Lessons Learned from Chile, Evaluating Strategic Reconstruction Master Plans in Post-Disaster Scenarios

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Maria Garces Marques
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List of Acronyms

CASEN	National Socio-economic Survey
	Acronym from Spanish: Encuesta de Caracterización Socio- Económica Nacional
CEPAL	Economic Commission for Latin America and the Caribbean
	Acronym from Spanish: Comision Economica para America Latina y el Caribe
CNDU	National Council of Urban Development
	Acronym from Spanish: Consejo Nacional de Desarrollo Urbano
INE	National Statistics Bureau
	Acronym from Spanish: Instituto Nacional de Estadística
MBBNN	Ministry of National Assets
	Acronym from Spanish: Ministerio de Bienes Nacionales
MINVU	Ministry of Housing and Urban Development
	Acronym from Spanish: Ministerio de Vivienda y Urbanismo
PRES	Strategic Sustainable Reconstruction Plan
	Acronym from Spanish: Plan de Reconstruccion Estrategico Sustentable
PRBC	Reconstruction Plan for Coastal Areas
	Acronym from Spanish: Plan de Reconstruccion Borde Costero
PRU	Urban Regeneration Plan
	Acronym from Spanish: Plan de Regeneracion Urbana
PUIR	Integral Urban Reconstruction Plan
	Acronym from Spanish: Plan Urbano Integral de Reconstruccion
SEREMI	Regional Ministry Secretary
	Acronym from Spanish: Secretaria Regional Ministerial

Abstract

Natural and manmade disasters have been increasing in the last decade all over the world affecting millions of people and generating high costs to recover from them. There is a need to implement policies that will foster mitigation and prevention measures and that will address recovery as a long-term process rather than short-term solutions. Chile has overcome several disasters in the last decade and has designed innovative tools to rebuilt from the aftermath. The purpose of this research is to evaluate one of these tools, Strategic Reconstruction Master Plans, and what lessons have the different government periods have learned from past disasters in order to apply them for future ones.

The research compares and contrasts two case studies in which master plans were the main tool implemented for recovery purposes, these are Pelluhue and Santa Olga, and both are located in the Maule region. The study evaluates the methodology that each project implemented to recover from the disaster period and what lessons are drawn from each case for future policy applications. The paper incorporates three main research methods. First, archival research on post-disaster efforts; second, technical documentation from each case study and local media from each period; and third, in depth interviews to experts and stakeholders involved in each process together with field observations.

Key words: urban planning, post-disasters management, master plans, reconstruction, governance.

1. Introduction

The thesis tackles a recurring issue in Chile and globally, which is how to recover from natural and manmade disasters. Chile has gained international recognition for being one of the most exposed countries to natural disasters, with high diversity of hazards (earthquakes, tsunamis, wildfires, landslides, volcano eruptions and more), and high frequency of events, which translates into high economic losses. Chile is also internationally respected due to its strong seismic culture and building codes that allows for low casualties when a given disaster hits. Recent reconstruction efforts implemented and designed master plans in order to achieve long-term sustainable development, rather than short-term emergency solutions; but the existing institutional structure in the country allows a weak planning system that has perpetuated the idea of individual approaches for each event, with no continuity over time and no cohesiveness between them. The thesis looks into the tools that were designed during two different disaster periods and two opposite political moments and draw lessons from both.

One of the tools designed and implemented were the Strategic Reconstruction Master Plans (PRES). These are documents designed specifically during post-disaster scenarios and provide a long-term navigation chart for future development as well as addressing the short-term emergency. Chile has suffered several natural and man-made disasters in the last decade; the sixth largest earthquake and tsunami hit large part of the central region of Chile in 2010 (USGS Earthquake Hazards Program n.d.), several landslides, wildfires and flooding have taken place in recent years (see Table 1). This has led the government to undertake a series of plans to address disaster recovery in very short timeframes given the state of urgency they had to face. Chilean cities and regions had no strategies in place to deal with disaster recovery, there were no immediate tools that they could implement straight away and were facing a never seen before level of destruction with no build back structure. These circumstances

represented an opportunity to develop new mechanisms to aid in the recovery process and provide guidelines for long-term development. Several PRES were developed for specific localities and designed in a short period with all their priorities in order and a general vision for future development.

Table 1 Previous Earthquakes in Chile, damage level and area affected.
Source: Roberto Morris - Resilient construction in Chile: Lessons and challenges

Event	***Earthquake and Tsunami 1960***	***Earthquake 1985***	***Earthquake 2010***	***Earthquake 2015***
Magnitude Mw (Richter)	9.6	7.7	8.8	8.3
Epicenter	Valdivia and Concepcion	San Antonio	Cobquecura and Pelluhue	Illapel
Affected area	VII-X Regions	V, VI and Metropolitan Regions	V-IX Regions	III-V Regions
Fatalities	6,000	177	524	21
Housing units destroyed	450,000	142,000	220,000	3,000
Affected area (Km²)	166,220	48,186	131,006	--
Area of the country affected (%)	8.30%	2.40%	6.50%	1.06%
Population affected	2,780,213	6,114,486	12,800,000	190,000
Total Population	7,374,115	12,102,174	17,094,275	17,760,000
Population of the country affected (%)	38%	50%	75%	5%
Total Economic losses (US$ 2010 M)	3,089	2,106	30,000	n/a

The research aims to evaluate the successes and failures of the PRES that were designed during post-disaster scenarios and how the decisions taken and how they were implemented had positive and/or negative results due to these decisions. In order to evaluate the PRES, I will compare and contrast two master plans designed and implemented during two different recovery processes and periods. The chosen case studies are Pelluhue's earthquake and tsunami occurred in February 2010, and the wildfires in Santa Olga that occurred during January 2017. Both areas are located in the same geographic study region, the Maule Region in Chile *(Figure 01),* and are similar in scale and damage level: both towns were practically wiped out from the map and had to face an entire reconstruction process from the ground up. For Pelluhue's reconstruction process, a PRES was developed and adopted to face the recovery in order to coordinate all the different stakeholders and set specific

priorities; and for Santa Olga, a PUIR was designed, which is similar to the PRES in the sense that it aligns the specific needs of each stakeholder within one document.

The socio-political climate during each disaster will also shed some differences between both case studies since two opposite political parties governed at those times. This will help illustrate and critically analyze the different and/or opposite approaches the Chilean government tried, if they learned from each other, its implementation processes, stakeholder involvement and participation, financing structures and institutions involved, and how they obtained (or are in the way of obtaining) different end outcomes.

Both case studies have had successes and pitfalls that were identified so that future policies can take those lessons learned and apply them when dealing with future disasters or designing a new master plan. Even though each locality has its own specific navigation chart, from research, it is clear that there are mechanisms that can improve, such as adapting existing legal and regulatory framework while at the same time, streamlining planning processes. Institutions can be enhanced in terms of their attributions and coordination among themselves so that there is clear delineation of power among those actors involved so that there is clear accountability. The findings are organized in patterns and themes that were identified during the analysis which provide insights for future policies related to post-disaster management.

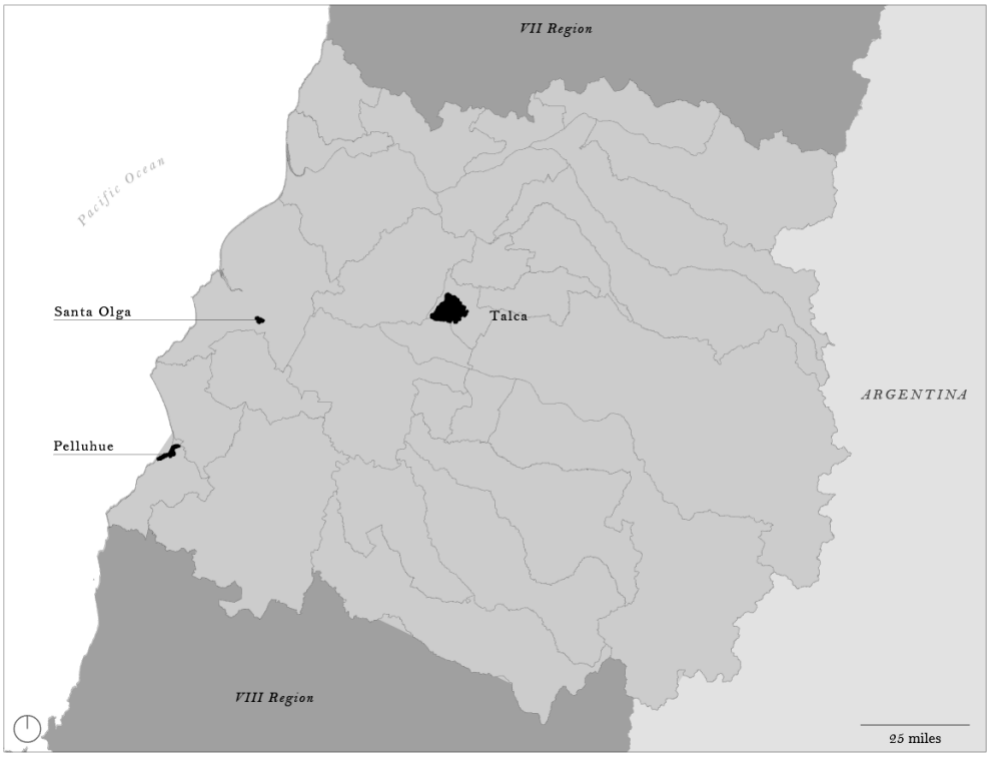

Figure 01 Location of both localities within the Maule Region

1.1 Thesis questions

The thesis aims to address the problem of post-disaster recovery from a planning perspective and evaluate how the different governments have approached this issue, what methods they used and why. The primary goal is to understand existing difficulties in post-disaster management, which set of tools are available to policy-makers and other stakeholders, and the relationship between them that ultimately shape the built environment. The selected case studies, Pelluhue's PRES and Santa Olga's PUIR, addressed post-disaster recovery and reconstruction in opposite directions and implementation approaches:

i) The 2010 earthquake and tsunami together with a center-right administration introduced a privatized model of reconstruction by introducing a multi-stakeholder approach involving private companies and NGOs into the design and implementation process.

ii) Santa Olga's reconstruction process was handled by a left-winged administration, which meant a more centralized governance structure (top-down) and decision-making process.

In order to evaluate each case study, the thesis poses an overarching research question: 'What lessons has all levels of the Chilean government learned from past experiences of post-disaster reconstruction processes?' This will be answered by asking the following sub-questions: What were the tools and methods employed to address the reconstruction? How did they shape the built environment? Did these tools engage a community that had urgent needs? If so, how? How did the government balance the short-term urgency reconstruction with long-term development goals, such as reducing the ongoing gaps? Has the PRES or PUIR in a post-disaster scenario been a successful tool in addressing existing housing deficit? Do they represent a replicable tool or method to address future disasters?

1.2 Geography and Characterization

1.2.1 Maule Region

The Maule Region is located about 200 km from Santiago. Its main economic activities are agriculture and forestry, where wine production represents 50% of the country's total export wines. The region is divided into 4 provinces (Cauquenes, Curico, Linares and Talca) and 30 communes, it has a projected population for 2015 was 1.042.989 with a density of 34.4 persons per square kilometer. (Biblioteca Congreso Nacional n.d.) About one third of the region's population lives in rural areas, representing the region with greatest proportion of people living in rural areas than any other. Its capital is Talca, a medium sized city which has a population over 230,000 people. (Biblioteca Congreso Nacional n.d.)

According to the Statistical report produced by the Chilean Central Bank, the unemployment rate in the region is 6.0% for October 2017 ("Boletín Mensual - Banco Central de Chile" n.d.) , which is lower than the national average (6.7%). The following chart shows the unemployment rate variation over the last seven years. It shows that in the last year the rate has been steadily lower than the national

average. Although this measure shows a better economic environment for employment purposes, the Multidimensional Poverty Index (MPI)[1] of the Maule Region for 2015 is 22.4%, compared to the 20.9% at the national level (Ministerio de Desarrollo Social 2016). This demonstrates high and persistent rates of inequality, especially for access to services, education and income distribution; the average monthly income in the region is $485,000 pesos (US$750), compared to the $705,000 pesos (US$1,100) national average. (Ministerio de Desarrollo Social 2016)

When looking at these numbers in reference to its post-disaster efforts, it is clear that there are still structural deficiencies that are difficult to overcome. Natural disasters such as an earthquake or wildfires are disruptions that not only increased poverty and unemployment levels, but helped perpetuate existing conditions.

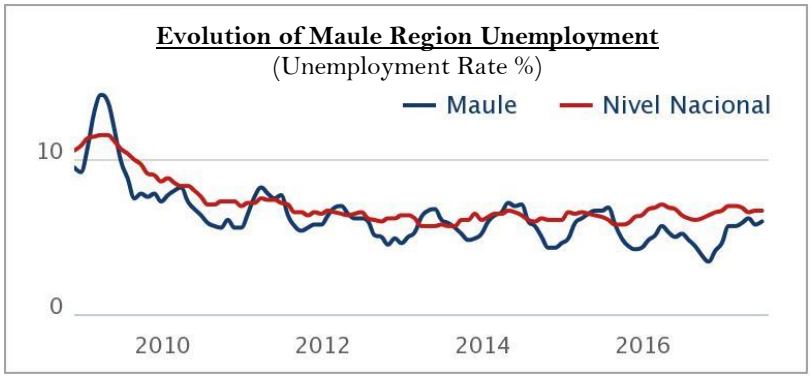

Chart 1 Evolution of Maule Region's Unemployment Rate

[1] Multidimensional poverty is an index that measures traditional income parameters with education, health (nutrition, mortality), quality of life (access to electricity, sewage, drinkable water, and others), Job and social welfare, living conditions and social cohesion and networks. (United Nations Development Programme 2016)

1.2.2 Pelluhue

Pelluhue is located in the Cauquenes province coastline in the Maule Region facing the Pacific Ocean. According to the 2012 National Census, Pelluhue had a total population of 6,636 people. The city's growth has developed over the last 30 years in two directions: North-South through the coastline border and East-West along Route M-50 that connects the coastal cities with Talca, the Region's capital. This growth has extended and reached other close localities such as Curanipe and Chovellen, creating a conurbation between the two most populated areas.

