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Disaster risk management: management framework and technical process of settling disaster damage claims

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Abstract: *Risk assessments are performed at multiple scales, from the global level to the community levels. These levels have their own spatial data objectives and requirements for hazard inventories, environmental data, triggers or causal factors and risk elements. The new catastrophic risk management systems include multiple approaches: i.e. vulnerability related approach, indicator-driven approaches, multiple risk approaches and spatial risk visualization. Multi-risk assessment is a complicated procedure that requires spatial data on several different aspects and a multidisciplinary approach. This paper provides an overview of the catastrophic risk management framework and the technical process for settling claims.*

Keywords: *risk managemnt, disaster risk, natural events, corporate insurance, remote sensing, spatial data, disaster risk reduction models*

JEL Classification: G32, G52, Q54

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1. INTRODUCTION

In recent decades there has been an exponential increase in the number of events due to various causes (Păvălaşcu & Gabor, 2020). Some of them can hold one's focus for a longer period, meaning those that strike suddenly and cause large scale losses and human suffering, such as earthquake, tsunami, hurricane and flood. There are also numerous serious slowly debuting geomorphological risks, such as the recent drought in the Horn of Africa (2011), soil erosion, land degradation, desertification, glacial retreat, rising sea levels, loss of biodiversity etc. Such processes and their related events may cause long term local, regional, and global impacts, but mostly receive less attention. Mega catastrophes: insurance industry observe catastrophes in order to monitor claim costs, and in doing so assign a particular number to each catastrophe. Each claim arising from an event is marked so that the total loss across the industry may be prepared. The catastrophe term is often narrowly used in the real estate insurance industry to mean a catastrophic event that goes beyond a USD threshold in payments of claims. This number has changed over time with inflation and growth of the developing areas that are exposed to natural disasters. In 1997 catastrophe was redefined to rise from 5 million $ to 25 million $ in insured losses. While 25 million$ is a big number for most people, five catastrophes occurred that should be treated as mega catastrophes, as they are far beyond this figure (International Insurance Institute, 2019). The first two of them, Andrew Hurricane (1992) and Northridge earthquake (1994), were events far more destructive that predicted. The third event, the terror attack on the World Trade Centre in 2001, changed insurers' view on man-made risks around the world. Katrina Hurricane (2005), which is the fourth catastrophe, is not just the costliest natural disaster ever recorded, but also an event that toned up nationwide talks about how natural and/or man-made catastrophes are handled.

In the USA for period 1997 – 2016, such events as tornados, hailstone and tornado-associated flood accounted for 39.9% of the total of the loss insured for catastrophe, as adjusted for inflation (Europe Re, 2020). Hurricane and tropical storms were the second biggest cause for catastrophe losses accounting for 38.2% of the losses followed by other wind / hailstone/flood (7.1%) and winter storms (6.7%). Terrorism and fires, including wildfires accounted for 5.9% and 2.0% respectively of the total catastrophe losses. Civil disorder, water damages and utility outages covered circa 0.2% of the losses. Disaster losses along the coast are expected to rise over the next years, partly due to the huge costs of development. A catastrophe modelling company predicts that catastrophe-caused losses are to double every decade due to the rise in both residential and business density, and high-priced properties.

Man-made catastrophes, such as the WTC attacks may also cause huge losses. The attacks made the Congress pass the Terrorism Risk Insurance Act (TRIA) in November 2002. Since its original enforcement, the terrorism risk insurance program has been revised on three occasions. The most recent expansion - Terrorism Risk Insurance Program Reauthorization Act in 2015 (TRIPRA) – ensures its enforceability through to December 31st, 2020. Since its inception, the program was devised as a mechanism to differentiate the *terrorism risks* between the public and the private sector respectively – with a massive share of the risk being borne by private insurers, which has seen a consistent expansion over time. Today, all the serious (and most likely, terrorist) attacks would be fully covered by the private sector.

The regular insurance policy for *property owners* covers damages caused by fires, storms, hailstone, rebellions and explosions, and further types of losses, such as theft and cost of living elsewhere while the relevant structure is being repaired or rebuilt after being damaged. Insurance

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policies for *commercial properties* typically cover the same causes of losses with a specific variation, based on the selected covers.

