Chapter 11.

NEW INSURANCE DIRECTIONS AS A RESPONSE FOR CLIMATE CHANGE

The global economy is experiencing a disastrous ecological loss of momentum, at present 1.5˚C of global warming. Additional warming will cause a butterfly effect leading to socio-environmental collapse. Climate change is leading to an increasing frequency and intensity of extreme weather conditions. Unsustainable use of energy and land, as well as the long-term burning of fossil fuels, is causing more frequent and intense extreme weather events, such as heatwaves, storms, floods, and droughts, which have serious consequences for people, ecosystems, and natural resources worldwide.

IPCC notes that existing government policies provide 3.5˚C of global climate warming in a century's lifetime for human and non-human life[279]. Scientific pieces of evidence show that the earth's pressures were low through the 1950s, with a lag between pressures and impacts[280]. The Global Footprint Network showed historical trends of planetary resource consumption. Based on their report we can conclude that development within planetary boundaries and ecological reserves came to an end in the 1960s[281].

Post-growth scholars see colonial nature of capitalism as a greatest concern and reason for multiple crises. Capitalism is dependent on perpetual growth, which implies increased resource use. To allow capitalism to thrive, it requires more resources than available. Otherwise, such systemic order will collapse.[282]

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[279] IPCC (2021). Climate change 2021, The phisical science basis. *Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (retrieved May 1, 2023 from https://www.ipcc.ch/report/ar6/wg1/)

[280] Steffen, W. et al. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science, 347*(6223), doi: 10.1126/science.1259855

[281] The Global Footprint Network (2021). Strategies for one-planet (retrieved Maj 1, 2023 from https://download.schneiderelectric.com/files?p_enDocType=Brochure&p_File_Name=Earth+Overshoot+Day+2021+eBrochure.pdf&p_Doc_Ref=earth_overshoot_dayprosperity)

[282] Kočović De Santo, M. (2022). *Eko + kulturni = odrast turizam: interdisciplinarne perspektive: ekonomike kulture, ekološke ekonomije, dekolonijalnih studija, komons i odrast teorije u funkciji kulturnog, prirodnog i živog nasleđa*. Belgrade: Faculty of Media and Communications, Faculty of Organizational Sciences

Instead of letting this scenario occur, the collapse has been globally externalized by causing our heating world to melt. The social and environmental costs of exponential growth are passed on to vulnerable and marginalized communities.

By tracking the progressive growth rate with other information from national accounts, crossed with global attitudes and behaviors, we can easily follow the aggregate production and demand trends on global scale. The production/consumption patterns, allows us to understand how uncontrolled exploitation of planetary resources caused ecological deficit and debt. Both, the ecological deficit (which exceeds the actual state of available resources), and ecological debt are strongly driven by economic growth, inequality and injustice. An ecological debt has been created, and we are currently consuming almost two planets of the necessary resources to continue in the same patterns [283]. The cost of socio-ecological crisis is too high to allow further destruction. We are aware that the primary goal of increasing aggregate production is to accumulate more profit. At the same time increased production seeks for more input materials, which devours planetary resources, by causing climate change disasters. Within existing system of unnecessary commodity production (luxuries), people around the world still struggle meet their basic needs.

The Oxfam report shows that extreme carbon emissions inequality is the primary cause of pushing the world to the brink of climate change. Moreover, annual emissions were increased by 60% between 1990 and 2015, while cumulative emissions doubled . The richest 1% alone accounted for over 15% of total emissions and consumed 9% of the carbon budget: more than twice as much as the poorest 50%. The global middle class accounted for 41% of cumulative emissions and 25% of the carbon budget, while the poorest 50% accounted for only 7% of total emissions and 4% of the budget[284]. Scientific evidence is clear that the rich economies of the high income economies (Global North - GN) bear overwhelming responsibility for the socio-environmental crisis[285]. The material and environmental footprint is extremely high, exceeds the limits of sustainability many times over, and goes far beyond the limits of what would be acceptable to ensure a decent life for all. Degrowth advocates for

[283] Kočović De Santo (2022), op. cit.