Over the last three decades, the coastal cities along the central region have shifted their character: they started as a primary economic activity area, where fishing and agriculture were the main industries, and evolved into of tertiary activities provider and services such as tourism. They became the main leisure spots in the Maule Region given their proximity with large urban centers and their attractive attributes such as its natural landscape including beaches and forests. Even though Pelluhue has many natural attributes, it is still one of the poorest and most vulnerable municipalities in the region. The following table shows the poverty rate between years 2009, before the disaster, and 2011, a year after. The decrease of 11% in poverty rates could respond to several factors, such as:

- Many families who were living in vulnerable conditions decided to move to other localities after losing their houses.
- Part of the population started working in housing and infrastructure construction. (Moris 2015)

Table 2 Poverty Incidence at Municipal Level

	2009			**2011**			
	Lower limit	Poverty rate	Upper limit	Lower limit	Poverty rate	Upper limit	% difference
Pelluhue	23.4	**28.3**	34.9	11.1	**17.3**	22.9	-11

Source: CASEN Survey 2011

Table (3) shows that the population concentrates in the Pelluhue area which has a more urban character and with more housing development that the other two localities that grew outwards from

Pelluhue. The main economic activities shown in Table (4), demonstrate how the general agricultural character is still ongoing but there has been an important increase in other activities, such as those related with tourism, which were the most vulnerable and suffered great damages with the earthquake and tsunami.

Table 3 Pelluhue Population Characterization

Districts in Municipality	Area (km)	Population (2009)	% of total	% rural population	Housing units (2002)
Pelluhue Conurbation	371.4	7,568.0	100%	39.6%	3,633.0
Pelluhue	129.3	3,337	44%	18.7%	2,041
Curanipe	101.4	1,769	23%	39.3%	724
Chovellen	140.7	2,462	33%	68.0%	868

Source: PRES Pelluhue, Informe OIT, 2010

Table 4 Pelluhue's dominating industries (2009)

Industry sector	Number	% of total
Agriculture, Forestry, Fishery	819	32%
Construction	365	14%
Commercial, Hotel, Restaurants	578	23%
Community Services	459	18%
Other	324	13%
Total	2545	100%

Source: PRES Pelluhue, Informe OIT, 2010

The 2010 earthquake and following tsunami only aggravated existing economic deficiencies. Before the earthquake and tsunami, people who worked in fishing and tourism ignored the threats of a potential tsunami and located their place of work and residence close to the coastline. The nonexistence of mitigation elements or policies that prevented the great level of damage and the lack of an evacuation plan increased the number of victims and physical damage to the area.

1.2.3 Santa Olga

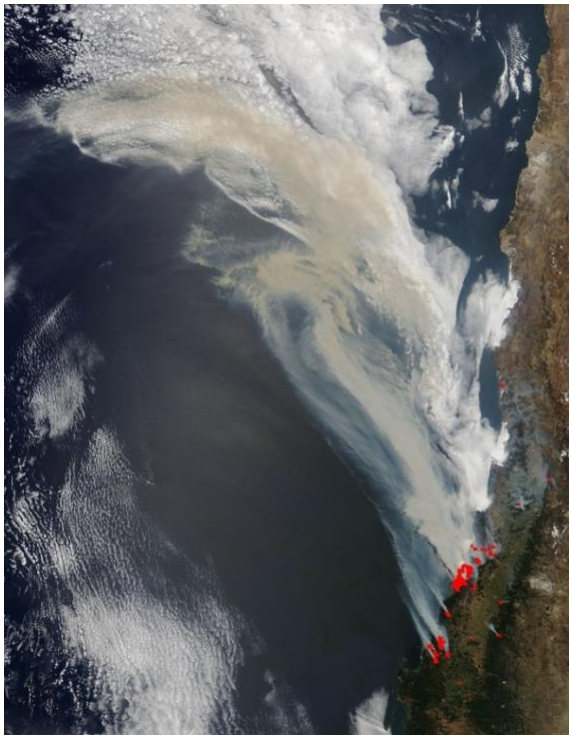

Figure 2 January wildfires affecting Chile's central region as seen from space. Source: NASA

Santa Olga was an unknown place before January 2017; it was a crossroad on the way from Talca to Constitucion, the largest coastal city in the region. During that month, the largest forest fires in Chile's recent history razed the central regions and destroyed over 612,000 hectares of land (over 2,000 square miles), and only in the Maule Region comprised of 289,000 hectares leaving over 2,900 people affected by the disaster, which represents 69% of the total number of victims reported country wide.

Santa Olga is located within the Municipality of Constitucion, about 88 Km to the West of Talca, the Region's capital. Its origins go back to the growth of the forestry industry in the area during the 1970's, when the central government subsidized about 70% of the plantation costs to support the industry (Kozak 2017). Workers of the state-owned timber business, Maderera Panguipulli, settled close to the road that connected to their place of work. Around the year 1990, this place would be known as Santa Olga. The town's growth followed a very irregular pattern, it started as an informal settlement where forestry workers and their families decided to settle there, and once it started to develop and more amenities were built, such as primary school, primary care facility and sports facilities, it contributed to its growth and attracted more families from other localities that worked in similar industries. The town had grown to about 5,000 people and 1,500 homes in 2017, where roughly 350 of them had access to drinking water and connection to sewage systems, and only half of them had access to direct electric supply. Due to the growth in population,

the newer families that arrived to Santa Olga began the process to regulate their housing tenure together with the MBBNN (Ministry of National Assets (Bienes Nacionales)). The following table obtained from the cadaster performed by SEREIMI MINVU from the Maule Region after the fires, shows the percentages of families according to their housing tenure and occupancy:

Table 5 Santa Olga Housing Tenure Distribution

Housing tenure and property	Family Percentage (%)
Home and lot owner	54
Renter	8,1
Lot occupancy permit	23,1
Irregular lot occupant	14
No information	0,8
Total	**100**

From the table above, it is evident that there is a large number of homes that were not assigned to their owners and their tenure was irregular. After the January 2017 wild fires one of the greatest challenges the reconstruction had to face was regulating tenure and to determine the original boundaries of every existing property in order to assign one to those who have no property title before the fire.

The authorities in charge of the reconstruction process saw the pre-existing vulnerable conditions as a "window of opportunity – a period during which there is potential to change and improve disaster preventions measures significantly." (March and Kornakova 2017) This way, the master plan could tackle these deficiencies and provide a navigation chart that will improve upon the existing conditions while incorporating risk and hazard mitigation measures into the planning process so that future development will be less exposed to potential fires.

1.3 Literature Review

In order to address the research question, a thorough evaluation of theory revolving around post-disaster management and reconstruction of the built environment is essential. This topic

has been studied from many different perspectives, compared with similar international experiences, and a broad range of sources from scholarly articles, published official documents and news clippings were evaluated. In order to offer a comprehensive understanding about the process of disaster management, March and Kornakova provide the theoretical and technical framework that relates planning within post disaster reconstruction. According to the authors, the urban planning discipline becomes the intersection between social, economic and physical actors and organizations. Disaster management entails effective urban planning and coordination between all active stakeholders, from all sectors. The authors begin by defining four phases during a disaster: *mitigation or prevention, preparation, response, and recovery*. The case studies that build the foundation of this project fit into the recovery phase (and some elements during the response phase), which "includes repairing damages and restoring essential community services, restoring community back to pre-disaster conditions, and creating new opportunities for future development." (March and Kornakova 2017) Recovery is the most challenging phase and it generally continues for many years because it entails achieving long-term goals through extensive collaboration between a broad range of disciplines and actors.

The following sections will describe several sets of literature that relate to the Chilean case in particular.

1.3.1 Reconstruction in Chile:

The 2010 earthquake and tsunami reconstruction has had much attention from scholars and academics in the last decade and provide an interesting set of opposing viewpoints which is interesting to investigate. The literature about Chile's experience with disasters has been studied and discussed from two opposing views that fit into the following themes: a) A Neoliberal-oriented set

of policies that favored a process led by private actors and that offered standardized solutions for all territories, and as a b) Innovative method of engaging the private sector and communities through the creation of public-private consortiums. Both positions offer interesting arguments that builds the foundation for the following sections in which both case studies will be evaluated.

a) Neoliberalism and its applications in reconstruction:

Cociña and Boano, in "Housing and Reconstruction in Chile (2010-2012): Institutional and Social Transformation in Post-Disaster Contexts", explore the effects of the 2010 recovery process, specifically the housing recovery program, through the lens of a neoliberal economic context, which according to the authors only deepened the existing inequalities and consolidated a model where private actors adopt public responsibilities without any accountability. The existing governmental structure in Chile, rigid and dependent in the central government, has shaped the outcomes of the 2010 reconstruction process (Boano and Cociña 2013). According to Arana in "Aftershocks of Pinochet's Constitution: The Chilean Post Earthquake Reconstruction" (Arana Araya 2017), some factors that influenced the privatization of the process was the lack of coordination between all levels of government: there is limited integration (vertical and horizontal) between all branches of government and other sectors, such as civil organizations. Ministries had to act independently, as well as Regions and Municipalities. (Arana Araya 2017) There are three factors that significantly constrained the municipalities' capacity to address the task, these were "absence of cross-sector planning instruments", where each locality has its own regulations and zoning instruments but are not integrated with to other levels of government. Secondly, "territorial planning instruments were outdated on the date of the disaster", they neither had any regulations set for potential hazard zones. Lastly, the "local administrations' institutional capacities were insufficient", this means that small or medium localities do not have planning experts or departments, which demonstrates the existing unbalance between larger cities and metropolis against the smaller towns who suffered the most during the disaster (Farías and Flores 2017) .

This ties well together with Cocina's perspective about the consequences of a neoliberal model used towards re-building after a disaster, "In neoliberal contexts, a few actors often control both the means of production and the decision power, and therefore have a strong capacity to use their agency to shape the process. In practice, it implies that in the course of reordering associations after a disaster, exclusionary processes can be exacerbated." (Boano and Cociña 2013) Tapia emphasizes this problematic by defining the source of this disparity in the overall discoordination and fragmentation of the reconstruction actions during the emergency phase. (Tapia Zarricueta 2014) If only one group is in control of the resources being allocated and the decision-making process during an emergency, then disparities arise and those in more vulnerable conditions feel their problems are being intensified.

Another interesting argument discussed in the literature mentions the missed opportunity the government had when facing reconstruction to create and transform institutions for a more efficient future disaster management, given the magnitude of destruction in terms of damage, geographic range and involvement of every level of government and civil society. Bresciani as well as Cociña and Boano, emphasize the need for a more decentralized governmental structure, where regions can have more independence from the central government and more attributions in decision-making. "Post-disaster context, as political processes facing the reshuffling caused by the catastrophe, offer an exceptional opportunity to think about the order of associations." (Boano and Cociña 2013; Bresciani Lecannelier 2010).

Even though most post-disaster approaches tend to use a centralized decision-making structure, decentralization of power has been a general theme in the existing literature. If transformation of institutions is desired, then a redefinition of the roles of the different actors involved in each process (private sector, government and citizens) have to be redefined together with how they relate with each other (Boano and Cociña 2013).

b) Innovation and Planning

On the other end of the spectrum, Mary Comerio (Comerio 2014a) thoroughly reviewed the National Reconstruction Plan published by the government only 6 months after the 2010 disaster, and concluded it was a successful planning experience due to the strong leadership and coordination between all sectors that came from the central government between the public, private and the civil society. Her article also discusses the interdisciplinary nature of the process, where participation from the private and non-governmental sectors was critical to achieve quality design alternatives for city plans. Her main takeaway for the planning practice involves strong government leadership and coordination, together with the engagement of local governments and citizen participation, including the private sector. Another interesting argument Comerio discusses relates to the lack of planning institutions in Chile and the existing fragmentation of institutions in which coordination is difficult, "there are no metropolitan systems (Santiago has 32 different municipalities) and it can take years to approve local plans. It is within this framework that the Ministry attempted to build a degree of coordination into the institutional framework of post-earthquake planning." (Comerio 2014b) Given this rigid framework and governmental structure, Cocina and Boano reasonably identify the 2010 reconstruction process as an improvement upon the existing conditions, where the central government incorporated different sectors and stakeholders in the planning discussion on how to build back better and the role each one should play. "There have been improvements to a system that needs to ask itself what the role should be for the state, private sector and citizens in the construction of the built environment. The earthquake in 2010's social context has appeared to be a great opportunity to re-ask such a question (…) these events shifts relations among human and non-human actors, triggering the possibility to reshape the social order, representing an opportunity for reducing asymmetries through a political process." (Boano and Cociña 2013) .