Insurance industry is divided based on the relevant markets. Some claim that as part of the existing system, government (and therefore taxpayers) pays for reconstruction, in any situation, using governmental subsidies and low interest loans and therefore such funds should be advisably spent better in a pre-planned, predicted manner. Other insurers claim that there is sufficient reinsurance capability worldwide to protect primary insurers against catastrophe losses and that the individuals who choose to live in disaster prone areas should not be protected against the costs of their decisions by subsidies backed by individuals who choose to live in a less risky area. They consider that the solution would consist in lawmakers or specific insurance market regulators developing stricter construction codes and tax reliefs for property owners to achieved preparedness for hurricanes. New research suggests that the activity degree of hurricanes in Atlantic Basin is not proof to the number of storms to hit the American coast. According to AIR Worldwide researchers, the likelihood of their occurrence is most closely related to the genesis of a storm or to where it is formed rather than the number of tropical storms in the Atlantic (International Insurance Institute, 2019).

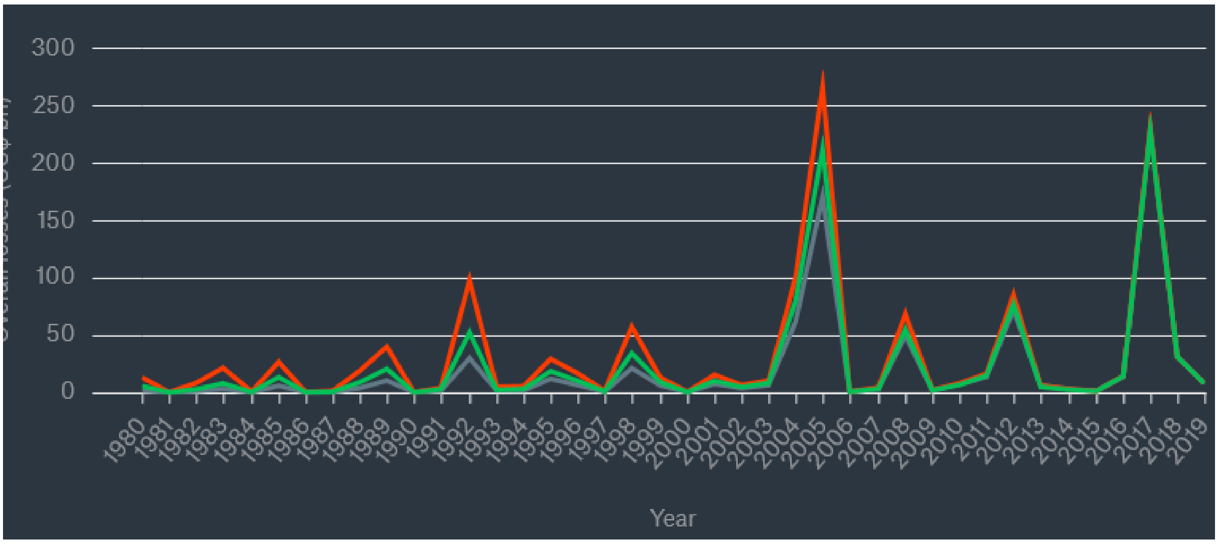
Recently computer-assisted simulation models were developed that can provide long-term disaster data with current demographics to produce potential losses for any geographical location in various scenarios. Such data allows insurers to better tell high risk areas from low risk areas in ocean bordering countries – an example would be US' Florida, where previously, during times when risks could be defined in a less accurate manner, the entirety of the state could have been deemed as high risk (TCFD, 2017). Moreover, the computer programs designed to help subscribers adjust the potential losses in a building caused by windstorms enable insurers to offer more accurate pricing in respect of insurance coverages for industrial properties. The capacity to generate such information also caused insurers to reassess their business strategies.

