process. Some of the VCMs mapped in the previous phase are maintained. Nevertheless, we observe some rather unusual collaborative trajectories due to changes in the involved actors. Sports organisations who complained were included towards the end. And some professionals in charge of the technical approvals left the process or were changed towards the end.

After the work-in-progress renders were posted in social media, some sports organisations had to be involved in the process. This was done time-barred and affected the overall sense of collaboration. The modifications they demanded had been already decided collaboratively in the conceptual phase. At that point most of them had been involved in the process but decided to abandon it at some point. After several months, a new meeting was held in person (13), and wrong expectations were given about possible project changes. The ministry opened up the project for modifications (11, 12), disregarding the urging of the design team for closure. The changes affected the layout and project details. This occurred at the end of the detailing phase raising budget and timing issues that the design team absorbed alone. This demonstrates how co-design approaches may be disrupted when actors make use of the power they have, damaging collaboration.

Some public servants in charge of the technical approvals within the leading public organisms left the process for personal reasons. This is depicted in the collaborative descent of number 14 in Figure 4.4. Processes deal with human beings, so interactions are simultaneously personal and technical. Whenever someone is missing or new actors are integrated, problems may arise due to lack of awareness or willingness to collaborate. Moreover, professional boundaries often blur if participants are connected outside the spheres of the co-design arenas. This may have been the case when subjective technical requirements were demanded as norms due to the lack of national skatepark regulations. The descending line depicted in the detailing phase contrasts with the overall ascending lines observed in the previous phases. It shows one of the main risks in pursuing co-design since there are no power-free institutional settings.

We concluded that VCMs facilitated all four design acts at different collaborative levels in each phase. Some focused on the consultation of strategic actors such as citizens or public organisations, and others facilitated participative approaches to analysis and projection with the public sector and some sportspeople. VCMs allowed the different parties' information, consultation, participation, and collaboration. Yet, according to the framework, the collaborative level was achieved because participation was fostered consistently throughout the process.

4.4.3 The contributions of Visual Collaborative Methods in Urban Co-design process

One of the main contributions of using VCMs in urban co-design processes is that they can be diverse and flexible enough to be used throughout the design process. There original plan evolved, so flexibility had to be kept throughout the process. Such flexibility is a prerequisite for collaborative endeavours but may also blur professional limits. This may have been the case of the sportpeople participating actively in the development of the project. They were not formally part of the team or were economically retributed. Scholars have previously highlighted such possible social justice issues in participatory endevours (Ersoy, 2017).

An interesting contribution of VCMs to the process is how they influence further steps of the process or the use of other methods. This is the case of the actor matrix (1) that allowed the identification of actors with whom we continued to collaborate. Also, the ideation steps (6, 7, 8, 9) used conventional visual tools in non-conventional ways to foster collaboration. VCMs used in the analysis and ideation steps (1, 3, 4, 5, 8) contributed to shared understandings and design outcomes.

The use of VCMs also influenced the design outcomes. The booklets (3) made explicit that gathering and warm-up spaces needed in the square to complement the sports structures and that natural sunset shadows could be tapped through the position of the climbing wall against the sun. Their discussion allowed for shared understandings of the sportspeople's values, motivations, and practices, which generated empathy and a sense of community. There was an additional agreement (5, 6) on the sports' formative and performative character, considering the park's scenic and central setting, so viewports, grandstands, staircases, and gathering spaces were incorporated into the design.

Finally, in a non-participatory context like Chile, the VCMs fostered co-design in a rather top-down urban development setting led by the public sector. The pandemic might have benefitted the processes in two ways: allowing for multiple images to be sketched and interchanged digitally and making it possible for team members to collaborate while dispersed worldwide. Anyhow, striving for co-design in a context where participation is not the standard always raises practical challenges.

4.4.4 The contributions of the Co-design Process framework

The use of the framework as an analytical tool allowed us to conceptualize a co-design process. We observe that the starting point in the lower-left area in Figure 4.4 is full of opportunities. We consider informative research as a building block for further collaboration (Gaete Cruz et al., 2022). From this point up, a co-design process can be mapped and analysed. The use of the framework allowed us to identify co-design trajectories and shifting arenas.

Three main co-design trajectories were recognised from this study: the early fuzziness, the collaborative trajectory, and the final fuzziness. The early fuzziness is where arts-based tools, and VCMs contributed experiential knowledge and values to the process. Previous studies have highlighted the fuzzy front end as the most fruitful co-design moment (Sanders, 2005). In the conceptual phase all strategic, transdisciplinary, design, and socio-cultural arenas interacted. Then, the transdisciplinary design arena ascended and achieved a collaborative trajectory with sustained transdisciplinary co-design moments in the embodiment phase. Finally, we recognise a fuzziness towards the back-end that may be considered rather non-conventional and certainly not desired. In this case, it happened due to the change in the professionals and sportspeople. This breakdown towards the end had a significant rise in the costs and duration of the process. This highlights the importance of maintaining communication, awareness, and willingness to collaborate throughout the process.

Some actors were recognised to have crossed the boundaries of design arenas (Gaete Cruz et al., 2022). We could say that some sportspeople transitioned from the socio-cultural towards the transdisciplinary design arena to sort more locally-suitable building solutions. One of the main facilitators of the collaboration achieved with one of the skaters was that he was a technical draftsman. So he knew how to understand, proofread and produce a technical design tool in the way the design team did. Using such visuals was easy and became a permanent communication language. Maintaining this long-lasting relationship throughout the process encouraged the skater to pursue strategic aims. His started to collaborate with the

Ministry in charge, the National Sports Institute, and some other relevant actors in the field pursuing the implementation and early activation of the space. Somehow this depicts how an actor may transition from the socio-cultural towards the transdisciplinary design arena and end up acting in the strategic one.

4.5 Conclusions

This study developed a framework for co-design processes to conceptualise and analyse design in collaboration. The framework follows a previous study and extends it into the three main design phases. We tested the framework by analysing a case in which the first author was involved in practice. Although a linear sequential framework, it clarifies the diverse collaborative interactions that occur in the cycles of problem-solving and solution-generation (Cross, 2018a). It depicts the variety of design aims pursued using VCMs and contributes to measuring co-design (Szebeko & Tan, 2010).

The study suggests that VCMs may contribute to co-design throughout the whole process. During the conceptual phase they mainly contribute to knowledge inquiry and collective brainstorming toward shared understandings. In the embodiment phase, they facilitate the analysis and evaluation of alternative solutions. In the detail phase, they contribute to integrating technical knowledge of experienced actors (Sanders, 2009). The analysis of planned and non-planned methods goes one step further in conceptualising the complexities of co-design processes, and the need for flexibility (Gaete Cruz et al., 2021). This study suggests that fostering collaboration and shared decision-making throughout the design phases may improve the suitability of the projects (Gaete Cruz et al., 2021).

This study from practice showed that co-design, while often understood as an idealist endeavour, has genuine and concrete benefits and challenges. One of the main difficulties experienced in the study was maintaining the awareness and willingness of the actors to maintain a collaborative approach. We conclude that awareness and willingness to collaborate are needed for the successful use of VCMs, and to achieve the aims of co-design (legitimacy, context-specificity, and feasibility; Gaete Cruz et al., 2022). The collaborative aim of the overall process should be known by all parties to manage expectations and deal with power issues. Such awareness and willingness will condition the availability to get involved, listen to others, and ultimately co-design. On the other hand, while some might think

that co-design questions the contribution of urban landscape designers, in such diffuse collaborative settings, it may emphasise their leadership and facilitators role highlighting the value of their problem-solving and solution-generation expertise (Cross, 2018b). The previous, only if achieved with high doses of empathy.

We also conclude that co-design is forcefully a flexible process. Flexibility is needed in planning such processes, undertaking them, and evaluating them. However, such flexibility in co-design processes has drawbacks: Co-design is less linear, more time-consuming, and more expensive than conventional processes. It involves more people, activities, and innovative methods, and consequently, its management is difficult but essential. Despite the above, great democratic, inclusive, and just benefits can be achieved when co-design processes embrace their challenges and pitfalls. In doing so, more context-specific projects can be achieved, more legitimate and empowering spaces can be created, and ultimately, more feasible projects can be implemented.

In this ARtD case study, we had the unique opportunity to plan, act, and reflect throughout a co-design process. Our process-oriented approach allowed us to analyse what happened between the planned activities and experience how VCMs were used daily to exchange views, express points of view and solutions, and make design decisions. Although the process outlined is an analytical reduction of reality, it illustrates the diversity of co-design acts and allows for generalisation and further discussion. Despite being an analytical tool, the co-design process framework captures the diversity of trajectories within co-design practice.

More applied research studies are needed to fully understand how VCMs contribute to co-design processes. For instance, the use of digital and non-digital VCMs could be studied. On the other hand, the co-design process framework we developed can be used to study other non-visual methods, the evolution of collaborative images, or the use of softwares in co-design practice. It may also contribute to analyse how knowledge and values are integrated into co-design processes. We argue the framework may be useful to plan co-design processes in practice.

Co-design may contribute to better informing the projects, legitimising the processes, and improving the appropriateness of the designed spaces (Gaete Cruz et al., 2022). Further research may focus on how co-design may condition the implementation and operation phases fostering collaboration in the operation, the activation, and the maintenance of future public spaces.

References

Arnstein, S. R. (1969). A ladder of citizen participation. Journal of the American Institute of Planners, 35(4), 216–224. https://doi.org/10.1080/01944366908977225

Baibarac, C., & Petrescu, D. (2017). Open-source resilience: A connected commons-based proposition for urban transformation. Procedia Engineering, 198(September 2016), 227–239. https://doi.org/10.1016/j.proeng.2017.07.157

Baibarac, C., & Petrescu, D. (2019). Co-design and urban resilience: Visioning tools for commoning resilience practices. CoDesign, 15(2), 91–109. https://doi.org/10.1080/15710882.2017.1399145

Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. Journal of Epidemiology and Community Health, 60(10), 854–857. https://doi.org/10.1136/jech.2004.028662

Bell, J., Cheney, G., Hoots, C., Kohrman, E., Schubert, J., Stidham, L., & Traynor, S. (2004). Comparative similarities and differences between action research, participative research, and participatory action research. Critical Inquiry - Runninghead: Comparative Similarities and Differences - (Group 2), Antioch University Seattle.

Buchanan, R. (1992). Wicked problems in design thinking. Design Issues, 8(2), 5–21.

Carpenter, J., Horvath, C., & Spencer, B. (2021). Co-creation as an agonistic practice in the favela of Santa Marta, Rio de Janeiro. Urban Studies, 58(9), 1906–1923. https://doi.org/10.1177/0042098020927964

Castro, D. (2021). Argumentation and persistent disagreement. Informal Logic, 41(2), 245–280. https://doi.org/10.22329/IL.V41I2.5580

Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. Design Issues, 17(3), 49–55.

Cross, N. (2018a). Developing design as a discipline. Journal of Engineering Design, 29(12), 691–708. https://doi.org/10.1080/09544828.2018.1537481

Cross, N. (2018b). Expertise in professional design. In K. A. Ericsson, R. R. Hoffman, A. Kozbelt, & A. M. Williams (Eds.), The Cambridge handbook of expertise and expert performance (2nd ed., pp. 372–388). Cambridge University Press. https://doi.org/10.1017/9781316480748

Cross, N., & Roozenburg, N. (1992). Modelling the design process in engineering and in architecture. Journal of Engineering Design, 3(4), 325–337. https://doi.org/10.1080/09544829208914765

Enserink, B., Monnikhof, R. A. H., & Enserink, B. (2003). Information management for public participation in co-design processes: Evaluation of a Dutch example. Journal of Environmental Planning and Management, 46(3), 315–344. https://doi.org/10.1080/0964056032000096910

Ersoy, A. (Ed.). (2017). The impact of co-production. From community engagement to social justice. Policy Press.

Ersoy, A., & Yeoman, R. (2020). Reconfiguration of public space via nature-based solutions. In J. Riegler & J. Bylund (Eds.), Unfolding dilemmas of urban public spaces. Recommendations by JPI Urban Europe's AGORA (pp. 25-29). Urban Europe.

Frankel, L., & Racine, M. (2010). The complex field of research: For design, through design, and about design. In Durling, D., Bousbaci, R., Chen, L, Gauthier, P., Poldma, T., Roworth-Stokes, S. and Stolterman, E (eds.), Design and Complexity - DRS International Conference 2010, 7-9 July, Montreal, Canada.

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. Ataov (Eds.), Governance of climate responsive cities (pp. 105-125). Springer.

Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. Urban landscape co-design as a knowledge co-production process: Trans-disciplinary trajectories of two urban parks. [Unpublished manuscript]. Management of the Built Environment, Delft University of Technology.

Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022). Towards a framework for urban landscape co-design: Linking the participation ladder and the design cycle. The CoDesign Journal.

Healey, P. (1992). Planning through debate: The communicative turn in planning theory. Town Planning Review, 63(2), 143–162.

Hooimeijer, F. L., & Maring, L. (2018). The significance of the subsurface in urban renewal. Journal of Urbanism, 11(3), 303–328. https://doi.org/10.1080/17549175.2017.1422532

Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory design, co-design and the public realm. CoDesign, 13(3), 148–159. https://doi.org/10.1080/15710882.2017.1355006

Jonas, W. (2007). Research through DESIGN through research. Kybernetes, 36(9/10), 1362–1380. https://doi.org/10.1108/03684920710827355
Jupp, E., & Inch, A. (2012). Introduction: Planning as a profession in uncertain times. Town Planning Review, 83(5), 505–512. https://doi.org/10.3828/tpr.2012.31
Mattelmäki, T., Vaajakallio, K., & Kosinen, I. (2014). What happened to empathic design? Design Issues, 30(1), 67–77. https://doi.org/10.1162/DESI_a_00249
Mattelmäki, T., & Visser, F. S. (2011). Lost in Co-X: Interpretations of Co-Design and Co-Creation. In N. F. M. Roozenberg, L. L. Chen, & P. J. Stappers (Eds.), Diversity and unity: Proceedings of the IASDR2011 - The 4th World Conference on Design Research. Delft, The Netherlands.
Metze, T. (2020). Visualization in environmental policy and planning: A systematic review and research agenda. Journal of Environmental Policy and Planning, 22(5), 745–760. https://doi.org/10.1080/1523908X.2020.1798751
Ostrom, E. (1996). Crossing the great divide: Coproduction, synergy, and development. World Development, 24(6), 1073–1087. https://doi.org/10.1016/0305-750X(96)00023-X
Palmås, K., & von Busch, O. (2015). Quasi-quisling: Co-design and the assembly of collaborateurs. CoDesign, 11(3/4), 236–249. https://doi.org/10.1080/15710882.2015.1081247
Parks, R. B., Baker, P. C., Kiser, L., Oakerson, R., Ostrom, E., Ostrom, V., Percy, Stephen L., Vandivort, Martha B., Whitaker, Gordon P., Wilson, R, Martha, B., Whitaker, Gordon P., Wilson, Rick. (1981). Consumers as coproducers of public services: Some economic and institutional considerations. Policy Studies Journal, 9(7), 1001–1011. https://doi.org/10.1111/j.1541-0072.1981.tb01208.x
Pocock, M. J. O., Evans, D. M., Fontaine, C., Harvey, M., Julliard, R., McLaughlin, Ó., Silvertown, J., Tamaddoni-Nezhad, A., White, Piran C.L., Bohan, David A. (2016). The visualisation of ecological networks, and their use as a tool for engagement, advocacy and management. Advances in Ecological Research, 54, 41-85. https://doi.org/10.1016/bs.aecr.2015.10.006
Roggema, R. (2016). Research by design: Proposition for a methodological approach. Urban Science, 1(1), 2. https://doi.org/10.3390/urbansci1010002
Roozenburg, N. F. M., & Eekels, J. (1995). Product design: Fundamentals and methods. John Wiley & Sons.
Rose, G. (2014). On the relation between "visual research methods" and contemporary visual culture. Sociological Review, 62(1), 24–46. https://doi.org/10.1111/1467-954X.12109
Sandercock, L., & Attili, G. (2010). Digital ethnography as planning praxis: An experiment with film as social research, community engagement and policy dialogue. Planning Theory and Practice, 11(1), 23–45. https://doi.org/10.1080/14649350903538012
Sanders, E. (2000). Generative tools for codesigning. In S. A. R. Scrivener, L. J. Ball, & A. Woodcock (Eds.), Collaborative Design. Springer, London. https://doi.org/10.1007/978-1-4471-0779-8_1 Springer.
Sanders, E. (2005). Information, inspiration and co-creation. In The 6th International Conference of the European Academy of Design (pp. 1–14). Bremen, Germany: University of the Arts, 1–14.
Sanders, E. (2006). Design research in 2006. Design Research Quarterly, 1(September), 1–25.
Sanders, E. (2008). An evolving map of design practice and design research. Interactions, 15(6), 13–17.
Sanders, E. (2009). Exploring co-creation on a large scale. Designing for new healthcare environments. In P. J. Stappers (Ed.), Designing for, with and from user experience. Symposium proceedings. (pp. 10–26). Delft: ID StudioLab Press. Retrieved from https://www.researchgate.net/publication/275965775_Exploring_co-creation_on_a_large_scale_Designing_for_new_healthcare_environments.
Sanders, E. (2014). Perspectives on Participation in Design. In C. Mareis, M. Held, & G. Joost (Eds.), Wer gestaltet die Gestaltung? Praxis, Theorie und Geschichte des partizipatorischen Designs (Bielefeld:, pp. 61–74). https://doi.org/10.14361/transcript.9783839420386.65
Sanders, E., Brandt, E., & Binder, T. (2010). A framework for organizing the tools and techniques of participatory design. In In T. Robertson, K. Bødker, T. Brattetig, & D. Loi (Eds.), PDC2010: Proceedings of the 11th Biennial Participatory Design Conference (pp. 195–198). Sydney, Australia: Association for Computing MachineryNew YorkNYUnited States. https://doi.org/10.1145/1900441.1900476
Sanders, E., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. CoDesign, 4(1), 5–18. https://doi.org/10.1080/15710880701875068
Sanders, E., & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. CoDesign, 10(1), 5–14. https://doi.org/10.1080/15710882.2014.888183
Sleeswijk-Visser, F. (2009). Bringing the everyday life of people into design. Technische Universiteit Delft. https://doi.org/Isbn 978-90-9024244-6

Smaniotto Costa, C., Mačiulienė, M., Menezes, M., & Goličnik Marušić, B. (Eds.). (2020). Co-creation of public open spaces. Practice—reflection—learning. Edições Universitárias Lusófonas. https://doi.org/10.24140/2020-sct-vol.4

Switzer, S. (2018). What's in an image?: Towards a critical and interdisciplinary reading of participatory visual methods. In M. Capous-Desyllas & K. Morgaine (Eds.), Creating social change through creativity: Anti-oppressive arts-based research methodologies (pp. 189–207). Springer. https://doi.org/10.1007/978-3-319-52129-9_11

Szebeko, D., & Tan, L. (2010). Co-designing for society. Australasian Medical Journal, 3(9), 580–590. https://doi.org/10.4066/AMJ.2010.378

Tufte, E. R. (1997). Visual explanations. Images and quantities, evidence and narrative. Graphics Press. https://doi.org/10.1213/00000539-199706000-00059

Van de Ven, F. H. M., Snep, R. P. H., Koole, S., Brolsma, R., Van der Brugge, R., Spijker, J., & Vergroesen, T. (2016). Adaptation planning support toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders. Environmental Science and Policy, 66, 427–436. https://doi.org/10.1016/j.envsci.2016.06.010

Van Melik, R., & Van Der Krabben, E. (2016). Co-production of public space: Policy translations from New York City to The Netherlands. Town Planning Review, 87(2), 139–158. https://doi.org/10.3828/tpr.2016.12

van Stijn, A. (2022). Guidance in the application of research through design: The example of developing circular building components. In L. H. M. J. Lousberg, P. Chan, & J. Heintz (Eds.), Interventionist research methods (in press). Taylor & Francis.

van Stijn, A., & Lousberg, L. H. M. J. (2022). Approaching research through design in the field of architecture and the built environment: Relating to the history, key theories and discourse. In L. H. M. J. Lousberg, P. Chan, & J. Heintz (Eds.), Interventionist research methods (in press). Taylor & Francis.