[284] Oxfam (2020). Confronting Carbon inequality - Putting climate justice at the heart of the COVID-19 recovery. *Oxfam Media Briefing* (retrieved May 1, 2023 from https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621052/mb-con fronting-carbon-inequality-210920-en.pdf?sequence=1&isAllowed=y)

[285] Hickel et. al. (2022). Imperialist appropriation in the world economy: Drain from the global South through unequal exchange, 1990–2015, *Global Environmental Change, 73.*

GN countries to abandon GDP growth as the ultimate goal, and forego unnecessary production to reduce both material and energy consumption - to meet the Paris Agreement 1.5 degrees Celsius.

Relying on the previous, we can conclude that degrowth / post-growth thought offers a solid empirical foundation for the needed transformation to organize the economy in line with equity, justice, sufficiency, by the work of empowered democracy to meet the development within planetary boundaries. Deprivation and problems of resource use, as well as misery on the path to well-being, are not new topics. Conflicts and instabilities triggered by COVID19 have mobilized UN organizations in ways seen never before. The consequences of natural disasters have drastically increased over the last 30 years, making them one of the biggest obstacles to sustainable development. Under their impact, decades of progress in achieving development goals can instantly vanish.

The international community has embraced the concept of "fair globalization," by recognizing that productive employment and decent work shall be at center of policy decisions to achieve fair globalization and poverty reduction. World leaders proclaimed that the key problem of our time is to ensure that globalization becomes a positive force for all, acknowledging that both its benefits and costs are unequally distributed. The declaration advocated for global policies and actions that address the needs of developing countries and transition economies *United Nations Millennium Declaration* [286], followed latter by UN summits and declarations which led to Milenium and Post-Milenium SDG goals. In *Millennium* and *Post-millennium* world, persistent hunger, widespread disease, rising inequality, increasing environmental degradation and catastrophic climate change - must rapidly confront its sources of destruction. The intrinsic pursuit of growth legitimized a series of measures and policies that have been devastating for people, the environment, and the economy itself. Eventually, it is not enough and there is more to be done.

Relyionf on Jan Tinbergen work (who got the first Nobel prize in economy) findings, some fresh research shown how to create GDP and SDG ratio, to understand GDP shadow and contribution in meeting the SDG targets[287]. Tinbergen mathematical suggestions regarding the maximization of “social welfare function” referred to the “SDG welfare function.”, which made possible

[286] UN (2000). *United Nations Millenium Declaration* (retrieved May 1, 2023 from https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_55_2.pdf)

[287] Thore, S., & Tarverdyan, R. (2021). *Measuring Sustainable Development Goals Performance.* Elsevier

to denote the SDG indicators and understand the total SDG achievements of the country i.e. GDP contribution to the SDG welfare success. Author Thore (2021) took six SDG indicators that reflect eocial, economic and environmental issues for 28 EU countries, to test the relation between maximizing SDG wellbeing function for any given level of imputed GDP expenses. Result shown that 19 nations meet Pareto optimality, whereas nine are Pareto nonoptimal; the latter list includes GDP-rich and highly industrialized countries such as Austria, Belgium, Germany, and the United Kingdom, which have SDG deficiencies. For them, rising GDP does not imply increased SDG performance.[288]

The intrinsic pursuit of growth legitimized a series of measures and policies that have been devastating for people, the environment, and the economy itself. What we need is to go far beyond "green washing" programs and solutions mainstreamed by international policies.

Each additional degree of warming exacerbates existing risks and accelerates the escalation of dangers. As climate change continues, extreme weather conditions are likely to become even more intense, contributing to further growth in risks to ecosystems and human health. Between mentioned changes there is a strong causality and correlation with economic growth. Consequently, we agree that aggregate production i.e. supply and aggregate demant must confront persistent hunger, widespread disease, rising inequality, increasing environmental degradation, and catastrophic climate change. To meet these challenges, economic theory must comprehend markets that are out of equilibrium and chaotic.

Insurance is an important sphere of financial sector. It deals by its nature with socialy importnt issues. To better understand the role of insurance in mittigating climate change, identifying opportunities for improving existing and developing new products, it is necessary to answer several research questions.

