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EVALUATION OF SOCIAL VULNERABILITY AFTER THE 2010 TSUNAMI AT TUMBES COVE – CHILE THROUGH THE “PRESSURE AND RELEASE” MODEL

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I. INTRODUCTION

Risks correspond to the potential losses that can occur to an exposed system or subject, result of the convolution of threat and vulnerability (Cardona, 2012). In this sense, a relevant part of international research has focused on evaluating risk factors that impact and define the magnitude of the damage in terms of human lives and material losses (Martínez & Aranguiz, 2016). On the other hand, modern philosophers like Phillippe Descola (2011) are right in stating that the separation between nature and human beings is artificial, because they are hybrid objects that determine reality. The same applies for “natural threat” and “social vulnerability”. It is for this reason that “socio-natural disasters” are not just synonyms of “natural threat”, as they depend on two complex factors: the threat of natural phenomena and the progression of vulnerability, which is essentially related to cultural, social and economic elements (Wilches Chaux; 1998; Blaikie et al, 1996; Wisner et al, 2006; Cutter et al, 2012; UNISDR, 2019). These conditions mainly increase the susceptibility of an individual, a community, possessions or systems to the impact of a given threat. Thus, “the vulnerability of a group of people will depend, among other things, on their situation in the urban space, their economic income and their role within society” (UNISDR, 2017).

Without a doubt, the great benefit of territorial organization or planning is that it facilitates a greater sustainability of natural resources, while its urgency mainly lies in the deterioration of the space and its resources. For Barragán (2001 and 2013), when it comes to analyzing this space, this must be done with a unitary sense, that is to say, addressing and integrating all its subsystems, be these physical, economic, administrative or legal. The study of Rodríguez made after the earthquake of 27F, on facing the tsunami risk along the coast, suggested a green barrier that consisted in three rows of *Cupressus macrocarpa* (Monterey cypress) and a plantation of *Pinus radiata* (Monterey Pine), with a density of 11 trees/100 m² and a width of 50 m> immediately behind the green barrier (Rodríguez et al, 2015).

The impression that exceptional events are occurring with greater regularity has appeared, when what really is occurring is the increased exposure of inhabitants to extreme events. Tolerance

thresholds against natural risks have been reduced due to population growth around the world and the intensive occupation of the land (Beck, 1996; McGee & Russell, 2003). Thus, the apparent balance, that is manifested in the continuity of a daily life “adjusted to its environment (López, Otero & Nieves, 2017), is discovered in all its imbalances when the disaster arrives, triggered by an external, physical, disturbing element, but determined by the conditions of human existence, location, structure and organization (Andrade, Arenas & Lagos, 2010; Romero Aravena, Fuentes Catalán & Smith Guerra, 2010).

Tumbes Cove is taken as the case study. Tumbes is a fishing community in Talcahuano (36°38' LS) (Figure 2), a district of the region of Biobío, with high poverty indexes, 27,135 people in multidimensional poverty (CASEN, 2017). This cove has 1,344 inhabitants (INE, 2017) who are dedicated to artisanal fishing, boat building, gastronomy and those who have their primary homes there. Tumbes was directly hit by the tsunami of 27F (Aránguiz, 2010; Barrientos, 2010; Quezada et al, 2012) that lashed the Chilean coast. According to Contreras & Winckler (2013), 2 deaths were reported, 40 homes destroyed and 0.05 km² flooded by the tsunami. Meanwhile, the Coastline Master Plan (PRBC 18) (GORE, 2010) highlighted damages to urban facilities like the local school, the jetty and the dry dock, affecting 4.91 hectares.

Figure 1. Study area and areas threatened by tsunami flooding at Tumbes Cove in the Bay of Concepción. Source: UBB (2010).

This research looks into the way to decompress a socio-natural disaster situation after the 2010 tsunami, at the Tumbes fishing cove in Central Chile. It also discusses about how the reconstruction strategies that the Chilean government implemented, contributed to the generation of conditions of greater vulnerability on focusing solely on the unsafe conditions (CI, in Spanish) and ignoring the progression of vulnerability that Wisner et al (2006) propose. The goal of this article is to evaluate the vulnerability of this fishing community before and after the reconstruction process, questioning whether the community of Tumbes is now more vulnerable after the reconstruction process. A mixed onsite information collection method is used through surveys and interviews with key community players. Finally, this article tries to contribute to the debate about the social construction of risk on the coastal areas of Latin America.

