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The (Re)Insurance Industry's Roles in the Integration of Nature-Based Solutions for Prevention in Disaster Risk Reduction—Insights from a European Survey

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Abstract: Nature-based solutions (NBS) are increasingly being considered as an option to reduce societies' vulnerability to natural hazards, creating co-benefits while protecting ecosystem services in a context of changing climate patterns with more frequent and extreme weather events. The reinsurance and insurance industries are increasingly cited as sectors that can play a role to help manage risks, by improving disaster risk reduction (DRR) and loss prevention. This paper investigates how the (re)insurance industry could support the transition from a paradigm focused on ex-post responses to ex-ante risk reduction measures including NBS, in line with the Sendai Framework. This paper presents the results of a series of 61 interviews undertaken with the (re)insurance sector and related actors under the EU H2020 Nature Insurance Value Assessment and Demonstration (NAIAD) project. Methods based on a Grounded Theory approach indicate how this sector can play different roles in loss prevention, including ecosystem-based disaster risk reduction (eco-DRR). Results illustrate how the (re)insurance industry, under these roles, is gradually innovating by having a better understanding of hazards and mitigation. The findings of the study contribute to wider discussions such as the

possibility of new arrangements like natural insurance schemes and evidence-based assessment of avoided damage costs from green protective measures, in Europe and beyond.

Keywords: natural hazard insurance; climate change adaptation; disaster risk reduction; nature-based solutions; nature assurance scheme; insurance value of ecosystems

1. Introduction

Following the 2015 fundamental year of key agreements (Sendai Framework, Paris-COP21, Agenda2030, Addis Ababa Action Agenda) and in the light of first publications on the projected climate change impacts on the insurance industry [1,2], one of the main current discussions considering climate change has moved towards the nascent increasing interest in nature-based solutions (NBS), and more globally towards preventive management [3,4]. Preventive measures are diverse, from planning (land-uses, building codes), mitigation (property level) and protection, (structural measures, NBS) to preparedness and recovery (soft) measures (early warning, emergency measures and insurance, etc.). NBS are defined by the European Commission to be "actions to help societies address a variety of environmental, social and economic challenges in sustainable ways, simultaneously providing human well-being and biodiversity benefits. They are actions which are inspired by, supported by or copied from nature, and which protect, manage and restore natural or modified ecosystems" [5]. There are a variety of nature-based measures that could provide solutions to growing societal challenges such as climate change, sustainable development and natural disasters [6–10].

Damage from natural disasters are expected to largely increase in Europe by 2050 as a result of climate change and increased vulnerability exposure. In mainland France, Caisse Centrale de Réassurance (CCR) has estimated that the insured property damage will rise by 50%, if no preventive measures are implemented [11]. At the urban level, the city of Copenhagen experienced a catastrophic cloudburst event in July 2011 causing almost 1 billion Euro in damage and an estimated damage in the same order of magnitude is expected for the near future in case no climate adaptation is implemented [12]. The insurance umbrella organization in Denmark (Insurance & Pension) analyzed the cloudburst data for this event in Copenhagen to support economic valuation of urban flooding [13]. There are several policies that link insurance to climate change, risk management and sustainable development objectives [14,15]. Despite the growing number of policies, there has been little research examining how effectively the industry is integrating these topics and what their new operational roles are [16–20]. Since 2016, research has mainly focused on innovative ways to link climate change adaptation (CCA) with disaster risk reduction (DRR) and NBS across different sectors with the reinsurance and insurance industries, as a key global player for risk management [17,21,22].

The core insurance business is based on risk transfer, which means shifting the financial consequences of risks from a household, a company, or a community to an insurer, who receives a premium payment in return for having to reimburse their clients after a disaster occurs. Less known by citizens, a similar risk transfer is possible for insurance firms themselves in order to secure their assets in case of an extreme disaster via reinsurance companies working on a larger, often international scale. The survey focuses only on interviews with non-life (re)insurance companies. In the paper we stressed that "insurance companies" comprise both reinsurance and insurance companies. Premiums are computed based on historical data for a similar risk and hazard. The industry relies on catastrophe loss risk modelling to understand the effects of hazards, vulnerability and damage. When disaster strikes, insurance companies play a crucial role in post-event recovery through compensations. Yet, the insurance industry is moving to earlier phases of the DRR cycle e.g., risk analysis, preparedness and early warning [23], and especially towards assessing the potential of prevention to reduce damage costs in addition to emergency relief after a disaster event. For example, with more accurate information on hazards, with early warning message to policyholders, and recently introduced research on protective

measures effectiveness, decision-makers are then capable to respond in a pro-active way to climate change challenges and disaster risk management [24].

The links between disaster insurance and nature-based-solutions have now merged into the concepts of "insurance value of ecosystems" (IVE) and "nature insurance value" [25]. As well as the concept of ecosystem-based disaster risk reduction (Eco-DRR) defined as "decision-making activities [...] that recognize the role of ecosystems in supporting communities to prepare for, cope with and recover from disaster situations" [26,27]. The latter concept was used during the interviews to incorporate all alternative solutions for sustainable risk management.

The paper is framed within the NAIAD H2020 project (Nature Insurance value: Assessment and Demonstration), which aims to deepen the scientific knowledge on the insurance value of ecosystems and on NBS to reduce the human and economic costs of risks associated with water (floods and droughts). Concepts, tools and methods have been developed and tested with local stakeholders to support mainstreaming of those solutions with replicable methods at demonstration sites scales from urban to catchment across Europe. The main aim of the paper is to draw the first-hand knowledge from the sector on how the European insurance sector considers ecosystems as a potentially reliable means to reduce risk, including how the national disasters insurance systems differ from each other.

Hence, this paper is focused on understanding the role of insurance in prevention through NBS under climate change. In other words, considering NBS as a potential tool to secure affordability of insurance contracts from the perspective of the insurance industry itself. Therefore, the current state-of-knowledge about integrating NBS within the insurance industry is investigated. The different natural hazard insurance schemes in Europe have been analyzed [28–30]. A literature review was undertaken on these topics to provide the state-of-the-art and to identify knowledge gaps. This study addresses the research gaps identified, by examining the current insurance knowledge, visions and expertise through 61 semi-directed interviews in ten European countries. The study offers new insights on the role that the insurance industry could play to help address DRR and CCA goals. Survey questions were collectively designed by NAIAD partners based on the literature review focusing on hazards under climate change, prevention and NBS. Using Grounded Theory [31], the findings explore the roles of insurance in earlier phases of DRR. In doing so, this study seeks to contribute with new work and a dialogue with the sector on roles and initiatives by the insurance sector in disaster risk management through synergies with other actors involved in the field. Firstly, how the insurance industry integrates and manages risks under climate change is investigated. Secondly, the current understanding of the concept of NBS to mitigate natural hazards and the insurance value of ecosystems is examined. Finally, the different and new roles that the insurance industry could play before disasters strike are highlighted.

2. Materials and Methods

2.1. Data Acquisition

This paper presents the results of semi-directed interviews conducted over a six-month period (from August to December 2017), substantiated by a NAIAD taskforce. The interviews have been performed after a large literature review related to the linkages between the insurance sector, natural ecosystems and disaster risk reduction. The literature review was initiated based on papers and reports published by previous European projects (i.e., Placard, Enhance, Esmeralda, Eklipse, Operas, Openness, Oppla, SmarteST, CascEff, Know4DRR, Imprex. For the core reference projects.) on the topics. After this first round, the review was completed by a literature surveillance of the most recent related publications (from 2015 to 2019) using the next keywords: "European natural hazard insurance", "insurance and risk reduction", "insurance and ecosystem services", ''value of ecosystem", "insurance value of ecosystem", "nature-based solutions", "natural infrastructure", "green infrastructure", "green measures", "ecosystem-based disaster risk reduction", "nature-based solution market", "ecosystem services and insurance system", "disaster insurance and nature-based solutions". This review identified

gaps in the literature in this research area, some specific articles that met the inclusion criteria are considered as core references [3,16–20,32–35]. These documents are not articles from periodicals, as well as documents on the evaluation of insured damages related to natural hazards, reports on the consequences of climate change on property insured damages or reports on the assessments of preventive measures. Some of these documents were written by insurance companies in the frame of partnerships with scientists, or as in-house research and development studies not published in periodicals. Nevertheless, the low number of publications found indicates a knowledge gap in the journals in this area.