Whyte, J., Tryggestad, K., & Comi, A. (2017). Visualizing practices in project-based design: Tracing connections through cascades of visual representations. Engineering Project Organization Journal, 6(2/4), 115–128. https://doi.org/10.1080/21573727.2016.1269005

Zwart, S. D., & de Vries, M. J. (2016). Methodological classification of innovative engineering projects. In M. Franssen, P. E. Vermaas, P. Kroes, & A. W.M. Meijers (Eds.), Philosophy of technology after the empirical turn (pp. 219–248). Springer. https://doi.org/10.1007/978-3-319-33717-3_13

TOC

5 Social-Ecological Knowledge Integration in Co-Design Processes

Lessons from two Resilient Urban Parks in Chile

The content of this chapter was published in: **Gaete-Cruz, M.(2023). Social-Ecological Knowledge Integration in Co-Design Processes: Lessons from Two Resilient Urban Parks in Chile.** ***Urban Planning Journal,*** **8(2).**

ABSTRACT Cities worldwide face multiple social and ecological challenges, such as climate change and its impacts. Adapting and transforming our urban environments is urgent to improve their resilience to uncertain scenarios. These challenges require renewed urban solutions, forcing us to rethink their design processes. Multiple actors are involved in such processes, come from different sectors, and have agendas and knowledge backgrounds. Many of these processes can be considered co-design processes, with actors interacting to improve the design quality, legitimacy, and feasibility. Many conceptualise cities as social-ecological systems and public spaces as their subsystems. A collaborative approach to designing public spaces contributes to integrating the social-ecological knowledge from the public, private, and citizen actors. The question remains: How is sometimes conflicting social-ecological knowledge integrated into public space co-design processes? We study

two large-scale urban parks in Chile. We framed them as social-ecological systems and analysed their co-design processes. This study aims to provide insights into the difficult-to-grasp phenomena of knowledge integration in co-design processes. We analysed these cases in previous studies. Now, we provide insights into social-ecological knowledge integration in co-design processes. Although framed in Latin America, the findings may be helpful elsewhere.

5.1 Introduction

Cities worldwide face multiple social and ecological challenges, such as climate change and its impacts. Impacts, floods and land erosions, displaced refugees, housing shortages, wildfires, wealth disparities, and pandemics are some of the problems cities face. They should be addressed with urban transformations in integrated ways (Webb et al., 2018). They require new solutions, so we should rethink the processes to design them (Colloff et al., 2017; Saad-Sulonen et al., 2018). Some suggest a resilient evolutionary approach (Davoudi et al., 2012) and climate-sensitive planning (Haasnoot et al., 2013; Peker & Ataöv, 2021) to adapting cities through nature-based solutions (Ersoy & Yeoman, 2020).

Resilience emerged in the 1970s in ecological research to define the ability of a system to change when under stress (Holling, 1973). This definition includes the capacity to withstand, re-organise, and recover (Berkes et al., 2008; Brown et al., 2021). Three resilience interpretations are often recognised: the engineering, the ecological, and the evolutionary. While the engineering approach focuses on returning to its previous state, the ecological approach accepts change as adaptation (Fingleton et al., 2012; Rose, 2004). The evolutionary resilience approach emerged to define the capacity of a system to change as a dynamic, relational, and transformable process (Carpenter et al., 2001; Davoudi et al., 2012; Folke et al., 2010; Gunderson & Holling, 2001; Walker et al., 2004). The latter is often suggested for urban planning (Davoudi, 2021). Urban resilience has been defined as the capacity of urban systems and their social, ecological, and technical networks across temporal and spatial scales to adapt or transform (Meerow & Stults, 2016). An evolutionary approach defines that cities should be prepared for change (Davoudi et al., 2012) through participatory approaches (Peker & Ataöv, 2021). In this study, we adhere to the evolutionary resilience approach and understand cities as social-ecological systems that can persist, adapt, and transform.

Cities are often conceptualised as complex and evolving social-ecological systems (Berkes, 2017; Biggs et al., 2021; Folke, 2006; Ostrom, 2009). An adaptive resilience approach to cities as social-ecological systems challenges expert-driven processes and call for new understandings of space and time (Davoudi, 2021; Gaete Cruz et al., 2021). This study addresses the dichotomy between social and ecological systems (Berkes & Folke, 1994), where diverse actors collaborate to respond to crises creating social networks and shared visions (Folke et al., 2005). This study conceptualises public spaces as social-ecological systems and analyses their co-design processes.

Designing public spaces requires social and ecological parties (Webb et al., 2018). Designers, experts, stakeholders, and citizens are involved in such processes, coming from different sectors with sometimes conflicting agendas, values, and knowledge backgrounds (Agid & Chin, 2019; Gaete Cruz et al., 2021, 2022a, 2022b). This diversification brings together different forms of knowledge from and beyond disciplines. Multiple formal and informal knowledge, empirical knowledge (Gibbs et al., 2018), local knowledge (d'Hont & Slinger, 2022), implicit or tacit knowledge (Sanders, 2002), and perceptions (Ducci et al., 2023) from practices and experiences, capabilities (Janssen & Basta, 2022), and even values, and aims converge (Gaete Cruz et al., 2022b). Indigenous, local, and citizen expertise knowledge forms can complement traditional academic disciplines (Biggs et al., 2021). Collaboration in design challenges conventional procedures within multi-stakeholder settings to improve context-suitability (Gaete Cruz et al., 2022b; Mattelmäki & Visser, 2011; Sanders & Stappers, 2008).

Public space processes involve actors with diverging aims and knowledge fields (Webb et al., 2018). They may come from different sectors and backgrounds. Public spaces are contested, and interventions often raise conflicts. In designing them, multiple aspects should be discussed, negotiated, and deliberated (Brysch & Czischke, 2022; Castro, 2021). The wider the diversity of knowledge, aims, and values integrated into the process, the more the awareness of the diversity and uncertainty in addressing social and ecological challenges. When intervening within cities, knowledge integration is critical for systemic change (Folke, 2006; Berkes, 2009).

The co-design concept defines design processes in which actors interact to improve the design quality, legitimacy, and feasibility (Gaete Cruz et al., 2022b; Sanders & Stappers, 2008). Such interactions may result in the integration of diverse knowledge forms. We found that in co-design processes, multiple actors interacted and played a role within three co-design arenas: strategic, transdisciplinary, and socio-cultural (Gaete Cruz et al., 2022b). Then we analysed the knowledge integration design mechanisms throughout the processes (Gaete Cruz et al., 2023). However, the types of knowledge integrated still need to be determined.

In designing within social-ecological systems, knowledge integration is crucial, especially when the knowledge is conflicting, diverse, and specific. This study aims to provide insights into the difficult-to-grasp phenomena of knowledge integration throughout co-design processes. It follows previous studies analysing the same co-design processes and advances in answering how is sometimes conflicting social-ecological knowledge integrated into public space co-design processes.

The question remains: How is sometimes conflicting social-ecological knowledge integrated into public space co-design processes? To answer this question, we conceptualise public spaces as social-ecological systems and analyse the integration of knowledge throughout the co-design processes. We study two large-scale urban parks in Chile. We aim to understand how social, ecological, and social-ecological knowledge is integrated throughout the design processes. We start by analysing the actors involved in the processes and the disciplinary or non-disciplinary knowledge from consultancies and organisations. Then, we analyse the integration of knowledge reported throughout the processes based on the interviews. We were able to map the trajectories of the cases throughout the design.

This study contributes to the difficult-to-grasp phenomenon of knowledge integration in blurry co-design processes. It provides new insights into social-ecological knowledge integration in public space co-design processes. It follows previous studies on the same cases (Gaete-Cruz et al., 2021, 2022b, 2023) and elaborates further on the complex phenomena of public space co-design for resilience.

5.2 Social-Ecological Co-design for Resilience

Due to the resilience approach's interdisciplinary nature, frameworks are essential as overarching guides for collaboration (Biggs et al., 2021). Frameworks identify and organise factors to understand a phenomenon (McGinnis, 2011). In social-ecological systems research, frameworks define concepts, elements, processes, and relationships to explain or predict outcomes (Biggs et al., 2021). This study combines co-design processes and the social-ecological systems approach. We build on literature to define the analytical approach to studying social-ecological knowledge integration.

5.2.1 Public Space Co-Design Processes

Design is both a practice and a discipline that uses and produces new knowledge to solve ill-defined problems (Cross, 1982; 2001; Krogh & Koskinen, 2020). Urban design and planning have dealt with uncertainties and change for a long time (Healey, 1992; Innes & Booher, 1999). Many collaborative and communicative turns have been suggested to overcome the distance between designers, planners, their users, and other stakeholders. Collaborative and participative approaches to design have emerged in the last decades to address complex problems (Manzini, 2015; Mattelmäki & Visser, 2011).

Co-design approaches refer to the collaboration of multiple actors in design processes to improve the projects (Sanders & Stappers, 2008). This study defines co-design as the collaborative approach to the design process in which multiple actors from diverse sectors and backgrounds interact, collaborate, and integrate knowledge (De Blust et al., 2019; Gaete Cruz et al., 2022b). Co-design processes are iterative and evolving, and most focus on the early phases and the fuzzy front end (Sanders & Stappers, 2014). We adhere to the iterative, cyclical, and somewhat chaotic nature of collaboration and its changes through time (Botero & Hyysalo, 2013; Di Siena, 2020; Gaete Cruz et al., 2022a).

In previous studies, we contributed two analytical co-design frameworks (Gaete Cruz et al., 2022a, 2022b). We adhered to the cyclical design conceptualisations defining the steps and phases of the projects (Hansen et al., 2019; Jonas, 2007; Roozenburg & Eekels, 1995). We then linked them to Arnstein's (1969) participatory ladder (see also Collins & Ison, 2006) to analyse processes and overcome the academic bias of focusing on co-design activities (McDonnell, 2018; Saad-Sulonen et al., 2018).

The design cycles occur throughout the phases and define how the project develops in the four steps of collection, analysis, ideation, and evaluation. This approach is conceptualised as the "trial-and-error process that consists of a sequence of empirical cycles in which the knowledge of the process, as well as the solution, increases empirically" (Roozenburg & Eekels, 1995, p. 90). As shown in Figure 5.1, the cycle is repeated in each phase as a frame for the analysis. The design process has a conceptual, a preliminary, and a final design phase before the implementation (Van de Ven et al., 2016). The problem, objectives, and foremost criteria are defined in the conceptual phase to produce outline proposals (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). In the preliminary phase, a scheme is developed from possible spatial layouts, functional displays, and material propositions (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). During the detailing phase, the technical definitions are developed and defined (Cross & Roozenburg, 1992).

FIG. 5.1 Generic timeline for co-design processes: Cyclical steps and phases.

Despite the linear timeline shown in Figure 5.1, our understanding of co-design processes is fuzzy (Sanders & Stappers, 2008), messy, and cyclical (Botero & Hyysalo, 2013). The timeline is a simplified conceptual representation to analyse different aspects of iterative co-design processes. This background section combines this timeline with a social-ecological system approach to further analyse knowledge integration processes.

5.2.2 Social-Ecological Knowledge

Urban and ecological approaches have been integrated for decades to produce socio-technical and ecological spaces and processes. For decades, urban functional approaches have been contested (Geddes, 1968; Lynch, 1964; Olmsted et al., 1997; Rossi, 1966), and many have urged for the integration of urban infrastructures and the environments that support them (Carson, 1962/2009; McHarg, 1969; Spirn, 1984). Urban and ecological approaches have been brought together to broaden the limits of urbanism (Bélanger, 2016; Brown & Stigge, 2017; Mostafavi & Doherty, 2016; Waldheim, 2016). In this integrative turn, the social-ecological systems approach helps conceptualise the two interlinked and interdependent systems. A collaborative approach to their design processes may improve such urban designs.

Cities have been conceptualised as complex and evolving social-ecological systems (Berkes, 2017; Biggs et al., 2021; Folke, 2016; Ostrom, 2009). The social-ecological system approach integrates humans into nature, stressing their interdependence, interconnectedness, and reciprocal feedback (Folke et al., 2016). Human and ecological systems are understood as interdependent, inseparable, and intertwined. The term emerged in the early 1990s amongst scholars in ecological economics and common-pool resource systems (Berkes et al., 1989; Ostrom, 2009). It combines social and ecological systems and an integrated adaptive system with feedback and dynamics (Biggs, Schluter, & Schoon, 2015; Folke et al., 2010) that constantly change in response to internal or external pressures (Davoudi et al., 2012).

In urban design, new projects should account for the interconnectedness and interplay between the social and ecological systems and their emergent features and processes (Biggs et al., 2021; Preiser et al., 2018). To do so, they use the available knowledge within their systems, combined into a whole through human creativity in design processes (Devisch et al., 2018; Roozenburg & Eekels, 1995).

Academic disciplinary knowledge is often conceptualised as mental frames and models, as well as technical and design knowledge (Christiaans, 1992). Non-disciplinary knowledge is often informal and refers to the practice, technical, experiential, and value-oriented knowledge. However, such classifications refer to the sources of such knowledge and their type. This study conceptualises knowledge as the information, methods, and solutions needed to design spaces, functions, flows, and institutions. It focuses on the systems that frame such knowledge types, particularly their co-design processes.

Social-ecological knowledge is needed to make cities for people and nature. Social, ecological, and social-ecological knowledge are defined in Table 5.1. For the scope of this study, such knowledge systems are focused on public space design. Our definition follows previous ones in understanding spatial, temporal, and organisational scales (Biggs et al., 2021). Also, the action-oriented perspectives define actors, areas, and flows (Tjallingii, 2015). We recognise that social, ecological, and social-ecological forms of knowledge are contributed to and integrated into co-design processes, as shown in Figure 5.2.

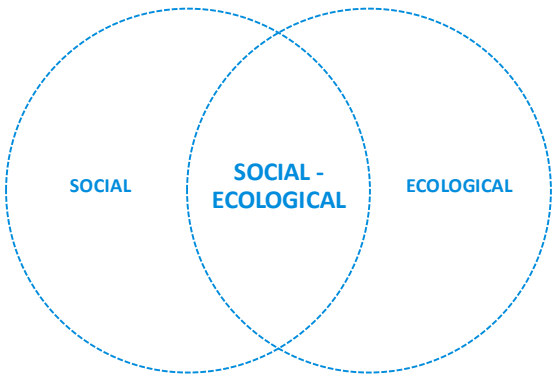

FIG. 5.2 Diagram of the social-ecological knowledge within the system.

TABLE 5.1 Definitions of knowledge systems.

	Definition	References
Social	Social, economic, political, cultural, technological, physical, dynamic, and institutional elements regarding communities and institutions, activities and flows, physical infrastructure, and geomorphologies	Biggs et al. (2021); Folke et al. (2016); Landman (2021); Ostrom (2007); Tyler and Moench (2012); Webb et al. (2018)
Social-ecological	Interconnected, interdependent, and interactive social and ecological systems are equally important; elements, relations, and processes	Berkes (2017); Biggs et al. (2021); Colding and Barthel (2019); Berkes, Folke, Colding (2000); Ostrom (2007)
Ecological	Biotic (population dynamics, food interactions, biodiversity) and abiotic (nutrient flows, climate patterns, forestry, water, soil, and air) physical, dynamic, and institutional elements	Biggs et al. (2021); Ostrom (2007)

We recognise social, ecological, and social-ecological knowledge systems, as shown in Table 5.1. We acknowledge that drawing boundaries to the components of systems is challenging but valuable for analysis (Biggs et al., 2021). For this study, these categories were defined to study them interconnectedly. The social knowledge system is broadly understood and comprises socio-cultural aspects, values, and physical infrastructure details to support human settlements. The ecological knowledge system is the information about biotic and abiotic elements that allow us to comprehend, protect, and intervene towards sustaining biodiversity, forestry, flows, and supporting structures. The social-ecological knowledge system is the combined approach to the information that links and connects social and ecological spaces, functions, and institutions. We acknowledge the importance of social-ecological integrated knowledge when designing integrated and resilient public space projects.

5.2.3 Social-Ecological Co-Design Process Framework

Due to the interdisciplinary nature of resilience and the social-ecological systems approach, there is a conceptual and methodological pluralism (Colding & Barthel, 2019). Analytical and conceptual frameworks have been said to be important in social-ecological systems research as overarching guides to facilitate collaboration (Biggs et al., 2021). They contribute to defining concepts, elements, and processes. In this study, we develop an analytical framework that allows different forms of knowledge to be mapped in a timeline (Figure 5.3).