II. THEORETICAL FRAMEWORK

In recent decades, international paradigms for risk analysis have begun to focus on analyzing vulnerability and on understanding risk as a social construct that arises from the historic occupation of territories (Ayala Carcedo & Olcina, 2002), where vulnerability is set out as a series of differentiated characteristics of society, or subgroups thereof, that are predisposed to experience damage when facing the impact of an external physical event or whose later recovery is complicated by this (Lavell, 2012). Although vulnerability is not just a result of poverty, disasters increase existing social

inequalities and harm those who are already vulnerable even more (UNISDR, 2019). Integrated Disaster Risk Management (GRRD, in Spanish) policies look to reduce vulnerability and build resilience, reducing the human and economic loss of disasters (Roberts et al, 2015), avoiding affecting the production and reproduction of vulnerability conditions that define and determine the magnitude of the effects when facing a natural threat (García-Acosta, 2005). For this reason, Wisner et al. (2004) state that considering vulnerability (V) as a static concept is not enough, because simply “it is there”, pressuring the lives of the people exposed to the threat. On the contrary, in their “pressure and release” model, a dynamic process is created from macro-social phenomena to unfavorable circumstances affecting the daily lives of people at micro-social levels (Figure 2).

This vulnerability progression model suggests the *source causes* (CF, in Spanish) in the macro-social and economic processes that may be determined by the nation-state, political-ideological conflicts or changes and international markets (lack of access to power, lack of access to educational institutions, lack of control over the markets, population growth, urbanization, etc.). The CFs operate “remotely” from those affected, that is to say, there is a spatial, temporal or cultural distance between them. Their impact on vulnerability is made invisible and has to be revealed through scientific or technical observation. The CFs do not affect the life of those exposed directly, but rather are transformed into *dynamic pressures* (PD, in Spanish). These are based on the CFs acting at a meso-social scale, transforming them into unfavorable conditions, Indigenous peoples with lack of access to power (CF), without political representation (PD) on forming opposition against the installation of a hydroelectric plant that would leave them at risk of a socio-natural disaster. *Dynamic Pressures* are transformed into *unsafe conditions* (CI, in Spanish) which emerge from the *Source Causes* and result in a direct hazard on the daily lives of those affected in the physical, economic, social or institutional setting, pushing the affected party against the danger imposed by the natural threat, thus generating pressure. The model of Wisner et al. (2006) shows that a socio-natural disaster cannot be reduced by reducing unsafe conditions, as these are based on *dynamic pressures*, which are macro-social structures. Social vulnerability can only be released by improving the *source causes*, which may imply changing the economic model.

Figure 2. Vulnerability progression model. Source: Wisner et al. (2004, p. 47).

III. METHODOLOGY

To get to know the vulnerability, information was collected onsite through conglomerate probabilistic sampling (López, 2004), dividing the study area into four zones, surveying people over the age of 18 (N=316), in five homes per zone (N=79). The evaluation model

with global vulnerability matrices was used (Wisner et al, 2006; Wilches-Chaux, 1993; Jaque Castillo, 2013; Cutter et al., 2012), which weighted diverse criteria to elaborate a closed survey (Appendix 3):

- The socioeconomic vulnerability considered the population exposed, their socioeconomic level – monthly income – and their productive activities (Appendix 1, Table N°1);
- For the physical vulnerability, work was done with a housing conservation status form collected during fieldwork (Appendix 1, Table N°2);
- Educational vulnerability considered knowledge indicators about the tsunami phenomenon, safety zones and the reaction during the event (Appendix 1, Table N°3);
- Governmental vulnerability considered the measures proposed and put into practice through the reconstruction process and the design of infrastructures to mitigate tsunamis (Appendix 1, Table N°4).

The results of previous matrices and the in-depth interviews applied were used as input to get to know the implications of the communities on the pressure and release model, (Appendix 4). These were applied during 2016 to a sample of relevant players or key informers. They were analyzed in Atlas TI, which sought to obtain textual analysis of the survey content and use of keywords to identify possible signs of *source causes* (CF), *dynamic pressures* (PD) and *unsafe conditions* (CI) in the socio-natural disaster and its reconstruction, allowing identifying the progression of visible vulnerability. As the CFs are not directly visible in the answers of affected people, a hermeneutic interpretation was made for this (Martínez Miguélez, 2015), that allowed showing the inherent structures in the situation of those affected, seeking the presence of certain codes in the answers (Table 5). Several vulnerability progression processes were qualitatively rebuilt through the codes and discourse analysis along with the effects the government led reconstruction process had (Brain & Mora, 2012).