2. DEFINING THE RESEARCH PROBLEM: CATASTROPHE EVENTS - STATISTICS AND THEIR IMPACT ON THE INSURANCE INDUSTRY

Global losses caused by natural catastrophes worldwide in 2019 accounted for a total of USD 150 bn, which is approximately consistent with the adjusted inflation rate over the past 30 years, down from USD 186 bn in 2018, according to Munich Re (2020). The causes of these natural or man-made disasters are very diverse:

- *natural causes:* typhoons (Japan), hurricanes (Dorian - $ 2 billion, Michael - $ 12 billion), storms, cyclones, earthquakes, floods, causes that caused a lot of human and material damage (Munich Re, 2018; Munich Re 2019; International Insurance Institute, 2019) according to Figure no. 1 and Table no. .;
- *man-made disasters*: for example, in 2019, they accounted for $ 6 billion in insured losses globally, down from $ 9 billion in 2018, according to preliminary data from Swiss Re (2020). In Table no. 2 are presented systematically the nuclear incidents worldwide (National Atomic Energy Agency).

Figure no. 1- Demages caused by huricanes 1980-2019 (billions USD)



Source: Munich Re

Table no. 1- Top 10 most significant earthquakes in terms of resulting demages

No.	Date	Location	Total losses (USD bn.)	Insured losses (USD bn.)	Fatalities
1	Mar. 11, 2011	Japan	210,000	40,000	15,880
2	Feb. 22, 2011	New Zeeland	24,000	16,500	185
3	Jan. 17, 1994	USA (CA)	44,000	15,300	61
4	Feb. 27, 2010	Chile	30,000	8,000	520
5	Sep. 4, 2010	New Zeeland	10,000	7,400	0
6	Apr. 14-16, 2016	Japan	32,000	6,200	205
7	Jan. 17, 1995	Japan	100,000	3,000	6,430
8	Nov. 13, 2016	New Zeeland	3,900	2,100	2
9	Jun. 13, 2011	New Zeeland	2,700	2,100	1
10	Sep. 19, 2017	Mexico	6,000	2,000	369

Source: adapted after International Insurance Institute, 2019

Disasters are defined under the *United Nations International Strategy for Disaster Reduction* as „*a serious disruption to society with massive human, material and environmental losses and these losses always go beyond the capacity of the affected society to cope with its own*

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resources" (UN-ISDR, 2004). While „natural disasters" in its strict meaning is a misnomer as disasters are the consequence of interaction between perils and vulnerable societies, the term is both commonly used and widely used in the relevant literature.

Table no. 2 – Nuclear incidents worldwide

Level	Description	Example	Location	Year
1	Anomaly	Sudden stoppage of main circulators and concurring loss of their roofing systems during reactor flaking	Finland	2008
		Exposure of two workers in the nuclear power plant overdose limits	, India	2012
2	Incident	Reactor set off due to high pressure reactor's pressure vessel	, Mexico	2011
		Overexposure of an intervention radiology MD over the annual limit	, France	2013
3	Serious incident	Leak of iodine-131 into environment out of Institut National des Radioéléments	, Belgium	2008
		Severe overexposure of a radiographer	, Peru	2012
4	Accident with local effects	Radioactive material in scrap market resulted in an acute exposure of scrap dealer	, India	2010
		Overexposure of four workers in an irradiation facility	, Bulgaria	2011
5	Accident with regional effects	Severe damages in the reactor core	, US	1979
		Four deaths after overexposure caused by forgotten, ruptured radiotherapy source	, Brazil	1987
6	Serious accident	Significant release of radioactive material into the environment after explosion of a high-activity waste facility	, Russia	1957
7	Major accident	Significant release of radioactive materials into the environment that resulted in impairment of health and environment	, Ukraine	1986
		Significant release of radioactive materials into the environment that resulted in impairment of environment	, Japan	2011