What needs to be done in sphere of economy with special focus on insurance market - to mitigate and prevent the future risks of climate change? What types of insurance already exist, which adress the risks caused by climate changes? What kind of sectoral approach at insurance market exist in dealing with climate risk mitigation (public, private, civil)? How can insurance industry contribute in solving the systemic pressures, which leads to emerging risks caused by climate change? What kinds of insurance do we need to achieve urgently to mannage the future climate change catastophes? Which sustainable development political and policy goals (such as reducing the green house

[288] Thore & Tarverdyan (2021), op. cit.

emissions, managing climate chnages) could be adequatly adressed through insurance? What types of insurance practise already exist that promotes sustainable practises and innovations in times of climate urgency? What kind of insurance product do we need, to deal with causes of climate change (such as: inequality, poverty and overwxploitation of natural resources)? How can we achieve insurance pools „democratization" that enable broader participation to meet the overall social protection from climate change risks?

Understanding and managing catastrophic risks is one of the key issues of sustainable development and sustainability. Managing these risks becomes even more complex when considering other global challenges, such as pandemics, geopolitical conflicts, migration, economic downturns, and poverty.

To reduce these risks and mitigate their consequences, comprehensive measures need to be taken, including reducing greenhouse gas emissions, promoting sustainable technologies and practices, and improving society's capacity to adapt to changing climate conditions. In this process, the insurance industry can play a very significant role, considering its capacities for providing financial support, expertise in risk management, and incentives for sustainable practices. Viewed from the business side, the financial result is no longer the only measure of success, but attention is increasingly focused on the sustainability principle, while preserving the existing values. In this process, key words are ecology, equilibrium, health, holistic approach.[289] Furthermore, it is essential to develop and enhance risk management mechanisms at local, national, and global levels to effectively respond to the increasing challenges posed by climate change.

Nearly half of the world's population lives in areas highly vulnerable to climate change.[290] In the past twenty years, the number of reported catastrophic events has significantly increased. The frequency of disasters during the period 2010-2019 was notably higher compared to the period 2000-2009, although the earlier period recorded a greater number of larger-scale disasters. While between 1970 and 2000, data on catastrophic events averaged about 90-100 annually, the number of such events between 2001 and 2020 increased to an

[289] Chroneos-Krasavac, B., Radosavljević, K., & Bradić-Martinović, A. (2018). SWOT analysis of the rural tourism as a channel of marketing for agricultural products in Serbia. *Economics of Agriculture, 65*(4), p. 1575.

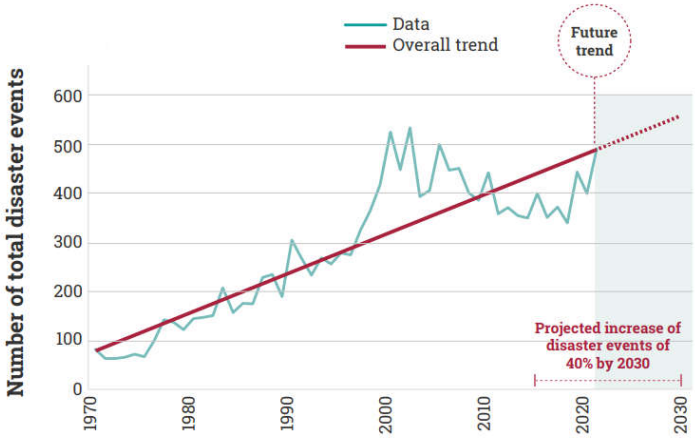
[290] IPCC (2023). *AR6 Synthesis Report: Climate Change 2023* (retrieved May 2, 2023 from https://www.ipcc.ch/report/ar6/syr/)

average of 350-500 per year.[291] This takes into account reports on medium and large-scale disasters, covering various phenomena such as geophysical (earthquakes, tsunamis, volcanoes), climatic and meteorological disasters, as well as biological hazards and epidemics.

In addition to climate change, the increase in the number of disasters is a result of exponential growth adressed in seminal ecological economics books and reports fifty years ago Club of Rome's 1972 report *The Limits to Growth* and *The Entropy Law and the Economic Process* (Georgescu-Roegen, 1971). Both seminal works highlighted that rapid economic growth is a major factor in the emergence of global environmental challenges, which is followed by population growth, the expansion of inhabited areas, unsustainable development (exploitation of natural resources, deforestation, soil erosion, inadequate water management), and other global trends.