Table N°5. Codes used for the textual analysis of the answers. Source: Own preparation.

IV. RESULTS

Vulnerabilities observed at Tumbes Cove

Economic Vulnerability

Most of the population works extracting seafood, so their monthly incomes are low and variable generating the first *source cause* (CI01: socioeconomic vulnerability). Many of these are conditioned by the price of products, state of the boats, good fishing days, weather, etc. With regard to the economic incomes, more than 50% of the cove's population receive incomes that are below the minimum wage established in Chilean legislation (~US\$ 376.16=320,500 CLP)⁴, allowing them to solely cover some basic

⁴ Law N°21.112, Official Gazette. The Official Gazette of March 14th, 2020, established in articles 1, 2, 3, 4 and 5, that the value of the monthly minimum wage would be \$320,500 CLP (\$376.16 USD). The amount of the monthly minimum wage for those over 65 and workers under 18 as of March 1st, 2020 will have a value of \$239,085 CLP.

needs month by month⁵; as such, on facing any socio-natural disaster, they have to wait for State support (PD02: dependence on the State) (CI01: socioeconomic vulnerability). This production sector is considered as the most vulnerable when facing a tsunami, due to the loss of their vessels and fishing tools (CI01: socioeconomic vulnerability).

Educational vulnerability

Questions about the level of formal study and knowledge about tsunamis were used for the educational vulnerability. 80% of the population did not reach secondary education, 5% were illiterate (CI02: low level of education / professional education). On facing the question “Do you know about natural events like tsunamis?” 45% said that they received information through TV stations; 40% radio stations. This allows seeing that many families manage knowledge about socio-natural risks only from what they watch or listen to on these broadcasters (PD03: Lack of organizations to educate and train). After the 2010 tsunami, 70% answered that they did not know about any evacuation plan for this phenomenon, and if there was one, it had not been shown to the community. Only 30% answered that they did know about a means of evacuation, but based on traditional knowledge (PD04: Lack of organization to educate and train), no mention was made about any evacuation plan from the local or central authorities, which is why they acted based on intuition (CF01: absence of socio natural disaster management).

The relationship among neighbors when facing a socio-natural disaster allowed coordinating the provision of mutual essential items, like clothing, blankets, etc., in the moments of social, political and economic imbalance that the natural catastrophe caused (PD05: Absence of central over local level). Living as a community is a feature of small towns, there is solidarity among them and some have known each other all their lives, which is why they are not indifferent to what happens to others (Galleguillos & Ojeda, 2016; Rojas et al., 2014) (CI05: Fragility of social integration: being dependent on solidarity which can be lost quickly). On facing the question, Do you think that your community was united when the Tsunami hit in 2010?, 65% of the population said that the cove was not united while 35% said it was (PD06: Fragility of social relations).

On asking: *When the 2010 Tsunami hit, was there anyone who took on a leadership role (innate) to guide the community to an evacuation or rescue route?* 80% answered yes and only 20% felt they were not guided and evacuated as quickly as possible (CI03: Need for spontaneous organization).

Physical Vulnerability

We asked “In what state of preservation are the houses currently in Tumbes? “How much did the reconstruction help to reduce

this vulnerability?”. When the tsunami hit, no house had a design or infrastructure that allowed mitigating the impact of a tsunami wave⁶ (CI04: Fragility of built setting), nor could the population apply any tsunami-resistant building technique to build their homes, given the lack of formal education and economic resources (CI02: Low level of education / professional education). The government’s reconstruction process projected buildings on the coastline that allowed mitigating the tsunami wave, “*Palafitos*”, a type of house built on stilts; this type of house was acknowledged by 70% of the surveyed population as houses that do have a design that mitigates the effects of a tsunami (CI02: low level of education / professional education). The houses that are present in the tsunami flood threat area mainly have two floors, with the exception of those built on stilts which have three floors, the first being uninhabitable and built with the intention of mitigating the flooding caused by the tsunami (Figure 3). The material of the constructions is 55% wood, 35% wood and brick mix, with only 10% built in masonry (CI04: Fragility of built setting).

Figure N°3. Photographs taken onsite of the “stilt”-type homes at Tumbes Cove. The original model is seen on the left and the adaptation made by the users, on the right. Sources: Photographs of the authors (2016).