Thus, a questionnaire was developed to address the knowledge gaps that had arisen during the literature-review by answering questions. The questionnaire gathered 58 questions divided into 8 sections (Appendix A) to better understand needs, gaps, challenges and opportunities for the European insurance sector. The scope of the NAIAD Insurance survey was to engage discussion with the insurance sector on DRR, NBS and IVE topics but not to gather monetary elements. During the interviews a tailored selection of the 58 questions was asked, selected according to the interviewee's profile. Semi-directed interviews, by nature, permit a long time frames for discussion, during which people could answer the questions included in the questionnaire. For example, the questions on how the national insurance scheme works were asked only if the functioning of the natural hazards insurance scheme had not been clarified by prior literature review. The latest document providing an up-to-date of the European insurance systems was published in October 2017 by the European Commission, during the development of the interviews [36]. As an example, Germany, the Netherlands, Slovenia and Switzerland are not covered in the document and the existing literature was not updated, therefore specific questions about the functioning of these schemes were specifically asked to the interviewees from those countries. In parallel of the interviews, 11 country fact sheets "how well do you know European natural hazard insurance systems?" have been created to visually summarize the schemes (Figure 1). In this context, the interviews also helped to validate the fact sheets with the participants and to clarify further less known insurance schemes.

Some closed questions that call for a yes-or-no answer or multiple-choice answer were asked to provide a first idea on the interviewees' knowledge or interest. It helped to skip questions or on contrary, to take a longer time for discussion. This allowed also for a quantitative analysis based on the percentage of responses related to the closed questions. The post-modern Grounded Theory for quantitative analysis has however not been applied [37].

The interviewers targeted were in order of priority, the insurance sector (31% are primary insurance and 22% are reinsurance companies), academic experts, banks, large project developers and ministries. Other stakeholders like non-governmental organizations, cities and landowners have also been contacted to provide a broader, more balanced and complementary knowledge. The recruitment of participants and interviews was carried out over the period June to December 2017, by the NAIAD taskforce for the survey and by the NAIAD demonstration sites partners (DEMOs). A snowball method was used for the selection of the interviewees, starting from the work and contacts developed by the NAIAD project partners.

The 61 interviewees were selected in ten European countries (Denmark, Germany, Spain, Slovenia, France, Italy, Romania, Netherlands, United-Kingdom and Switzerland) and at the European level to provide a wide overview on the insurance industry and to understand current practices throughout the EU (Table 1). Figure 2 indicates the panel of interviewees according to their sectors and on the right the interviewees in relation to the insurance sector.

In relation to informed consent, NAIAD's ethical and safety requirements were followed to ensure the full freedom of expression and to guarantee that data collected during the interviews was strictly confidential and only accessible to a limited number of members of the NAIAD taskforce. All participants gave their signed informed consent before participation in the interviews. The raw material of these interviews will never be published and the recordings have been deleted after transcriptions. The quotations available in the "Conclusions" part are strictly confidential and have been anonymized.

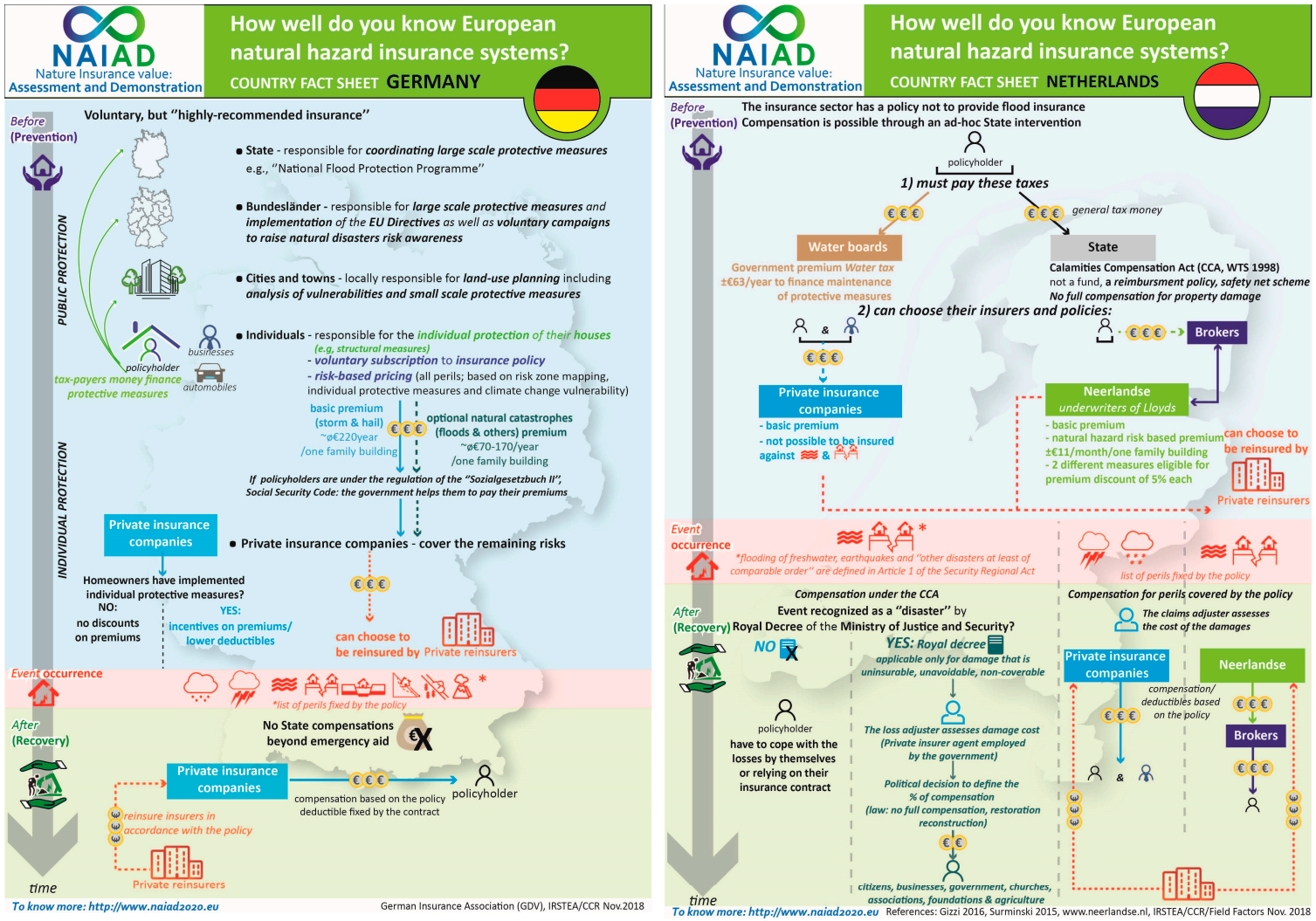

Figure 1. On the left, the country fact sheet for Germany based on the interviews and on the right, the one for the Netherlands based on the literature and up-dated with the interviews. The 11 NAIAD Country Fact Sheet are available in the Supplementary Materials. (source: Authors' own).