Source: International Atomic Energy Agency

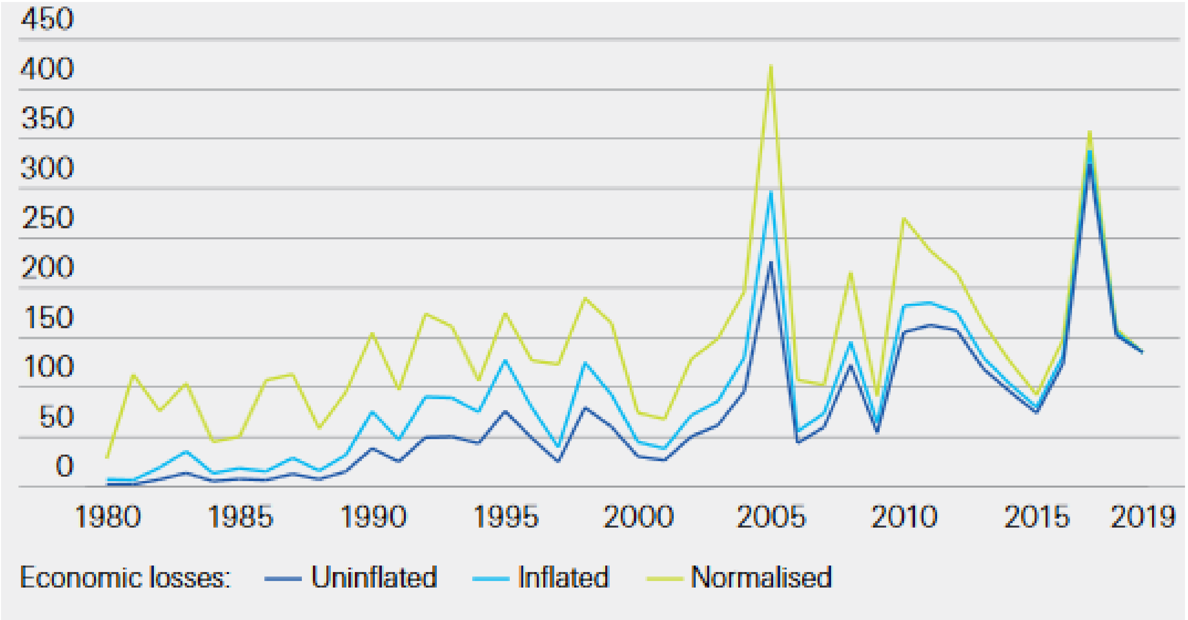
The rising losses, number of disasters and affected people cannot be simply explained by more media coverage of disasters and accurate reporting methods and, the lack of which may have helped such number appear as too small for the first part of the past century. There are several factors that drive the rise of the number of disasters that can be sub-divided as those that result in a higher *vulnerability* and those that lead to a *higher occurrence* of dangerous events.

Rising vulnerability is attributable to multiple causes:

- *the rapid growth of world population*, which has doubled in size from three billion in 1960s to 7.51 billion in 2017 according to the World Bank. According to the forecast growth rates, population is expected to range between 7.9 billion and 11.0 billion by 2050 (UNPD, 2010).

The rise in the magnitude of disaster impact is nevertheless higher than population growth, which is indicative of further significant drivers that raise the overall vulnerability of the population.

Figure no. 2- Economice losses caused by disaster events



Sursa: Swiss Re

- *the high urbanization rates*. According to ONU (UNPD, 2010), the worldwide urbanization percentage rose from 29% in 1950 to 50% in 2010 and is expected to hit 69% in 2050 (UNPD, 2010). Related to population growth, another factor is that the areas that previously were avoided due to their proneness to natural perils become settlements. Many of the biggest cities in the world, the so-called „Megacities" are located in dangerous regions in coastal areas or in active seismic regions (Smith and Petley, 2008);
- *the development of the highly sensitive technologies* and the growing sensitivity of modern industrial societies to the breakdown of their infrastructure. Data from Munich Re (Munich Re, 2020) shows that economic losses have risen by a factor of 8 over the last 50 years, and the insured losses by a factor of 15.

Table no. 3 - Losses caused by catastrophic events during the last 30 years

	2019	2018	Average of damages over the past 10 years (with damages adjusted for inflation)	Average of damages over the past 30 years (with damages adjusted for inflation)
Number of events	820	850	660	520
Total damages (USD m)	150,000	186,000	187,000	145,000
Insured losses (million USD)	52,000	86,000	65,000	43,000
Fatalities	9,000	15,000	37,400	51,600

Source: 2020 Munich Re, NatCatSERVICE

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There is an inverse relationship between development level and loss of human life in case of disaster. An approximate 85% of the victims caused by disaster are found in less developed countries, where more than 4.7 billion people live. Higher rates of life loss is due to lower quality of buildings, lack of construction codes or lack of enforcement thereof, construction of buildings in dangerous areas due to no planning of land usage, no awareness and preparedness for disasters, less accurate or nor early warning systems, no evacuation planning, no search and rescuing capabilities and medical assistance. As shown above, the occurrence of disaster events (Table no. 3) that resulted in a generation of significant damages and a rise in the number of fatalities has decreased during the last two years, while the decade average is still impressive.