Governmental Vulnerability

80% of the population headed to the areas considered as safe, 10% tried to save as many material goods as they could and 5% waited in their homes, while 5% of the population went down to the beach to see the behavior of the ocean. (CI02: Low level of education / professional education). When facing the question, “What was the alarm? Who did you hear it from?”, none of those interviewed heard the tsunami warning from the police or the fire service (PD01: Lack of local structures), 60% of the population stated having been warned by their neighbors, 29% evacuated the floodable area immediately after the earthquake, 52% did so between 5-15 minutes after, 9% did so 15-25 minutes after and 5% evacuated after 25 minutes. Only 5% did not evacuate and stayed in their home (CI03: Need for spontaneous organization).

The population surveyed thinks that Tumbes is vulnerable to the threat of tsunamis. However, the population of the cove has other concerns (GORE, 2014). As often happens, the presence of the threat does not play a leading role in daily life. The community depends on the sea and on their close connection to it. Nevertheless, upon returning to normal life, the requirements for every day survival is what influences their decisions. (CF03: Overestimation and ignorance of the centralist state: ignoring the needs of the players).

⁵ Last January, the basic food basket had a value of \$42,840 per person, the poverty line per person was the equivalent of \$162,830 CLP and the extreme poverty line per person was the equivalent of \$108,553 CLP. That is to say, that a family of four requires \$434,212 CLP (\$509.62 USD) to be on the poverty line (Social Development Ministry, 2019)

⁶ See Appendix 2, Table 2 “Physical Vulnerability”.

The safety area defined by the Hydrographic and Oceanographic Service of the Navy (SHOA, in Spanish) in Tumbes corresponds to a wave-cut platform (> 100 m.a.s.l.), which is accessed to by a tight abrupt road⁷. 35% of the people reached the safety area in less than 7 minutes, 30% took between 10 and 15 minutes, 25% between 15 and 20 minutes and 10% took over 20 minutes. Here, the main difficulty expressed by the population was the tight roads Tumbes has, with just one road to the safety site and no stairs to evacuate vertically (Figure 4). Finally, the sum total of the vulnerabilities studied above presents us with a scenario that favors conditions that, on facing a new tsunami, the necessary precautions, either from the inhabitants or the governmental entities to avoid material and human losses, are not in place.

Pressure and Release Model at Tumbes Cove

Process I. Destruction of the social fabric

The need of organizing a spontaneous socio-natural disaster management (CI03) by the community and the fragility of social integration (CI01) generated the support from relatives or neighbors in the first moments after the event. The reconstruction process after the socio-natural disaster brought with it not just a structural renewal of the homes, but also social conflicts that began to divide the population, generating a social breakdown. On one side were those who had received help due to their material needs and, on the other, there were those who “took advantage” of houses given to people who did not have family (non-renters), while in other cases, there were fishermen who received new motors when they did not own fishing boats (CF05: Lack of trust in the Chilean society).

Figure N°4 Process 1. Destruction of the social fabric after errors in resource distribution. Source: preparation by the authors, adapted from the Wisner et al. model (2014)

Process II: Reconstruction with stilts without training the inhabitants on how to live in them

The neoliberal economic model (Fuster-Farfán, 2019) considers that the responsibility for welfare lies with the individual (CF02). This leads to a lack of education and training regarding socio-natural disasters (PD03) which, for a community, is possible with the support of the State. This dynamic pressure caused insecurity (CI02) because at the moment of the impact, the exposed inhabitants did not how to react in a better way (Figure 5).

The start of the housing reconstruction was marked by the visit of top authorities, as one of those interviewed mentions: “*the Government was involved, the Ministry of Housing and Urbanism, the Mayor came, the police, civil defense, NGOs came to offer help*”. The new construction was not fully imposed, the people

decided which type of house they preferred from all the options provided by the council, considering that the main need was that they were tsunami-resistant. According to an interviewee: “*When they held the meeting, everyone said they agreed with the houses being on stilts due to flood issues, a committee was set up, one person per family was called. There were only three old people who did not agree due to the difficulties they were going to have on climbing the stairs*”. They choose the “stilt houses”, which were delivered in 2015, sparking joy among the people and gratitude for having received them, as one of those interviewed mentions: “*There was nothing else left to do, they had to build the houses for the people. Now, if the houses do not meet their needs, that’s something else, but that they built the houses is something I agree with*”. After this process, many of those interviewed reveal that the cove has lost its identity because the rebuilt homes have a “modern, unfinished” façade, reducing interest from tourists to visit, as one mentions: “*the reconstruction could have been better for the artisanal fishermen, because they had something that was better*”.