Table 1. Number of interviews per country (source: Authors' own).

Country	Number
Denmark	1
Germany	2
Spain	7
Slovenia	13
France	12
Italy	2
Romania	7
Netherlands	6
United-Kingdom	6
Switzerland	3
European level	2

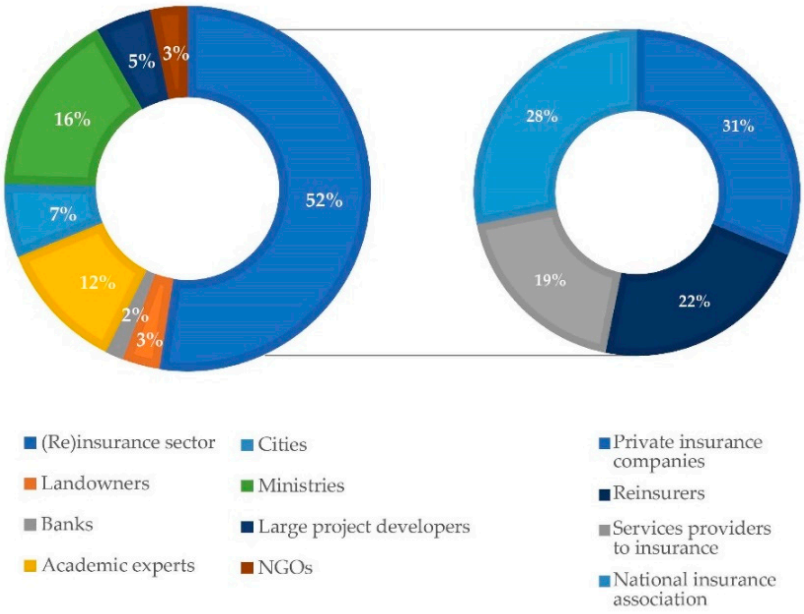

Figure 2. On the left, the panel of interviewees and on the right the interviewees in relation to the insurance sector (source: Authors' own).

2.2. Research Method

In-person interviews were recorded, transcribed verbatim and translated to English to facilitate analysis between the European team of authors. The 61 interviews lasted on average 60 minutes; the shortest interview lasted 30 minutes and the longest 95 minutes. All interviews were analyzed based a Grounded Theory approach. A sample of 25 to 40 or more interviews are required to apply this method. The Grounded Theory methodology is based on an in-depth analysis and summarizes qualitative textual data to broaden explanation of a process which is at its infancy or non-existent [31]. Grounded Theory avoids forcing theory and preconceptions into data, by translating the responses of participants through different steps (coding process and case-based memos writing). The coding process is based on six precise codification steps to be followed for each interview [38], (Table 2).

At the same time, memos are written to gather relevant information and the assumptions identified during the coding procedures. These memos were used during theoretical coding. Then, at the end of the process, codes and memos were mixed and compared to the core categories. Thus, theories and memos were then continuously compared and grounded on the data [39]. Figure 3 summarizes these different steps and their relationship to Grounded Theory.

The Table 3 below presents an example of the coding processes and the Figure 4 presents the process for axial and theoretical codings.

Table 2. Six codification steps of the Grounded Theory (source: Authors' own).

Code Name	What the Code Highlights?	Code Characteristics
"In Vivo"	Action oriented, capture behavior or processes. Can provide imaginary, symbols or metaphors.	Direct language of respondent, use "quotation", the terms used by the participants themselves.
"Process Coding"	Actual or conceptual actions—routines, rituals.	"-ings", what people do (rather than have).
"Initial Coding" or so-called "Open Coding"	Extractions of relevant concepts (labelling), deeper analysis, being open to selective coding Those codes are grouped into similar concepts. All the codes are gathered within a codebook.	Based on the lines and paragraphs from the data. To code directly from the data and not to force data into preconception.
"Focused Coding" or so-called "Selective Coding"	Highlight major categories and themes from the data (core variable analysis) theory—memos as a basis for the formulation of the final reports.	Frequency and significant codes are needed to develop categories (larger segments of data).
"Axial Coding"	Relationship between categories and codes. Links between one data to another and comparison between the data Those concepts generated categories which are the basis to write memos (highlight hypotheses about connections between categories, new questions, ideas, relationship between codes). Memos have to be seen as "intellectual workspace for documenting analysis"—all the memos formed memo banks.	To design diagrams of temporal/spatial and cause/effect relationships of the phenomenon (clustering codes into new or more specific codes).
"Theoretical Coding"	To identify conflict, obstacles, problems, issues. To integrate and synthesize the categories to create new theories. Consequently, all theories are identified and organized allowing for comparison between them and data, theoretical coding.	To find core categories To condense into a few words that seem to explain, what the research is about.

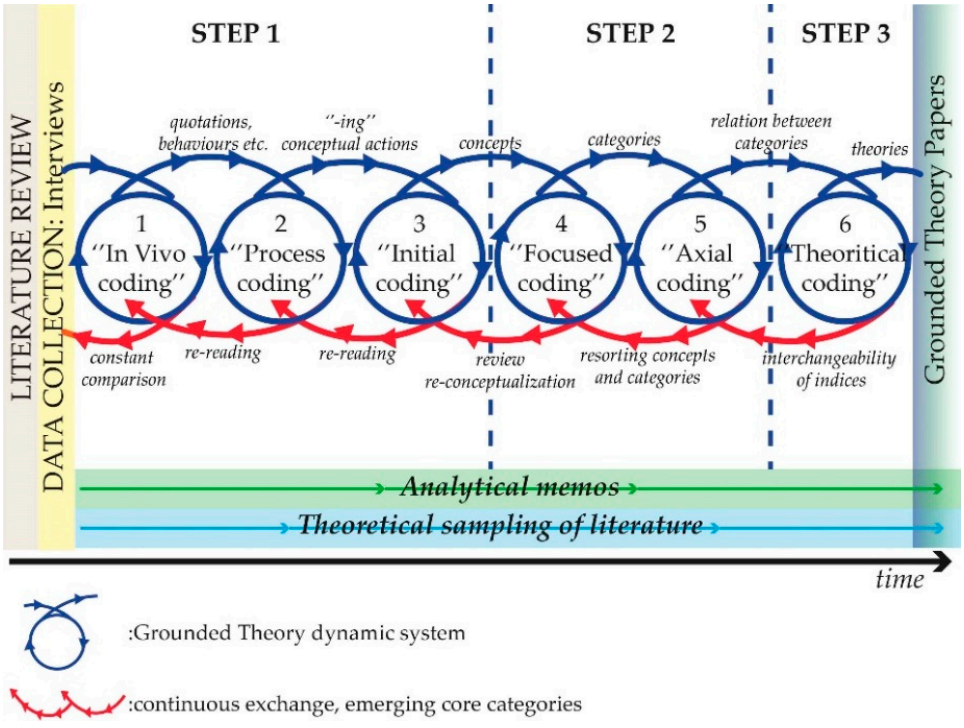

Figure 3. Grounded Theory, methodology explanation from data to results (source: Authors'own).

Table 3. Example of coding processes (source: Authors' own).