The 2010 earthquake and tsunami reconstruction process were the first time the Chilean government relied on the private sector (private companies, academic institutions and NGO's) to

produce a set of master plans for those localities who suffered the most. According to Allard, the reconstruction processes and interventions should take into consideration the existence of local resources, its needs, perceptions, potentials, constraints and expectations in order to achieve a comprehensive view and proposals that are tied to its location (Allard and Arrasate 2016), rather than depending on rigid instruments that constrain resident's ability to employ them, hence, leading the way to untrained and informal constructions. According to Ebru Gencer, "These problems [rigid and expensive legal framework] stress the significance of good urban governance in bringing together different groups to input for decisions concerning the future of the city. Such a multi-dimensional planning process can provide the way to reducing disaster risk while producing a sustainable urban development…" (E. Gencer 2008)

1.3.2 International experiences: similarities with the Chilean case

Reconstruction processes in other countries and their approach are valuable sources as well. Gencer explores several cities that suffered from natural disasters and compares them to Istanbul's experience and their approach taken towards reconstruction within a sustainable development model after the earthquake in Marmara in 1999. As in Chile, Turkey before the 1999 earthquake had a vast set of organizations and regulations related to disaster management but focused mainly in post-disaster rather than in pre-disaster preparation and mitigation. Once the earthquake hit, a number of studies and decrees were developed which resulted in the creation of Disaster Management Agencies to support disaster management in Turkey. The chosen case of Istanbul is due to its similarity in scale with Santiago and its administrative structure; both have about the same number of municipalities within its metropolitan area, but in the case of Istanbul, its governmental structure is not as fragmented, they have the Province Governor as the head followed by a Metropolitan Mayor. Both positions manage a Disaster Management Agency, centralizing actions and economic resources (E. A. Gencer 2013). This governmental structure and agencies were in charge of producing the Istanbul Earthquake Master Plan together with incorporating risk assessment, and selecting urban transformation projects, producing a comprehensive and multidisciplinary effort towards recovery, whereas in the case of Chile, each locality as small as they were, had its own master plan which sometimes did not correspond with the next level of planning.

The Mexican experience during the 1985 8.1 Richter scale earthquake, as told by Diane Davis is also interesting and under the scope of this research project because she examines the impacts of that specific disaster in the city's social fabric. Mexico City shares some similarities with Santiago in which they both serve as the nation's economic and political engine within a very centralized country. The Mexican reconstruction process was shaped by a centralized process and at the same time, it empowered its citizens to organize and held Mexican authorities accountable, which had direct impacts in the political sphere and its leaders (Vale and Campanella 2005).

1.3.3 News and local media review:

Besides scholarly articles and journals, local media, newspaper articles, interviews and clippings from Chilean and international press provide an additional layer of insights towards the findings and discussion part of the research for both case studies. Press articles links the perception that exists on the ground at the time of implementation of each Plan with the view from the technical and political sectors and local media becomes a tool to hold authorities accountable to their promises.

1.4 Research Design and Methodology

The research methodology implemented for this project divides between primary and secondary data collection and analysis.

1.4.1 Archival research and bibliographic study

The first part of this research project was to go through existing literature and documentation related to post-disaster recovery processes as discussed in the previous section. They were analyzed and cross-referenced with other sources about the reconstruction processes in each locality. This builds the research base about post-disaster reconstruction applied specifically to the Chilean context. The consulted sources range from Journal and Academic articles to Chilean Policy documents that were provided by Guillermo Saez, Urban Analyst for the SEREMI of Housing for the Maule Region. Specific information for both localities including but not limited to master plans for each one and other technical documentation provide a technical framework that help evaluate results and compare both localities with the same degree of information and level of detail. Local media is also a valuable source that provided information about what happened "on the ground", and how both reconstruction processes look from a perspective other than the government. They also allow having a better sense of how each process was evolving through time.

1.4.2 Primary data:

1.4.2.1 Field Observation and Photographic Record:

I conducted field observations during a field trip in November 2017, prior to conducting interviews. The observations were recorded in a double-entry notebook that separates the observations from any personal thoughts to avoid any possible bias together with creating a photographic record from the visit. I aimed to register the current conditions of each place, how people interact and use the space and develop a comprehensive understanding of each reconstruction process within their context. They provided a better sense of each locality and helped better frame the interview questions.

1.4.2.2 Interviews

The third part of this research incorporates open ended and semi-structured interviews with relevant and expert stakeholders involved in each of the chosen case studies. The interviews aimed at obtaining the expert's views on each reconstruction process and the lessons learned from each one from their particular experience. The set of questions were prepared based on the literature and theory mentioned before and were modified according to any observation recorded during the field trip. Since the interviews were semi-structured, the questions led to an open conversation and free response, that facilitated information exchange; the answers provided more in-depth background that helped elaborate the characterization of each locality.

Each interview subjects I selected are all from Chile and consisted of professionals working domestically in different fields who were involved in one of the two processes. They range from an academic researcher, governmental official, and a professional architect. The range of professional fields of each interviewee was an important criterion in the selection of each subject in order to get a

broader understanding about the topic, their different points of views and their experience working on these processes.

I was able to interview a total of three subjects. All interviews were in Spanish and their duration ranged from half an hour to over one hour. The questionnaire[2] contained an introductory section in which each interviewee introduced themselves, its academic and/or professional background and their years of experience working their field. Then, the questions focused on each interviewee's professional experience related to each reconstruction process, their perception of the process itself and their overall satisfaction with the results. Specific questions about each case study were asked depending on their involvement in each case. In the case of the NGO representative, the questions were aimed at obtaining information about the level of engagement of these types of organizations during the reconstruction process and their perspective from an organized civilian stand point. I asked each interviewee about alternative recommendations for future reconstruction processes depending on their own experience.

The following were the subjects I interviewed:

1) Daniela Soto (government official) – Architect from Universidad de Santiago de Chile. Currently, she works as the Head of the Urban Development Department for the SEREMI of Housing and Urban Development of the Maule Region. She has been mainly involved in the Santa Olga reconstruction process, leading as chief coordinator between all ministries. Before coming into this project, she managed the Aldeas y Campamentos Department in SERVIU Maule.
2) Roberto Moris (academic/researcher) – Architect, M. S. City Design and Social Science from the London School of Economics and Political Science. He currently serves as the Principal Investigator at the Research Centre for an Integrated Risk Management (CIGIDEN), he is

[2] See Appendix A for sample questionnaire.

also the Director of the Cities Observatory UC (OCUC) and Professor of the Urban and Territorial Studies Institute (IEUT). Moris was involved in the design and implementation of the PRES Pelluhue.

3) Carlos Moreno (private professional) - Architect, Ms. in Landscape Architecture from Universidad Catolica, Chile. Former Reconstruction Manager for the Maule Regional Govt. Former Chief of City Plans and Projects for the SEREMI of the Maule Region during 2010-2012. During this period, he was in charge of planning and implementing a series of urban projects in the Maule Region, together with an interdisciplinary team and with local coordination.

I conducted interview content analysis by identifying common themes and patterns between the two case studies together with recognizing any gaps and differences between them. As the interviews were semi-structured and open-ended, the conversation facilitated free response, which allowed for a greater variety of topics being discussed. These nevertheless provided useful information for this research project.

1.4.3 Research Methodology limitations:

The above-mentioned methodology has several research limitations depending on the type of data collection tool implemented for this study.

a) Archival research and bibliographic study:

The availability of reliable and updated information about Chile was lacking, especially when obtaining detailed data about each locality. Even though there was a national registry for the families who suffered from the 2010 earthquake, that information is not publicly available and there is no geographic information tied to those numbers that could have helped in determining the magnitude of the disaster in Pelluhue. On the other hand, the wildfires in Santa Olga are very recent, so the

information available is limited to press and local media and government technical documentation. There are no academic/journal documents published at the time the research was conducted.

b) Primary data:

As the Researcher in this project, I had limited access and time to perform a thorough field analysis so all field observations are based on one visit and the existing conditions during that day. This data is self-reported, hence, there is potential for subconscious bias in the note and observation collection process.

Interviewing has its own limitations as well; it is time-consuming and in turn, a very small-scale study. Only "experts" involved in the reconstruction process were interviewed leaving other interesting groups behind because of time constraints, such as community leaders and overall population living in these localities. There is also a potential for bias that could be present in the way the questions were asked, the note collection process, and the conclusions drawn from them.

2. Post-disaster reconstruction in Chile

2.1 Physical and political context

Chile is a vulnerable geography, prone to earthquakes and all sorts of natural disasters. The earthquake and tsunami that hit Chile on February 27 2010 has been the largest event in terms of damage level ever experienced. It hit six regions, including three largest of the cities (Santiago, Valparaiso and Concepcion) and over 900 smaller cities and towns distributed in 239 municipalities. This represents over 75% of where the Chilean population currently live. In terms of physical destruction, the earthquake and tsunami destroyed over 220,000 housing units[3] and a large number of fundamental infrastructure, such as:

- 4,000 schools
- 17 hospitals, and 40 more in need for severe repairs (75% of the health network was affected)
- 1,554 Km of roads
- 212 bridges
- 9 airports
- 28 fishermen's cove
- 748 rural water supplies
- 41 water reservoirs
- 53 ports, including the Naval Base and Talcahuano International Port
- 10 jails

Besides the physical impacts that this event had on Chilean territory, social and political conditions are important to consider as well in order to understand the implications of the reconstruction process. By March 10th , a week after the earthquake, the newly elected president, Sebastian Piñera took office. He represented the center-right parties in Chile; he "symbolized the inauguration of a businessman government" (Boano and Cociña 2013) that ran on a campaign of

[3] The total number of housing units destroyed could never be quantified precisely. This number represents the number of families who applied for a subsidy for reconstruction.

business-friendly regulation, sound economic policy and overall economic growth government. Reconstructing the country was his main task from the very beginning of his term; this meant coming up with a plan that would address emergency needs as well as long-term recovery given the level of damage and the vast area covered by destruction.

Besides having to overcome the reconstruction process from the beginning, the new government had to face a very rigid and bureaucratic governing apparatus that would difficult the institutionalization of a specific branch for recovery management. Chile did not have specific tools or instruments to face any type of disaster, so the government had to work with existing legislation and come up with new ordinances to expedite the process, especially when assigning housing vouchers to victims and obtaining special funding for emergency management.

In the larger scale, Piñera's government developed the 2010 National Reconstruction Plan (NRP) that entailed Master Plans as the main planning tool. The goal was to "orient decisions regarding reconstruction subsidy assignments; prioritization of infrastructure projects by optimizing resources; establish criteria for long-term investments and city planning; incentivize economic, social and environmental development; incorporate community participation initiatives and integrate variables that will allow improving the existing urban standard of our country." (Forttes Valdivia 2014) The designed Master plans had the technical studies and preliminary proposals for mitigation, urban design, infrastructure, housing and participatory initiatives so that each locality could coordinate with the different ministries or governmental institutions.

The government's action plan focused in channeling private entities and civil organization's aid (mainly economic) through public-private partnerships led by the local governments. This was the first time the central government relied on the private sector and other organizations, including universities, to take on such responsibilities without any formal compromise or definition of the role they had to undertake. According to Pablo Allard, National Coordinator for the 2010 NRP for

MINVU, "In most situations, reconstruction will require a combination of different policies to make critical decisions to achieve transformation. (…) The central government took the lead in the reconstruction process, not by imposing top-down decisions, but as an intermediary between the different players involved in this process, linking the private sector with the affected families and articulating actions and policies." (Allard and Arrasate 2016)

The multi-stakeholder alliances formed between public and private entities was tried for the first time during this period and became a new method of policy-making for the newly assumed government. "Although there are successful international cases of city reconstruction, the volume, dispersion and diversity of affected communities requires an equally diverse approach, capable of meeting the needs and aspirations of each community, avoiding not only the standardization and privatization of solutions, but also the perverse territorial effects on migration and job loss that the destruction generates, especially in historical centers and small rural localities." (Bresciani Lecannelier 2010)

The central government, with its historically centralized structure made room for the creation of a new planning instrument, a decentralized and flexible master plan for each regional unit that required one. According to Aravena, the process of decentralizing planning for reconstruction was a way to get results faster and more effectively and a way in which the public would be more represented and heard. (Aravena n.d.)

The master plans had to be specific to each locality, addressing every need and designed in a short period of time (12 weeks for preliminary studies), so that the 2011 fiscal budget could include the necessary resources to address larger scale projects and other priorities. There were three types of plans designed to address specific areas of the country through a series of project portfolios and proposed financing structure:

a) Strategic Reconstruction Plan (PRES) designed and financed by the private sector. There were 27 PRES in total. The central government took a side seat and transferred leadership to the private sector who offered their support and expertise. Pelluhue was one of the localities that developed a PRES.

b) Reconstruction Plan for Coastal Areas (PRBC), VIII Region, developed by the Regional Government together with local universities. 25 PRBC were designed through regional leadership and without intervention from the central government (during the first stages).

c) Urban Regeneration Plans (PRU), in which the design and implementation was financed by each regional MINVU. These targeted small and medium sized localities and developed a series of detonating projects. 112 localities had a PRU's.

Before this event, previous natural disasters have faced reconstruction in a project-base process rather than planning for longer-term and larger scale interventions. The central government acts as a subsidiary of those who lost their homes through the provision of housing subsidies, and there is no institution or planning instrument that helps tackle reconstruction as a recurring issue. Hence, the State has demonstrated a very narrow and limited ability to learn from these experiences due to the bureaucratic and rigid structure of the Chilean government.

On the other hand, Santa Olga's reconstruction process occurred during Michele Bachelet's second government in 2017. The central government, through Housing and Urbanism Ministry Maule Region (MINVU), approached the disaster through the creation and implementation of a specific master plan as a tool to coordinate and organize the many priorities that were urgent for that locality. This master plan was named Integral Urban Reconstruction Plan (PUIR) and worked around a series of multidisciplinary work sessions throughout the whole process, involving the local government and the civil society (represented by families who lost their homes).

The selected case studies, Pelluhue (PRES) and Santa Olga (PUIR) are two singular examples that will draw lessons and indicate possible directions to refine the existing ways in which to approach post-disaster recovery in Chile. The following sections will describe in more detail the design of each master plan, who participated in them and how they were implemented.

2.2 PRES Pelluhue

2.2.1 Post-disaster conditions and characterization

As mentioned previously, the PRES plans came mainly from the private sector. In these cases, the central government allowed different organizations that offered economic and technical resources to design and implement a series of plans for the reconstruction process. Even though these private contributions were welcomed by all levels of government, they did not have an adequate legal or management framework to follow; so among the 27 different PRES there is a great difference in the level of political attention and physical outcomes.