3. PRESENTING THE RESEARCH FINDINGS: DISASTER RISK MANAGEMENT FRAMEWORK

Disaster Risk Management (DRM) is defined as „*the systematic process of using administrative decisions, organization, operational abilities and capabilities for implementation of society's and communities' policies, strategies and combatting capabilities to minimize the impact of natural perils and environment and related technology*.“ This comprises all forms of activities, including structural and non-structural measures to avert (prevent) or contain (mitigation and preparedness) the adverse effects of perils (UN-ISDR, 2004).

As disaster impact has grown dramatically in this decade, the *international community* decided to carry on this effort after 2000 in the form of an international strategy for disaster reduction (ISDR). ISDR emphasized the need to transition from a top-down disaster management and a cycle focusing on reconstruction and preparedness to a more comprehensive approach that attempts to avert or minimize risk prior to disaster actual occurrence and also supports more awareness, public commitment, exchange of knowledge and partnerships towards implementing various risk minimization strategies across the board.

Risk evaluation is the combination of risk analysis and risk assessment. This is more than a merely scientific enterprise and should be looked upon as a collaborative activity that brings together professionals, certified disaster managers, local authorities and people living in exposed areas. Disaster risk reduction should be achieved by putting together structural and non-structural measures focusing on emergencies (e.g. awareness, early warning systems etc.), inclusion of risk-related information in long-term planning and evaluation of the most effective risk reduction measures.

Risk evaluation using the GIS (Geographic Information System) can be achieved at various geographical scales. While it is possible to use a series of spatial resolutions of input data for the GIS analysis (calculation scale), in practice geographical scale determines the size of the research area to be analysed (van Westen, 2012). However, this fact itself restricts the scale of the input data and the resolution of the data used for calculation purposes. Geographical scale also determines the representation scale of the end products (cartographic scale). There is a number of factors that play a role in deciding which risk evaluation scale and which risk scale should be selected. These are first about the purpose of danger evaluation, the peril type, and the scale of operation where such danger processes are triggered and manifested.

Evaluation of multiple risks and subsequent evaluation of the risks is a highly intensive procedure. Availability of specific types of space -temporal data may be one of the major limitations in conducting specific types of analysis. The core types of GIS data required for evaluation of the risks and the risks can be split into three groups: (1) peril inventory data; (2) environment factors; and (3) triggers.

Environment factors are a collection of GIS data layers expected to impact the occurrence of perilous phenomena that can be used as *causal factors in predicting future events* (based on numerous assumption). Peril is evaluated at various scales, and *peril evaluation methodologies depend on the specific type of peril and availability of input data.*

3.1. Multi – peril risk assessment

Quantitative approaches are about expressing risk in quantitative terms either as *probabilities* or *forecasted losses*. They can be either deterministic (i.e., scenario-based) or probabilistic (i.e., based on the effects of all possible scenarios and uncertainties).

Qualitative risk assessment (QRA) pursues an engineering approach and is focused on evaluating *direct physical losses* resulting directly from a peril's impact (e.g., flooded buildings, fallen buildings) (Gupta, 2013). Some also assess consequential losses caused by loss of function (e.g., disruption of transport, loss of business or cleaning costs). A greater emphasis is placed on *tangible losses* with a monetary (replacement) value. Disasters also cause a great number of *intangible losses* e.g., lives and injuries, cultural heritage, environment quality, and biodiversity.

Qualitative methods for risk assessment are useful as a process of initial screening to identify risks. They are also used when the assumed risk level fails to account for the time and effort used to collect the vast amount of data needed to perform a quantitative evaluation of risk and where the possibility of eliciting numeric data is limited (UNDRR, 2019). The most basic form of *qualitative risk* evaluation is combining risk maps with elementary risk maps in GIS using a matrix with a simple risk where classes are defined qualitatively.