Raw Data	Initial Coding	Focused Coding	Theoretical Coding
Q: What is the (re)insurance company conceptual understanding of insurance value of ecosystem?			
I am little bit surprised, because I do not understand the meaning of insurance value of ecosystems (IVE), and there seems to be a little bit of confusion concerning this term. I would understand the IVE, as the value of risk reduction.	New concept, confusing but trying to define it		
Q: What are tangible examples of projects to address existing or potential climate risks your organization has pursued?	Classification of examples to address risks Awareness on climate change	Confusion Asking for evidence-based findings on NBS	The process of making sense of evidence on prevention and construction of knowledge in partnerships (practical programs)
Our company is addressing future risks by taking into account climate change. It is a part of our DNA, of our responsibility. There are some examples of projects to address risks: there are the risk management aspects, which is the communication to our customers, we try to highlight, anticipate, adapt and mitigate climate change risks. On the investment side, we are investing in green bonds. It requires wider demonstration of nature-based solutions (NBS) effectiveness in order to increase investments in that side. Finally, the importance of practical programs to understand risk exposure and resilience.	Risk management for communicating Already investing in green bonds Practical programs on hazard and resilience	Awareness of the on-going business changes	The process of using and developing roles in both ex-post (risk management) and ex-ante (resilience)
Case-based memo			
This was quite an eye-opening interview in the sense that after several performed interviews and discussions with the other interviewers, we had a concern with the IVE concept which creates confusion, positive and negative feelings. This interview was key in our consideration of the IVE concept. So, my question really is, shall we change the terminology to be more understandable and better fitted to the insurance sector? I am so glad we had this interview as the interviewee was very practical and open. The other key element, is that during the interview, when we enter in the questions of the section 7 to the end, I learn so much and the element of responses of some questions (such as in the examples above). I definitely learned that insurers' business is changing, at the end of the day the on-going reflection within the industry on the issues of climate change and loss prevention. During the interview, there was an explanation of the "roles" of the industry, right now I really need to take care with these "roles" to understand what they are and if other interviewees referred to that . . . Maybe the axial coding will highlight this within interviews and by comparison between them. As this would largely have impacts on the business model and on the mainstreaming of NBS. On the other hand, it is interesting that the interviewee provides examples on their daily job to integrate climate change into their catastrophe models and on loss prevention, especially on flood events. It was also interesting to gather points of view on financing aspects, notably on green bonds and elements on required regulations. So, I guess that the company of this insurer is really advanced on that topic and had a trusted experience. I tried to highlight differences between the natural hazard insurance schemes; the interviewee neutrally explains how it works. After the different interviews, for now, there is no differences in the understanding or about loss prevention between countries. It is more related to the state of advancement, dedicated research (I will not forget the fact that some of participants cannot explain due to confidentially reasons) between companies.			
The memos are written after each interview and the responses to the questions are coded in a table following the Grounded Theoryframework. The constant comparison between the coding processes are exemplified in the following example of axial and theoretical coding. The conceptual memos, categories, subcategories and theorization are the findings presented in 3 of this paper.			

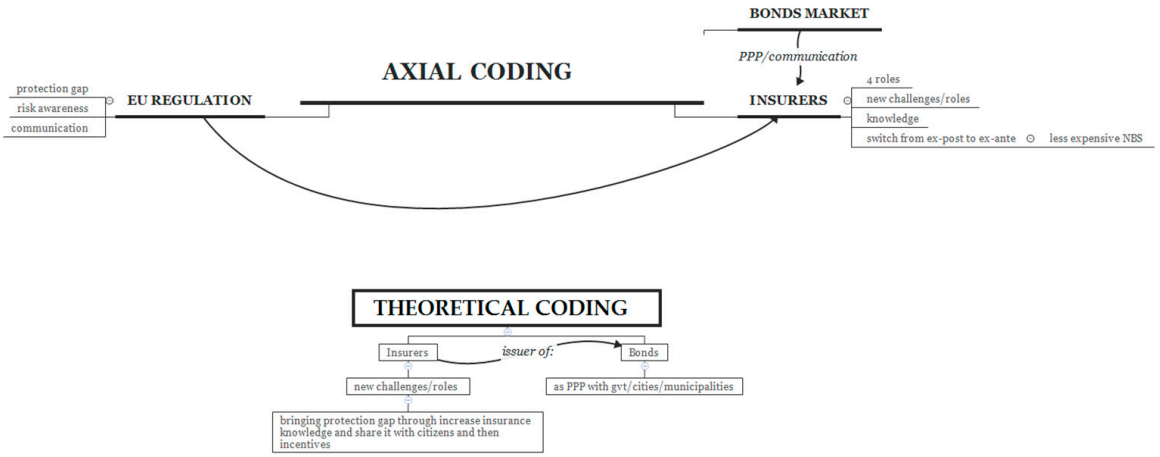

Figure 4. Grounded Theory, methodology explanation from axial coding to theoretical coding (source: Authors' own).

This theory was suitable for the present study to collect and analyze data to generate conceptual theories on the main factors that influence the insurance sector's involvement in climate change adaptation (CCA) and risk prevention through natural infrastructures for five reasons:

(1) it is based on a literature review that provide both background knowledge and interview questions to bridge the research gaps. The combination of the two allows for a deeper theoretical framework and to theorize subcategories, presented within the results, more easily;
(2) Grounded Theory was chosen because it gives room to emergence from the findings from insurance industry and stakeholders involved around the sector as research that will benefit science and new knowledge. The basis was also that this research would be of use to the sector itself and potentially be actionable or transferable to their business model;
(3) it is a useful method to analyze qualitative textual data from semi-structured interviews that target new research topics that are either in their infancy or non-existent. This is particularly suitable to the NAIAD project because research on linkages between risks-NBS-DRR-insurance industry are being developed;
(4) this method is a suitable approach for managing voluminous qualitative data; during the interviews, an hour and a half long interview generated on average 12 pages of text;
(5) the categories and the developed theories in the results are based on the data only and are not developed from researchers' hypotheses. The objective to emphasize the current elements of knowledge, feelings, main questions and understanding from the European insurance industry on CCA, loss prevention and NBS.

3. Results

This section presents the main results from the NAIAD Insurance interviews, the results are presented using the development of categories which include: namely (1) the insurance industry and climate change; (2) the insurance industry's understanding of ecosystem-based DRR and NBS; (3) the role of insurance in eco-DRR; (4) the different roles insurance could play in relation to eco-DRR. The elements within these categories and subcategories (i.e., the different roles of the insurance industry) were thus theorized. Finally, the categories are considered together as a whole in the discussion.

3.1. The (Re)Insurance Industry's Vision of Climate Change

Climate change challenges are being integrated in the insurance industry scenarios, although with different viewpoints. Climate change impacts are considered in three subcategories (1) as a challenge for affordable insurance; (2) as a challenge for risk modelling; and (3) as a potential opportunity to generate a range of innovative services. The first subcategory theorized highlights that participating

insurance companies are reinforcing their internal on-going research to assess climate change impacts in combination with increasing exposure of assets and geographical concentration of wealth. The interviewees raised concerns on the fact that natural hazards are expected to become more frequent and intense with climate change (physical risks). The companies also declared, that in recent years, insured damages due to natural hazards have largely increased and are expected to further increase. Only two of the participants shared their reports, the others did not give precise figures.

Also, the interviewees had the opportunity to rank the main natural hazards threats. Meteorological hazards are the main hazards perceived as risks by the insurance industry (38%), followed by hydrological risks (31%), geophysical risks (16%), climate (14%) and pollution risks (1%).

This poses specific challenges for risk modelling based on catastrophic risk modelling expertise (second subcategory). Some companies are developing their own in-house models using historical data and other companies rely on models developed by private consulting companies. The main difference between reinsurance and insurance companies is the development of CAT models. All surveyed reinsurance companies had their own CAT models, on the contrary, most of the insurance companies were using models developed by private consulting companies.