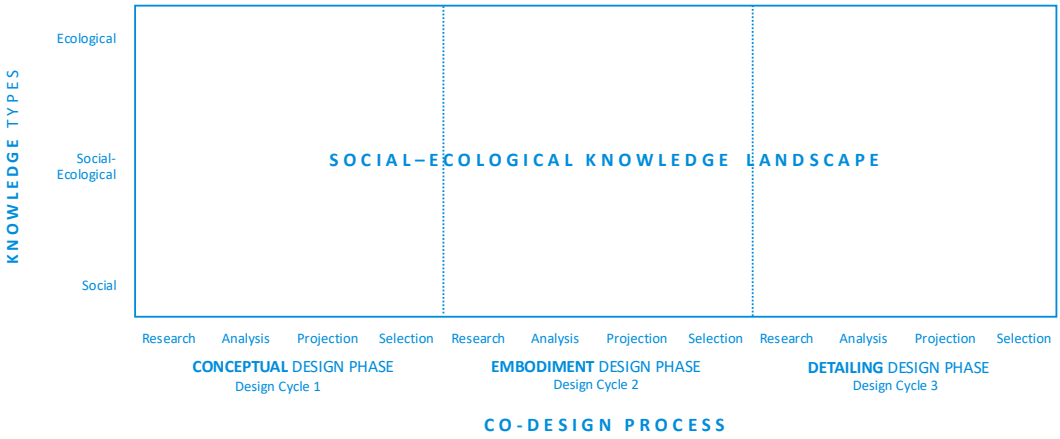

FIG. 5.3 The social-ecological co-design framework.

This study's analytical framework links social, ecological, and social-ecological forms of knowledge with a generic timeline. The framework focuses on the types of knowledge present in co-design processes. In doing so, a social-ecological knowledge landscape is defined. Although schematic, the framework allows different co-design processes to be mapped, and different process trajectories can be compared for further analysis.

The framework is an evolution of the co-design process framework previously developed by the author (Gaete Cruz et al., 2022a) and contributes to further conceptualising co-design processes (Bossen et al., 2016; Drain & Sanders, 2019; Nguyen, 2022; Szebeko & Tan, 2010). It contributes to studies on the resilience of social-ecological systems.

5.3 Method and cases

A case study approach was used to compare two urban park co-design processes in the Atacama Desert in Chile. This section briefly introduces the cases and methodological approach.

This study analyses two co-design processes of public space projects that the author had previously analysed (Gaete Cruz et al., 2021, 2022b). The two cases were selected due to their resilience approach and collaborative design processes. Both cases are big-sized urban parks. In their design, multiple actors contributed knowledge and collaborated. The designers, experts, stakeholders, and citizens involved belonged to the public, the private, the third sector, and academia. These cases are some of the few examples of this in the country.

5.3.1 Kaukari Urban Park

Kaukari Urban Park is a naturalisation of the riverbank of the Copiapó River in Copiapó City (Figure 5.4). The urban park is 60 ha wide and develops along the river for 3.5 km in the middle of the city. In the design processes, multiple actors were involved. The process studied consists of a conceptual phase (2009–2010), where the municipal regulation plan was developed; the preliminary design phase (2011–2012), where the urban park was further designed; and the detailing phase (2013–2014), where the construction documents and plans were developed. Many participatory sessions were undertaken with citizens throughout the process. Two public ministries had a strategic role; one (Ministry of Housing and Urbanism) focused on the urban park, while the other (Ministry of Public Infrastructure) focused on the riverbank restoration.

FIG. 5.4 Picture of Kaukari Urban Park.

All interviewees considered Kaukari Urban Park an integrated social and ecological park. As defined early in the process, the riverbed urban park provides social and ecological urban solutions. This was done by integrating social and ecological knowledge provided by relevant actors such as the landscape architect and hydraulic engineering design teams and was driven and supported by the public entities involved in the process (Ministry of Housing and Urbanism and the Ministry of Public Infrastructure). However, as reported, such a solid and integrated stakeholder cohesion was complemented by a rather conventional and informative citizen participation process within a non-participative and top-down social scenario (Gaete Cruz et al., 2021).

Even though there was a general sense of urgency to restore the riverbed due to the drought (dry from 2005 until 2012), an initial lack of agreement on how the vast area had to be addressed was reported. Some initiatives that reveal such a lack of compatibility are the Rock Without River music festival on-site, the Active River water mirror, and playground structures to be installed in the river. The Kaukari Urban Park riverbed restoration can host festivals, playground areas, and other functions.

The project was designed based on community participation, which was reportedly shallow and conventional, achieving informative and consultive collaboration levels (Gaete Cruz et al., 2022b). This can be observed in the designed project with generic recreational functions and areas: multifunction squares, football fields, multi-sport fields, public toilets, extended planters, tree-lined boulevards, and promenades. This was reported to have changed in recent years as citizen participation evolved, and a wider diversity of cultural, sports, and economic functions were incorporated into the original project. One interviewee reported: "We now involve citizens in the decision-making processes of the park."

Climate change awareness was said to have evolved in the community. There was a lack of trust in such a different approach to river flooding defences. The project support started to change after implementing one park section, and two catastrophic flooding events occurred in the city (2015 and 2017). This happened towards the end of the process, requiring the project to be adjusted. As one of the interviewees commented: "We had to improve the river's capacity dramatically…after the floodings."

Ecological restoration and naturalisation of the river were central aims of the project, so river inflow knowledge was a central research concern and project outcome. During the design process, the caring capacity of the project was defined considering the available knowledge. However, the water volume had to be updated after the design process due to the improved climate change awareness acknowledging uncertainty. Even though the riverbed restoration played a central role in the design, it may have shadowed other ecological restoration opportunities identified in the early research phase, such as the existing greenery and trees in the desertic valley, the tailing dumps, and the possible nearby rainwater drainage, amongst others.

5.3.2 Antofagasta Seaside Park

Antofagasta Seaside Park is a public space throughout the 35-km-long city (Figure 5.5). CREO Antofagasta, a public-private citizen partnership with a living lab approach, led the project. First, many actors were summoned during the partnership's initial years in a relationship-building process (2012–2014). Then, a public contest for ideas defined the design consortium based on a proposal. Finally, the consultancy occurred (2017–2021).

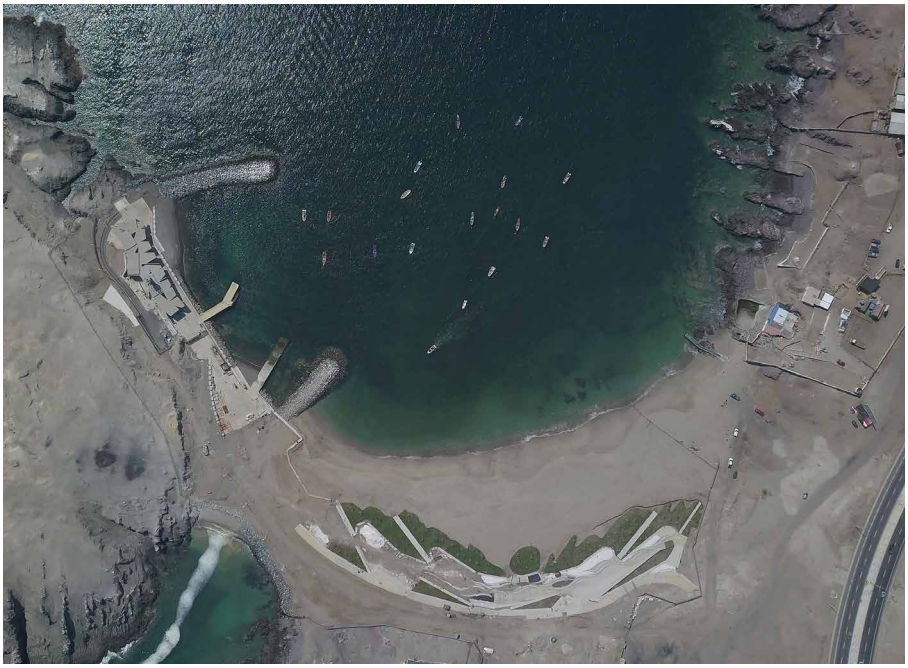

FIG. 5.5 Picture of Antofagasta Seaside Park.

The interviewees valued Antofagasta Seaside Park due to the initial collaborative approach. Stakeholders from diverse backgrounds and sectors (public, private, third sector, community, academia) were involved in an open process where the problem was defined and analysed. From this early set of participative activities promoted by the CREO Antofagasta NGO, a partnership was built for developing this and other urban development projects for the city. Interviewees valued the shared understandings as outcomes of the process. Some interviewees reported trust issues due to the lack of communication in the following phases (Gaete Cruz et al., 2022b). However, most interviewees felt that the leading designers were recognised as high-quality, so there was a sense of expectation about the resulting project.

The general community supported the project due to the collaborative collection that had taken place over a couple of years. Industry associations, academics, and community and sports organisations reported this. A general sense of awareness had been built regarding the seaside's socio-cultural value and urban functions and the need to integrate the existing interventions (restaurants, sports fields, fishing areas, seaside sports structures, greenhouses, commercial areas, artificial beaches, amongst others). With a conflict matrix method, conflicting areas and activities were collectively recognised.

Neither interviewee did not report climate change awareness, and there was no mention of the sea level rise in the design process. However, interviewees reported that many natural and ecological hotspots were recognised and spatially protected early in the process with the built structures and didactic signages. This was the case with water springs, birds nesting, fishing, and rocky seashell areas.

The design team reported some iterations regarding diminishing the breakwater defence structures in the beach areas. This demonstrated a will to use fewer materials and intervene at the seaside less. They reported having opted for an overall discreet intervention of the coastal areas focalising major structures only on the two artificial beaches to be built.

5.3.3 Case Study

This study uses a case study approach to analyse a contemporary, complex, and context-sensitive phenomenon of co-design for resilience (Yin, 1994). We chose two cases and analysed their co-design processes retrospectively. This approach allows the analysis of processes from practice and develops new knowledge (Ridder, 2017). We aim to produce both specific and generalisable knowledge for science and practice. We took an instrumental approach and developed a framework that structured the analysis and interpreted the results (Stake, 1995).

The study builds on primary and secondary data that the author obtained in fieldwork conducted in Chile in 2019 and 2020. Primary data consisted of 27 semi-structured in-depth interviews with key actors of the cases studied. To make the sampling extensive, the interviewees were selected from diverse sectors such as the public, private, third sector, academia, and society (Ridder, 2017). Secondary data were written reports, social media, press, project plans, and images.

The interviews aimed to collect the participants' perceptions regarding the processes they were involved in. They were asked to define the processes and their involvement. Explicit questions regarding the social and ecological knowledge and aspects of public spaces are designed to capture perceptions of the social-ecological systems. The interviews and data underwent a content analysis with the Atlas Ti software. A coding system was developed to classify data based on the framework of this study (Table A1 in the Supplementary File).

The author has previously studied both cases. The enablers and barriers to collaboration and design were analysed from an evolutionary resilience approach

(Gaete Cruz et al., 2021). Then, the levels of collaboration of the diverse actors in the different design steps were assessed by analysing the co-design activities (Gaete Cruz et al., 2022b). The acknowledgement of the relevance of knowledge integration and co-production in co-design processes was made evident. From there, another study analyses how interdisciplinary and transdisciplinary knowledge integration occurs in co-design processes, especially if framed as multi-stakeholder design processes (Gaete Cruz et al., 2023). This study analyses the types of knowledge integrated throughout the process and validates the co-design phenomenon's results and overall complexity.

The author of this study was partially involved in the two co-design processes. In the first case, she was the project leader within the leading architecture design firm Teodoro Fernández Associated Architects. In the second case, she was the design leader of the CREO Antofagasta NGO during some time of the co-design process. The key roles in both processes allowed access to data and interviewees that would have been impossible otherwise. Additionally, valuable insights were gained due to her previous involvement in the cases and connections to relevant practitioners and organisations. We acknowledge that such involvement might bring legitimacy issues, so we addressed it through verification and triangulation. The study of these co-design processes has been iterative and from diverse conceptual approaches, as reported in previous academic publications (Gaete Cruz et al., 2021, 2022b). The analysis and results of this study were shared and verified with some interviewees for clarification and validation purposes.

5.4 Results: Social-Ecological Knowledge Integration

5.4.1 Social-Ecological Knowledge in the cases

We classified the main stakeholders, design teams, and experts involved in the two processes according to their main knowledge contribution. The interviewees were asked to report on the knowledge or information that may have played a role in the co-design processes. The questions were kept open for them to reflect on the main aspects discussed and how they evolved when collectively prioritised. Sometimes interviewees referred to the design outcome and how the designed project considered, disregarded, or neglected certain aspects.

The interviews were complemented and verified with secondary data. This was done in two steps. First, a classification of the stakeholders, and then the design teams and experts. Table A2 in the Supplementary File shows the main stakeholders involved in the cases studied, and Table A3 the main disciplines and experts involved in the design consultancies.

In Figure 5.6, the stakeholders are classified according to their main knowledge focus. Different actors took an integrated social-ecological approach in the two cases. In Case 1, the leading stakeholders were reported to be interested in the urban park's social and ecological functions. In Case 2, not all leading stakeholders aimed for a social-ecological approach. However, this was a primary concern for the leading NGO CREO Antofagasta, the architectural firm, and some community organisations. Interestingly, no stakeholder was reported to pursue predominately ecological aims.

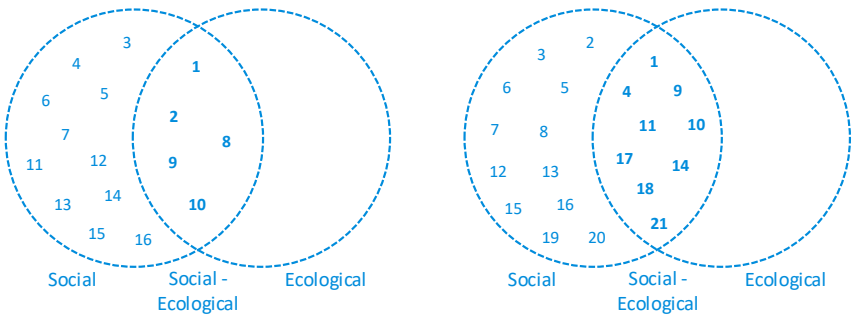

FIG. 5.6 Classification of the stakeholders involved in the co-design processes according to their main knowledge focus.

Figure 5.7 shows the design disciplines and expert studies for each design consultancy (Table A3 in the Supplementary File). This data was collected from reports and other secondary data and verified with the interviews. In Case 1, the leading design teams were urban landscape designers and hydraulic engineering design. They have played one of the most critical roles in the design process, combining river tide and urban park requirements in integrated spaces. It is worth noticing that social aspects were mainly reduced to public consultancies about the possible recreation functions of the park. Also, technical engineering projects were classified under the social category because they aim to address human needs. For Case 1, the leading design teams, and public organisations (Ministry of Housing and Urbanism and the Ministry of Public Infrastructure) aimed for a social-ecological integrated approach. This was confirmed by some interviewees that the design teams of architects and hydraulic engineers "had a common idea on the naturalisation and restoration of the riverbed" and that they "developed a way of working together throughout the design process." This was also confirmed by the public servants that commented: "They had to convince the higher authorities to work together with the Ministry of Housing and Urbanism." In Case 2, only the urban designers aimed for social-ecological knowledge integration. This may explain why they reported difficulties getting the engineers on board with such an approach. The public servants interviewed commented that they "tried to convince the neighbour public entities to commit to the project." This is further explained in the following sections.

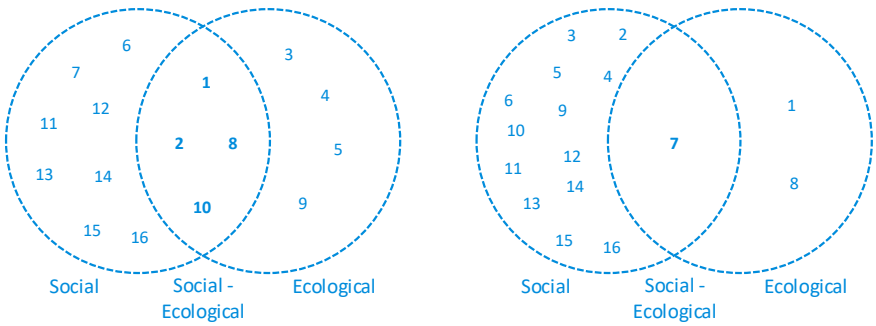

FIG. 5.7 The design teams and experts involved in the co-design processes are classified according to their main knowledge focus.

The interviewees were asked for the informal knowledge gathered to complement the analysis of the design teams and experts involved. According to the interviewees, both cases initially aimed to collect information from citizens and citizen organisations. For both cases, this social-ecological knowledge was reported to have been collected in the conceptual phase. It influenced the following phases in which more conventional design disciplines played a more relevant role.

For Case 1, only a low amount of informal knowledge from citizen participatory studies was reported. Much of what was reported consisted of public space requirements such as football fields, traditional dance squares, market areas, open-air auditoriums, kiosks, and skate squares. Although these requirements are very relevant, they are rather conventional and generic.

Case 2 had much more informal social and ecological knowledge brought to the process. The informal social knowledge reported to have been gathered consisted of requirements for recreation and commercial functions (fishing market areas, delimitation of car parking areas, distributed cafeterias, and snack bars, amongst others), the experiential usage knowledge from citizens, sports organisations (bodyboard, surf, swimming, water polo), and local fishermen, and the existing commercial uses and activation hotspots. This was complemented by social-ecological knowledge from the historical evolution of the seaside, the experiences of the annual Sea Festival to test and promote water sports, and the value of several sports waves for surf and bodyboarding. This is in addition to the ecological knowledge of bird nesting zones, the biodiversity in the rocky seaside areas, the water spring as ecological hubs in the desert, and the natural rock pools throughout the seaside.

Social, ecological, and social-ecological knowledge was recognised to have been relevant in the co-design processes. Both cases dealt with social awareness building, social activities, and social spaces. The processes considered ecological site-specific values spatially, and conservation and restoration areas were combined with urban functions. Some sense of awareness of the climatic crisis was observed in both cases. The following section explains how knowledge integration evolved throughout the processes.