Pelluhue is a particular case to study; it was the city closest to the earthquake's epicenter and the one that suffered most fatal victims in relation to its total population; 45 people lost their lives and its economic base was devastated due to the tsunami. Figure (3) illustrates how the area around

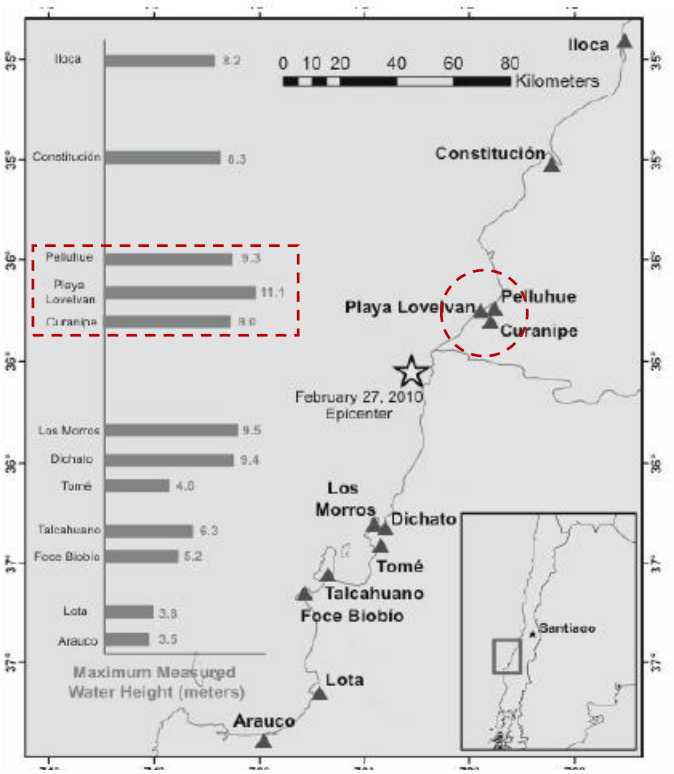

Figure 3 Map of Chile with epicenter and localities affected by Earthquake and tsunami. Source: USGS in RMS (2010)

Pelluhue and Curanipe suffered the highest and strongest waves following the earthquake. Parallel to the disaster, the city did not have a mayor (they had an interim mayor who was elected by the city council rather than by popular vote), which provided an additional level of fragility in terms of its governance during the immediate moments after the shock.

It is also important to mention the lack of territorial planning tools available in the region at the moment of the disaster in order to understand the complexities that the PRES had to evaluate while developing the plan. Pelluhue had four planning instruments that were in effect or in the way of obtaining approval at that moment, but they lacked specific information in terms of urban design and seismic and tsunami preventive regulations. The existing regulatory framework was the following:

1. PRDU (Maule Regional Development Plan) – 2004: There is no specific information about tsunami and earthquake risks except general concepts due to the nonexistence of valid recent data.
2. PRI (Intercommunal Regulatory Plan) – 2003: Special concern to urban development in higher slopes and steeper surfaces. It also specifies a no-build area of 20 meters from the high-tide level in the area's coastline.
3. PRC (Municipal Regulatory Plan) – 2005/2006: It was still awaiting its approval at the time of the tsunami, so the local government had no recent regulatory document that organized the territory.
4. Urban Growth Boundary (Pelluhue and Curanipe) – 1970: Both boundaries were established in 1970 but urban growth expanded outwards with no respect for those limits due to a lack of enforcement. The PRC would establish new boundaries including those areas as 'expansion zones'.

This regulatory scenario illustrates the existing deficiencies in terms of urban planning in the Pelluhue region. There is no document that references seismic and tsunami hazards that would constrain any future development in risk areas. Given this framework, the PRES had to be a guiding instrument that would balance the economic activities of the region integrating risk management to achieve a strategic and sustainable development without compromising the safety of its residents.

According to CEPAL, "the reconstruction phase must comprise of activities that would reorder the physical space and the environment in order to assign resource according to the new priorities that emerged from the disaster, with the objective to restore the functionality of the economic activities that will recover the social fabric." (CEPAL 2014). The following table (Table 6) and map (Figure 4) describe the large amount of damaged structures (shown in red); among them, many housing units were left inhabitable together with several important infrastructures that were located in hazardous zones, such as the water treatment plant, municipal services, schools and sports facilities. In the economic sector, the disaster affected Pelluhue in a sever way because it accentuated existing vulnerabilities which had to be addressed at the same time as the emergency period.

Table 6: Summary of damages and affected housing in Pelluhue.
Source: Moris et al (2010), UTPCh.

Description	Quantity	Description	Quantity	Description	Quantity
Affected family registry	679	Inhabited units	624	For repairs	55
Damaged Housing units	373	Inhabitable units	196	Under repair	177
Emergency housing units delivered	471	Units in emergency villages	49	Built in own site	368

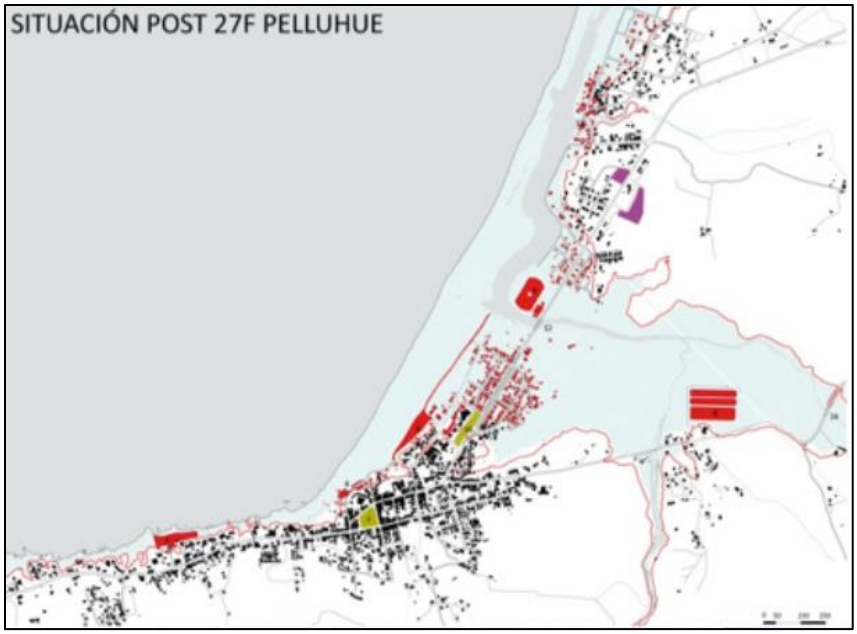

Figure 4 Post-earthquake and tsunami situation in Pelluhue.
Source: PRES Pelluhue

2.2.2 Stakeholders involved

The newly elected [central] government had a key role during the design and implementation process of the Plan. The President made its first priority to lead the reconstruction process as efficiently as possible and to overcome the 'emergency' status as quickly as possible. To do this, he and his team determined that help was needed from outside the political sphere, particularly from the private sector, which required some adjustments of traditional and existing planning tools. In Pelluhue, a multisector alliance was formed on May 25th 2010, headed by the interim mayor and SEREMI MINVU from the Maule Region, and incorporated other stakeholders (IEUT-UC 2010):

- Un Techo Para Chile (UTPCh): Non-profit organization that works all over Latin America and the Caribbean and looks to overcome poverty and slums through the construction of basic dwellings, community development and policy making. In Pelluhue, they were in charge of emergency coordination and contingency planning from the very beginning, such as food and water deliveries, among others. Later, they worked on the emergency housing plan at a national level.

- Instituto Estudios Urbanos y Territoriales, Universidad Catolica (IEUT): Academic unit from the Architecture, Design and Urban Studies School at Universidad Catolica. Their main activities involve teaching, research and territorial management. Their role in Pelluhue centered in surveying and gathering data for risk assessment studies.
- Undurraga & Deves Architects: Distinguished architectural and urban design studio. They participated in the PRES' overall urban design.
- Poch Engineers: Multidisciplinary consulting firm who facilitated public participation throughout every stage of the project.
- British Embassy in Chile: These organization was already working with the IEUT in other research projects and decided to participate with them in the PRES. They financed the plan's creation and a research program in the IEUT related to sustainable reconstruction and its possible replication in other affected localities.

2.2.3 Timeline and Implementation process

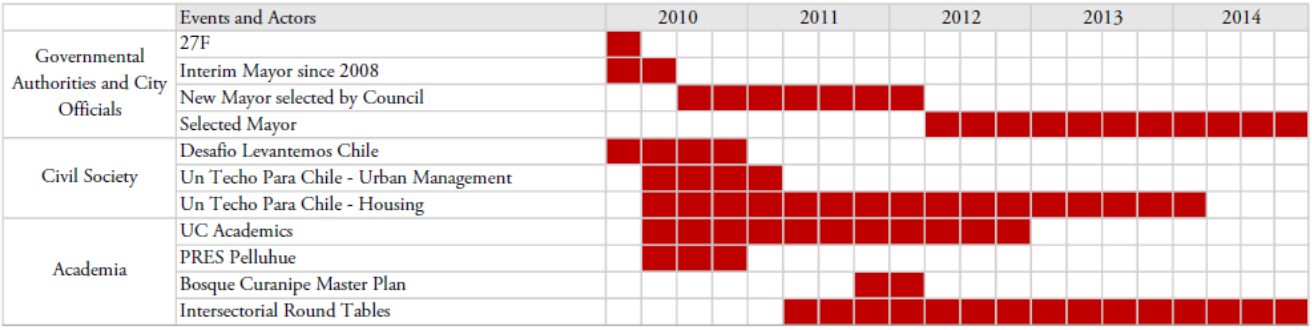

Chart 2 Timeline of actors involved in PRES Pelluhue.
Source: Self compiled based on PRES Pelluhue 2010

Before the consortium formation mentioned above, Pelluhue had to recover from the disaster and face the emergency period. Following the timeline above (Chart 2), there are three main phases during this reconstruction process:

a) Emergency/Response period (2010): members of the civil society and non-profits aided in the reconstruction efforts, mainly distributing food, water and shelter. During this period, UTPCh completed a full diagnosis of the whole territory, which exposed a considerable vulnerable condition as described in Chapter 1.

b) PRES Pelluhue Design (2010): specific guidelines and actions were established based upon the first diagnosis performed by UTPCh, and in May 2010 the consortium was formed among stakeholders from all sectors to design a masterplan for the area.

c) Implementation Phase (2011-2014): The PRES' were supposed to last the whole period (four years) of the newly elected government in order to coordinate the yearly budget with the projects that came from each reconstruction process. After signing the agreement, the PRES began organizing its priorities and target areas. To do this, four different round tables were established:

   - Territorial planning: In charge of incorporating hazard and risk mitigation elements, recovery of heritage areas, adjustments to the local land use and zoning documents.
   - Housing: prioritize rebuilding in own site; locate new sites for reconstruction.
   - Infrastructure and Amenities: Prioritize the recovery of the sewage and water supply. Promote resiliency infrastructure, recover public buildings and school infrastructure.
   - Community & Economic Development: Improve cultural amenities, leadership programs, promote local businesses and job training.

Throughout these four round tables, community leaders, municipal officials and private sector actors participated during the whole design and implementation process of the PRES, where specific projects were identified and organized according to their priority. This meant that some projects would take place after 2014, when transition of power occured, which put more pressure on accelerating the bureaucratic process and take immediate action. Chart 3 below shows the methodology implemented

for the PRES, in which every decision was based on the initial diagnosis produced by *Un Techo Para Chile* (UTPCh) and it became the basis in which any future investment would work around.

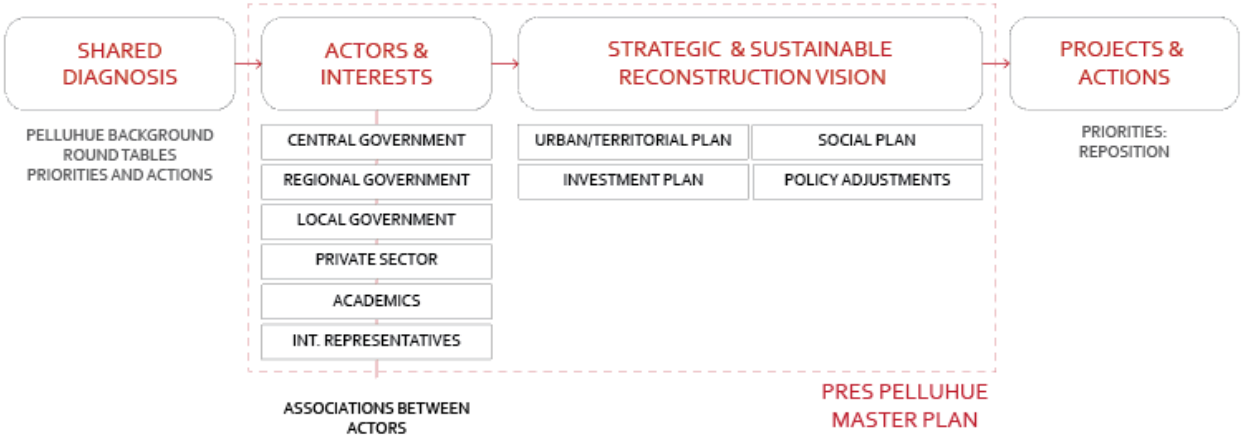

Chart 3 PRES Pelluhue Methodology. Source: PRES Pelluhue 2010

According to Roberto Moris, from IEUT, "…given the local government's fragility, we worked with them anyways, and we understood the central government's structure and its own logistics. We understood the plan could play an important part, and it could create a dialogue with these logics. We formed a team of people with public service experience and worked forward from the diagnostic made by UTPCh, which was extremely thorough, and had validation by the Municipality and the community."[4]

The PRES' main objective is to 'incentivize urban sustainable development in economic, social, and environmental terms that would lead to the area's rehabilitation and raise its standards, which creates an engine for future development and improvement of its citizen's quality of life.' (IEUT-UC 2010) To achieve these goals, the PRES becomes an instrument that has to be realistic to the area's character and existing situation, by defining clear actions and promoting associations between the different actors. The 'strategic' component of the PRES involved three main action paths (IEUT-UC 2010):

[4] Moris, Roberto, Personal Interview, November 2017

1. Future development vision: Relate Pelluhue with its closest neighbors within the region and promote its economic development throughout these connections. Future development must include sustainable criteria in every scale, from the territory to the specific site; and most importantly, make sure that any future investment contemplates the reduction of vulnerability standards and guarantees sustainable development.
2. Identify strategic areas for investment (Integrated Management Zones – ZGI): Identify precise projects and policies in which different actors, resources and conflicts can articulate. This meant studying the use and availability of public land to help articulate some of these projects, such as the waterfront park and stadium.
3. Key structuring projects: That will impact in a positive way and achieve several goals. Within this path, a specific short-term plan was designed called "Summer Action Plan" in order to facilitate the coastal area recover quicker for the next summer season. The following priority focused on rehabilitation and recovery of basic and important infrastructure (schools, health, sports, tourism and local economies).