If current trends persist, the annual number of disasters at the global level is expected to increase from around 400, as recorded in 2015, to 560 disasters per year by 2030. This represents a 40% increase during the Sendai Framework period (see Figure 1).[292]

Figure 1. Catastrophic events in the period from 1970-2020 and growth projection from 2021-2030



Source: UNDRR analysis based on EM-DAT (CRED, 2021)

[291] United Nations Office for Disaster Risk Reduction (2022). *Global Assessment Report on Disaster Risk Reduction 2022: Our World at Risk: Transforming Governance for a Resilient Future.* Geneva: UNDRR

[292] Ibid.

Natural disasters pose a serious threat to societies around the world, especially in unerdeveloped or developing countries (Global South – GS). Their consequences include significant economic losses, loss of life, and long-term damage to infrastructure. Globally, the economic damage from disasters have averaged about $170 billion per year over past decade, with peaks in 2011 and 2017 when recorded losses exceeded $300 billion.[293] The high losses in 2011 were due to a magnitude 9.0 earthquake that struck Japan, which triggered a massive tsunami and claimed nearly 20,000 lives, as well as floods in Thailand that killed over 700 people.[294] The reason for the high losses in 2017 was an intense cyclone season in East Asia and the North Atlantic.

The earthquake that struck Turkey and Syria in February 2023 showed how devastating individual disasters can be. According to a World Bank report, two powerful earthquakes in Turkey caused a massive damage of $34.2 billion, which corresponds to 4% of the country's GDP in 2021.[295] In Turkey, data from AFAD[296] indicates that over 44,000 people died, while in Syria the death toll reached nearly 6,000.

Although absolute losses from disasters tend to be higher in developed countries, underdeveloped countries suffer the greatest relative losses.[297] According to UNDRR analysis, low- and lower-middle-income countries lose, on average, between 0.8% and 1% of their GDP per year to disasters. In contrast, this percentage is 0.1% and 0.3% in high- and upper-middle-income countries, respectively (see Figure 2).

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[293] United Nations Office for Disaster Risk Reduction (2022), op. cit.

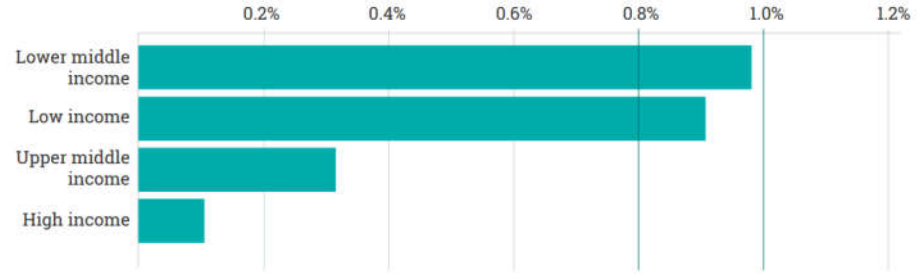
[294] Okazumi, T., Nakasu, T., Sugimoto, M., & Adikari, Y. (2013). *Lessons Learnt From Two Unprecedented Disasters in 2011 – Great East Japan Earthquake and Tsunami in Japan and Chao Phraya River flood in Thailand.* Tsukuba: International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of UNESCO/ Public Works Research Institute (PWRI)

[295] World Bank (2023). Earthquake Damage in Türkiye Estimated to Exceed $34 billion: World Bank Disaster Assessment Report. *Press Release,* February 27, 2023 (retrieved May 2, 2023 from https://www.worldbank.org/en/news/press-release/2023/02/27/earthquake-damage-in-turkiye-estimated-to-exceed-34-billion-world-bank-disaster-assessment-report)

[296] Official website of Republic Of Turkey Ministry Of Interior Disaster And Emergency Management Presidency, https://en.afad.gov.tr

[297] Janković, D., & Tešić, N. (2015). Major Cat Losses in Past Two Decades. *Catastrophic risks and sustainable development,* Kočović, J., Jovanović Gavrilović, B., Đukić, V. (eds.), Belgrade: Faculty of Economics, University of Belgrade