5.4.2 Social-Ecological Knowledge Integration throughout the co-design processes

Co-design processes can be understood throughout the three phases in which the project is developed. Figure 5.3 shows how social, ecological, and social-ecological knowledge was (or was not) integrated into the two cases throughout the different phases.

The design processes started with the conceptual phase, and collaboration was fostered to integrate social and ecological knowledge from multiple actors. According to Figure 5.8, in Case 1, social and ecological knowledge was integrated. As reported by interviewees, this mainly occurred amongst the design teams and the two public entities involved. On the other hand, in Case 2, social and ecological knowledge was integrated, but the design teams lost the social-ecological integrated approach in the following phases.

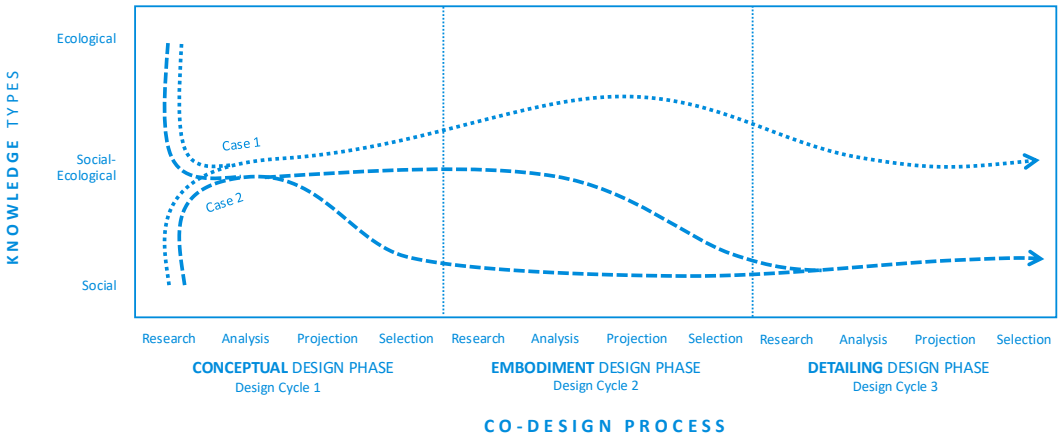

FIG. 5.8 Social, ecological, and social-ecological knowledge in the co-design processes of Kaukari Urban Park (Case 1) and Antofagasta Seaside Park (Case 2).

TOC

In the preliminary phase, one first design is developed, which is further technically detailed in the final phase. In Case 1, this phase sustained the social-ecological knowledge integration achieved in the previous phase. The leader of the architectural firm reported to "have worked in the same office with the hydraulic engineering team." The engineering design leader commented: "We worked together, and both disciplines developed the plans and proposals together."

On the contrary, in Case 2, the preliminary phase was challenging and failed to maintain social and ecological knowledge integration. Interviewees within the architectural design teams reported having problems "working with the engineers because of their conventional ways" and no "flexibly or willingness to make any extra coordination work." This aligns with the miscommunications and mistrust reported by industrial and society interviewees.

Towards the end, the project's technical aspects are defined in the detailing phase. Expert designers conventionally do this, so collaboration with other actors may only occur if fostered by them. How social-ecological knowledge integration happens in the previous phases determines how the technical design decisions respond to them. However, in co-design processes, knowledge influences the technical details of the projects implemented and the space's future use, management, and cooperation. Other actors may play relevant roles in preparing the future implementation of the projects.

In Case 1, Ministry of Housing and Urbanism started with the "governance of the park" meetings to open the operation decision-making to interested people. They "invited public servants, cultural organisations, NGOs, academics and citizens" and reported that this measure improved the project's legitimacy and social knowledge towards the end of the process. This allowed them to verify some functions and sports that could be changed in the project to suit the current needs better. Similarly, the floodings that occurred towards the end of the design process also prompted changes in the final project. An additional design change had to be done to the hydraulic design for the river to contain more significant amounts of water to safeguard the city in extreme weather events.

Moreover, in Case 2, the leading NGO organisation changed its executive director, and the project leader assumed its leading role. This was said to improve the communication and involvement of the relevant actors in the first phase and to improve the process and the project definitions in this final stage.

5.5 Discussions and the three dimensions of public spaces as Social-Ecological Systems

In this study, we adhere to the conceptualisations of cities and their public spaces as social-ecological systems under uncertainty. Urban design practices should be collaborative to address such complexities. In doing so, social, ecological, and social-ecological knowledge are integrated. We have taken a co-design approach to analyse two co-design processes from practice.

According to the results, all three types of knowledge play a role in public space design. In the processes studied, there were different trajectories due to how the integration evolved from the initial collection of knowledge to the development of the projects where the leading design teams had a predominant role in knowledge integration. In Case 1, the leading design teams worked integrated, which was reported from the processes, the practices, and the project. In Case 2, the design teams did not maintain the initial integration. Even though the project did not address many ecological aspects, they were reported to have protected most of the ecological values mentioned.

Knowledge integration is crucial when co-designing social-ecological systems. Conflicting knowledge and polarisation were observed in the cases studied. First, there were conflicting agendas and aims amongst the diversity of stakeholders involved in the projects. Then, the projects to be implemented generated conflict among the different actors. In Case 1, the citizen and social media were sceptical of the project and its implementation. In Case 2, the inclusiveness of the conceptual phase was challenging to maintain in the following phases, so the project was mistrusted and had to change over time. The idea of knowledge integration speaks of selection. Conflicting knowledge needs to be addressed and therefore prioritised. This is especially relevant when integrating social, ecological, and social-ecological knowledge. From the knowledge collected, some aspects were disregarded or not addressed in the final designs.

Four design steps were used to conceptualise the design cycles. The first three steps are crucial to knowledge integration. The first step contributes to collecting data, information, and knowledge. The analysis and synthesis are crucial in prioritising different forms of knowledge. In this step, selection occurs with conflicting knowledge, which leads to knowledge integration. This was the case

of some stakeholder or citizen knowledge and requirements that could have been considered in the projects. The ideation step is where new knowledge is produced. In some cases, social-ecological knowledge was produced as design strategies or designed projects.

Social and ecological knowledge was reportedly integrated into both processes studied. We found that knowledge is attached to its institutions. A collaborative approach to urban landscape design facilitates knowledge integration. A social-ecological approach to knowledge may contribute to opening design not only to spaces, functions, and flows but also to less conventional forms of knowledge. In these cases, many involved actors and stakeholders pursued urban and social aims rather than ecological ones. The fact that the Natural Environment Ministry of Chile, currently in charge of promoting climate adaptation projects throughout the country, was not involved in the cases may suggest why the projects privileged urban requirements over ecological ones. This may be why ecologically focused projects are still exceptional in the country. In this study, we found that there is no perfect process and no perfect social-ecological project.

In the conceptual phase, the problem is defined and agreed upon, which allows for defining the main criteria and objectives to which the project should respond. The fact that social-ecological knowledge was present and increasing in this phase influenced the following phases. In the embodiment phase, the first design proposals are ideated, so if relevant knowledge was integrated before, it is used. The detailing phase is often technically oriented, but it is also when the implementation, use, management, and further operation can be fostered.

Findings suggest that the social-ecological systems approach to public space design may widen urban design's focus on spatial layouts and essential functions. As suggested by the interviewees, the physical and spatial dimensions were combined with dynamic and institutional ones. We found that an urban landscape project should consider physical and temporal (dynamics, flows, and activities that can be unexpected) and that they depend on their institutional systems. We confirmed that public spaces could be conceptualised as social-ecological systems. The physical dimension of public spaces considers their spaces with urban and ecological elements. The dynamic dimension involves flows, activities, mobility, and ecological biodiversity. The institutional dimension refers to the actors, their rules, and their interactions. Urban social-ecological systems should be conceptualised, analysed, and designed as interdependent spaces, dynamics, and institutions. Doing so may contribute to the awareness of social and ecological conflicts and uncertainties and open possibilities for urban resilience and adaptation.

Social-ecological systems should be studied across space and time, considering the actors at stake. This should happen not only during the design process but also throughout the whole span of the lifecycle of public space, including the previous and the implementation and operation phases. The more the awareness of unpredictable functions flows, and dynamics, the more flexible and transformable spaces will be incorporated into the design. Designers should define the crucial elements of their social-ecological systems while keeping them open for future change.

5.6 Conclusions

We analysed knowledge integration throughout the co-design processes of two big-sized public spaces. We wanted to answer how is sometimes conflicting social-ecological knowledge integrated into public space co-design processes. We wanted to know who contributed and integrated, what kinds of knowledge, and when this happened.

To answer the research question, we developed an analytical framework to analyse social-ecological knowledge in co-design processes. The two cases had been previously studied (Gaete Cruz et al., 2021, 2022b). This study conceptualises social-ecological systems and knowledge in co-design processes and focuses on the contents of the projects.

This study connects various bodies of academic literature. It builds on co-design literature following the author's previous studies (Gaete Cruz et al., 2022a, 2022b, 2023). This study is a step towards uncovering the roles of knowledge in co-design processes, which is especially relevant in social-ecological systems literature. According to the main findings, more stakeholders and design teams should hold a social-ecological integrated approach. Ecological expertise and design approaches should be fostered to improve urban resilience in contexts where innovation is rare.

The findings of this study should be contrasted by analysing other cases. The difficulty in grasping and communicating knowledge made it difficult for interviewees to relate to the object of study. There may be limitations to the framework's applicability and findings in other contexts. The trajectories express knowledge integration but must differentiate between interdisciplinary and transdisciplinary

approaches. Further studies could focus on the roles of knowledge within and beyond disciplines. Also, the roles of tacit and explicit knowledge could be studied. This would be especially interesting if analysed in the different design steps.

Analysing social-ecological knowledge in co-design processes allowed us to discuss generalisable and context-specific findings and contribute knowledge for practice. This study contributes an analytical framework to study co-design as a social-ecological knowledge integration process. We found that multiple forms of knowledge were integrated (social, ecological, and social-ecological) throughout the three design phases (conceptual, preliminary, and detailing). This knowledge integration occurs in the collection, analysis, and ideation design steps. Stakeholders, design teams, experts, and citizens contribute and integrate knowledge in these steps. This study advances the conceptualisation of knowledge integration in co-design.

Further research should aim to understand how integrating sometimes conflicting social-ecological knowledge may improve resilience. Approaching social-ecological systems as unfolding in space, dynamics, and institutions may allow the assessment of urban resilience. This study is the baseline for analysing public space projects and the embodied resilience of their design strategies. The author is currently assessing the resilience of public space design strategies.

Although the cases are framed in the Latin American context, findings may be useful elsewhere. The framework may be used for social-ecological systems research, and findings may provide guidelines for co-design practice.

References

Agid, S., & Chin, E. (2019). Making and negotiating value: Design and collaboration with community led groups. CoDesign, 15(1), 75–89.

Arnstein, S. R. (1969). A ladder of citizen participation. Journal of the American Planning Association, 35(4), 216–224. https://doi.org/10.1080/01944366908977225

Bélanger, P. (2016). Landscape as infrastructure: A base primer. Routledge.

Berkes, F., Feeny, D., McCay, B. J., & Acheson, J. M. (1989). The benefits of the commons. Nature, 340, 91-93.

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organisations and social learning. Journal of Environmental Management, 90(5), 1692–1702. https://doi.org/10.1016/j.jenvman.2008.12.001

Berkes, F. (2017). Environmental governance for the Anthropocene? Social-ecological systems, resilience, and collaborative learning. Sustainability, 9(7), Article 1232. https://doi.org/10.3390/su9071232

Berkes, F., Colding, J., & Folke, C. (2008). Navigating social-ecological systems: Building resilience for complexity and change. Cambridge University Press.

Berkes, F., Folke, C., & Colding, J. (Eds.). (2000). Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge University Press.

Berkes, F., & Folke, C. (1994). Linking social and ecological systems for resilience and sustainability.

Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (Eds.). (2021). The Routledge handbook of research methods for social-ecological systems. Routledge. https://doi.org/10.4324/9781003021339

Biggs, R., Schlüter, M., & Schoon, M. L. (2015). An introduction to the resilience approach and principles to sustain ecosystem services in social-ecological systems. Principles for building resilience: Sustaining ecosystem services in social–ecological systems, 1-31.

Bossen, C., Dindler, C., & Iversen, O. S. (2016). Evaluation in participatory design: A literature survey. In C. Bossen, R. C. Smith, A. M. Kanstrup, J. McDonnell, M. Teli, & K. Bødker (Eds.), PDC '16: Proceedings of the 14th Participatory Design Conference (Vol. 1, pp. 151–160). Association for Computing Machinery. https://doi.org/10.1145/2940299.2940303

Botero, A., & Hyysalo, S. (2013). Ageing together: Steps towards evolutionary co-design in everyday practices. CoDesign, 9(1), 37–54. https://doi.org/10.1080/15710882.2012.760608

Brown, H., & Stigge, B. (2017). Infrastructural ecologies: Alternative development models for emerging economies. The MIT Press.

Brown, P., von Daniels, C., Bocken, N. M. P., & Balkenende, A. R. (2021). A process model for collaboration in circular oriented innovation. Journal of Cleaner Production, 286, 125499. https://doi.org/10.1016/j.jclepro.2020.125499

Brysch, S. L., & Czischke, D. (2022). Affordability through design: The role of building costs in collaborative housing. Housing Studies, 37(10), 1800–1820.

Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: Resilience of what to what? Ecosystems, 4(8), 765–781. https://doi.org/10.1007/s10021-001-0045-9

Carson, R. (2009). Silent spring. Houghton Mifflin Harcourt. (Original work published 1962)

Castro, D. (2021). Argumentation and persistent disagreement. Informal Logic, 41(2), 245–280.

Christiaans, H. H. C. M. (1992). Creativity in design: The role of domain knowledge in designing [Doctoral dissertation, TU Delft]. TU Delft Repositories. http://resolver.tudelft.nl/uuid:cb556def-8fe0-497d-88ba-0f8a5a7b572f

Colding, J., & Barthel, S. (2019). Exploring the social-ecological systems discourse 20 years later. Ecology and Society, 24(1).

Collins, K., & Ison, R. (2006, June 4–7). Dare we jump off Arnstein's ladder? Social learning as a new policy paradigm [Paper presentation]. Participatory Approaches in Science & Technology Conference, Edinburgh, UK.

Colloff, M. J., Martín-López, B., Lavorel, S., Locatelli, B., Gorddard, R., Longaretti, P.-Y., Walters, G., van Kerkhoff, L., Wyborn, C., Coreau, A., Wise, R. M., Dunlop, M., Degeorges, P., Grantham, H., Overton, I. C., Williams, R. D., Doherty, M. D., Capon, T., Sanderson, T., & Murphy, H. T. (2017). An integrative research framework for enabling transformative adaptation. Environmental Science & Policy, 68, 87–96. https://doi.org/10.1016/j.envsci.2016.11.007

Cross, N. (1982). Designerly ways of knowing. Design Studies, 3(4), 221–227. https://doi.org/10.1016/0142-694x(82)90040-0
Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. Design Issues, 17(3), 49–55. https://www.jstor.org/stable/1511801
Cross, N., & Roozenburg, N. (1992). Modelling the design process in engineering and in architecture. Journal of Engineering Design, 3(4), 325–337. https://doi.org/10.1080/09544829208914765
Davoudi, S. (2021). Resilience, uncertainty, and adaptive planning. In A. Ataöv & E. Peker (Eds.), Governance of climate responsive cities: Exploring cross-scale dynamics (pp. 9–19). Springer. https://doi.org/10.1007/978-3-030-73399-5_2
Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., Fünfgeld, H., McEvoy, D., & Porter, L. (2012). Resilience: A bridging concept or a dead end? Planning Theory & Practice, 13(2), 299–333. https://doi.org/10.1080/14649357.2012.677124
De Blust, S., Devisch, O., & Schreurs, J. (2019). Towards a situational understanding of collective learning: A reflexive framework. Urban Planning, 4(1), 19–30. https://doi.org/10.17645/up.v4i1.1673
Devisch, O., Huybrechts, L., Vervoort, P., & Pisman, A. (2018). Fuzzy participatory planning processes as arenas for collaborative learning. Town Planning Review, 89(6), 557–574. https://doi.org/10.3828/tpr.2018.39
d'Hont, F. M., & Slinger, J. H. (2022). Including local knowledge in coastal policy innovation: Comparing three Dutch case studies. Local Environment, 27(7), 897–914.
Di Siena, D. (2020). Diseño cívico: proceso circular [Civic Design: A circular process]. Actas de las Jornadas de Investigación de la FADU-UBA, 2020, 539–559. http://repositoriouba.sisbi.uba.ar/gsdl/collect/actasfadu/import/2020/36.html
Drain, A., & Sanders, E. (2019). A collaboration system model for planning and evaluating participatory design projects. International Journal of Design, 13(3), 39–52.
Ducci, M., Janssen, R., Burgers, G.-J., & Rotondo, F. (2023). Mapping local perceptions for the planning of cultural landscapes. International Journal of E-Planning Research, 12(1), 1–27. https://doi.org/10.4018/ijepr.317378
Ersoy, A., & Yeoman, R. (2020). Reconfiguration of public space via nature-based solutions. In J. Riegler & J. Bylund (Eds.), Unfolding dilemmas of urban public spaces: Recommendations by JPI Urban Europe's AGORA (pp. 25–29). Urban Europe.
Fingleton, B., Garretsen, H., & Martin, R. (2012). Recessionary shocks and regional employment: Evidence on the resilience of U.K. regions. Journal of Regional Science, 52(1), 109–133. https://doi.org/10.1111/j.1467-9787.2011.00755.x
Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change, 16(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002
Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. Ecology and Society, 21(3), Article 41. https://www.jstor.org/stable/26269981
Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. Ecology and Society, 15(4), Article 20. https://doi.org/10.5751/es-03610-150420
Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. Annual Review of Environment and Resources, 30(1), 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511
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: Exploring cross-scale dynamics (pp. 105–125). Springer.
Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022a). A framework for co-design processes and visual collaborative methods: An action research through design in Chile. Urban Planning, 7(3), 363–378. https://doi.org/10.17645/up.v7i3.5349
Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022b). Towards a framework for urban landscape co-design: Linking the participation ladder and the design cycle. CoDesign. Advance online publication. https://doi.org/10.1080/15710882.2022.2123928

Gaete Cruz, M. (2023b). Co-design for Uncertainty; Design principles for public space resilience. Proceedings of the Congreso Intersecciones, IV Congreso Interdisciplinario de Investigación en Arquitectura, Diseño, Ciudad y Territorio – Entre escalas, agencias y territorios en Latinoamérica, Chile, mesa 23.