For those companies that have their own CAT models a total of 65 percent of the participating companies declared to have started mapping and understanding the impact of climate change. In contrast, 35% of companies stated that they had not included climate change scenarios due either to the lack of data or to the lack of development of their own models. The survey indicated that not all companies are using projected future data and are assuming stationary scenarios in which underlying assumptions on boundary conditions do not change over time. During the discussions with insurance companies, the participants explained that there is a recent development of in-house CAT models by insurers to improve their knowledge on hazards, vulnerability and damage assessments. In addition, during the interviews, the uncertainties related to determining where and what new type of risks may be appearing with climate change have also be raised. The main barrier identified by the interviewees were the differences between insurers' models and scientists' models, which can limit the integration and knowledge exchange between these two communities. Indeed, it has been justified that non-life insurance have a short perspective for defining the premium each year and the investment terms are about 1–5 years. Thus, this leads to the third subcategory that improvements in sharing risk management expertise could help to address future physical risks and increase the knowledge on climate change potential impacts on institutional investments (assets side). Raising the insurance's sector own awareness and developing targeted communication for their customers is both considered as insurers' responsibilities.

3.2. The (Re)Insurance Industry—Understanding of New Concepts: "Eco-Drr", "Nature-Based Solutions (Nbs)" and "Insurance Value of Ecosystems" (IVE)

In this part, two subcategories were highlighted during the interviews: (1) knowledge and understanding of the sector on NBS and IVE; and (2) reflections on NBS/IVE integration into insurers' models. The analysis of the interviews does not emphasize differences in the state of knowledge between reinsurers and insurers. Rather, it provides an up-to-date review on the current perspectives on these topics for the sector. The interviews conducted illustrate how loss prevention and mitigation are important areas, where the insurance industry is engaging increasingly. Examples provided included: research projects, early warning, and encouraging build back better approaches (resilience), etc. A total of 44% of the respondents claimed to know the eco-DRR concept as related to prevention, even if most did not have a very precise definition, 28% of them gave a comprehensive definition of the concept, while the remaining 28% of the respondents did not know the term. Therefore, given this level of knowledge and awareness on eco-DRR, it is safe to conclude that the insurance industry is currently in a process of increasing its own awareness on NBS. Meanwhile, in relation to the concept "insurance value of ecosystems", 70% of the interviewed expressed unfamiliarity. The remaining 30% had a precise definition and understanding. However, what emerged as one of the main results of the survey

is the reluctance of the insurance sector to adopt the IVE concept. Survey participants indicated that IVE concept was a confusing and/or inaccurate concept for the insurance industry. The general feeling was that the concept narrows the value of ecosystems to the avoided damage and would therefore miss the multiple co-benefits of ecosystems. Some interviewees preferred the "resilience dividend of nature" concept instead of the IVE, in order to integrate both avoided damage and the co-benefits of protecting nature. Nevertheless, interviewees had knowledge on the ecosystem's role in risk reduction. Thus, 38% of the participants have knowledge on eco-DRR but are still challenged by its integration into their models. Companies that had their own models commented on the possibility to use their models to measure the effectiveness of NBS in terms of avoided damages due to the reduction of hazard (e.g. extension or water heights). The same participants underlined that currently the assessment of conventional civil engineering measures such as dykes and dams is still at the research project stage. The participants commented how the ability to estimate damages or preventive measures is a nascent field for the sector.

The natural hazards from ecosystems increasing the risks (obstruction of hydraulic structures related to woody debris or vegetation growth) have been raised by 19% of the respondents. The vulnerability of NBS to climate change was considered as a potential reason that could further restrict the successful integration of NBS into insurance business models (by 5% of them). For 39% of the participants, the lack of knowledge and lack of practical demonstrations on the NBS role on hazard reduction were also posed as reasons for the limited action on the topic. When asked which knowledge and tools would be required to integrate NBS into catastrophe loss risk models, 37% of people interviewed commented on the need for more exchanges with the scientific community; 41% of them asked for new studies and data related to NBS; 11% of them considered enough knowledge was already available; and 11% of them had limited suggestions on what would be needed. These responses are linked to the non-life insurers' requirements to have the best understanding on their portfolio exposure. The integration of preventive measures into catastrophe loss risk models is at its infancy for most of the companies interviewed.

3.3. (Eco)-Disaster Risk Reduction and the (re)Insurance Industry

Based on the experiences of the participants, a number of challenges exist to get insurers to participate in eco-DRR. These challenges fall into four subcategories: (1) affordable coverage for weather-related hazards; (2) increasing interest in DRR; (3) changing business models; (4) changing people's perception on the industry.

The assumption was posed that the insurance industry is raising concerns on its liability side (risk providers), with the increasing extreme weather-related hazards and society's vulnerability in a changing climate. The affordability of insurance contracts was raised. The findings indicate that risk management expertise is being developed by the industry to better understand often poorly known natural hazards such as coastal flooding, urban surface runoff or land subsidence.

The interviews confirmed that natural disaster prevention is something relatively new for the (re)insurance industry with a different nuances. The interviews revealed that insurers have taken time to consider natural hazard prevention as an area where insurance could intervene. Indeed, in comparison to fire/thefts prevention, the insurance industry's involvement in natural hazards prevention and mitigation is still small.

The awareness of climate change as a threat to biodiversity and to engineered DRR measures was also raised. The findings highlight that the sector considers NBS assessment even more challenging than mitigation measures. The latter are located at the property level, as compared to NBS which are generally operational at the collective level. It poses specific challenges for integration into the business models (see Section 3.4.1). So, 67% of the interviewees have no specific strategies to incorporate NBS in catastrophe loss risk models. 15% of them have it under consideration and 18% of them have indicated to have the methodology to do so. Results thus show that eco-DRR is considered as an opportunity for the insurance sector to support preparedness for the anticipated impacts from

climate change. Yet, the interviews revealed the need for evidence-based knowledge and a high level of confidence on the effectiveness of these proposed green measures and NBS on risk reduction and on the co-benefit generation. The evidence and guidance elements could be provided by both engineering offices which are expert in the area, or by in-house experts in risk assessments. The subcategory "changing business model" was theorized since it is a central theme in the survey. It frequently appears in the data and almost all the participants could relate to the concept. This theme made the participants raise a very important point: a paradigm change from response-based measures towards ex-ante prevention, before a disaster occurs. In addition, for market actors, it could also lead to a strengthening of their position in the market as early movers, by improving the industry's image and the communication of its role in disasters. The insurance industry is currently facing a citizens' risk awareness gap. To bridge this gap, the industry is now promoting better risk communication, climate change, sustainable development and prevention.

3.4. Roles of the (Re)Insurance Industry in Supporting (Eco)-Disaster Risk Reduction

The theorization of the categories, subcategories and of memos offered new insights in the roles of the insurance industry as a driver for natural hazards resilience based on eco-DRR. Two of the four roles: as risk transfer provider and as investors, are the core of the insurers' business with emerging uses of these roles related to eco-DRR. The two other roles and their uses: innovators and partners roles have also been codified and thus analysed.

3.4.1. (Re)Insurers as Providers

The interviewed reinsurers and insurers both stressed the importance of offering affordable insurance coverage, and of reducing the costs from natural disasters. Therefore, the main concern for the interviewees was the affordability of insurance coverage as a societal issue, as mentioned in Section 3.1.

The interviews have confirmed the differences in the national natural hazards insurance schemes to underwrite risks, as well as the current integration of mitigation measures into premiums calculation. For example, for market-based insurance schemes (UK or Germany), the assessment of collective or individual preventive measures are integrated within the risk-based premiums. On the contrary, for mandatory insurance schemes (France or Spain), reinsurance and insurance companies are directly linked to prevention objectives (i.e., Barnier Funds in France), therefore these companies have performed or have required studies to assess the effectiveness of prevention since these companies participate in the financing of those measures. Interviewees from countries with a current low penetration rate on property insurance (Romania, or Slovenia) expressed an interest to have better knowledge on natural hazards and preventive measures to help bridge the current protection gap.