3.2. Technical process of settling disaster damage claims

While claims for significant damages caused by natural catastrophes and other perils around the world have slumped over the last two years, the blasts that killed 173 people and injured nearly 800 in Tianjin, China, in August 2015 served as a reminder for this kind of risk. Managers must continue to be watchful of the possibility of losses anywhere in the world (Parchure & Soman, 2016).

Besides maintaining an adequate insurance cover, companies need full-fledged, redundant emergency plans and policies to be able to keep up their critical business in case of loss or to resume business in due time. In the wake of any loss event, a company's recovery capability often depends to how well their claim for damages is handled.

3.3. Insurer's loss adjustment and negotiation process insurer

Another key in successfully handling damage claims is effectively controlling the process. Anytime a loss occurs, the claim team, including both internal and third-party resources, must be able to control any phase of the claiming process through a successful resolution. Where a loss occurs, the managing team may expect that the affected branch or business unit to keep or resume critical operations in a timely manner. Therefore, in case of significant

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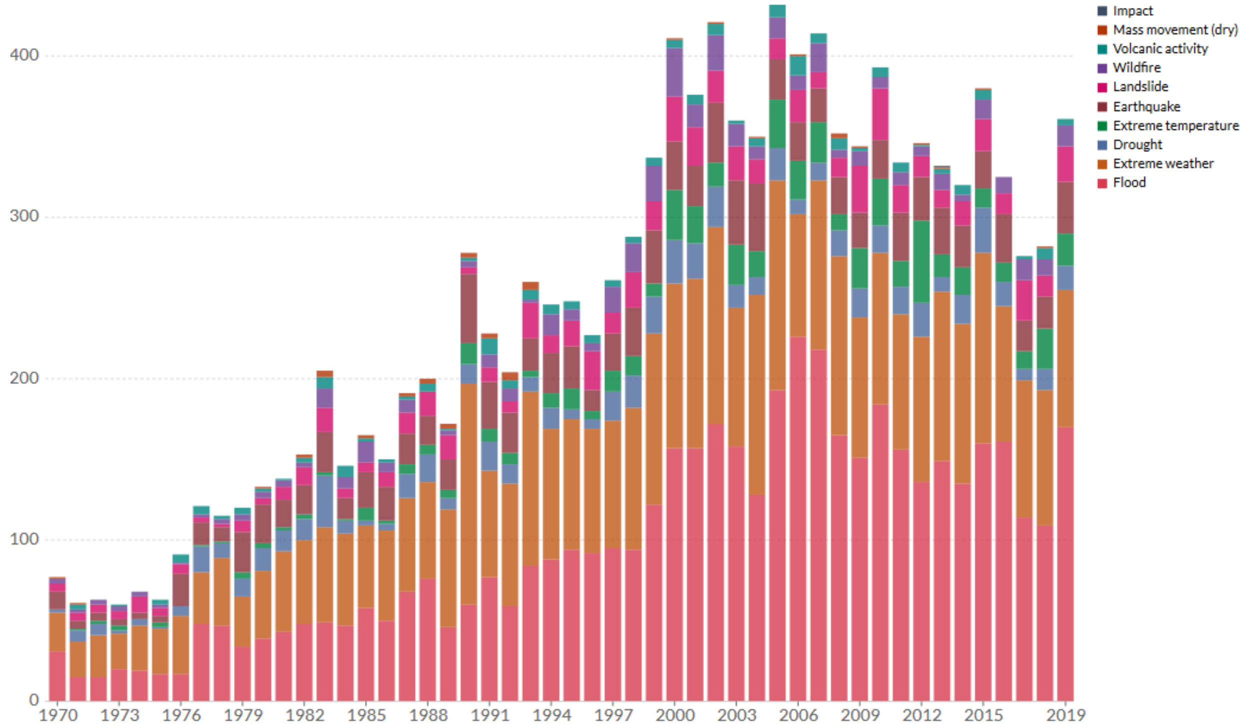
disruptions associated with regional disasters, a company's *Business Interruption* insurance, claims and recoveries should be properly structured and adapted to approach any related financial consequences (Gupta, 2013).