Moris, very emphatically, explained how the PRES "…made sense and the investment projects were well rounded. Even though the local government had its weaknesses, it kept working and a committee was formed, a round table in which several ministries participated and it really worked. I think it is one of the few experiences that have continued over time and people are still witnessing the long-term results."[5] The implementation approach was centered on the PRES and the coordination of each structuring project in order to replace and restore essential community services and improve the previous conditions for future development.

[5] Moris, Roberto, Personal Interview, November 2017

2.2.4 Finance Structure

The 2010 earthquake and tsunami reconstruction, at a national level, had diverse financing sources in order to repair the estimated costs of MM US$30,000. The central government created a National Fund for Reconstruction (FNR) in May 2010 destined to "finance the reconstruction, reposition, restoring and rehabilitation of infrastructure, services, historic architectural heritage, located in the municipalities or regions affected by earthquakes, tsunamis, volcanic eruptions, flooding, landslides and other catastrophes that might occur in national territory." (Ministerio de Hacienda 2010) The fund is comprised by a series of funding sources, such as: private donations made by national and international entities which, according to the law, must be spent in a period of two years after the donation is made, and whoever donates receives incentives in the shape of tax credits; tax revenues from the increase in taxes collected from tobacco sales; specific tax applied to the mining (copper) industry; and from budget modifications. According to Useem et. al., this fund intended to incentivize private donations that would finance public projects in every affected locality (Useem and Kunreuther 2017).

In the local level, the 26 PRES that were designed were financed through a series of public-private partnerships that became an institutional management model. These associations between different stakeholders and the public sector was aimed at "improving the region and its cities competitiveness since it allows for territorial synergies among the different actors without overlapping efforts" (IEUT-UC 2010) together with acknowledging that the existing regulations and planning instruments were not sufficient to approach recovery processes.

PRES Pelluhue, as mentioned previously, was designed through a multi-stakeholder alliance in which the British Embassy donated the necessary economic resources for the Plan's design and implementation. Later, once the structural projects[6] were defined and its costs estimated, the Plan

[6] See Appendix C for list of Projects and its funding sources.

coordinated who would be in charge of executing each one, either the public sector through its Ministries (MINVU or MOP) or the private sector through the donations made to the FNR. This structure made sense at the time given the level of damage and the large territorial scale it encompassed. Centralizing the donations through the National Fund was a way to allocate resources according to each locality's scale and needs as a more equitable distribution scheme.

2.2.5 Outcomes

In order to define the different priorities and organize stakeholders and organizations that were involved in the process, the PRES defined three geographic pieces within Pelluhue, shown in Figure 5. These pieces were organized to have a set of components that combined urban design of public space elements with singular buildings that together formed a cohesive proposal. The project aims to preserve the area's identity while at the same time providing urban infrastructure that would respond to existing urban problems or deficiencies that would mitigate any future hazards.

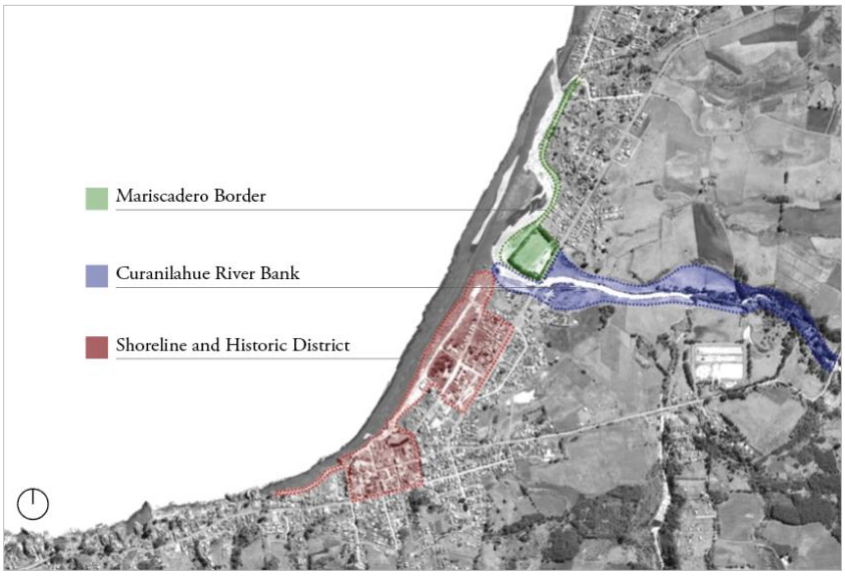

Figure 5 PRES proposal: three main pieces. Source: PRES Pelluhue 2010

a) Shoreline and Historic district: This piece contemplated the construction of bike lanes, tsunami memorial, mitigation infrastructure (by expanding the shoreline and integrating the

beach, park and boardwalk), and public spaces, among others. It also considered the design and implementation of evacuation routes.

b) River bank: This piece works on improving the channeling of the Curanilahue River and the construction of a Recreational Park.

c) Mariscadero border: This final piece had the most infrastructure projects: reconstruction of the Municipal Stadium, (which also represents a mitigation element) bridge reconstruction, bike lanes, and boardwalk that would continue the proposed shoreline park in Piece a).

As mentioned before, the political organization in Pelluhue was very fragile when the earthquake and tsunami hit and they had no specific tools or expertise in handling the many responsibilities that were demanded when facing such level of destruction, the PRES became the main planning tool to organize the next steps and priorities to restore activities. The established action lines explained in the previous section represented a strategic vision and action plan for the next years together with a mechanism developed to facilitate a multisector approach.

Today, after eight years from the disaster, not all of the infrastructure has been completed. Various political shifts in local and central government have impeded the continuity of some projects due to resource allocation, but the most important ones have been completed: Shoreline boardwalk, Municipal Stadium, Curanilahue Bridge together with improvements in the overall infrastructure (lighting, bike lanes, paving, and more).[7] These physical improvements provided Pelluhue of much needed infrastructure that incorporated resilient elements to mitigate future events along the waterfront. During my field trip, which occurred during a weekday, I was able to observe how local students used the many amenities the boardwalk provides: gym equipment, shaded areas, sports fields and more.

[7] See Appendix B for before and after pictures. The latter were taken during the field trip in November 2017.

2.3 Santa Olga PUIR

2.3.1 Post-disaster conditions and characterization

Santa Olga's PUIR is built upon the devastating wildfires that razed the Maule Region during January 2017. The consequences of this disaster were the destruction of over 600,000 hectares in the central regions of Chile. In the Maule Region in particular, the fires left 2,976 victims whose houses were burned to the ground, which represent around 69% of the total number of overall national victims (SEREMI MINVU 2017). The first step to avoid any fatalities took place before the fires reached Santa Olga, which meant its residents evacuated the area for safety precautions. Indeed, the night of January 25th 2017, Santa Olga practically disappeared from the map, as figure 7 below illustrates the before and after. The next step towards recovery was to activate emergency protocols in order to assure people had access shelter, food, and water, and making sure they would not return to Santa Olga until the authorities had a specific plan in motion that would assure their long-term safety.

As mentioned in Chapter 1, Santa Olga is part of the Municipality of Constitucion and has an important forestry component within its local economy. Santa Olga developed around the forestry industry due to its close proximity to several companies and most of its residents currently work in

Figure 6 Santa Olga before the fires, around 2013 (left) and after (2017).
Source: Google Earth, Terraserver

that sector. The historically scattered development of the forestry industry has been difficult to manage and the residential [informal] settlements around them have grown organically without any organization and respect for projected right of ways and other physical regulations. This led to a greater hazardous condition, especially for those living in defined risk areas (landslides, forest fires and others).

In terms of infrastructure and services, before the fires Santa Olga had a primary health center, a primary school and a police department that covered its resident's demands, but it lacked paved roads, sidewalks and basic services such as continuous water service and a sewer or septic system, hence, its conditions were untenable in the long term, especially if the city projected further growth.

The survey completed by MINVU during the post-disaster period showed that the fires razed not only with forest plantations and houses, which meant the residents lost their houses and in many cases their place of work; the fires also destroyed a series of basic services and critical infrastructure needed for the city's normal functions. This level of destruction that affected all aspects of people's lives (economic, social and physical) meant that the reconstruction had to be approached from all three aspects and utilizing this opportunity to repair, improve and mitigate for future events and hazards.

Before the wildfires, Servicio Pais[8] had already done a general survey in Santa Olga to characterize its residents in terms of employment and occupations, ages, educational attainment, housing tenure and more. The PUIR's design used this data together with on the ground surveys developed by the SEREMI MINVU of the Maule Region. Table (7) and (8) show the results from the survey performed by MINVU in order to understand the magnitude of the disaster as well as understanding what was the tenure of each lot. Besides understanding the level of damage, extensive fieldwork was undertaken to analyze the land's suitability for future development, establish growth boundaries and hazard areas. As shown in the figure below (Figure 7), Santa Olga's growth has extended along the highway and

[8] Servicio Pais is a social intervention platform created by Fundacion para la Superacion de la Pobreza that aims to transform rural communities through increasing technical capacities of these communities so that they can initiate their own businesses and overcome poverty with support from young professionals.

formed three more localities. According to the survey by Servicio Pais, the physical boundaries are also related with the existing social networks and linkages with the forestry industry. The residents of each sector feel represented and tied to their place of residence. This social element was taken into consideration when developing the PUIR in order to preserve the existing connections and encourage community building between each one.

Figure 7 Separation of localities in Santa Olga
Source: Google Earth, Santa Olga PUIR 2017.

Table 7 Santa Olga Population Estimates by locality

Locality	Housing Units Surveyed	Surveyed Residents	Housing Units not Surveyed	Estimated Number of Residents	Total Housing Units	Total Residents	Percentage
Santa Olga	574	1,621	6	17	580	1,638	54.35
Los Aromos	329	876	9	25	338	901	29.91

Altos de Moran	57	164	94	263	151	427	14.18
El Membrillo	8	21	9	25	17	46	1.53
No information	1	1	-	-	1	1	0.03
Total	**969**	**2683**	**118**	**330.4**	**1087**	**3013.4**	**100**

Source: SEREMI MINVU Maule

Table 8 Survey of Damaged housing units by locality
Source: SEREMI MINVU Maule

Locality	Owner	Renter	Occupancy permit	Irregular occupancy	Total
Santa Olga	293	41	137	102	573
Los Aromos	190	30	71	38	329
Altos de Moran	28	6	22	1	57
El Membrillo	2	n/a	5	1	8
No information	1	1	n/a	n/a	2
Total	514	78	235	142	969

2.3.2 Stakeholders involved

Environmental conditions during the summer of 2017, strong winds, high temperatures and decades of drought in the central regions of Chile, exacerbated the strength and magnitude of wildfires that consumed over 600,000 hectares of land. President Bachelet called this event the "greatest forest disaster" in Chilean history (Watts, 2017)(Martinez 2017): the fires wiped out entire towns, around 1,500 homes, 11 people perished together with livestock. This event affected large part of the country and Santa Olga became the symbol of the disaster: its population evacuated while flames took over the whole area. Given the magnitude of the disaster, the central government took a leading role in its response and recovery process. During the first phase, which was to control the spread and contain the fires, the Chilean government asked for international assistance to help stop 108 major active fires burning simultaneously (NASA Earth Observatory 2017). Even though help from abroad was extremely helpful, Santa Olga could not be saved from uncontrolled flames.


ENVIRONMENT JANUARY 20, 2017 / 6:05 PM / A YEAR AGO

Chile declares state of emergency due to massive wildfires

Reuters Staff 2 MIN READ

SANTIAGO (Reuters) - Chile declared a state of emergency on Friday as more than a dozen wildfires that have scorched nearly 50,000 hectares (123,500 acres) threatened to encroach on towns, factories and vineyards.

Fire is seen on a hill in a town called Pirque, on the outskirts of Santiago, Chile January 20, 2017 REUTERS/Javier Torres/AtonChile

Figure 8 Reuters news clipping, reporting state of emergency due to wildfires. Source: Reuters.