The interviewed insurers also presented the new services developed for their customers on early warning (automatic SMS alerts, etc.) and post-event recovery process (recommendations for reconstruction, etc.). The interviews investigated the current understanding of the insurance industry on the potential integration of scientific evidences of natural infrastructures into insurance business model. The participants stated some key opportunities or barriers to this integration. The first point to be considered is that most of the protective measures are not insured, governments or local authorities insure the structures themselves. Natural areas (forests or marsh areas) owned by landowners are insured for civil liability or for business interruption and are not considered as NBS for their role in reducing risks. This underlines the current lack of knowledge with regards to NBS effectiveness when assessing natural hazard protection measures and highlights the current predominance of grey measures.

Interviewees recognized the need for limiting ecosystems degradation, with some of them highlighting the potential of NBS for insuring degradation or damage as a hazard reduction potential. Regarding the multiple benefits of NBS, the insurance industry expressed interest to link co-benefits' impacts on health insurance.

3.4.2. (Re)insurers as Investors

Results demonstrate that for European insurers to act as institutional investors, further evidence is required on the disaster risk reduction benefits. Viable business models—e.g. like the natural assurance scheme developed under the NAIAD project—where these benefits are demonstrated could play a significant role to increase the financing for the development of NBS. Behaviors towards sustainable and responsible investments are emerging to decrease risks and to diversify investments through the development of loss prevention which could eventually include NBS. Some of the interviewees exemplified the avoided damages from natural infrastructures implementation with a positive return on investments from their in-house research. Participating companies mentioned the current offer of financial products such as green or cat bonds to help finance conservation, restoration, the implementation, maintenance and monitoring of NBS projects. It has been argued that NBS projects, at different scales, could help to support a diversification of risks and to help develop a larger portfolio of return on investments. Some barriers to the integration of NBS into insurance products lie in the current difficulties to assess who would pay and benefit from these measures. Liability of failure and investments that could be beneficial for other insurance companies are some of the other barriers mentioned. Another issue raised during the interviews was the lack of appropriate NBS labels which could impact investors' confidence. Although some industry entities have integrated investments in low-carbon projects and improved environmental performance in their building assets and their governance, in those cases, it has however been highlighted by some participants that the Solvency II Directive [40] penalizes long-term investments as a contradiction to the on-going debates for longer term investments.

3.4.3. (Re)Insurers as Innovators

In light of the current CCA and DRR objectives, the insurance industry has been engaged in the identification of innovative communication tools to increase the awareness of future risks.

The interviews indicated the importance of the insurer´s role to act also as a prevention-advisor to help limit disaster impacts. Some of the participants exemplified this with the role insurance can play for example to foster a more sustainable land-use planning, better building codes, encourage the building of resilient protective infrastructures and on build back-better (BBB) measures. In addition, some of the interviewees highlighted that this sharing of experience could take the form of e.g., performing risk exposure analysis for an area, or a cost-benefit analysis of natural (green/blue) infrastructures by assessing the insurance losses reduction for various scenarios.

This main theme can be theorized on the role that the insurance industry can offer rooted on its wide expertise in risk management for society at large, and on also advice to specific actors based on the requirement of their natural hazards insurance scheme. Some of the insurers, during interview discussions, compared the different schemes to identify the best practices from different schemes. However, some of the respondents questioned whether this was/should be the role of the industry.

Innovation is strongly linked to policy and regulations. The interviews revealed the potential for example for an NBS Floods Directive based on the same principle as the Floods Directive (risk maps integrating protective measures, greener risk financing). Findings revealed the need for clear European and national roadmaps for sustainable insurance. This survey also demonstrates that insurers consider the scale of the European Union as a key area to scale-up socio-economic resilience to natural hazards through policy/regulatory frameworks, and to help foster a greener economy. This underlines the current trigger point on the worldwide natural disaster insurance protection gap [41,42] and the European objective to bridge the gap in the EU through innovative insurance products [5].

3.4.4. (Re)Insurers as Partners

Increasingly, insurers see themselves as institutional partners to help build up societies' resilience after and before a disaster strikes. This can be exemplified in the engagement in ex-ante risk

management, developed by the industry for societal and general interest benefits. There was a clear momentum during the interviews were interviewees raised who to foster further collaboration with: the European Commission; national governments; local authorities; scientists; citizens; for loss prevention, CCA, damage estimation or data sharing.

The participants stated that these exchanges are needed to increase knowledge on natural disasters in terms of costs and vulnerability. The willingness for collaboration between reinsurance, insurance companies and scientists on the damage reduction effectiveness of NBS has been pointed out. In that context, the participants emphasize that scientists could provide relevant expertise on hazard assessment while the insurers undertake the damage part. To analyze NBS and their co-benefits on economic and human levels, the catchment scale has been suggested as a good operational level for analysis and implementation. The provided justifications were: it is a relevant scale for land use planning (risk prevention plans); for the maintenance of those measures (water sewage systems, dikes, dams, water retention basin etc.); interesting scale for the possibility of public-private partnerships. In that context, the examples of the France natural hazards insurance scheme, the mechanisms linking compensation (insurance) to prevention (Barnier Fund) and data exchange (ONRN) were raised as good practice. The scheme thus brings together insurers, French State and local governments to manage risks and to foster preventive measures (structural or non-structural ones). Concerning other European schemes, it is the privileged relationship with the insured people that has been raised by insurers, as a support to participate and to define their roles as partners in prevention. Finally, participants from voluntary insurance schemes argued on the need to work with institutional banks. The latest are both change drivers for DRR and CCA and are often linked to insurance contracts. For instance, in some countries it is mandatory to subscribe to natural hazards insurance coverage to obtain mortgages (UK, Sweden).

4. Discussion

Nature-based solutions are seen as a new paradigm for loss prevention to deal with natural hazards in a changing climate [10,27,43–50]. Yet, despite positive debates and discussion, little research has been carried out and published in journals on how exactly the insurance industry can facilitate the operationalization of eco-DRR [16,19,21,51,52]. Natural hazards management requires an integrated approach towards risk management, involving different stakeholders to share the burden of preventive measures. In this study, it was found that the eco-DRR concept, i.e., DRR using NBS, is gaining importance within the insurance industry. In the context of the NAIAD Insurance Survey, the NBS and IVE concepts have been discussed with the insurance industry. The IVE concept seems to create a level of confusion in the insurance industry and for other actors, which could lead to misunderstandings. On the one side, this is due to the lack of knowledge in the industry about these concepts which could result in different understanding from one actor to another, without an agreed definition. On the other side, terminologies already exist for the same or very similar concepts, e.g., resilience dividend of ecosystems, natural infrastructure for green infrastructure, green infrastructures. In this paper, we recommend to use the term *"natural assurance value"*, as a metaphor for the capacity of ecosystems to reduce risk, as compared to the natural insurance value which reflects the possibility of insuring NBS for their risk reduction function. It is important to find ways to mainstream and support NBS implementation, while avoiding the multiplication of terms related to one concept through policy changes.