Figure nr. 3 – Taxonomy of the number of catastrophic events over the last 30 years



Source: https://ourworldindata.org/grapher/natural-disasters-by-type)

3.4. Unique **challenges in international partnerships in indemnity**

The litmus test for a global insurance program is whether it will effectively respond to a loss event as expected. Acting based on a well-thought-out insurance program, effective management of indemnification can ensure payment to meet client's expectations. However potential cultural and linguistic barriers may be encountered that may result in delays in preparing and processing a claim. This is more the reason why the claims team should be effective in its co-operation with the local management (Mohan & Ramacharla, 2013). While differences will be found in how providers of adjustment and claims settling services operate in specific countries, all of them are bound to meet a consistent set of global standards established by the all-risk's management team. This applies in countries where local insurance companies are required by the law to participate in any insurance program.

Another priority involves the search for providers that comply with globally recognised methodologies. An insurer must identify those providers that can constantly deliver for any property claim, whenever that arises. Ideally providers can help insurer follow up on the progress of a claim against the industry's benchmarks for similar losses anywhere in the world. Despite of efforts by companies operating in various parts of the world to manage exposures and prevent losses, loss-making cases will always exist.

4. CONCLUSIONS

A disaster is an event that makes it impossible to continue normal functioning, and a disaster recovery plan consists in the precautions taken to minimize the effects of any disaster. The likelihood of a disaster to occur in an organization is extremely uncertain. Disaster recovery becomes an ever-increasing consideration for a business. In spite of the number of public disasters since 9/11, 50% of the companies do maintain a disaster control plan but are yet to test it.

Industry has to integrate and dynamically monitor the climate change effects, adjusting models to an ever-changing risk landscape. This involves that two new dimensions be embedded in risks evaluation. The first one is the time scale. Insurers should model for what comes next (short term), while also preparing a long-term plan. The second one is the level of confidence in what concerns the expected results in various weather-related hazards. Climate changes make risk landscape dynamic, and insurers should provide an appropriate response. Many of the existing catastrophe models are too deeply rooted in the past. They fail to fully pay due regard to the rising exposure to the increasing concentration of value in a fast-urbanizing world and is sometimes more vulnerable, particularly when expanding into higher risk regions. Other complex factors such as increasing losses are also a challenge for modelling. Loss is about increasing losses over. There may be many contributing factors, including social inflation or lack of coordination in claim processing, which drive up losses to levels much higher than expected. The (re)insurance companies are faced with climate change risks on both sides of their balance sheets, which may adversely affect the profitability and solvency of long-term underwriting. As far as liabilities are concerned, the leading risk is underrating the insurance risk premiums due to dependency on data concerning the historic losses or incomplete/obsolete models. On the other hand, the exposure of assets derives from the impact of the physical risks and transition risks attached to invested assets, including infrastructure funds and corporate bond holdings.

While academic research around the macroeconomic impact of climate changes only identifies a moderate impact on GDP level by 2100 for even more severe levels of temperature changes, the core models face a series of acknowledged limitations. Even more recent systems still use historic data to make prospective predictions for temperature-GDP scenarios that have not been seen on a human scale and, therefore, they are likely to be biased. More detailed research on nature-related *economic risks* shows that more than half of the world's total GDP is moderately or highly dependent on nature and its services and is therefore exposed to the risks caused by nature loss.

Similarly, an analysis based on case studies on local effects shows a much more severe economic impact. Tremendously important, climate risks are not uniform distributed across geographies. These depend on the geographic framework and the economy's sectorial composition.

An effective damage control process is crucial for a company's financial recovery and even for the sustainability of its local business. Having implemented an international compensation strategy, risk managers are able to help their companies approach loss events anywhere they do business and reduce the total risk cost in the process.

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Future research will be directed at *special disaster risk programs in developing countries* (such as the Caribbean - CCRIF, South-Eastern Europe, etc.) and at *international disaster risk assessment cooperation* (such as oasis Hub, GAR Atlas, NATHAN, etc.). As regards the disaster risk minimizing methods, regional co-operation is key to knowledge exchanges and creation of capabilities between the countries sharing similar risk profiles and regional concerns, and for providing mechanisms for managing the development-related funding and providing risk funding for the Member States.

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