The reconstruction process for Santa Olga operated in a different manner. Once the emergency period was under control the MINVU instructed its regional office, SERVIU Maule, to start working on a reconstruction plan that would improve the past conditions in Santa Olga. SERVIU Maule determined that the task was extremely complex and needed help from other public entities in order to organize next steps. Another important element that is common during post-disaster scenarios is the almost immediate desire to help that came from NGOs such as UTPCh or Desafio Levantemos Chile, which in the case of Santa Olga were eager and participate during the recovery efforts. Private

sector companies were also interested in helping and providing economic resources in order to restore their employee's place of residence. The following were the main stakeholders involved in the recovery process as well as in the Plan's design and implementation:

- **Central Government:**
    - National Reconstruction Representative: President Bachelet named this position to face the new series of catastrophes that began with the 2017 wildfires. Its responsibility is to coordinate with the head of each ministry the reconstruction process.
    - Regional Reconstruction Head – Ricardo Carvajal: This figure was also created to face the reconstruction process following Santa Olga's fire. His job is to coordinate every multisector action for the 'new Santa Olga.'
    - SEREMI MINVU Maule: Regional office for the MINVU; institution in charge of general coordination among all other governmental entities, heading the round tables and community presentations. It was also in charge of the PUIR's design and implementation process.
    - Other SEREMI's (Public works, Health, Education, Sports, Roads): Each regional office was in charge of the design and implementation of specific projects for Santa Olga, such as the new bus station, new school, parks, hospital and more. Each unit had to collaborate with SEREMI MINVU and follow the PUIR's design and coordination.
    - CEHU – Urban Housing Studies MINVU: Unit dependent on MINVU, in charge of gathering and analyzing data related to housing and urban development to support the implementation and monitoring of public policies. During the PUIR's development, CEHU supported data collection process.
- **Local Government – Municipality of Constitucion:**
    - SECPLAN - Planning Department: Its objective is to support and guide the Mayor and Council urban policies together with the creation and evaluation of plans,

programs and municipal projects. Constitucion's SECPLAN was the administrative link between the SERVIU Maule and the Municipality D.O.M.

- D.O.M – Department of Municipal Buildings: Its main role during the PUIR's implementation process was to expedite the bureaucracy to obtain building permits so that the reconstruction process can proceed more efficiently.
- DIDECO - Community Development Department: Its goal is to improve the quality of life of the residents in the community through activities that promote organized participation. In the case of Santa Olga, the DIDECO helped establish round tables between community leaders and governmental representatives, in order to have community input throughout the whole process.

- **NGOs:**
  - Un Techo Para Chile (UTPCh): Same as in Pelluhue, UTPCh was in charge of emergency coordination: emergency housing planning and, food and water supply.
  - Desafio Levantemos Chile: NGO created in 2010 after the earthquake and tsunami. Its mission was to restore public schools along the country. In the case of Santa Olga, they provided over 240 definitive housing units and are currently developing the construction of a new school.
  - Hogar de Cristo: Public charity and foundation that works with over 25,000 people living in extreme poverty. During the Santa Olga wildfires, they were in charge of restoring the Kinder Garden through donations from the private sector.(Hogar de Cristo 2017)
- **Private sector:**
  - Arauco Forestry Company: Given their economic connection to Santa Olga and its surroundings (they own about 80,000 hectares of forest plantations (Forestal Arauco 2017)), their commitment consisted in rebuilding the El Cruce sawmill where 125 people from Santa Olga work at, this way those families were able to secure their income.
  - CMPC – Paper and Cardboard Manufacturing Company: Provided donations in wood and construction materials.
  - AOA – Architect's Offices Association: they offered their knowledge and experience during reconstruction process through a collaborative process with

MINVU. They donated the designs for several community centers, the fire department and other information.

2.3.3 Timeline and implementation process

The Ministry and Regional office determined that the residents of Santa Olga should remain away from the area in order to plan an efficient relocation, so they had to restrain civil organizations from entering the area. In order to develop an organized recovery process, the stakeholders mentioned above were coordinated through the SEREMI MINVU office. The proposed course of action was to develop a strategic organization of the territory through consensus obtained by regular meetings with all departments involved, private sector and civil society. The proposal became the PUIR, which addressed previous needs that were identified through the survey and improve them, and it would also represent rebuilding the physical environment from the ground and become the navigation chart for its reconstruction based on a series of projects that addressed short-term infrastructure needs to long-term future development.

The PUIR has to work with an existing planning framework and planning documents that provide important information and reference tools. The following chart (4) shows the relationship between

these documents that affected Santa Olga. In terms of scale, these documents can be organized from a larger regional scale to the local context as follows:

a) Maule Region Development Strategies 2008-2020: Its goal is to plan the growth and expansion of the region's main cities and its investments.
b) Urban and Territorial Infrastructure Development Plan: Its main goal is to reduce the existing gaps in terms of access to transit and connectivity, in order to strengthen the region's economic development.
c) Municipal Development Plan – 2016-2019: Creation of a vision and project portfolio for a given period of time. This plan was developed with community participation.
d) Municipal Zoning Plan – 1988: This plan only covers the city of Constitucion, leaving out other towns in the area. This document is currently undergoing updates (since 2004) and plans to include localities such as Santa Olga.

Once Santa Olga's population was evacuated and the fire was extinguished, the following step was to do an extensive survey to determine the number of houses that were lost, who lived in each one and begin to weave the existing networks in order to understand how Santa Olga operated. This period

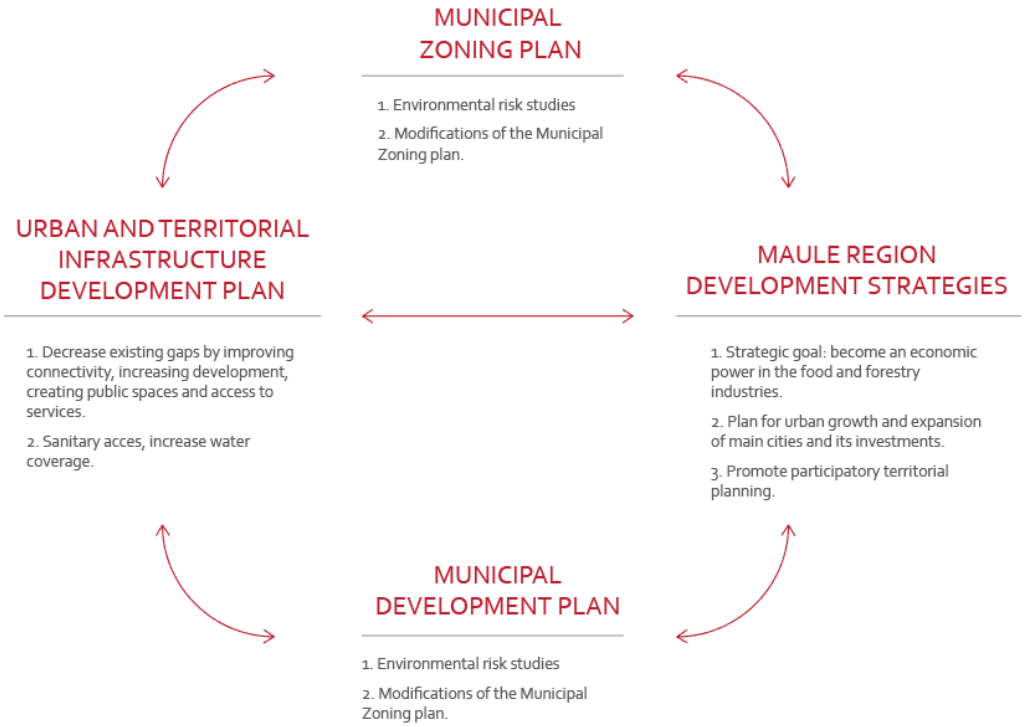

Chart 4 Existing Territorial Strategies affecting Santa Olga
Source: PUIR Santa Olga, 2017

was extremely important because with this information, together with the previous survey completed by Servicio Pais, the PUIR could begin to form a general picture identifying specific needs and how immediate they were or not. Following the timeline below (Chart 5), there are three main phases during this reconstruction process:

a) Emergency and Response period: once the area was clear and secured (families were moved to other nearby localities), the surveying began, together with organizing several

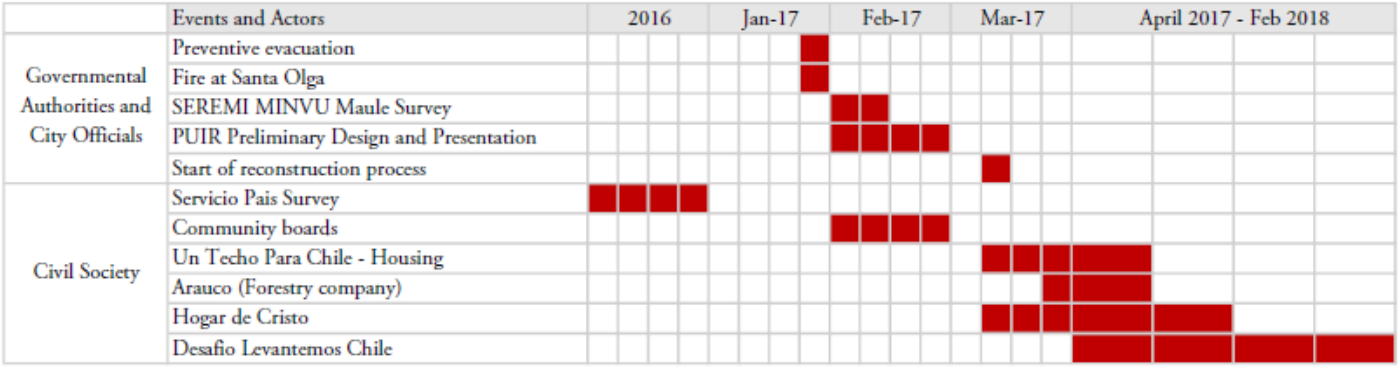

Chart 5 Timeline and Actors involved in Santa Olga's Reconstruction

meetings with the community, civil society and other parties who were interested in providing help and resources. This stage called for much collaboration and coordination between the entities mentioned before.

b) Santa Olga PUIR Design (1 month): With the data collected from the survey and other land analysis performed by other organizations, the Plan's design took place. The first version of the plan was presented to the community one month after the fires, and it involved a general vision for the town together with specific areas of intervention based on the priorities that were identified during the first phase. The Plan was designed by SEREMI MINVU from the Maule Region and it incorporated every ministry involved. The main areas that were identified were:

1. Basic Services: Provide Santa Olga with basic services such as continuous water supply, sewage and electricity (improvement from previous condition).
2. Roads and Public Space: The goal was to pave all streets and alleys together with normalizing widths and including basic services below them in order to improve overall accessibility and connectivity to other localities. Another goal was to add new

public spaces that would sum over 56,000 square meters, especially by creating risk boundaries and adjusting the road network.

3. Amenities: Some amenities would need to be relocated to be closer to the primary road network or because they were built in hazard areas. Some of the amenities the plan considered were: Fire department, sports, stadium, kinder garden, high school, Primary Care Facility, Bus station, Cultural center, and more.
4. No-build areas: Regulating boundaries for no-build areas that represent future risks and hazards (landslides, fires, and more).
5. Housing improvements: make sure that all residents have access to quality housing even if it means regulating tenure.

Along with these areas, a project portfolio was created in which details about each element in the plan were defined. Each project had requirements made by the institution in charge and whoever was in charge had to comply. They were all aligned with the PUIR's general guidelines.

c) Implementation Phase (Feb. 2017 - ongoing): The implementation process began once the PUIR was designed and validated by the community (through round tables and presentations along the process). In this phase, other stakeholders who wanted to participate could select a project from the project portfolio, this way, economic and professional resources were assigned specifically to each project.

During the design and implementation phase a series of round tables were established that helped keep every entity involved aligned with the Plan's goals. Throughout weekly meetings, community leaders, all levels of government, especially the heads of each regional office, and municipal officials participated. During these instances, priorities were defined as well as identifying the institution who would be in charge of each project or element of the plan. A final project portfolio was established that addressed needs in the short, medium and long-term.

The following chart illustrates how the process works by involving every actor from the start in order to formulate an action plan and assign responsibilities. It then goes to a technical advisory group in order to validate the project by local laws and regulations and then, the final step is to get validation from the community.

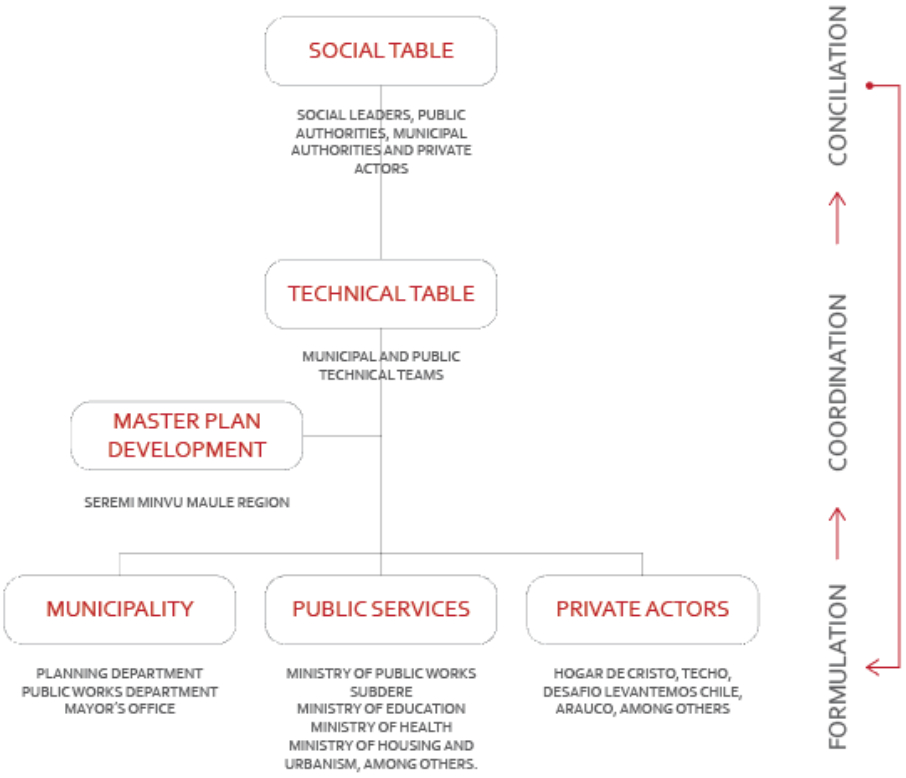

Chart 6 PUIR Decision making structure. Source: PUIR Santa Olga, 2017

2.3.4 Finance Structure

In order to organize the financial aspect each element of the Plan, the project portfolio established a structure in which each of the 34 projects were organized according to its time frame (short, medium and long-term), scale (Housing, Neighborhood and City levels) and typology (Public Space, Amenities and Infrastructure).[9] This list was then opened to every entity who would take charge of each element. Out of the 34 projects, 15 will be completely financed and executed by the public sector, which

[9] The project portfolio list can be found in Appendix C.

includes main infrastructure (water, sewage, road paving and electricity) and some services like the bus terminal, primary care facility and all public space projects; ten of them will be done by the private sector, such as community centers, cultural center, primary school and religious buildings; and the rest with a mixture of both. The reason behind this structure is that all the main infrastructure that had to be built in the short-term (roads, sewage, and more), had to be coordinated among the different ministries involved (Public Works, Health, and Housing) before involving any other actor to take over projects that were going to be implemented in the medium to long-term.