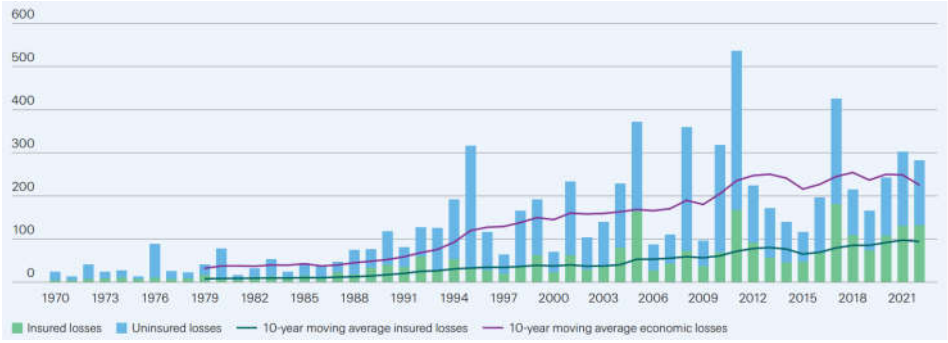
Figure 2. Average economic loss due to disasters as a percentage of GDP, by country income (Sendai Framework, Target C) (2010-2020)



Source: United Nations Office for Disaster Risk Reduction (2021). Sendai Framework Monitor. Geneva: UNDRR, www.sendaimonitor.undrr.org; DesInventar Open Source Initiative, www.desinventar.net/

Figure 3 shows that in 2022, more than half of the losses due to natural disasters were uninsured (of the $275 billion in total losses, only 45% was covered by insurance).[298] Between 1980 and 2018, around 40% of losses were insured. Despite the fact that the proportion of covered losses has increased since the preceding era, insurance is still more prevalent in developed countries. In developing countries, the insured portion of losses is less than 10% or even close to zero[299]

Figure 3. Insured and uninsured losses in billions of USD (at 2022 prices), 1970-2022



Source: Swiss Re (2023), op. cit.

[298] Swiss Re (2023). Natural catastrophes and inflation in 2022: a perfect storm. *Sigma, 1*(2023), Zürich: Swiss Re

[299] Munich Re (2023). Natural disaster risks - Rising trend in losses (retrieved May 2, 2023 from https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards.html)

People afflicted by natural disasters must either endure the financial burden on their own or rely on charity. This protection gap highlights the importance of creating novel techniques in the insurance sector to enhance the accessibility to GS through socialization, participation, and insurance democratization in developing countries.

1. ROLE OF INSURANCE IN ADDRESSING CLIMATE CHANGE

Climate change unequivocally represents one of the greatest challenges humanity faces in the 21st century. As society strives to develop and implement sustainable ways of living and doing business, it is still necessary to ensure protection from climate risks. In this regard, insurance plays a crucial role in providing financial protection and support in the event of damage caused by climate extremes. In recent years, losses due to natural disasters have been increasing. Sectors such as trade, agriculture and tourism are particularly vulnerable to the negative impacts of climate change. Therefore, many developed countries have introduced multi-risk insurance and new insurance models such as crop and yield insurance based on weather derivatives, total crop value insurance or crop income insurance.[300] In this chapter, the role of insurance in addressing climate change is analyzed. The ways in which insurance companies can improve and democratize insurance to provide broader protection from climate risks are explored.

Private (re)insurance should serve as the first line of protection for covering losses due to climate disasters. In practise, insurance actors are mostly from the private sector. The use of financial markets to transfer risk through catastrophe bonds can also support the reinsurance of such risks.[301] Capital market instruments, such as catastrophe bonds, can contribute to insurance schemes by providing rapid liquidity for reconstruction after disasters.[302] However, climate risks are unlikely to be fully covered by the private sector, indicating the need

[300] Radosavljević, K. (2021). Agricultural insurance as a means of financial protection of agribusiness in Serbia. *Contemporary Challenges and Sustainability of the Insurance Industry,* Kočović, J., Jovanović Gavrilović, B., Boričić, B., Koprivica, M. (eds.), Belgrade: Faculty of Economics, University of Belgrade, p. 208.