Geddes, Patrick (1968). 'Sociology as Civics' in Philip Abrams The Origins of British Sociology, University of Chicago Press. Chicago.

Gibbs, P., Neuhauser, L., & Fam, D. (2018). Introduction–The Art of Collaborative Research and Collective Learning: Transdisciplinary Theory, Practice and Education. Transdisciplinary Theory, Practice and Education: The Art of Collaborative Research and Collective Learning, 3-9.

Gunderson, L. H., & Holling, C. S. (2001). Panarchy: Understanding transformations in human and natural systems. Island Press.

Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Global Environmental Change, 23(2), 485–498. https://doi.org/10.1016/j.gloenvcha.2012.12.006

Hansen, N. B., Dindler, C., Halskov, K., Iversen, O. S., Bossen, C., Basballe, D. A., & Schouten, B. (2019). How participatory design works: Mechanisms and effects. In A. Lugmayr (Ed.), OzCHI'19: 31st Australian Conference on Human-Computer-Interaction (pp. 30–41). Association for Computing Machinery. https://doi.org/https://doi.org/10.1145/3369457.3369460

Healey, P. (1992). Planning through debate: The communicative turn in planning theory. Town Planning Review, 63(2), 143–162.

Holling, C. S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4, 1–23. https://www.jstor.org/stable/2096802

Innes, J. E., & Booher, D. E. (1999). Consensus building and complex adaptive systems: A framework for evaluating collaborative planning. Journal of the American Planning Association, 65(4), 412–423.

Janssen, C., & Basta, C. (2022). Are good intentions enough? Evaluating social sustainability in urban development projects through the capability approach. European Planning Studies. Advance online publication. https://doi.org/10.1080/09654313.2022.2136936

Jonas, W. (2007). Research through DESIGN through research. Kybernetes, 36(9/10), 1362–1380. https://doi.org/10.1108/03684920710827355

Krogh, P. G., & Koskinen, I. (2020). Drifting by intention: Four epistemic traditions from within constructive design research. Springer.

Landman, K. (2021). Rapidly changing cities: Working with socio-ecological systems to facilitate transformation. Urban Planning, 6(2), 139–142. https://doi.org/10.17645/up.v6i2.4472

Lynch, K. (1964). The image of the city. MIT press.

Manzini, E. (2015). Design, when everybody designs: An introduction to design for social innovation. The MIT Press.

Mattelmäki, T., & Visser, F. S. (2011). Lost in Co-X: Interpretations of co-design and co-creation. In N. F. M.Roozenberg, L. L. Chen, & P. J. Stappers (Eds.), Diversity and unity: Proceedings of the IASDR 2011—4th World Conference on Design Research (pp. 1-12). International Association of Societies of Design Research.

McDonnell, J. (2018). Design roulette: A close examination of collaborative decision-making in design from the perspective of framing. Design Studies, 57, 75–92. https://doi.org/10.1016/j.destud.2018.03.001

McGinnis, M. D. (2011). An introduction to IAD and the language of the Ostrom Workshop: A simple guide to a complex framework. Policy Studies Journal, 39(1), 169–183. https://doi.org/10.1111/j.1541-0072.2010.00401.x

McHarg, I. L. (1969). Design with nature. American Museum of Natural History.

Meerow, S., & Stults, M. (2016). Comparing conceptualizations of urban climate resilience in theory and practice. Sustainability, 8(7), Article 701. https://doi.org/10.3390/su8070701

Morton, S. (2015). Progressing research impact assessment: A "contributions" approach. Research Evaluation, 24(4), 405–419.

Mostafavi, M., & Doherty, G. (Eds.). (2016). Ecological urbanism. Zurich, Lars Müller.

Nguyen, Q. (2022). Evaluation in participatory design—The whys and the nots. In V. Vlachokyriakos, J. Yee, C. Frauenberger, M. Duque Hurtado, N. Hansen, A. Strohmayer, I. Van Zyl, A. Dearden, R. Talhouk, C. Gatehouse, D. Leishman, S. Agid, M. Sciannamblo, J. Taylor, A. Botero, C. Del Gaudio, Y. Akama, R. Clarke, & J. Vines (Eds.), PDC '22: Proceedings of the Participatory Design Conference 2022 (Vol. 2, pp. 161–166). Association for Computing Machinery. https://doi.org/10.1145/3537797.3537828

Olmsted, F. L., Beveridge, C. E., & Hoffman, C. F. (1997). The Papers of Frederick Law Olmsted: Writings on public parks, parkways, and park systems (Vol. 1). Johns Hopkins University Press.
Ostrom, E. (2007). Sustainable Social-Ecological Systems: An Impossibility? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.997834
Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. Science, 325(5939), 419–422. https://doi.org/10.1126/science.1172133
Peker, E., & Ataöv, A. (2021). Governance of climate responsive cities: Scale matters! In A. Ataöv & E. Peker (Eds.), Governance of climate responsive cities: Exploring cross-scale dynamics (pp. 1–8). Springer. https://doi.org/10.1007/978-3-030-73399-5_1
Preiser, R., Biggs, R., De Vos, A., & Folke, C. (2018). Social-ecological systems as complex adaptive systems: Organizing principles for advancing research methods and approaches. Ecology and Society, 23(4), Article 46. https://doi.org/10.5751/ES-10558-230446
Ridder, H. G. (2017). The theory contribution of case study research designs. Business Research, 10(2), 281–305.
Roozenburg, N. F. M., & Eekels, J. (1995). Product design: Fundamentals and methods (1st ed.). Wiley.
Rose, A. (2004). Defining and measuring economic resilience to disasters. Disaster Prevention and Management: An International Journal, 13(4), 307–314. https://doi.org/10.1108/09653560410556528
Rossi, A. (1966). La Arquitectura de la Ciudad, Editorial GustavoGilli, Barcelona.
Saad-Sulonen, J., Eriksson, E., Halskov, K., Karasti, H., & Vines, J. (2018). Unfolding participation over time: Temporal lenses in participatory design. CoDesign, 14(1), 4–16. https://doi.org/10.1080/15710882.2018.1426773
Sanders, E. (2002). From User-Centered to Participatory Design Approaches. https://doi.org/10.1201/9780203301302.ch1
Sanders, E., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. CoDesign, 4(1), 5–18. https://doi.org/10.1080/15710880701875068
Sanders, E., & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. CoDesign, 10(1), 5–14. https://doi.org/10.1080/15710882.2014.888183
Spirn, A. W. (1984). Granite garden. Basic Books.
Stake, R. E. (1995). The art of case study research. Sage.
Szebeko, D., & Tan, L. (2010). Co-designing for society. Australasian Medical Journal, 3(9), 580–590. https://doi.org/10.4066/AMJ.2010.378
Tjallingii, S. (2015). Planning with water and traffic networks: Carrying structures of the urban landscape. Research in Urbanism Series, 3(1), 57–80. https://doi.org/10.7480/rius.3.832
Tyler, S., & Moench, M. (2012). A framework for urban climate resilience. Climate and Development, 4(4), 311–326. https://doi.org/10.1080/17565529.2012.745389
Van de Ven, F. H. M., Snep, R. P. H., Koole, S., Brolsma, R., Van der Brugge, R., Spijker, J., & Vergroesen, T. (2016). Adaptation planning support toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders. Environmental Science and Policy, 66, 427–436. https://doi.org/10.1016/j.envsci.2016.06.010
Waldheim, C. (2016). Landscape as urbanism: A general theory. Princeton University Press.
Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. P. (2004). Resilience, adaptability and transformability in social-ecological systems. Ecology and Society, 9(2). https://doi.org/10.5751/es-00650-090205
Webb, R., Bai, X., Smith, M. S., Costanza, R., Griggs, D., Moglia, M., Neuman, M., Newman, P., Newton, P., Norman, B., Ryan, C., Schandl, H., Steffen, W., Tapper, N., & Thomson, G. (2018). Sustainable urban systems: Co-design and framing for transformation. Ambio, 47(1), 57–77. https://doi.org/10.1007/s13280-017-0934-6
Yin, R. K. (1994). Case study research and applications: Design and methods (2nd ed.). SAGE.
Yönder, Ç., Hamarat, Y., Elsen, C. (2023). Matters of Knowledge in Co-Design and Their Methodological Implications. (Manuscript submitted for publication).

6 Conclusions

The introductory chapter of this research emphasised that responding to climate change through implementing resilient public spaces requires a collaborative approach to their design. The primary research question centred on **how a collaborative approach contributes to the urban design processes of resilient public spaces**. The studies focused on the practices and mechanisms of urban co-design processes, particularly in Chile. It views urban design not merely as the domain of one specialised discipline but as an open forum for stakeholders who may even lack formal training or experience in design practice. This poses various challenges because the success of a co-design process depends on how multiple actors and knowledge backgrounds nurture the design process over time. This research is situated in Chile, where fragmented institutions and shallow citizen participation exist. As illustrated in the introduction and the cases studied, collaborative approaches to urban design are still emergent and scarce in the Chilean context. Many are based solely on one disciplinary field or a single collaborative moment. This research studied some of Chile's most notable examples of design processes for resilient public spaces. This concluding chapter elucidates the main research contributions, offers guidelines for urban design practice, reflects on the research choices, and gives recommendations for further studies.

6.1 Research contributions

This research contributed to the theory and practice of co-designing resilient public spaces (Table 6.1). The main contributions are synthesised in two parts. First, section 6.1.1 defines the theoretical contributions to co-design and resilience theories. Section 6.1.2 defines the methodological contributions.

TOC

TABLE 6.1 Synthesis of research contributions.

	Co-design	Resilient Public Spaces
Theoretical contribution	Defining co-design processes through the Co-design Framework and recognising three actor arenas (*chapters 3 and 4*).	Operationalising the Evolutionary Resilience Framework and conceptualizing public spaces as Social-Ecological Systems (*chapters 2 and 5*).
Methodological contribution	Developing the Co-design Framework for analysing such processes and validating the Action Research through Design approach (*chapters 3 and 4*).	Developing the Evolutionary Resilience Framework for analysing co-design processes (*chapter 2*).

Section 6.1.1 explains the main theoretical contributions to resilience and co-design theories. Initially, co-design processes are conceptualised, and the Co-Design Framework is developed to revise and bridge conceptualisations of collaboration, the design cycle, and design processes. Subsequently, three co-design arenas are identified to engage in such processes with distinct aims. The Evolutionary Resilience Framework is then operationalised, and a flowchart is devised. Public spaces are then conceptualised as social-ecological systems, and finally, social-ecological knowledge systems in co-design processes are conceptualised. Ultimately, this research modestly contributes by operationalising co-design and bridging it with resilience theories.

The primary methodological contribution of this research is the Co-Design framework developed in chapters 3 and 4. In Chapter 3, the Co-Design framework proved valuable for analysing co-design processes in practice. Chapter 4 further extends the framework to plan, execute, and analyse a co-design process in practice. The Action Research through Design approach employed in Chapter 4 enriches our understanding of this recently coined methodology.

6.1.1 Contribution to Theory

Contribution to Co-Design Theory

Conceptualising co-design processes

Recent studies have suggested that there is a lack of theoretical clarification in co-design literature (Drain & Sanders, 2019; Nguyen, Q., 2022; Szebeko and Tan, 2010) and that further development of process-oriented conceptualisations of co-design is needed (Halskov & Hansen, 2015; Huybrechts et al., 2017; Koskela-Huotari et al., 2013; Manzini and Rizzo, 2011; Ávila-Garzón and Bacca-Acosta, 2024). This research draws on these studies' theoretical backgrounds and discusses their findings to contribute to the theoretical understanding of co-design literature.

A framework was developed based on the theoretical backgrounds of the studies. In developing the conceptual Co-Design framework (Chapter 3; Gaete-Cruz et al., 2022a), co-design processes were conceptually defined by breaking down the concepts of collaboration and design. Co-design was conceptualised as a cyclical process with levels of collaboration that actors achieve in specific design steps of such processes (Chapter 3). The subsequent study expanded the co-design cycle into the main design phases to conceptualise a linear process over time (Chapter 4; Gaete-Cruz et al., 2022b).

In the second study (Chapter 3), Arnstein's Ladder (Arnstein, 1969) was reinterpreted to define levels of collaboration. The ladder is often used to assess citizen participation in design (Andersen et al., 2015) but has been criticised as being too static to represent a continuum that adequately captures processes that evolve (Andersen et al., 2015; Bowen et al., 2013; Collins & Ison, 2009; Greenhalgh et al., 2019). Some levels of the ladder were disregarded, and others were included. Lower participation ladder levels were considered not part of collaborative processes, so they were omitted. Additionally, collaboration was considered superior to participation because the latter is partial, whereas the former is horizontal and long-lasting. The steps of the collaboration ladder were defined as information, consultation, participation, and collaboration.

Furthermore, the design steps were defined based on the basic design cycle proposed by scholars in the design field (Jonas, 2007; Roozenburg & Eekels, 1995; Zwart & de Vries, 2016). Four steps were categorised as cyclically repeated in design processes: search, analysis and synthesis, projection, and evaluation. Co-design was conceptualised through a framework that defines different design activities in which actors collaborate in cycles. Rather than a ladder or a cycle, the Co-design Framework defines a landscape in which co-design processes unfold.

In the subsequent study (Chapter 4), co-design was also conceptualised as a linear process, following the tradition in the design field that considers it both cyclical and linear (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). The conceptual framework was expanded into a timeline. According to design literature, the three main design phases are the conceptual, embodiment, and detailing (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). One design cycle was considered to occur in each one of the design phases.

The Co-Design Framework is one of the main theoretical contributions of this research. Bridging the participation ladder to the design steps is novel and more comprehensive than existing frameworks. The blocks defined within the framework are not prescriptive and depict possible co-design activities and methods that

can occur in practice. For example, a co-design workshop may be placed at the intersection of the collaborative and projection cells (more explanations in section 6.2.2). Maintaining the framework's flexibility is valuable for analysing existing processes and may be used to plan for further co-design processes. For example, the author held a workshop with professionals and experts in Santiago de Chile in 2023 (explanations in section 6.2.2) and has recently been used to study digital technologies in urban design processes in the European context (Slingerland et al., 2024). Although a Co-design framework linking collaboration and design is apparent, studies didn't exist before this research.

Recognising three interacting co-design actor arenas

The discussion of the findings from the second study (Chapter 3; Gaete-Cruz et al., 2022a) illuminates how the various actors involved in co-design processes group into co-design arenas. An arena is an analytical unit that conceptualises the arrangement between institutions (Ostrom, 2008) as social spaces where actors interact, exchange ideas, and make decisions (Björgvinsson et al., 2010). From the study, three co-design arenas were identified to pursue different objectives. Firstly, the strategic co-design arena aims to assess the feasibility and viability of projects. Next, the transdisciplinary co-design arena focuses on context specificity and integrating multiple aspects of projects. Lastly, the socio-cultural co-design arena aims to legitimise designs. These distinctions are conceptual and underscore the importance of fostering cross-feedback. The three arenas are considered interwoven throughout the co-design processes. Actors are not confined to specific arenas and may interact in more than one arena or shift between them during the processes. Efforts should be made to ensure their integration because isolating them can impede co-design processes.

In many instances, the transdisciplinary arena takes the lead, so its willingness, awareness, and availability to collaborate with others will largely determine the achievement of the main co-design objectives (feasibility, context specificity, legitimacy). The transdisciplinary co-design arena significantly influences problem definition and the provision of solutions. This arena fosters shared understandings and knowledge integration, further examined in Chapter 5. While co-design is often viewed as a linear process (Roozenburg & Eekels, 1995), conceptualising the three co-design arenas demonstrates that interactions among actors evolve. Co-design processes should progress up the co-design staircase, striving for higher levels of feasibility, context specificity, and legitimacy.

Contribution to Resilience Theory

Operationalising the Evolutionary Resilience Framework

Urban resilience is frequently employed to conceptualise the adaptability of cities and urban projects to crises (Meerow S, Stults M, 2016). Recently, institutional resilience has gained significance in the urban context (Davoudi, 2016). Consequently, resilience is pursued not only by physical cities but also by their institutional settings seeking preparedness. Due to the interdisciplinary nature of this theory, conceptual frameworks have been deemed crucial as overarching guides for collaboration (Biggs et al., 2021). However, scholars have noted conceptual pluralism among scientists (Colding & Barthel, 2019).

Evolutionary Resilience emerged to conceptualise the capacity of complex socio-ecological systems to adapt and transform in response to stresses (Carpenter et al., 2001). The Evolutionary Resilience Framework defines that in change processes, institutional systems' preparedness capacity could be understood through persistence, adaptation, and transformation (Davoudi et al., 2013). Persistence consists of resisting change; adaptability is the ability to absorb change and the flexibility to evolve; transformability considers innovation and the creation of new structures. These three mechanisms condition the preparedness of governing bodies as dependent components (Davoudi et al., 2016).

This research's first exploratory case study operationalised the Evolutionary Resilience Framework and proposed a flowchart to identify factors influencing co-design processes (Chapter 2; Gaete-Cruz et al., 2021). To do so, the three mechanisms were sequentially organised. Defining the sequence further clarified how evolutionary resilience occurred over time. The study evaluated the barriers and enablers to collaboration and design to persist, adapt, or transform. 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. Institutional preparation was further conceptualised by organising the three mechanisms in a sequence. This contributed to clarifying the gradual character of resilience and, thus, of co-design processes. Therefore, an overall availability to accept change and adapt is crucial in such design processes. The flowchart offers an additional understanding of the Evolutionary Resilience Framework that highlights human action and intention embedded within institutional systems.

Conceptualising public spaces as social-ecological systems

In Resilience studies, cities are often conceptualised as complex and changing social-ecological systems (SES) (Berkes, 2017; Biggs et al., 2021; Folke, 2006; Ostrom, 2009). SES are at the core of Resilience theory and are often described as functioning interdependently. They integrate social and ecological systems into an adaptive system with feedback and dynamics (Biggs et al., 2015; Folke et al., 2010) that constantly change in response to internal or external pressures (Davoudi et al., 2012).