This financing structure serves the purpose of assigning roles and responsibilities to each actor and at the same time it supports the public sector, who has limited economic resources, to provide additional infrastructure through public-private partnerships. Past events, such as Pelluhue, has demonstrated that public-private partnerships are an effective method of involving other actors in the implementation process of a master plan: they take on specific projects and execute them in an cost-efficient way, rather than going through bureaucratic and tedious processes as public investments usually do. In the case of Santa Olga, which many of the projects are still under construction or preliminary design stages, there is still time to see expected results in order to properly evaluate such action plan and the type of financing used for each project. Although the Plan is not completed yet, the organization mentioned above there is clear about the objectives each project must accomplish, what are the requirements and guidelines that were previously established by the Plan which helps developers have clear expectations about their investments, and this in turn, lead to clear accountability once the projects are completed.

2.3.5 Outcomes: expected and under development

The PUIR's main projected outcome aims at repopulating the area and transform it into a central location within its rural context. To achieve this, the plan's design established a three-part matrix in

which all actions and projects will promote and strengthen the existing positive qualities of the area while at the same time preventing past patterns that threatened the safety and quality of life of its residents (PUIR 2017). The main themes that group several variables are the following:

a) Progressive growth: Promote job opportunities, facilitate access to quality housing, avoid inorganic growth that leads to informal settlements, and provide basic services. By providing new and better services, new businesses and job opportunities outside the forestry industry could emerge and provide space for working woman and other disadvantaged groups.
b) Sense of belonging: Provide amenities to elderly groups so they can convey the sense of belonging to younger generations; control and regulate the construction of secondary units in one lot; design risk management measures and regulate urban growth to generate confidence in the safety of the area.
c) Promote the central location within its rural context: Improve connectivity; provide a set of quality amenities and services to attract visitors from other localities; reinforce its 'node' quality. Main projects that will be executed to achieve this are: Primary Care Facility, High School and the Bus station.

As mentioned in the implementation section, the PUIR began its construction in March 2017 with participation of several private actors who provided economic and professional resources. During this past year, some results are visible today: According to MINVU's press release (MINVU 2018), the bus terminal is almost completed and more than 40% of the main infrastructure is ready. Over one hundred housing units are currently under construction and 45 units have already been delivered to its owners. Even though the number is small considering the original need for almost 1,000 units in total, the main developments have been in terms of infrastructure: paving the streets and incorporating

basic services to all lots so that when the houses are completed they boast quality services and improve previous conditions.

The following images were taken during the field trip in November, which show the progress of public infrastructure as well as the housing typologies.

Figure 9 Santa Olga, pictures taken during November 2017 field trip.

3 Discussion

When combining the aforementioned literature on post-disaster management and reconstruction together with the detailed study on two Chilean cases, particularly on how each of them approached the design and implementation process, the interviews I conducted suggest there is a number of common patterns and themes that can be helpful when evaluating post-disaster recovery processes as well as differences and gaps between them. This thesis does not look at which one did best or achieved most goals, it rather examines each governance structure and what can be learned for future events. Since both events represented a disruption from normal activities, similar themes were identified even though the two cases represent quasi-opposite approaches. The following are the main themes that were identified through the analysis process combined with the literature review provided in Chapter 1.

3.1 Shift towards decentralization

Chile's governmental structure can be considered as centralized, where each level, regional and municipal, depends on the central government. This relationship has historically constrained smaller localities' capacity to address important tasks since there is little to no integration between them and each level has limited attributions to work independently as Arana Araya exposed. The lack of integration and attributions has led Municipalities to either take the lead and promote planning at the local level (those who have resources), or on the other hand, left other ones without any regulatory framework that would guide the city's future development, such as Pelluhue.

During the 2010 reconstruction, a new approach was implemented geared towards integrating different stakeholders into the planning process, a more decentralized operation, particularly focused on what the private sector could offer which were mainly economic and professional resources. A shift towards a more neoliberal way of operating, as Cociña suggests. The reconstruction process also

integrated a variety of professionals, from the Academic sector, who provided technical knowledge; the NGO sector who offered volunteers and infrastructure aid; and the community, through round tables and community meetings. According to Roberto Moris, this approach was "the demonstration of a government that was very open to the private sector without much public-sector experience, and this meant at the same time, that they came without any prejudice, which is a good thing. (…) They did not hesitate in deciding what to do. (…) That lack of prejudice helped engage the private sector in the reconstruction process, diverging from what the previous planning culture had been."[10]

The 2010 recovery process revealed that the existing governmental structure had important deficiencies due to its fragmentation and lack of integration, where more than 200 localities had to fend for themselves without resources and depending on help that came from the central government in the shape of subsidies and complicated bureaucratic processes and regulations during this period, Municipalities had no special attributions to deal with the magnitude of the disaster and depended on the help that came mainly from the private sector and NGO. Within this context, the reconstruction process promoted by the [right-winged] government, sought this opportunity to introduce a new methodology that allowed new stakeholders into the planning and implementation process. In this sense, the approach employed tried to offer a more decentralized way of doing things but at the same time were faced with a rigid regulatory and legal framework. Time constraints did not allow to re-think and reorganize the existing structures and transform the model into a more participatory and decentralized one; as Boano and Cociña discuss, to take this opportunity in which every relation between actor's shifts, to reduce the existing asymmetries through a political process *(Boano and Cociña 2013)*.

The PUIR on the other hand represents the continuity of a top-down scheme in which there is a head, in this case the Ministry of Housing and Urban Development (MINVU), that coordinates

[10] Moris, Roberto, Personal Interview, November 2017, Santiago, Chile

every other actor involved, including other Ministries. Even though the process was more centralized, the decision-making process in this case was done through a multi-sectorial round table in which all actors participated throughout the whole process: community leaders from Santa Olga, technical heads of each Ministry involved, Regional offices, private sector and NGO's. This meant the Plan was designed according to the urgent needs and wants of the community and at the same time with a well-defined regulatory framework that put initial requirements on the plan from the start. "The PUIR gathers every data available and creates a detailed project portfolio in which every Ministry in charge of services (sewerage, water, street paving, schools, hospitals and more) commits on developing the projects according to our guidelines. We were able to coordinate every project from the start. If we did not do this, we would have had to re-do many of them."[11]

Research has shown that both cases when faced with a disaster ideated different methodologies to adapt an existing rigid legal and regulatory framework in order to design plans that could be implemented in a more flexible and participatory way. Each case engaged actors in different ways and managed to establish clear goals and specific tasks for each one involved. This reveals an existing deficiency in institutional structures that will be analyzed in the following section.

3.2 Governance and recovery

Traditionally in Chile and Latin America, reconstruction processes are mostly seen as a housing provision problem, focusing mainly in reducing the deficit through subsidies, providing immediate shelter and sorting through the emergency period. The case studies analyzed for this thesis are two of many other examples recently implemented in Chile that search for new solutions through the adaptation of existing legal and regulatory frameworks that go beyond housing provision and

[11] Soto, Daniela, Personal Interview, November 2017, Talca, Chile.

provide guidelines for future urban development.[12] Both cases, according to Moris, illustrate an increasing concern towards the urban environment, which goes in the opposite direction than traditional planning-for-risk methods. "Previous events have demonstrated that the traditional approach to recovery has been through the use of existing documents or instruments in order to get things done faster. Reality has shown that these instruments experienced many revisions in order to adapt them to each context and situation post-disaster. For the Ministry is clear why they promote this: it is easier to use existing instruments rather than to modify them; and historically, every time an event occurs, documents get modified and there is no continuity."[13]

Even though Pelluhue and Santa Olga reconstruction processes are two different approaches, both of them look to restore and improve the previous conditions, searching for a more sustainable and equitable development (PRES Pelluhue, 2010). Although both cases used the same planning 'tool' to address the problem, their implementation and internal organization are almost opposite: the PRES privileged the involvement of the private and NGO sector through financing and design of the master plan, while on the other hand, the PUIR promoted a top-down multi-sectorial organization, in which there was a head who coordinated every other entity involved.

The 2010 earthquake and tsunami, according to Moris, "generated a crisis of the State's structure and how to approach the disaster. In this sense, the disaster is a positive event because the State learned from the experience and spent more resources than before to understand natural phenomenon such as these ones."[14] This disaster also revealed that the existing government structure lacked the institutional capacity to deal with such level of damage in a traditional top-down practice,

[12] Both Plans use existing subsidy allocation to solve the housing requirements following disaster. In the case of PRES Pelluhue, housing provision was approached through state subsidies that families could apply to and choose from a series of alternatives provided by private developers that fit their needs and budget. On the other hand, Santa Olga's housing units were assigned by the State through the initial survey that identified the original residents (owner or renter) who applied for subsidies in a much more streamlined process and without the private sector participating.
[13] Moris, Roberto, Personal Interview, November 2017, Santiago, Chile.
[14] Moris, Roberto, Personal Interview, November 2017, Santiago, Chile.

so they came up with a mechanism that would allow them to restore localities to their previous conditions with the help of different stakeholder groups. Through the design and implementation of strategic master plans, the PRES' were developed to address the post-disaster period and were meant to be a tool that specified the guiding principles and establish responsibilities among the actors that participated in each one, rather than establishing policies and a new legal framework to address the problematic. As mentioned previously in Chapter 2, the post-disaster recovery in 2010 was dealt through a consortium in which all sectors participated in the design and implementation of the Plans. It was important for these documents to align interests and concerns and assign responsibilities to each stakeholder so that results can be monitored and there is accountability once the implementation process is completed. In this sense, Carlos Moreno was very emphatic about the role of the Plans during that time: "The Plans have to adapt to existing regulations. They are not documents that recreate everything, it is a navigation chart of what needs to be done to recover a locality facing disaster. It has to comply and accommodate to all pre-existences and it has to consider which regulations are in place in order to propose any new project. On the other hand, from the Plans, modifications to the PRC are possible and could arise."[15]

Nonetheless, the Santa Olga process followed a different structure, a more top-down approach, as previously mentioned. Even though the structure allowed less flexibility than the PRES, the PUIR managed to incorporate different stakeholders into the conversation. They identified the need to have every interested party become part of the design process in order to have a successful project, one that the community will validate and feel as their own. In this sense, Daniela Soto explained why the PUIR's process was so efficient and successful in its own terms, "Previous events are handled efficiently during the emergency period with aid being transported from one part to another and providing shelter as a priority. But there is not an established procedure on how to handle

[15] Moreno, Carlos, Personal Interview, November 2017, Talca, Chile.

such an event in the long-term. We have learned through this process that planning comes first: form multi-sectoral round tables in order to coordinate and assign responsibilities so that every goal is aligned to the general navigation chart and everyone knows what they are in charge of."[16]

3.3 Clear delineation of power between actors and stakeholders

A common theme in both case studies was the active participation of a large group of different stakeholders throughout the whole process. Both Plans were not designed and implemented within closed doors, instead, were effectively done through several meetings, gatherings and engagement activities, in which coordination and delineation of roles was key to achieve successful results.

Firstly, PRES Pelluhue was conceived from the start as a consortium of academics, NGO's, Municipal officials, Regional and National entities and the private sector who supported the design through economic resources. Each stakeholder involved knew their role in the process, as mentioned in Chapter 2, and each actor was held accountable for their responsibilities. Even though they were clearly delineated, the integration among them was not as strong, and actors were mainly focused on the physical reconstruction through large scale infrastructure projects rather than in the social impacts they would have. The Plan itself called for large infrastructure elements (stadium, fishing wharf, waterfront park, bridges and more) that given the scale of Pelluhue, were not economically feasible, so there was an adaptation process that had to be done in order for the proposals to fit into the locality's context. "I believe the PRES is a plan that concentrates many of the community's needs and wants, but there are projects and ideas that were not well formulated and had no chance of getting financial resources. They did not respond to any goal set by the Regional government or the Ministry."[17] According to Moreno, this situation happened with many other reconstruction initiatives

[16] Soto, Daniela, Personal Interview, November 2017, Talca, Chile.
[17] Moreno, Carlos, Personal Interview, November 2017, Talca, Chile.

that had ambitious ideas that were hard to materialize, which in turn, generated great expectations especially in the community. "Every plan should consider the reality in which they are set into and the way in which to align the projects to the existing instruments."[18] The Municipality, in the case of Pelluhue, had a very weak capacity to guide and plan the type of development the city needed, and relied on experts who came up with an ambitious plan for reconstruction. The regional and central government were, at the same time, excited to see plans of such magnitude being presented and implemented along the central regions affected by the disaster.