This survey indicated that the insurance industry is concerned on how climate change could have an impact on natural hazards and ecosystem services. Findings indicate the need for the sector to improve its knowledge on NBS functioning for its potential to help generate avoided damages and co-benefits. This findings is coherent with other studies [18,48,52,53]. Nevertheless, during the interviews it was complex to get access, or to discuss the monetary side. The costs of insured damages are shared annually, or after large damaging events, and mostly by large reinsurance companies. Generally speaking insurance companies do not communicate on the damages, this is more the role of reinsurers or of national federation of insurers. Also, the preventive measures assessment performed by

the sector have been developed only twice. One explanation is that during the interview's performance, there was a terminological confusion on the topics. In addition, some interviewees declared not to share information on their on-going research on NBS effectiveness and its integration into their business models due to business and competitiveness confidentiality requirements. The main findings from the survey are that the insurance industry is moving towards more ex-ante actions, in addition to actions in compensation. As found, the sector requires clear demonstration of DRR benefits for each and every dividend. This is aligned with the *"triple dividend of resilience"*; the first dividend is the compensation of losses and avoiding long-term negative impacts of disasters; the second dividend is the simulation of economic activity through risk reduction; the third dividend is the importance of socio-eco-environmental co-benefits [33]. Currently, the benefits of disaster risk management investments are underestimated, and the common opinion is that investing in disaster resilience will be beneficial only once a disaster strikes [54,55]. The triple dividend of resilience concept highlights good reasons for the insurance industry to move towards embracing natural hazards protections. Table 4 synthetizes the triple dividend for DRR, including its counterpart for the insurance sector and how to integrate the different roles of the insurance industry.

Table 4. Triple dividend of risk reduction of insurances, adapted from Surminski, S. & Tanner, T. [56].

What Type of Good Reasons?	Benefits	Role of Insurances
Compensation of losses, reduction of negative impacts from disasters	Availability and affordability of reinsurance and insurance contracts	Providers
Investment in prevention and mitigation	Decrease (non)insured losses, i.e., secured portfolio	Investors
Money saved can be reinvested	Investments dedicated to innovation, research and development, policies and regulation	Innovators
Economic security and co-benefits	Portfolio diversification, valuing co-benefits	Partners/Providers

According to the findings of the NAIAD Insurance Survey, a range of potential uses and new roles of the insurance sector to face natural hazards.

In the case of the interviews presented here, the involvement of the insurance sector is also influenced and dependent by the peculiarities of national insurance schemes, with different relations and visions for the role of the sector on prevention and eco-DRR [36]. The investor role is also particularly important, even if the industry (along with other potential impact investors) requires a strong evidence-based and set of examples that bring a significant return on investment [57]. Their investments can help mainstream the use of NBS in prevention. As shown through the NAIAD Insurance Survey, approval towards financing natural infrastructures can increase the number of NBS projects at catchment scale that support the long-term affordability of insurance. The EU taxonomy work was not yet published when the interviews were performed [58]. This work on sustainable finance has a large impact on what is defined as green investments (EU green bond standards) and green adaptation measures by companies. The report also mentions the importance of better information/data sharing. Under the Non-Financial Reporting Directive [59], banks and insurance companies are targeted to share "non-financial" climate-related information. The findings of the survey present also a theorization on two roles for the industry: innovators and partners. The uses of these two roles can help the sector to develop further advancements in catastrophe risk models and the generation of knowledge and evidence to assess the avoided damage attributable to NBS. This is coherent with the literature review, notably the engagement with different actors through (public-private) partnership mechanisms [60–63]. Some of the participating companies stressed the need to work within research projects. Proactively, the sector can engage governments at different levels and create partnerships to help guide large scale risk management activities, increasing the territorial protection and resilience [34,35].

The findings indicate that the Grounded Theory approach has the potential to reveal a rich and deep understanding of the (re)insurance industry experiences, including the ways that the sector

interacts with climate change, their understanding of the NBS and IVE concepts, the specific challenges posed by the eco-DRR, and the different uses of their roles in supporting loss prevention.

Grounded Theory is a systematic method, to deal with interviews, collected self-reported knowledge, opinions and perceptions [36]. The subject of the survey was relatively new and complex for the insurance sector. Another benefit of Grounded Theory is the continuous process of gathering information without preconceptions, helping to provide new information. For example, if literature becomes available then comparison between the current survey results and further investigations will also be possible in the future. Furthermore, if other surveys are conducted, information could be added in the same manner using Grounded Theory to capture specific elements resulting from the interviews. Alternatively, if future updates are made to the underlying NAIAD Insurance Survey questionnaire, the set of interviewees could be extended to capture and to compare these additional results. An important area for further research would be to conduct the survey with other public and private actors involved in risk management (i.e., institutional banks, water agencies and utilities, local authorities, etc.), to better understand their perspectives, actions, and constraints. In short, how to understand better the overall roles in risk management of those actors to mainstream NBS remains a critical issue for further research. Lastly, while the Grounded Theory here is focused on questions raised by the NAIAD project, the theory could be applied to other topics, scales and actors.

5. Conclusions

This paper provides an up-to-date explanation of how the reinsurance and insurance sector is one of the important actors for addressing natural disasters and loss prevention. The use of Grounded Theory, applied to 61 interviews, facilitated the identification of key elements on the challenges related to eco-DRR, IVE and NBS for the insurance industry. The sector is moving from ex-post to ex-ante preventative roles. The main conclusions from the analysis developed are explained below:

(i) The findings highlight the current understandings of eco-DRR, NBS and IVE concepts by the insurance industry. The IVE concept can be misunderstood (insurance that can be applied to a natural system in case it is damaged by a natural hazard vs. the reduction of risks that a natural system can provide (and hence, act as a natural insurance). To avoid such a misunderstanding, we propose the use of "natural assurance value" to define the reduction of risks that natural systems can produce.

(ii) European natural hazards insurance systems have different considerations of risk management and adaptation strategies, as well as considering ecosystems as reliable means to reduce risks. The generalization of the use of NBS as tools to reduce the impact of natural hazards may take a different time frames in European countries, depending on the existing policies, political frameworks and insurance schemes. Moreover, there is no universal solution for business integration, due to Member States' specificities, different insurance penetration rates and natural hazards/protective measures portfolios. To achieve the European Commission's objective to mainstream the use of NBS to mitigate the effect of natural hazard, differences among insurance schemes, opportunities and barriers, presented in this paper, need to be considered.

(iii) Regarding the roles of the insurance industry (insurance providers, investors, innovators and partners in resilience to natural hazards), it is important to highlight that the industry has still great potential to deliver knowledge, evidence tools and technologies throughout transdisciplinary partnerships. The insurance industry plays a strong role in risk perception (sensibilization, alerts, prevention, incentives, etc.) which could lead to drawing up intelligent coverage concepts and new products to mitigate natural disasters losses. Therefore, the insurance industry has a big role in the mainstreaming of NBS as useful and valuable tools for DRR. The insurance industry can as well have a role to develop new investment strategies (e.g., sustainable investments with green/blue/cat bonds, etc.); to create innovative green ways; to mainstream new environmental partnerships; and to reduce its own environmental impacts. Clarifying, defining and integrating ecosystem co(st)-benefits into the core insurance business is an emerging way to tackle the impact

of natural disasters in the future. Thus, NBS may be especially suited for coping with specific hazards and possibly are more scalable.

(iv) The insurance industry requires a clear demonstrations of the DRR benefits as well as viable business models to invest in natural infrastructures. The industry needs clear data that supports that NBS are in good combination: economically viable, financially attractive for investment and measures of the positive effects of NBS on risk reduction. The growing role of the insurance industry in DRR recognizes these new challenges to be addressed. The insurance industry can play a key leading part on the necessary research to help generate new supportive facts and knowledge, always if possible, working in partnerships with the scientific community.

(v) The regulatory frameworks are crucial for the functioning of the insurance systems and, therefore the European Union has an opportunity to stimulate new roles from the insurance industry. As raised during the interviews, the insurance industry is asking for clear European and national roadmaps leading to sustainable insurance systems that include NBS as valuable DRR tools. There are as well divergent opinions on the idea of an EU top down leading role.

(vi) The information gathered during the interviews is aligned with the large work performed by the EU on sustainable finance. Contributions from projects like NAIAD are useful to fill the knowledge gaps since it includes scaling-up experimentations, testing and demonstrating the applicability and the limits of NBS for eco-DRR.