In the last study (Chapter 5; Gaete-Cruz, 2023), public spaces are conceptualised as social-ecological systems, and their design processes are examined. This conceptualisation recognises that public spaces have social, ecological, and social-ecological components. According to SES theory, social components encompass socio-cultural, economic, political, and technological elements. Ecological components relate to biotic and abiotic elements such as biodiversity, nutrients, climate patterns, water, and soils. Social-ecological elements are particularly interesting as they bridge social and ecological interactions.

In discussing the study's findings, public spaces as SES were conceptualised in three dimensions: the physical, the dynamic, and the institutional. This approach to public space expands urban design's focus beyond spatial layouts to include their essential functions and institutions. The physical dimension of public spaces considers their urban and ecological elements. The dynamic dimension involves flows, activities, mobility, ecological flows, and biodiversity. The institutional dimension frames the involved actors with their rules and interactions. Urban SES should be conceptualised, analysed, and designed as interdependent social and ecological spaces, dynamics, and institutions.

Towards conceptualising knowledge integration in co-design

Resilience and co-design theories are interdisciplinary at their core. However, little attention is given to how different forms of knowledge are integrated to improve the outcomes of co-design processes (Szebeko & Tan, 2010; Bossen et al., 2016; Drain, 2019; Nguyen, Q., 2022). Most studies focus on the collaborative dynamics in co-design (Sanders, E., 2008; McDonnell, 2018; Saad-Sulonen et al., 2018). In the last study, knowledge integration was conceptualised and examined. Specifically, who contributed and integrated, what kinds of knowledge, and when did this happen? This issue was crucial for uncovering the mechanisms through which the transdisciplinary co-design arena contributed to the context-suitability of the design outcomes.

Starting with conceptualising public spaces as SES, social-ecological knowledge systems were recognised as integrated into public space co-design processes. In such processes, different forms of knowledge converge beyond the disciplines and actors involved. Diverse formal and informal knowledge, empirical knowledge (Gibbs et al., 2018), local knowledge (D'Hont & Slinger, 2022), implicit knowledge (Sanders, 2002), and perceptions (Ducci et al., 2023) from practices and experiences, as well as values and aims, intersect (Gaete Cruz et al., 2022b). Indigenous, local, and citizen expertise knowledge forms can complement traditional academic disciplines (Biggs et al., 2021). Under the SES conceptualisation, humans are integrated into nature, emphasising their interconnectedness and reciprocal feedback (Folke et al., 2016). Human and ecological systems are understood as interdependent, inseparable, and intertwined.

An analytical framework was developed to map different forms of knowledge over time (Chapter 5; Gaete-Cruz, 2023). This contributed to conceptualising public space co-design as a social-ecological knowledge integration process where multiple forms of knowledge (social, ecological, and social-ecological) are integrated throughout the design phases (conceptual, preliminary, and detailing). Stakeholders, design teams, experts, and citizens contribute to and integrate knowledge in the co-design processes. Knowledge is often collected, and then integration occurs in the analysis and ideation design steps. This study advances the conceptualisation of knowledge integration in co-design processes.

6.1.2 Methodological Contributions

Using the Co-Design Framework for studying co-design processes and methods

Many co-design scholars have highlighted the need for conceptual clarification in studying and applying co-design methods (Nguyen, Q., 2022; Ávila-Garzón and Bacca-Acosta, 2024). While processes in practice combine multiple methods, most studies focus on the one-time use of such methods (Carpenter et al., 2021; Sanders & Stappers, 2014). Little importance is given to how early or late in the process they are used and, consequently, how influential they are on the design outcomes.

Conceptualising co-design processes through the Co-Design Framework (Chapter 3; Gaete-Cruz et al., 2022a) envisions various uses of methods and diverse activities throughout such processes. The conceptualisation of co-design processes clarifies

TOC

the design objectives of the co-design activities and allows for a more comprehensive classification of the co-design methods used. These activities include searching for information and knowledge, analysing and prioritising knowledge, information, and design strategies, ideating design options, evaluating the options, and defining the subsequent steps.

Particularly in the third study (Chapter 4; Gaete-Cruz et al., 2022b), Visual Collaborative Methods (VCMs) used in a co-design process undertaken in practice were mapped and analysed. The Co-Design framework conceptualises interactions and clarifies co-design processes (Szebeko & Tan, 2010). In the findings, the notion of trajectories was introduced. This way, processes can be analysed according to their levels of collaboration throughout the different phases. Processes can be very collaborative initially and drastically drop over time or remain collaborative and participative until the end. This may show the influence of the co-design activities on the projects being designed. The main design strategies will likely be robust if collaboration is present in the early phases and remains throughout the process.

Moreover, shallow decisions will be made collectively if collaboration occurs towards the end. An example is the selection of the colours of urban furniture. Even though actions like these are often used as collaborative expressions, the relevance of their outcomes is not high. Moreover, defining colours can hardly be called a design action; thus, it can hardly be called a co-designed public space. Furthermore, if crucial design strategies are changed in the later design phases, conflicts will likely arise, and either costs will increase, or time extensions will occur.

Additionally, the methodological contribution of the Co-Design Framework also lies in its use not only for analysing co-design processes but also for planning them. In Chapter 3, the framework is developed to analyse three co-design processes from practice. In Chapter 4, the framework is used to plan for a co-design process in practice and then expanded to study the use of visual collaborative methods retrospectively. These studies found the Co-Design framework helpful as a lens or matrix for analysing co-design processes. Consequently, it was recently used by a team of scholars from The Netherlands, Switzerland, and Austria to study European urban design processes (Slingerland et al., 2024). The study of different cases allowed the identification of similarities and differences and findings that were context-specific and generalisable. Furthermore, a study on the last three decades of co-design studies reported that the Co-Design Framework developed notably contributed to establishing the steps and levels of collaboration in such processes and was a notable contribution to theory since most co-design studies do not report on the processes' methods, steps, and phases (Ávila-Garzón & Bacca-Acosta, 2024).

Validation of the Action Research through Design Approach

An Action Research through Design (ARtD) approach was adopted to plan, execute, and analyse co-design processes in practice. From a research standpoint, a collaborative approach is not novel, and many interdisciplinary research studies involve multiple actors (Shirk et al., 2012; Gibbs et al., 2018). The novelty of the ARtD approach lies in its potential to generate knowledge from practice through active engagement (Van Stijn et al., 2021) by intervening in problem definition and generating solutions (Buchanan, 1992). The ARtD approach has been developed to merge action research with research through design methods (Van Stijn et al., 2021). In action research, knowledge is acquired through stakeholders' participation in open-ended processes with flexible objectives (Baum et al., 2006). Research through design supports inquiry through reflections while generating new designs (Cross, 2001; Frankel & Racine, 2010; Jonas, 2007; Roggema, 2016). These two approaches pursue different objectives and originate from different disciplinary contexts. Although other models exist for guiding research through co-designing (Busciantella-Ricci & Scataglini, 2024), the ARtD is considered suitable for addressing co-design-oriented research in practice since it allows for three operational levels: planning the co-design processes, executing the design processes to produce the design outcome, and finally, reflecting on such endeavours.

Our study methodically strengthens the recently coined ARtD approach (Van Stijn et al., 2021). It provides an additional application of the method in a different context, such as public space design. The researcher has undertaken close to the academic Van Stijn, so its application is based on its publications and academic conversations. The relevance of the ARtD approach builds in the social sciences and design trajectories and provides space for new collaborative design approaches in research contexts (Busciantella-Ricci & Scataglini, 2024). The ARtD approach conceptualises a phenomenon occurring in academic contexts where design is used as a research method by involving actors from practice (Gaete-Cruz & Hamida, 2025).

Developing the Evolutionary Resilience Framework (flowchart) for analysing co-design processes

Despite the extensive tradition of resilience and its relevance to cities and human settlements, there is, to date, a need to clarify urban resilience, particularly public space resilience (Meerow & Stults, 2016). Resilience is not only relevant to cities but also to their institutional systems (Ostrom, 2007). Resilience is particularly relevant to urban design processes (Davoudi, 2012); however, it is rarely emphasised as such. In its studies, Davoudi (2012) coined Evolutionary Resilience as a process of change

TOC

in which institutions become prepared through the mechanisms of persistence, adaptability, and transformability. However, the framework was not readily applicable to urban processes in practice. In the first study (chapter 2; Gaete-Cruz et al., 2021), the Evolutionary Resilience framework was operationalised as a flowchart to study the barriers and enablers of co-design processes from practice. Doing so emphasised the relevance of flexibility in such processes and explained how barriers persisted, were adapted, or transformed.

6.2 Guidelines for a Collaborative Urban Design Practice

The primary contributions of this research have been translated into guidelines for urban design practice. These directives are pertinent to urban designers and other decision-makers involved in the design processes of resilient public spaces. They encompass architects, engineers, landscape architects, public and private sector professionals, NGOs, and other non-professionals and citizens from local communities. They are applicable in planning, executing, and evaluating public space co-design processes.

The guidelines outlined in this section are primarily directed at collaborative urban designers in their crucial role throughout co-design processes. The conventional role of urban design encounters challenges in co-design settings addressing complex problems. Its function extends beyond technical aspects to encompass strategic considerations. Design serves not only to identify appropriate solutions but also to achieve consensus. This paradigm shift in urban design underscores the necessity for collaborative urban designers, whose roles may vary across the spectrum of leading and facilitating co-design processes. The guidelines presented herein are valuable for all practitioners in the urban field, especially, collaborative urban designers.

These practice guidelines encompass the enabling and crucial factors and the framework as an actionable canvas for practice. Section 6.2.1 specifies three conditions necessary to enable and facilitate co-design processes in practice and delineates the critical elements in resilient public space co-design processes. Section 6.2.2 elaborates on using the Co-design framework as a canvas for

co-design processes in practice and an actionable protocol for utilising it in a workshop format.

6.2.1 Facilitating a Collaborative Urban Design Practice

The studies revealed three crucial enablers and essential elements to consider when planning, undertaking, and evaluating co-design processes. Three conditions were deemed relevant in three of the four studies, highlighting the crucial role that collaborative urban designers can have in fostering a collaborative approach to urban design processes. Also, collaborative urban designers should focus on carefully managing actor arenas, methods, and social-ecological knowledge. This section provides guidelines for their selection, use, and integration accordingly. These elements are essential for planning, executing, and assessing co-design processes in practice.

Conditions for facilitating Co-design: Awareness, Willingness, and overall Flexibility.

Collaborative designers must demonstrate openness to collaboration with actors from diverse sectors and with varying knowledge backgrounds. Setting themselves apart from others, collaborative urban designers should be willing to collaborate and aware of diverse approaches and backgrounds. They must adeptly apply design thinking skills to navigate potentially conflicting contexts amongst institutions, teamwork, and societal actors. As networkers, collaborative urban designers are open to involving others in design processes and adaptable to accommodate their contributions. This section sheds light on their desirable attitudes in their collaborative role.

The studies highlighted the importance of continuously fostering awareness and willingness to collaborate among the involved actors. This aspect was predominantly addressed in Chapter 3. Awareness and willingness were crucial from designers, other experts, stakeholders, and societal actors. Awareness encompassed the understanding and knowledge about the collaborative approach to design. Design leaders had to ensure that participants in the processes were aware of the co-design approach being undertaken.

TOC

Moreover, beyond awareness, willingness was imperative. For such an approach to be viable, actors must be inclined and prepared to collaborate in design. Given the novelty of the co-design phenomenon, awareness and willingness were deemed indispensable, particularly in non-participative and silo-based contexts, such as the one studied in Chile.

A recurring condition for co-design was identified as flexibility. Collaboration was constrained without it, limiting the aims, and adversely affecting the designed projects. Chapters 2, 3, and 4 underscored the significance of flexibility in enabling collaboration throughout design processes, even within constrained, non-participatory, and silo-based institutional settings. Chapter 2 specifically delved into this aspect, elucidating how contextual enablers and barriers to collaboration and design were addressed in the cases examined. The studies revealed that flexibility varied across institutional settings, existing as a pre-existing condition, shared among some actors, or developed throughout the processes. Addressing process barriers with flexibility facilitated co-design, with institutional and organisational efforts observed in promoting and sustaining collaboration in design.

In conclusion, co-design processes demand flexibility, but they have drawbacks. Co-design is less linear than conventional design processes, resulting in more time-consuming and expensive endeavours. The challenge of involving more actors and methods in leadership, management, and facilitation is significant yet essential. Nonetheless, significant democratic and inclusive benefits can be realised through co-design processes. They can lead to more context-specific public spaces, foster the creation of more legitimate and empowering spaces, and ultimately facilitate the implementation of more feasible projects.

The research posits that public space projects should be co-designed with the involvement of multiple actors, design teams, experts, stakeholders, and community organisations. It also demonstrates that such design processes should be treated as projects themselves. Public space projects must be co-designed, and co-design processes can be collaboratively designed. This represents a paradigm shift for designers and practitioners conducting public space design processes in practice.

Selecting actors to interact within three co-design arenas.

Co-design processes can involve actors from various sectors and knowledge backgrounds. The cases studied often involved citizens, the third sector, other organisations, and the public and private sectors. However, it became evident that the sectors and their objectives and contributions to the processes were crucial.

Three co-design arenas were delineated by examining the interacting actors within co-design processes. An arena is an analytical unit for scrutinising concurrent institutional arrangements (Ostrom, 2007) as social spaces where participants engage and make decisions (Björgvinsson, Ehn, & Hillgren, 2010). These arenas were classified based on their respective objectives. The strategic, transdisciplinary, and socio-cultural arenas pursued the aims of feasibility, context-specificity, and legitimacy, respectively.

The strategic co-design arena contributed to the project's economic, regulatory, and political feasibility. The transdisciplinary co-design arena enhanced the context-specificity and local suitability of the projects through knowledge integration. The socio-cultural co-design arena bolstered the legitimacy of the projects and empowered actors in subsequent co-production phases. Identifying these arenas is valuable for clarifying the varied contributions of co-design. Collaboration in design influences the quality, feasibility, and legitimacy of projects. Recognising these arenas underscores the importance of fostering collaboration across all three domains. Neglecting to do so has proven detrimental to the objectives pursued through such processes.

Acknowledging the interaction of three co-design arenas may clarify that a co-design approach enhances the quality of public spaces and their feasibility and legitimacy. In essence, awareness of the arenas can aid in identifying and involving crucial actors as knowledge providers, thereby enabling, and legitimising their involvement. Early engagement of decision-makers in the process and its development can ensure feasibility. Furthermore, the participation of those involved in the use and operation of public spaces can legitimise public space projects. Acknowledging the three co-design arenas elucidates how to engage different actors based on their distinct objectives. It also raises awareness of the evolving nature of co-design processes, wherein actors may shift or combine multiple objectives.

Using Co-design methods in practice

Collaborative practitioners should understand that a co-design workshop is not a complete process. Co-design is a long-term endeavour; a workshop can only be genuinely collaborative during an ongoing process. Emphasising the process is essential for comprehending how the use of one method influences and builds upon the preceding one. As argued by Ávila-Garzón and Bacca-Acosta (2024), it is imperative to delineate concrete steps and methods for co-design. The Co-design framework offers a means to define these steps and methods for practical implementation.

In the third study, various Visual Collaborative Methods were categorised within the co-design framework, each serving specific objectives (see Figure 6.1). These co-design methods are not merely theoretical constructs but are applied throughout the design process, fostering stakeholder collaboration. As an example, collaborating amongst actors in the analysis and synthesis step may set the basis for the project to be designed. The conceptualisation may empower practitioners by illustrating how co-design methods can be utilised to achieve specific aims in their co-design processes.

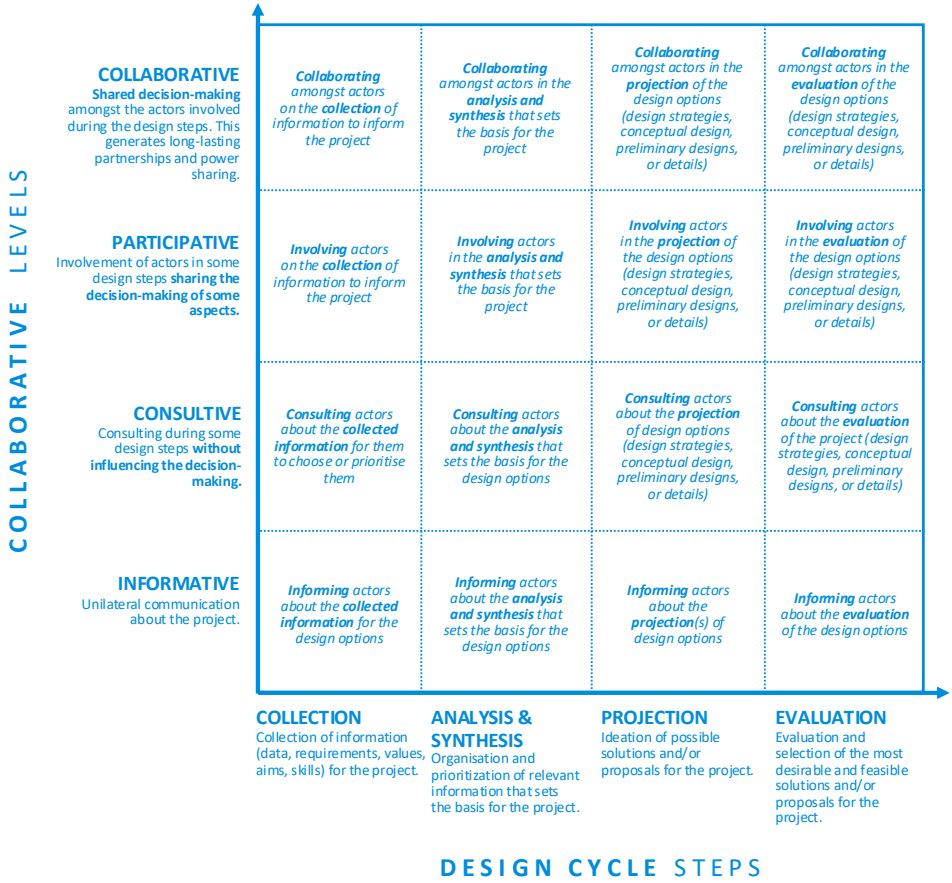

FIG. 6.1 The main objectives of co-design methods classified in the Co-design Framework.

TOC

The uses of co-design methods vary depending on the design steps in which they are employed. During the data collection, analysis, and ideation steps, these methods facilitate knowledge sharing among stakeholders. The analysis and synthesis phase becomes pivotal for integrating this knowledge. Stakeholders and design teams must adopt collaborative approaches to reach a consensus and combine disciplinary design strategies to design resilient public spaces.