Santa Olga's PUIR was also ambitious in the sense that they seized the opportunity to re-build the city from the ground up and provide great improvements to pre-disaster conditions. They had the chance to do so because they had *tabula rasa*, much different to the conditions faced in Pelluhue. The multi-sectoral round table that was formed was headed by MINVU Maule, who coordinated all other governmental entities and actors outside the public sphere. According to Soto, "It was very important for them [other actors] that we told them what needed to be done and to support them through this process. Previous events were led by a Mayor or a political figure that determined what the people needed, which is why many of the investments done in the past were not sustainable, it is not that people did not want them, it did not represent them."[19] One of the lessons the PUIR drew from past events is the relationship to establish with the private and NGO sectors. Previously, both actors were invited to lead areas of the reconstruction process, taking on responsibilities they sometimes were not trained or had the capacity to deal with, especially in circumstances were the social factor is strong. As Cociña and Boano explained, sometimes the consequences of implementing a project through a neoliberal approach, in which few actors are in control of all decisions and resources, it leaves behind the reality of the location and its people. "The private sector supports these processes through

[18] Ibid.
[19] Soto, Daniela, Personal Interview, November 2017, Talca, Chile.

economic resources but they do not have the expertise to deal with the community. They do not know what public service is, which is why many projects needed to be grounded and defined technically to fit the reality. It is key that the teams are technically and socially strong for a future plan."[20]

From the research conducted, the PUIR has a better understanding and delineation of responsibilities for each sector. They were able to have multiple stakeholders participate throughout the whole process because they identified the need to have such a structure. The State works with limited resources; and even less for reconstruction purposes, so the PUIR needed the private sector and NGO's to donate their resources, in the shape of economic donations, professionals and materials, so that the project could be successful. To do so, they delineated a specific action plan in the shape of a project portfolio (see Appendix C) where whoever wanted to participate could choose one item and claim total responsibility. This way, the Ministry through MINVU Maule were the coordinators and responsible to help get projects underway quickly and efficiently by dealing directly with other levels of government.

Even though both Plans have been successful in their own terms, as shown in appendix B, the learning process from one to the other is shown in the three themes identified and, in the future, new lessons can be drawn from other events, in order to have a streamlined procedure to face these events. Both cases exposed the need to incorporate other actors that can support through financing and providing technical support, but how they incorporate them has to be clearly started and responsibilities established from the start so that there is clear accountability and coordination between all actors. PRES Pelluhue, and the rest of the 26 PRES that were designed, was an innovative tool that for the first time in Chilean planning history, incorporated sustainability and resiliency aspects to a long-term vision. They were strategic in the sense that the plan fostered physical recovery, and at the same time promoted social cohesion, economic development and public participation.

[20] Ibid.

Both disasters as Moris discussed, were an opportunity to build back better considering the limited resources available and having clear objectives for the future of each locality. Both plans have been able to address environmental hazards which now form part of the municipal regulations and at the same time, have helped educate the population about hazards and potential risks.

4 Planning implications

This thesis tackles with a recurring issue in Chile and globally, which are natural and man-made disasters and how to recover from them in an efficient and sustainable way. Chile has gained international recognition from its reconstruction efforts, especially during the response phase (March and Kornakova, 2017) where specific processes and protocols are in place that help reduce the time spent in this phase and proceed to the next one: *recovery phase*.

Both cases analyzed in this thesis revealed at their time the lack of physical and social preparedness to face large-scale disasters, and an overall unorganized action protocol; both of them approached disasters differently, even opposite, which shows that there is no continuity in public policies related to disasters and risk mitigation and it all depends on who is in charge at the moment. Even though both cases had interesting and attractive outcomes, there is still lessons to be learned that go beyond political sides, and ways of doing things that need to be updated in order to address future events through a more streamlined process and with participatory measures in place that clearly assign responsibilities and resources. This way, future reconstruction processes are not isolated in time and place but can be organized to follow an action protocol that is overarching to all entities, public or private. This does not mean that every recovery process must be approached as a standardized procedure overlooking local issues, rather the opposite: by having a more streamlined action plan, there is more room, time and resources that could be allocated in a more efficient way without needing to adapt policies every time a disaster happens.

The chosen case studies also recognized the limited attributions that each level of government has and that new methods to engage all governmental entities together with non-public sector actors must be designed to face disasters of such magnitude, which are becoming more frequent in recent years. Both recovery processes identified that reconstruction should be done in terms of a long-term and comprehensive plan in which specific goals are established that encompass every aspect of an

urban environment, rather than focusing just on housing provision, which was normally the case. By engaging with different sectors, the PRES and PUIR have identified that there is a recurring need to incorporate the private and NGO sector into the equation: they provide economic and professional resources that the State sometimes cannot afford and execute projects in a more efficient way. For future disaster scenarios, an important task will be one that addresses the types of partnerships that can be arranged with both sectors, private and NGO, that will align with the established goals without compromising community expectations or quality.

Even though each locality has its own navigation chart specific to its locality, it is clear from the research conducted that there are mechanisms that can be improved and institutions to be enhanced in terms of their attributions and coordination. In order to achieve a well-rounded participation of all actors, a legal framework would have to provide security for those sectors as well as regulations that will represent the voices of those who are not at the table. By establishing such framework, reconstruction or other processes can overcome bureaucratic obstacles and allow projects to run smoothly, while at the same time, enabling different entities to participate in traditional state-led processes, which in turn, will promote innovative and creative outcomes. One must be aware that such framework could lead to other issues about competition, potential corruption and opportunistic behaviors, which is why supervision and constant update of "game rules" should promote the desire outcomes.

5 Appendices

A: Interview Questions

The following questionnaire was prepared beforehand and helped guide the interviews. The first part are questions regarding their professional and academic experience in order to understand the role each interviewee had during each reconstruction process. The following sections are semi-structured and open-ended questions that allowed the conversation run smoothly.

Education

- What is your last, or most recent degree?
- What school did you attend?
- What year did you graduate?

Professional experience:

- Current position (check one):
    - Public
    - Private
    - Non-profit
    - Other: _____
- Years of experience per Sector:
    - Public: ___
    - Private: ___
    - Non-profit: ___
    - Other: ___
- What was your position/role during the Reconstruction process? (2010-2014, for the Pelluhue case and today for Santa Olga)

Post-disaster Reconstruction

- What was your specific role and duties during the reconstruction process?
- What were the priorities you encountered from the start? How were they addressed?
- Did the process engage the community? If so, how was this done?
- Did you encounter any problems along the way? What were they? How were they addressed? Did they shape the outcomes?
- How did the different stakeholders come together and align their interests and priorities? Was this a difficult process?
- How was the project able to align with the existing regulations that were in place prior to the disaster? (e.g. Zoning ordinance, Municipality's Development Plan).
- If you could do this again, what would you do differently? Why?
- What are your recommendations for improving the process of reconstruction in the future?

Post-disaster Reconstruction in Pelluhue:

- Would you say the Pelluhue case was successful in terms of goals achieved? If so, how do you measure them?
- What were the determinant factors that influenced the project's success or failures?
- Do you think this is a replicable model that could be applied in future disasters? If so, why? If not, why not?

Post-disaster Reconstruction in Santa Olga:

- What were the key issues that needed to be addressed during the plan's design?
- How did these objectives align with other priorities that were urgent prior to the disaster?
- Could you talk about the short-term and long-term objectives that were determined and how?
- Given the regularity of disasters in Chile and the urgency they need to be handled, do you think the process in Santa Olga learned from past experiences? If so, could you talk about the lessons learned and how they were applied in this case?
- How did Santa Olga's Reconstruction Plan differ from other plans? In what ways do you think this case is better or not?
- What do you expect some of the long-term outcomes will be?

B: Field Observations; Before and after pictures.

Pelluhue

Figure 10 Above: Pelluhue post-tsunami, below: Pelluhue during November 2017 field trip.

Figure 12 Waterfront park, differences in height will provide protection from future tsunamis or floods.

Figure 11 New stadium in Pelluhue, built as a resilient infrastructure.

Santa Olga, pictures taken during Field Trip (November 2017)

Figure 13 New houses and street layout. November, 2017

Figure 14 Paved streets and houses almost completed (November 2017)

Figure 15 Bus terminal in the process of construction (Nov. 2017)

Figure 16 Bus terminal almost completed (March 2018, source: MINVU)

C: Pelluhue Project Portfolio & Funding Sources

Table 9 Pelluhue Project Portfolio and its funding sources.
Source: National Fund for Reconstruction, May 2010.

NOMBRE PROYECTO	ETAPA	TOTAL (M$)	FINANCIAMIENTO
Normalización del sistema de tratamiento de aguas servidas - Pelluhue	EJECUCIÓN	20.000	FNDR
Construcción Iluminación pública I Etapa - Pelluhue	EJECUCIÓN	30.000	SUBDERE
Construcción Iluminación pública II Etapa - Pelluhue	EJECUCIÓN	35.000	SUBDERE
Estadio Municipal - Pelluhue	DISEÑO	57.630	FNDR
Reposición del Estadio Municipal - Pelluhue	EJECUCIÓN	1.921.012	FNDR
Puente Mariscadero - Pelluhue	DISEÑO	10.565	FNDR
Reposición Puente Mariscadero - Pelluhue	EJECUCIÓN	117.395	MOP
Construcción ciclovía - Pelluhue	EJECUCIÓN	10.672	MINVU
Reposición Iluminación pública I Etapa - Pelluhue	EJECUCIÓN	34.000	SUBDERE
Construcción Iluminación pública II Etapa - Pelluhue	EJECUCIÓN	30.000	SUBDERE
Parque Dunario, recreacional y paseo peatonal borde costero - Pelluhue	DISEÑO	25.613	FNDR
Construcción Parque Dunario, recreacional y paseo peatonal borde costero - Pelluhue	EJECUCIÓN	200.000	FNDR
Construccion y habilitación de vias de Evacuación (14) - Pelluhue	EJECUCIÓN	96.000	MINVU
Construccion y habilitacion de Zonas Seguras (6) - Pelluhue	EJECUCIÓN	60.000	MINVU
Regulación Zona de Sacrificio Ministerio de tierra, caleta blanca, mariscadero y parte baja - Pelluhue	EJECUCIÓN	10.000	MINVU
Reparación Internado Mixto, Primera etapa - Pelluhue	EJECUCIÓN	80.000	MINEDUC
Construcción puente I Etapa (peatonal) Rio Curanilahue - Pelluhue	EJECUCIÓN	96.050	FNDR
Normalización terreno BBNN - Pelluhue	EJECUCIÓN	15.000	MUNICIPAL
Reposición y Mejoramiento espacio público Piedra Rota al sur - Pelluhue	EJECUCIÓN	58.163	MINVU
Reposicion Iluminación Pública I Etapa - Pelluhue	EJECUCIÓN	20.000	SUBDERE
Construcción Iluminación pública II Etapa -Pelluhue	EJECUCIÓN	213.445	SUBDERE
Construcción de ciclovia -Pelluhue	EJECUCIÓN	17.075	MINVU
Reposicion y mejoramiento de plaza costanera -Pelluhue	EJECUCIÓN	70.000	MINVU
Parque Dunario, recreacional y paseo peatonal borde costero - Pelluhue	DISEÑO	47.811	FNDR
Construcción Parque Dunario, recreacional y paseo peatonal borde costero - Pelluhue	EJECUCIÓN	425.824	FNDR

C. Santa Olga Project Portfolio

Table 10 Project Portfolio for Santa Olga's PUIR.
Source: SEREMI MINVU Maule Region, Urban Development Department

	Project or Program	Term	Typology	Scale
1	Paseo Avenida Santa Olga	Short	Public Space	City
2	Plaza Acceso Parque Santa Olga	Short	Public Space	Neighborhood
3	Plaza Activa Los Aromos	Short	Public Space	Neighborhood
4	Plaza Cívica De Santa Olga	Short	Public Space	City
5	Estudio Fundado De Riesgos Para Plan Regulador Comunal De Constitución Localidad De Santa Olga	Short	Studies	City
6	Obras Provisorias De Vialidad	Short	Infrastructure	City
7	Paradero De Locomoción Colectiva	Short	Amenities	City
8	Regularización De Loteo Irregular	Short	Housing	City
9	Reposición Jardin Provisorio Personitas (Provisorio)	Short	Amenities	City
10	Adecuación Loteo Alt os De Morán	Medium	Housing	City
11	Ampliación Repos. Ruta L- 30- M Cr. Long. San Javier- Const itución	Medium	Connectivity	City
12	Cesfam Santa Olga	Medium	Amenities	City
13	Iglesia Católica Santa Olga	Medium	Amenities	City
14	Iglesias De Madera (10)	Medium	Amenities	Neighborhood
15	Cuartel De Bomberos	Medium	Amenities	City
16	Centro Cultural Santa Olga	Medium	Amenities	City
17	Diseño y Ejecución Proyecto De Alcantarillado Altos De Morán	Medium	Infrastructure	City
18	Rehabiliación Estadio	Medium	Amenities	City
19	Modificación Plan Regulador Comunal De Const itución	Medium	Studies	City
20	Pavimentación	Medium	Connectivity	City
21	Redes De Agua Potable	Medium	Infrastructure	City
22	Habilitación De Alcantarillado	Medium	Infrastructure	City
23	Luminaria Pública	Medium	Infrastructure	City
24	Conjunto Habitacional Los Aromos	Medium	Housing	City
25	Muros De Con ención Para Viviendas	Medium	Housing	House
26	Relocalización Liceo Enrique Mac Iver, y Sala Cuna y Jardín Infantil Personitas	Medium	Amenities	City
27	Sedes Sociales (4)	Medium	Amenities	Neighborhood
28	Circuitos Áreas Verdes Altos De Morán	Long	Public Space	Neighborhood
29	Circuitos Plazas Altos De Morán	Long	Public Space	Neighborhood
30	Espacios Públicos Entorno Estadio Santa Olga	Long	Public Space	City
31	Parque Santa Olga	Long	Public Space	City
32	Paseo Los Aromos	Long	Public Space	Neighborhood
33	Paseo San Martín	Long	Public Space	Neighborhood
34	Plaza Circunvalación De Santa Olga	Long	Public Space	Neighborhood

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