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Appendix A Full Questionnaire

Section 1 Risk-assessment related with natural hazards

1. Have you made a risk assessment of your networks and key assets/Demo/Region? Which assets are more at risk?
2. What are the main natural hazards you perceive as risks for your country/Demo/Asset?
3. Are Climate-driven extreme events one of them?
4. If so, how: do you integrate climate change scenarios in risk evaluation? How is the climate change included in your models? How do you generate climate scenarios?
5. What are the physical parameters describing risk at your country/Demo/Asset? (e.g., wind speed, water level, etc.)
6. How do you cope with (often imperfect) information and knowledge? How are uncertainties taken into account?
7. Is the information/data available to everyone? Where people can find data and other information on natural risks? Can this information help people to have a better understanding of the risk?
8. Who are your peers? How do you seek advices?
9. Who carries the risks of extreme events? You or your (public) client?

Section 2 The role of the protective measures against natural hazards

1. How do you manage the risks (list mentioned above) under your responsibility? We would value concrete examples.

    (a) Taking prevention measures: risk mitigation- risk reduction measures, structural measures, if so, which?
    (b) Preparedness and Crisis Management protocols?
    (c) Insurance/ transferring the residual risk or pooling/compensation.

2. How risks are managed along the project cycle of infrastructure investments (where water management is relevant) and how these risks are shared with the private sector? Give an indication of:

    (a) Which sector—public or private—is responsible for managing these risks and therefore willing to invest in DRR measures?
    (b) Gaps within the investment system that need to be solved with DRR and system understanding expertise.

3. Who maintains and operates protective (Mitigation/adaptation) structures? How are they funded? Who carries the risk of failure?
4. Are insurance contracts available for those protective structures, or are they considered in insurance contracts?

Section 3 Development of a new European legal framework for implementation of the IVE

1. Does the current European legal and market framework permit to harmonize insurance premiums at the EU level? (Develop and discuss your opinion)
2. What are the main differences between legal and market frameworks in each country?
3. Is it possible to create a regional risk-pooling scheme at the EU level? (Develop and discuss your opinion)
4. How are climate risks assigned, for different economic sectors, by European insurance companies? Are these policies under any degree of reconsideration?

Section 4 (re)insurance framework descriptions

1. Can the insurer refuse to cover a property because of the future expected natural hazard (in your country)? Does everybody have access to insurance? If insurance coverage is not possible, what is done in this case?
2. How do you economically assess the indirect costs/effects of a disaster? (e.g., road/airport closure consequences; business interruption)
3. Which insurance options do you have for your key assets and per type of risk?
4. Could you give us an impression of the comparative size of insurance premiums you pay for natural hazard risks, versus other risks as safety of employers, fires, burglary, etc.?

   How are these insurance policies aggregated? (Which subcategories are there and their relative size)

5. How do you evaluate your own insurance system?

Section 5 Economic issues related to insurances

1. What is the basic knowledge for premiums calculation and how are they calculated?
2. Could your insurance company create financial incentives (e.g., premium reduction) for policyholders who have implemented prevention/mitigation measures and what is provided to whom they have not implemented that before any (flooding) natural hazard?
3. Are risk reduction measures considered to modify premiums? If yes, which type of measures are they? Please rank these different resilient measures based on which criterion?

Section 6 Risk awareness risk perception: current knowledge and gaps

1. Does the insurance industry have mechanisms in practice or under development to deal with variance in perception of risk?
2. How far do the member state's risk culture aspects have to be considered by your insurance company in your proposal of risk mitigation measures? What are the main risk culture differences in the EU countries?
3. How would you most likely communicate with your customer about flood/droughts/other climate related hazard resilience? (e.g., standards for reconstruction of their houses, etc.)
4. How has your risk perception changed with the climate change? (brokers: about the perception of their clients)

Section 7 Linkages between the insurance sector and NBS, ecosystems

1. What are the new challenges for your insurance company to cope with climate-related risks?
2. What are tangible examples of projects to address existing or potential climate risks your organization has pursued?
3. What is the insurance company conceptual understanding of ecosystem-based disaster risk reduction?
4. What is the insurance company conceptual understanding of insurance value of ecosystem?
5. What is your current knowledge of positive or negative effects of ecosystems?
6. Do you recognize any particular ecosystem as a defense or resilient measure to face natural hazards?
7. Is there any insurance contract for risks related to ecosystem effects? (e.g., wildfires, woody debris jamming on bridges, etc.)
8. Do you have a specific strategy to incorporate nature-based solution or insurance value of ecosystems in risk assessment strategies? (e.g., key green policies, monetary choices for integration into green solutions portfolios)

9. How your insurance company can develop models for calculating scenarios of risk reduction for different types of ecosystem services?
10. Which knowledge and tools would be required? Do you know of tools being developed? (Please list them)
11. How your insurance companies can/could develop methods to implement the concept of insurance value of ecosystem?
12. To what extent has the concept of nature-based solution been integrated in your policy framework? Are there pioneer examples around the world?
13. How could you do partnerships with insurance companies/clients? To design insurance schemes and NBS standards that strengthen and incentive DRR?
14. Tell us more about how could that work? (e.g., who pays what, required regulatory changes or economic instruments?) Have you seen such example elsewhere, in EU or outside Europe?
15. What do you know and think of Resilience/Green/Cat Bonds? Could they work to finance NBS? Under which conditions? Which other similar products in development you know of?
16. In addition to risk reduction role of ecosystems, can the environment preservation be an additional motivation for your insurance company? (e.g., for your image? if so, which options would have your preference?)
17. Do you ever finance risk reduction measures? As "insurance" company? And/or as institutional investor? How do you separate these two roles?

    (A) If you do invest as insurance company, would you be willing to finance Nature-Based Solutions for DRR? Why?
    (B) And as Institutional Investor? If you are investing, could you give us examples? If not, specify the reasons and/or bottlenecks?

18. Do you ever reimburse risk reduction investments made by your clients?

In example, health insurance policies sometimes reimburse the costs of a gym subscription. Are there plans to do so in this field?

19. What can be the minimal amount of your (re)insurance companies' investments, that will be required to fund those measures? How much of loss can your (re)insurance companies avert, with investments in what grey, green/blue, hybrid measures? (calculating benefit/investment ratios)
20. How do your models take into account the green/NBS options for DRR taken by your client? Why?
21. Concerning the barriers in hindering the uptake of nature-based solutions in practice into insurance policies: How important are the following barriers? Could you please give concrete examples per category?

    Natural (physical barriers)
    Social (social validation)
    Human (cultural)
    Financial
    Legal

Section 8 Funding DRR measures and ecosystem services

1. What are the most important sources of Funding for Disaster Risk Reduction Measures? Taxes, Tariffs or Transfer? (Explain more in detail) and who collects them and is responsible for their budgeting? And procurement?
2. Are there any additional important sources of funds (e.g., Structural funds) and/or strategic partners for the implementation, funding and/or financing of DRR measures?—and for NBS specifically?

3. Are Public-Private Partnerships contracts being used for the procurement of DRR measures? If so, could you give us examples?
4. Which innovative Green/Climate finance (Urban and Rural NBS, Watershed conservation, Natural Foreshores) Funding strategies, financing mechanisms and innovative business models have been applied in your country?

   We would value concrete examples and/or contact persons.
5. Which economic and regulatory instruments do you consider key in incentivizing private sector and society to opt for NBS, for Resilience and Water Security?
6. Do you think a new model would be needed to consider NBS or should we only adapt the current scheme?
7. Do you think a preliminary marketing survey would be needed to check that a market really exists? (a real demand from possible customers)
8. Do you think using NBS could provide a competitive advantage for your company?
9. Do you think those new business models could be created by companies or should it be imposed by European regulations?

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