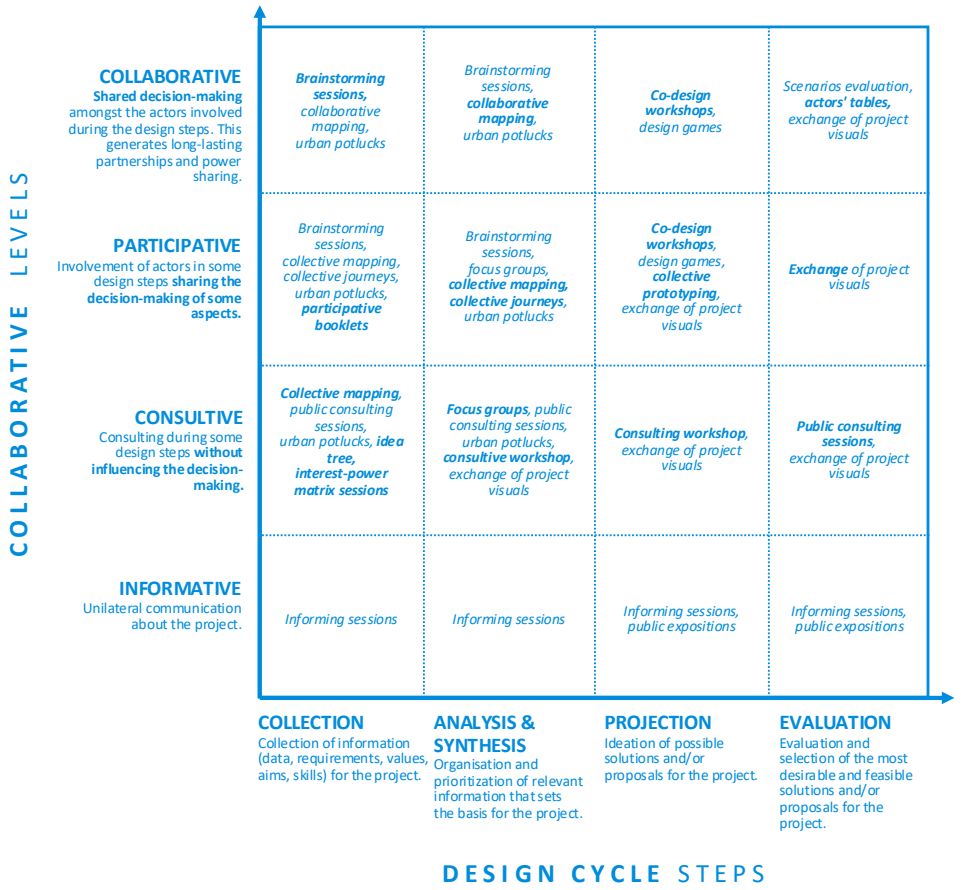

FIG. 6.2 Co-design methods classified in the Co-design Framework.

TOC

Visual Collaborative Methods, as examined in Chapter 4, serve different purposes across the design phases. In the conceptual phase, they aid in knowledge acquisition and fostering shared understanding. During the embodiment phase, they assist in analysing and evaluating alternative solutions. Finally, in the detailing phase, they integrate the technical expertise of involved stakeholders. In Figure 6.2, diverse co-design methods are classified in the framework as examples for practice. These methods are examples collected from the different cases studied (chapters 3 and 4) and the framework's application as a canvas in a co-design workshop (further explained in section 6.2.2). Subsequent sections will elaborate on the nuances of knowledge integration during the co-design processes of resilient public spaces.

Integrating Social and Ecological Knowledge

From the studies, it became evident that the implications of co-design extended beyond collaborative interactions among actors. They contributed their knowledge and sometimes integrated it into the designs. Actors shared their knowledge, values, and aims in their respective arenas toward context-specific and integrated solutions. In the transdisciplinary co-design arena, knowledge integration was crucial. There, actors brought their expertise, collaborated in its analysis, and participated in ideating the projects. This highlighted the significant role of actors in influencing the designed projects.

To design resilient public spaces, it is imperative to integrate social and ecological knowledge. Fostering social-ecological expertise can enhance resilience, promoting nature-based solutions and other innovative approaches, especially in contexts where innovation is rare. Involving actors from social and ecological knowledge backgrounds in co-design processes is essential. Various visual and non-visual methods can facilitate communication among participants with diverse backgrounds. Recognising the importance of social-ecological knowledge is critical for defining and preparing Visual Collaborative Methods, guiding the collection, analysis, and integration of knowledge into the designed projects. This opens possibilities for future practices to influence the design of public spaces.

Furthermore, conceptualising public spaces as social-ecological systems that unfold spatially, dynamically, and institutionally provides insights into their design practice. Increased awareness of their unpredictable functions and flows may lead to the design of more resilient spaces characterised by flexibility and adaptability to future changes. Collaborative urban designers should identify persistent social-ecological elements while ensuring others remain adaptive and transformable to meet evolving needs.

6.2.2 The Co-design Framework as a canvas for a Collaborative Urban Design practice

The Co-Design framework was developed across the studies, combining collaboration levels and design steps. The Framework, developed in an academic context (Chapters 3 and 4), is translated into an actionable canvas for practice. This section explains how it can be used by those planning co-design processes and as a roadmap for urban designers in practice.

The Co-design Framework was developed, integrating collaboration levels and design steps throughout the co-design process. It connects collaboration levels on the Y-axis and design steps across the design phases on the X-axis. Figure 6.3 illustrates the framework defining four collaboration levels. The top two levels represent forms of collaboration: participation involves partial involvement, while collaboration signifies a higher and more enduring form of shared space. The lower levels are regarded as foundational blocks for collaboration. Design steps characterise the primary objectives aimed at specific activities or co-design methods. The landscape of the co-design process can encompass various elements, including actors, arenas, and methods.

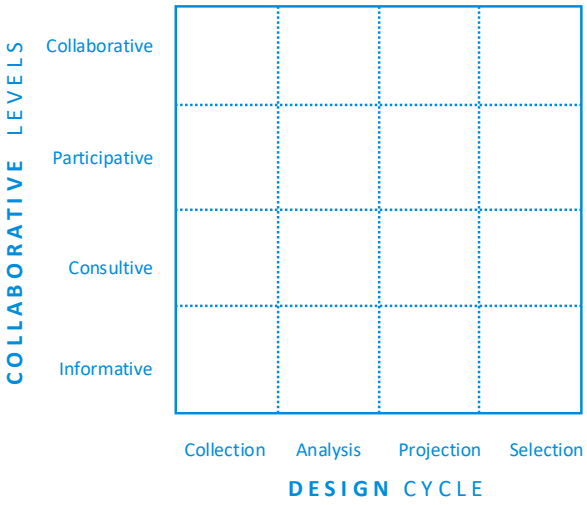

FIG. 6.3 Canvas for Co-Design based on the Co-Design Framework developed.

TOC

Figure 6.4 depicts the expanded framework, incorporating three primary design phases. It delineates the scope of analysis and broadens the typical focus in the initial design phases. The framework's significance lies in its capacity to structure activities and methods based on the level of collaboration aimed at different design steps throughout a co-design process. This is crucial for planning and understanding such processes.

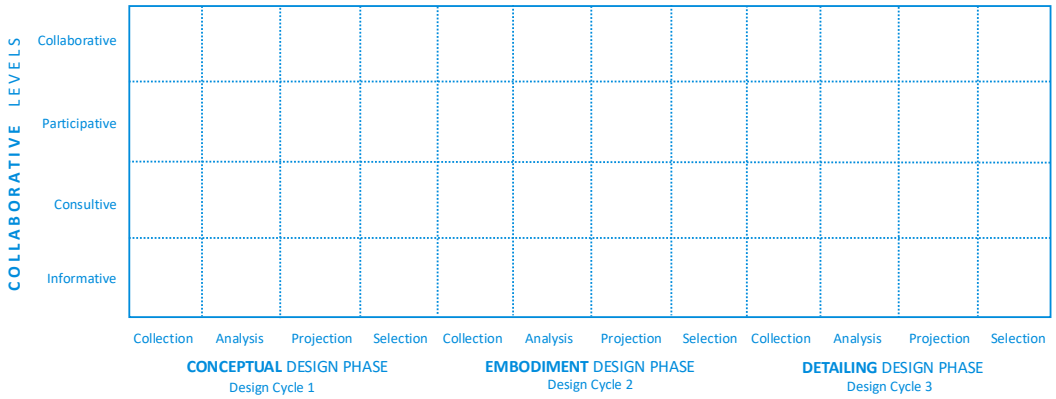

FIG. 6.4 Co-Design Process canvas developed based on the Co-Design Process Framework.

Urban designers can apply the Co-design Framework in practice in three ways: as a protocol for planning co-design processes, as a guide when conducting a co-design process, and as a framework for evaluating a process. It can guide determining which activities and methods to employ at a particular stage of a process within a specific context. Chapter 4 demonstrates this through the Action Research through Design approach. Furthermore, section 6.2.4 elucidates its utility as a canvas for a co-design workshop.

Collaborative urban designers are responsible for designing projects and their accompanying design processes. Public spaces must be co-designed, and so should their co-design processes. This represents a significant paradigm shift for collaborative designers who lead and facilitate co-design processes in practice. The following section presents an actionable protocol for planning the co-design process involving various actors in a workshop format.

An actionable protocol for designing Co-Design Processes in a Workshop

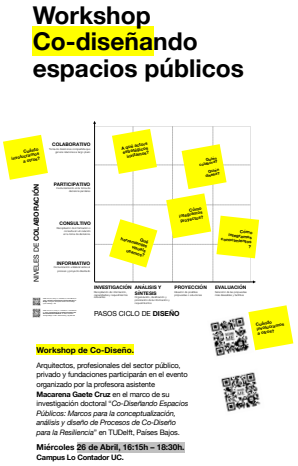

FIG. 6.5 Image and poster of the workshop.

In a workshop format, the Co-design Framework was tested by experts and professionals in Chile to co-design a hypothetical resilient public space along the Mapocho River in Santiago (see Figure 6.5). The workshop occurred on Wednesday, April 26th, 2023, from 16:30hrs to 19:00hrs at Campus Lo Contador, *Pontificia Universidad Católica de Chile*.

TOC

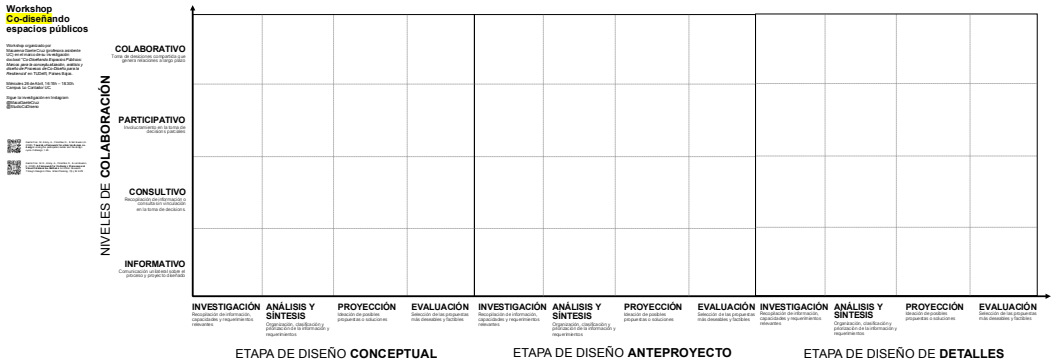

FIG. 6.6 Canvas used for the workshop based on the Co-design Framework.

The author facilitated the event, drawing from her prior workshop experiences with master students at the same university in 2022 as part of the Landscape Architectural Design Master Program. This section delineates the protocol and briefly reflects on the event. Figure 6.6 was utilised in the workshop organised involving expert and professional participants in the urban design field in Chile.

A workshop protocol for (Co)designing public space co-design processes

The workshop followed the diagnosis, planning, facilitation, and analysis phases (Storvang et al., 2018), resulting in a canvas based on the Co-Design Framework. Experts and professionals used this canvas to explore and design a co-design process for a hypothetical resilient public space in Santiago. They filled in information with post-its on printed canvases as analytical and ideational tools (see Figure 6.7).

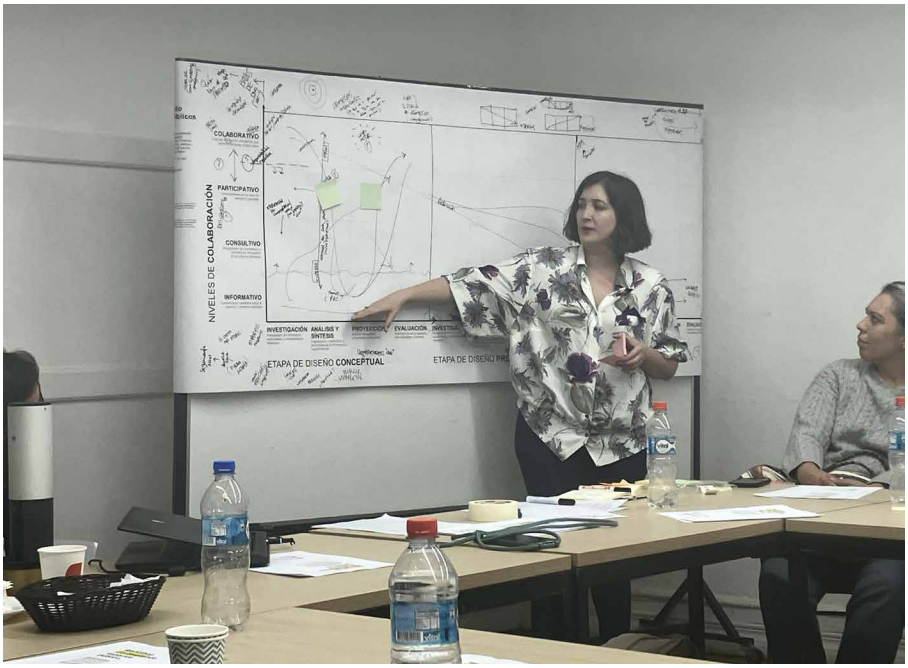

FIG. 6.7 Canvas used during the workshop.

The agenda was structured to guide participants through one design cycle, with the session segmented into sensitising, analysis and synthesis, and ideation phases. These steps enabled participants to contribute their knowledge and experiences to co-design, collaboratively designing a hypothetical co-design process for a specified project.

Sensitisation of the participants was conducted in the initial step, where the facilitator contextualised the workshop within the broader research project, introduced the co-design approach, and presented the hypothetical case of a resilient public space. This phase also included sharing previous experiences, presenting canvases, and conducting a brief stakeholder analysis. In the subsequent analysis and synthesis step, co-design experiences were gathered from the participants and mapped onto the canvas. Finally, the ideation phase allowed participants to design the hypothetical co-design process, concluding with a reflective discussion among the participants.

Using the framework as a canvas for practice

As elucidated earlier, the Co-design Framework conceptualises the co-design phenomenon, serving as a framework “for” and “of” co-design. It can be used as a canvas to map activities and co-design methods throughout a process, classifying them based on their respective co-design steps (research, analysis, ideation, selection) and phases (conceptual, embodiment, detailing).

These canvases are designed to support practitioners and individuals from various backgrounds and sectors, serving as visual aids to enhance communication and interactions (Kirkpatrick & Kirkpatrick, 2006) and as generative tools (Sanders & Stappers, 2016). In co-design processes, such canvases serve as visual collaborative methods, designed to be simple and efficiently utilised with everyday office supplies such as pens and Post-it notes. The objective is to disseminate academic knowledge to society by enhancing transferability and improving its impact. By visualising decision implications, these canvases aid decision-making processes and strategic negotiations within teams.

6.3 Reflections on research choices and recommendations for further research

6.3.1 Reflections on Research Choices

Two methodological approaches were employed to analyse the same phenomena, enhancing the validity and consistency of this research. Although the three co-design processes studied shared some similarities, their differences provided enriching insights into the different actors and knowledge fields involved.

A significant contribution of this research was the application of the Co-Design Framework both for analysing and designing co-design processes. Conducting a co-design process within the framework of Action Research through Design enriched this research, aligning with the views of scholars (Busciantella-Ricci & Scataglini, 2024) who argue that such a collaborative approach in design processes promotes diversity and facilitates knowledge production for research purposes.

Conducting different case studies to analyse the same three co-design processes with distinct conceptual frameworks adds depth to this research. The Kaukari Urban Park, the Antofagasta Seaside Park, and the Sea-hill Pathways were analyzed in chapters 2, 3, and 5, focusing on different units of analysis: enablers and barriers, co-design activities, and knowledge backgrounds integrated. The deliberate choice to analyse cases using different conceptual approaches contributes to understanding the contemporary phenomenon of co-designing resilient public spaces.

Focusing on the Chilean context was partly due to circumstantial factors such as the pandemic. However, it also provided an opportunity to study a geographical and institutional setting familiar to the researcher through both practical experience and academic studies before this research. The unique setting of the Atacama Desert added richness to the study, and efforts were made to ensure that the findings were both generalisable and context-specific. The discussion of the findings aims to contribute not only to theories but also to local contexts.

6.3.2 Recommendations for Further Research

Recommendations to further expand and validate the findings

Recommendations for further research to expand and validate the findings may include testing the Co-Design Framework for analysing additional cases from practice within new fields of application, such as service design, placemaking design, and even other disciplinary fields, using the framework to design co-design processes, and further testing and developing the Action Research through Design approach.

First, testing the Co-Design Framework for analysing additional cases from practice using case study approaches would continue to validate the framework and offer insights on how it could be expanded or modified. The collaborative levels, the design steps, and the phases established are subject to change or additional ones to be added as the phenomenon of urban co-design itself evolves. As an example, a recent study used the analytical Co-Design Framework developed in Chapter 3 (Gaete-Cruz et al., 2022) to study digital technologies in urban design processes in the European context (Slingerland et al., 2024). It expanded the framework, suggesting that a higher level of collaboration was missing, and defined it as “self-determined” (Slingerland et al., 2024, p.273). Using the Co-Design Framework outside the Chilean context shed light on its generalizability and applicability in other contexts. Further using it to compare other urban design processes in different settings or timeframes may further expand it to suit the evolving character of urban co-design.