Figure N°5 Process 2. Reconstruction with stilts without training the exposed families on how to live in them, maintaining their tsunami-resistant function. Source: preparation by the authors, adapted from the Wisner et al. model (2014).

Process III. Maintaining an unsuitable infrastructure

The absence of socio-natural disaster management (CF01) and the overestimation of a centralist state (CF03), together with an orientation towards great economic players (CF04) have maintained the absence of suitable road infrastructure development. There is a highway that reaches the place, but there are no stairs from the beach to the hill for a quick vertical evacuation, resulting in a permanent fragility of the built setting (CI04). In the reconstruction process, the government has increased the density of the place with larger homes, but has not improved evacuation route accessibility or infrastructure.

Figure N°6. Process III. Unresolved unsuitable infrastructure. Source: preparation by the authors, adapted from the Wisner et al. model (2014).

Process IV. The socioeconomic vulnerability is not reduced

CF02 and CF04 have created a dynamic pressure that is summarized as dependence from the State and the market (PD02). After the reconstruction, this situation does not appear to have improved. Before the 2010 tsunami, fishing was organized among families. The seafoods, on reaching the port, were washed, cleaned, and sold in local markets, directly located on the coastline. What was not sold in the market was sent to a large number of local restaurants and part of the products were sold to regional markets. This production model has been

⁷ See the link of SHOA http://www.shoa.cl/servicios/citsu/pdf/Bahias_Concepcion_San%20Vicente.pdf

restored after the tsunami. The government has acted through subsidies, “bonuses” in cash or in kind. It is seen that instead of supporting fishermen to recover the pre socio-natural disaster state, a valuable opportunity to form resilience in these coastal spaces has been lost. The State contributed to recover the local economy, in part, in the post-disaster stage, but there was no type of innovation in socio-natural disaster management.

Figure N°7. Process IV. Socioeconomic vulnerability is not reduced, the state did not act by structurally modifying this vulnerability. Source: preparation by the authors, adapted from the Wisner et al. model (2014).

Process V: Lack of ethical perceptions and solidarity on facing the socio-natural disaster

The lack of trust towards the State in Chile (Huneus, 2003) and among different political and social groups is patently clear in Tumbes (CF05), creating dynamic pressure (PD06) and fragility of the local social relations (Figure 8). When the socio-natural disaster occurred, the affected parties supported each other, but they distinguished who to support, in other words, an individual depended greatly on a social network that worked well. However, they could not expect help simply because they were affected (CI05).

The people of the cove can be divided into the big winners and losers as according to what they have been able to analyze themselves, concluding that the former are the fishermen because of all the help they received, especially in: new fishing boats and motors, monetary resources, fishing projects and renegotiation of credits. This is confirmed by one of the interviewees: “*the artisanal fishermen who had never had anything were the big winners at that time*”. In this way, Tumbes represents a milestone where the reconstruction process strengthened the emergence of rivalries and conflicts expressed in the breaking down of old community organizations that were overwhelmed by entities created by the regional government, who were in charge of distributing the help.

Figure N°8. Process V. Ethical and solidary perceptions before the socio-natural disaster. Source: preparation by the authors, adapted from the Wisner et al. model (2014).

government increased house sizes, but did not improve the evacuation accessibility or infrastructure, thus contributing to the social construction of the risk.

National and regional governments have not been sufficiently responsible for the development of coastal towns, concentrating on the economic development of “big business”. This capital concentration phenomenon on tourist beaches like Dichato or in the regional capital, Concepción, is not exclusive to the Biobío Region, but rather is a phenomenon that can be seen along the coasts of Latin America (Hidalgo et al, 2016). The fishermen of Tumbes have a subsistence economy, that on being their main economic activity, it is going to be affected by a socio-natural disaster. They depend completely of the investment support by the State.

This is how, in the case of Tumbes, the reconstruction process after the socio-natural disaster brings with it not just a structural renewal of the houses, but also social conflicts that divided the population. On one hand, there were those who had received help for material needs, and on the other, were those who due to their networks, received more support than they should have, ending up reproducing conditions of vulnerability (García-Acosta, 2005). Therefore, the need to organize socio-natural disaster management policies that the community itself can immediately respond to, as well as the fragility of the social integration based on the support of relatives or neighbors in the first moments after the event, allows extrapolating, from a systemic level, the damage that the implementation of the Chilean neoliberal economic models has had, which makes apparent that the exclusive responsibility of welfare after disasters lies with the individual.