TOC

Then, the Co-Design Framework could be used to compare cases in a different design disciplinary field. The framework was developed for the urban design field. Still, given its design-oriented approach, it may also apply to other design fields where collaboration is a valid and desirable approach. Its use to study other design processes, such as service design, placemaking design, and even other design fields, such as industrial design, would validate its applicability and eventually provide disciplinary variants of the Co-Design Framework. Such variants would contribute to the robustness of the framework, the definition of its disciplinary aspects, and those of its core design ones.

Finally, the Co-Design framework could be used to plan and implement a design process using an Action Research through Design approach in academic-practice settings. As such, its use as a planning and route-map tool would validate its usefulness as a practical tool. The framework could be incorporated into manuals and practice literature to reach practitioners and decision-makers outside academia.

Recommendations for subsequent research streaming

This research explores the mechanisms with which a collaborative approach to urban design can occur in contexts where actors from multiple sectors and backgrounds may have a say. Chapter 4 explored visual collaborative methods, and Chapter 5 the forms of knowledge integrated into the urban design processes studied. A consecutive study could focus on the mechanisms with which different forms of knowledge are integrated and prioritised in design processes. Knowledge forms may include concepts, strategies, contextual features, and solutions. Knowledge integration mechanisms may occur in the analysis and synthesis design step, as well as the ideation and projection steps. Studying the mechanisms with which knowledge is integrated into design processes would interest urban design and other design disciplines. It would be especially relevant to disentangle the diverse forms of knowledge, the mechanisms with which they are integrated, and the collaborative design methods to support them.

Moreover, assessing the resilience of different public spaces would enhance co-design processes and contribute to understanding the outcomes of knowledge integration. According to existing literature, the resilience of public spaces could be assessed at different levels. This could include developing a resilience assessment framework for public spaces or urban design projects. This would aid in analysing diverse cases within academia and inform their design in practice.

References

Andersen, L. B., Danholt, P., Halskov, K., Hansen, N. B., & Lauritsen, P. (2015). Participation as a matter of concern in participatory design. CoDesign, 11(3-4), 250-261.

Arnstein, S. R. (1969). A ladder of citizen participation. Journal of the American Institute of planners, 35(4), 216-224.

Avila-Garzon, C., & Bacca-Acosta, J. (2024). Thirty Years of Research and Methodologies in Value Co-Creation and Co-Design. Sustainability, 16(6), 2360.

Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. Journal of epidemiology and community health, 60(10), 854.

Berkes, F. (2017). Environmental governance for the anthropocene? Social-ecological systems, resilience, and collaborative learning. Sustainability, 9(7), 1232.

Biggs, E. M., Bruce, E., Boruff, B., Duncan, J. M., Horsley, J., Pauli, N., ... & Imanari, Y. (2015). Sustainable development and the water–energy–food nexus: A perspective on livelihoods. Environmental Science & Policy, 54, 389-397.

Biggs, R., De Vos, A., Preiser, R., Clements, H., Maciejewski, K., & Schlüter, M. (2021). The Routledge handbook of research methods for social-ecological systems (p. 526). Taylor & Francis.

Björgvinsson, E., Ehn, P., & Hillgren, P. A. (2010). Participatory design and" democratizing innovation". In Proceedings of the 11th Biennial participatory design conference (pp. 41-50).

Bossen, C., Dindler, C., & Iversen, O. S. (2016). Evaluation in participatory design: a literature survey. In Proceedings of the 14th Participatory Design Conference: Full papers-Volume 1 (pp. 151-160).

Bowen, S., McSeveny, K., Lockley, E., Wolstenholme, D., Cobb, M., & Dearden, A. (2013). How was it for you? Experiences of participatory design in the UK health service. CoDesign, 9(4), 230-246.

Buchanan, R. (1992). Wicked problems in design thinking. Design issues, 8(2), 5-21.

Busciantella-Ricci, D., & Scataglini, S. (2024). Research through co-design. Design Science, 10, e3.

Carpenter, S. R., B. H. Walker, J. M. Anderies, and N. Abel. (2001). From metaphor to measurement: resilience of what to what? Ecosystems 4:765–781.

Carpenter, A., Council, D., & Burnett, J. (2021). Understanding how community resilience can inform community development in the era of COVID. In COVID-19: Systemic Risk and Resilience (pp. 345-357). Cham: Springer International Publishing.

Colding, J., & Barthel, S. (2019). Exploring the social-ecological systems discourse 20 years later. Ecology and Society, 24(1).

Collins, K., & Ison, R. (2009). Jumping off Arnstein's ladder: social learning as a new policy paradigm for climate change adaptation. Environmental policy and governance, 19(6), 358-373.

Cross, N. (2001). Design cognition: Results from protocol and other empirical studies of design activity. Design knowing and learning: Cognition in design education, 79-103.

Cross, N., & Roozenburg, N. (1992). Modelling the design process in engineering and in architecture. Journal of Engineering design, 3(4), 325-337.

Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., ... & Davoudi, S. (2012). Resilience: a bridging concept or a dead end?"Reframing" resilience: challenges for planning theory and practice interacting traps: resilience assessment of a pasture management system in Northern Afghanistan urban resilience: what does it mean in planning practice? Resilience as a useful concept for climate change adaptation? The politics of resilience for planning: a cautionary note: edited by Simin Davoudi and Libby Porter. Planning theory & practice, 13(2), 299-333.

Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary resilience and strategies for climate adaptation. Planning Practice & Research, 28(3), 307-322.

Davoudi, S., Zaucha, J., & Brooks, E. (2016). Evolutionary resilience and complex lagoon systems. Integrated Environmental Assessment and Management, 12(4), 711-718.

d'Hont, F. M., & Slinger, J. H. (2022). Including local knowledge in coastal policy innovation: comparing three Dutch case studies. Local Environment, 27(7), 897-914.

Drain, A., & Sanders, E. B. N. (2019). A collaboration system model for planning and evaluating participatory design projects. International Journal of Design, 13(3), 39-52.

Ducci, M., Janssen, R., Burgers, G. J., & Rotondo, F. (2023). Co-design workshops for cultural landscape planning. Landscape Research, 48(7), 900-916.

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. Global environmental change, 16(3), 253-267.
Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: integrating resilience, adaptability and transformability. Ecology and society, 15(4).
Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. Ecology and Society, 21(3).
Frankel, L., & Racine, M. (2010). The complex field of research: For design, through design, and about design.
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: Exploring cross-scale dynamics (pp. 105–125). Springer.
Gaete Cruz, M., Ersoy, A., Czischke, D., & Van Bueren, E. (2022a). Towards a framework for urban landscape co-design: Linking the participation ladder and the design cycle. CoDesign, 19(3), 233-252.
Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022b). A framework for co-design processes and visual collaborative methods: An Action Research through Design in Chile. Urban Planning, 7(3), 363-378.
Gaete Cruz, M. (2023). Social-Ecological Knowledge Integration in Co-Design Processes: Lessons From Two Resilient Urban Parks in Chile. Urban Planning, 8(2), 359-373.
Gaete Cruz, M. & Hamida, M. (2025). Participatory Action Research through Design: A conceptualisation bridging the gap between three interrelated concepts. Exploring Research Through Co-Design: Multiple Perspectives for Collaborative Inquiry", Human Factors and Ergonomics Book Series, Taylor & Francis.
Gibbs, P., Neuhauser, L., & Fam, D. (2018). Introduction–the art of collaborative research and collective learning: Transdisciplinary theory, practice and education. Transdisciplinary Theory, Practice and Education: The Art of Collaborative Research and Collective Learning, 3-9.
Greenhalgh, T., Hinton, L., Finlay, T., Macfarlane, A., Fahy, N., Clyde, B., & Chant, A. (2019). Frameworks for supporting patient and public involvement in research: systematic review and co-design pilot. Health expectations, 22(4), 785-801.
Halskov, K., & Hansen, N. B. (2015). The diversity of participatory design research practice at PDC 2002–2012. International Journal of Human-Computer Studies, 74, 81-92.
Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory design, co-design and the public realm. CoDesign, 13(3), 148-159.
Jonas, W. (2007). Research through DESIGN through research: A cybernetic model of designing design foundations. Kybernetes, 36(9/10), 1362-1380.
Kirkpatrick, D., & Kirkpatrick, J. (2006). Evaluating training programs: The four levels. Berrett-Koehler Publishers.
Koskela-Huotari, K., Friedrich, P., & Isomursu, M. (2013, June). Jungle of “co”. In Proceedings of the Naples Forum on Service (pp. 18-21).
Manzini, E., & Rizzo, F. (2011). Small projects/large changes: Participatory design as an open participated process. CoDesign, 7(3-4), 199-215.
McDonnell, J. (2017). Design Roulette: A close examination of collaborative decision making in design from the perspective of framing. In Analysing Design Thinking: Studies of Cross-Cultural Co-Creation (pp. 373-388). CRC Press.
Meerow, S., & Stults, M. (2016). Comparing conceptualizations of urban climate resilience in theory and practice. Sustainability, 8(7), 701.
Nguyen, Q. (2022, August). Evaluation in Participatory Design–The Whys and the Nots. In Proceedings of the Participatory Design Conference 2022-Volume 2 (pp. 161-166).
Ostrom, E. (2008). Developing a method for analyzing institutional change. In Alternative institutional structures (pp. 66-94). Routledge.
Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. Science, 325(5939), 419-422.
Roggema, R. (2016). Research by design: Proposition for a methodological approach. Urban science, 1(1), 2.
Roozenburg, N. F. M. (1995). Product Design Fundamentals and Methods. John Willy & Sons.
Saad-Sulonen, J., Eriksson, E., Halskov, K., Karasti, H., & Vines, J. (2018). Unfolding participation over time: temporal lenses in participatory design. CoDesign, 14(1), 4-16.
Sanders, L. (2008). An evolving map of design practice and design research. interactions, 15(6), 13-17.

Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. CoDesign, 10(1), 5-14.
Sanders, E. B. N., & Stappers, P. J. (2021). Convivial toolbox.
Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. Ecology and society, 17(2).
Slingerland, G., Mikusch, G., Tappert, S., Paraschivoiu, I., Vettori, B., & Tellioglu, H. (2024). The role of digital technologies in urban co-creation practices. Human Technology, 20(2), 244-284.
Storvang, P., Mortensen, B., & Clarke, A. H. (2018). Using workshops in business research: A framework to diagnose, plan, facilitate and analyze workshops. Collaborative Research design: Working with business for meaningful findings, 155-174.
Szebeko, D., & Tan, L. (2010). Co-designing for society. Australasian Medical Journal (Online), 3(9), 580.
van Stijn, A., & Lousberg, L. H. M. J. (in press). Approaching research through design in the field of architecture and the built environment: Relating to the history, key theories and discourse. In L. H. M. J. Lousberg, P. Chan, & J. Heintz (Eds.), Interventionist research methods. Taylor & Francis.
Zwart, S. D., & de Vries, M. J. (2016). Methodological classification of innovative engineering projects. In M. Franssen, P. E. Vermaas, P. Kroes, & A. W.M. Meijers (Eds.), Philosophy of technology after the empirical turn (pp. 219–248). Springer. https://doi.org/10.1007/978-3-319-33717-3_13

TOC

Curriculum Vitae

Macarena Gaete Cruz

Education

2008 - 2011 **Master of Science in Architecture**, Pontificia Universidad Católica de Chile. Highest distinction.

2003 - 2007 **Architecture degree**, Pontificia Universidad Católica de Chile. Highest distinction.

Academic Positions

2018 - today **Assistant Professor** at the School of Architecture, Pontificia Universidad Católicade Chile.

2014 - today **Researcher at the City & Mobility Laboratory**, Pontificia Universidad Católicade Chile.

2017 - 2018 **Full Professor** at the School of Architecture Andres Bello University.

2015 **Postgraduate Program Director**. School of Architecture, Pontificia Universidad Católicade Chile.

2014 - 2016 **Master's Instructor Professor**. School of Architecture, Pontificia Universidad Católicade Chile.

Academic Experience

2012 - today **Teacher in diverse Design Studio courses**, diverse academic positions, Pontificia Universidad Católica de Chile.

2022 - 2024 **Thesis Supervisor for Master's students** at the AMS Institute, The Netherlands.

2021 - 2022 **Group coordinator in The Urban (Re)Development Game course,** Master Management in Built Environment, Delft University of Technology, The Netherlands.

2020 - 2021 **PhD Council representative**, Faculty of Architecture and the Built Environment, Delft University of Technology.

Practical Experience

2022 – today **Director and founder of Taller Blanco Architecture**.

2024 – 2025 **Design leader for Miyawaki Forest Design in Santiago**. Bosko NGO, Santiago Regional Government.

2024 **Design leader for Nature-based Solution designs** to prevent floodings and foster biodiversity in Concepción. Urbancost team, GEF Humedales Costeros, AFI Initiative, Aubudon.

2019 – 2021 **Director at Co-Diseño Urbano Consultants**.

2016 - 2017 **Director of the Design Department Plan CREO Antofagasta NGO**.

2015 **Design consultant for the Housing and Urbanism Ministry of Atacama**, Chile.

2012 - 2014 **Project Leader at Teodoro Fernández Architecture Studio.**

Press Appearances

2024 **Radio Interview in Condell Radio** Radio with Catalina Castro. Conversation about Nature-based Solutions for preventing floodings in the Maule Region.

2020 **Radio Interview in Pauta Radio** with Constanza López. Conversation about Resilience and Nature-based Solutions for Chile.

2018 **Radio Interview in Cooperativa Radio**. Conversation about the controversy of the plebiscite for the Intercomunal Park of La Reina.

Awards and Honours

2024 **2nd Place, Contest for the New La Reina Park**. La Reina Municipality, Chile. Team with Juan Pablo Ivanovic, Taller Blanco Arquitectos, and ORBE Ingeniería.

2023 **Selected proposal. Contest for the Alonso de Cordova Boulevard.** Vitacura Municipality, Chile. Team with Urbanismo y Territorio Consultants (UyT).

2019 **1st Place, Contest for Riverside Design, Summer School I-surf.** AMS Institute, Amsterdam, The Netherlands.

2015 **Honourable mention, Contest for the Esplanade of the Markets**. Team leader in the City & Mobility Lab proposal, Pontificia Universidad Católica de Chile.

3rd Place, Contest for the New La Reina Park. Team with the Island Hills NGO.

Honourable mention, Contest Passatges Barcelona. Team leader in the City & Mobility Lab proposal, Pontificia Universidad Católica de Chile.

Macarena has lived in Paris, Shanghai, Groningen, Delft, Antofagasta, and Santiago de Chile. She has both Chilean and Spanish Nationalities.

List of publications

Peer-reviewed Journal Articles and Book chapters

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: Exploring cross-scale dynamics (pp. 105–125). Springer. (6 citations at the publication of this book).

Gaete Cruz, M., Ersoy, A., Czischke, D., & Van Bueren, E. (2022a). **Towards a framework for urban landscape co-design: Linking the participation ladder and the design cycle**. CoDesign, 19(3), 233-252. (30 citations at the publication of this book).

Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022b). **A framework for co-design processes and visual collaborative methods: An Action Research through Design in Chile**. Urban Planning, 7(3), 363-378. (14 citations at the publication of this book)

Gaete Cruz, M. (2023a). **Social-Ecological Knowledge Integration in Co-Design Processes: Lessons From Two Resilient Urban Parks in Chile**. Urban Planning, 8(2), 359-373. (1 citation at the publication of this book).

Gaete Cruz, M.,Ersoy, A., Czischke, D., & van Bueren, E. (2023c). **Knowledge Integration in Urban Landscape Co-design Processes; Trajectories of two urban park design processes in Chile**. Proceedings of the Congreso Intersecciones, IV Congreso Interdisciplinario de Investigación en Arquitectura, Diseño, Ciudad y Territorio – Entre escalas, agencias y territorios en Latinoamérica, Chile, mesa 2.

Gaete Cruz, M. & Hamida, M. (2025). **Participatory Action Research through Design: A conceptualisation bridging the gap between three interrelated concepts**. In Exploring Research Through Co-Design: Multiple Perspectives for Collaborative Inquiry, Human Factors and Ergonomics Book Series, Taylor & Francis.

Relevant Conference Papers

Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2022). A Framework for social-ecological urban co-design: Lessons from two urban parks in the Atacama Desert. Proceedings of the Beyond All Llimits Conference, International Conference on Sustainability in Architecture, Planning, and Design, Dadi_Press, Italy, 2022, 401-408.

Gaete Cruz, M. (2023b). Co-design for Uncertainty; Design principles for public space resilience. Proceedings of the Congreso Intersecciones, IV Congreso Interdisciplinario de Investigación en Arquitectura, Diseño, Ciudad y Territorio – Entre escalas, agencias y territorios en Latinoamérica, Chile, mesa 23.

Gaete Cruz, M., Ersoy, A., Czischke, D., & van Bueren, E. (2023c). Knowledge Integration in Urban Landscape Co-design Processes; Trajectories of two urban park design processes in Chile. Proceedings of the Congreso Intersecciones, IV Congreso Interdisciplinario de Investigación en Arquitectura, Diseño, Ciudad y Territorio – Entre escalas, agencias y territorios en Latinoamérica, Chile, mesa 2

25#04

The challenge of collaboration in urban design

Co-designing resilient public spaces in Chile

Macarena Gaete-Cruz

Climate change affects cities in every region of the world, and cities need to improve their urban resilience. Resilient measures are often implemented in public spaces because they are the urban voids in which infrastructures, water, biodiversity, mobility, and human life unfold. However, their institutional settings often make their design processes significantly challenging. Many complexities must be agreed upon and integrated into designing resilient public spaces. Taking a collaborative approach to designing public spaces has been said to improve their resilience by involving different actors and integrating their aims and knowledge. However, the mechanisms to do so remain unclear. This research explores how a collaborative approach can contribute to the design processes of resilient public spaces. It does so in the geographical context of Chile, a territory prone to diverse climate change impacts. It poses that revised urban design processes are crucial for implementing resilient public spaces. It focuses on co-design processes and their mechanisms and methods to integrate the diverse knowledge backgrounds of the involved actors. The studies examine the co-design processes of prominent resilient public spaces in Chile and design one in the same context. This research aims to contribute to urban design by formulating a comprehensive framework and guidelines for designing resilient public spaces collaboratively. It contributes generalisable and context-specific findings with particular emphasis on the Chilean context.

A+BE | Architecture and the Built Environment | TU Delft BK