V. CONCLUSIONS

Socio-natural disaster management, also known as Disaster Reduction and Risk (GRRD, in Spanish) is an aspect with limited development in Chile, favored by the overestimation of a greatly centralized government, that does not acknowledge that the efficient handling of vulnerability on facing socio-natural disasters is key to reducing risks and that it cannot be done without including the inhabitants affected by these. On the contrary, a lack of local structures prepared to face emergencies is generated. For example, in the reconstruction process, the

Traducido por Kevin Wright/ Translated by Kevin Wright

Variables	Low Vulnerability	Medium Vulnerability	High Vulnerability
Exposed population	0-30 inhabitants	31- 60 inhabitants	More than 61 inhabitants
Socioeconomic level of the population	Income level that allows sufficiently covering needs.	Income level that allows satisfactorily covering needs.	Income level that only covers basic needs.
	Between \$400,000 and \$1,000,000 CLP	Between \$200,000 and \$400,000 CLP	Between \$90,000 and \$200,000 CLP < Chilean minimum wage (276,000 CLP)
Type of economic activity	Population who reside in Tumbes Cove, but their productive activity is outside the cove and is linked to the industrial sector or tertiary activities.	Population who reside and work in the tertiary sector, in services in Tumbes Cove.	Population who work in the area in production activities linked to the extraction of seafood. Commercial activities. Pensioners.

Table 1. Socioeconomic vulnerability. Source: Own preparation

Variables	Low Vulnerability	Medium Vulnerability	High Vulnerability
Number of floors	With 3 or more floors	2 floors	1 floor
Materiality	Concrete	Masonry	Wood, adobe, zinc
State of care	Good	Regular	Bad

Table 2. Physical Vulnerability. Source: Own preparation

Variables	Low Vulnerability	Medium Vulnerability	High Vulnerability
Knowledge about tsunami related flooding.	Population who are aware of and prepared to face an eventual tsunami risk.	Population who feel that a tsunami could hit Tumbes again. Uses the media, preferring TV and radio, to learn about the issue.	Population who feel that a tsunami could hit again but only in the long-term and do not have more information on the issue.
Identification of safety areas and evacuation routes.	Has good knowledge of the safety areas and evacuation routes set out by the governmental entities.	Has knowledge of the evacuation routes and safety areas thanks to their parents and neighbors.	Does not know about the safety areas or the evacuation routes set out by governmental entities.
Reaction of the population when tsunami hit	Immediate went to the so-called safety area.	People who stay in their homes watching the sea and then a few minutes later head to the safety area.	People who stay in their homes, waiting out the event, not knowing what to do because they do not have information about how to act during a tsunami.

Table 3. Educational Vulnerability. Source: Own preparation

Variables	Low Vulnerability	Medium Vulnerability	High Vulnerability
Measures proposed and put into practice to reduce tsunami-related risks	The people know the measures proposed to reduce the risk of tsunamis at Tumbes Cove.	The people know some measures, but do not trust government indications regarding tsunami risk mitigation measures.	The people do not know any measures, plans or studies that allow mitigating tsunami risks. They do not sense a commitment of state institutions in facing a tsunami risk.
Design of infrastructure that is applied to mitigate a possible tsunami.	The people know about a construction design to mitigate tsunamis and also apply it to their homes.	The people know about dwellings with a construction design to mitigate tsunamis, but this is not fully applied to the dwellings in Tumbes.	The people do not apply any measure, nor do they know about any construction design to mitigate a tsunami.

Table 4. Governmental Vulnerability. Source: Own preparation

2010 earthquake and resulting tsunami in Tumbes	Interests of the players	Changes in social relationships	Reconstruction
Tsunami resistant dwellings	Interests of third-parties	Conflicts among inhabitants	Acceptance of the reconstruction
Acceptance of type of rebuilt dwelling	Interests of Tumbes' inhabitants	Social breakdown among the population	Reconstruction players
Reconstruction considered the fishermen	Identify of the inhabitants	Winners and losers not considered by the reconstruction	

Table 5. Codes used for the textual analysis of the answers. Source: Own preparation