[301] Cummins, J. D., & Weiss, M. A. (2009). Convergence of insurance and financial markets: hybrid and securitized risk-transfer solutions. *Journal of Risk and Insurance, 76*(3), pp. 493-545.

[302] Cummins, J. D. (2012). Cat Bonds and Other Risk-Linked Securities: Product Design and Evolution of the Market (retrieved May 2, 2023 from https://ssrn.com/abstract= 1997467)

for additional risk-sharing solutions, such as insurance pools and public-private partnerships (PPP).[303] . What we need in the future of insurance are partnerships between public-private and civil sectors to meet the more socially inclusive systemic solutions for insurance pools to deal with natural and cultural goods and resources.[304][305][306]

Also, the ways in which insurance products can contribute to goals such as reducing greenhouse gas emissions, adapting to climate change, addressing inequality, poverty, and over-exploitation of natural resources are considered. In other words, how insurance can contribute to reducing the pressures of modern capitalism, promoting economic justice, and supporting social and environmental initiatives. Based on the given analyses, a better understanding of the importance of insurance as a tool in combating climate change and building a more sustainable society can be gained.

As key actors in the corporate world, insurers advocate for activities that reduce and prevent risks.[307] Catastrophic risk insurance represents an essential instrument for reducing macroeconomic consequences after extreme climate events, as it provides urgent fundings for recovery and promotes risk reduction and adaptation.[308] For years, the insurance sector has been warning of additional dangers associated with climate change, loss of biodiversity, and depletion of

[303] World Bank (2022). *Preparing, Procuring and Implementing Climate-Smart PPPs.* Washington, DC: The World Bank (retrieved May 2, 2023 from https://ppp.worldbank.org/public-private-partnership/climate-smart/climate-smart-clean-technology-ppps/preparing-procuring-and-implementing-climate-smart-ppps#Insurance)

[304] Đukić, V., & Kočović, M. (2016). The role of state insurance of cultural heritage form terrorism risk. *Risk management in the financial services sector,* Kočović, J., Jovanović Gavrilović, B., Trifunović, D. (eds.), Belgrade: Faculty of Economics, University of Belgrade, pp. 565-612.

[305] Kočović, M. (2015). The role of protected areas in managing catastrophic risks and contribution to sustainable development. *Catastrophic risks and sustainable development,* Kočović, J., Jovanović Gavrilović, B., Đukić, V. (eds.), Belgrade: Faculty of Economics, University of Belgrade, pp. 451-470.

[306] Kočović, M., Jovičić, E., & Babić, J. (2018). Izazovi i alternative za postizanje održivog razvoja zaštićenih područja i komonsa u Srbiji oslonjeni na finansijsku analizu i upravljačke opcije. *Teme*, *42*(3), pp. 939-359, doi:10.22190/TEME1803939K

[307] Mills, E. (2005). Insurance in a climate of change. *Science, 309*, pp. 1040-1044.

[308] Linnerooth-Bayer, J., & Mechler, R. (2009). Insurance against Losses from Natural Disasters in Developing Countries*. UN/DESA Working Paper*, No. 85. New York: UN/DESA.

key ecosystems such as forests and water resources.[309] In addition to providing financial support, insurance also acts as a driver of social and ecological sustainability.[310] Disasters with greater insurance coverage can have less harmful consequences for the economy, as insurance helps finance reconstruction and reconstruction, thereby contributing to sustainable development. The total social cost of a disaster depends not only on the intensity of the initial damage but also on the speed at which recovery can be carried out.[311] If insurance funds are available, recovery can be accelerated, otherwise, reconstruction could be lengthy or even incomplete due to lack of resources.[312] Insurance payouts reduce uncertainty, support aggregate demand, and investments in recovery, enabling faster economic recovery and limiting the period of reduced economic productivity.[313]

Insurance can mitigate climate risks in various ways. Insurance companies, for example, can offer products that encourage clients to reduce risks through energy efficiency in buildings or investments in renewable energy sources. Also, insurance companies can collaborate with governments in creating national and regional insurance schemes for covering climate risks.[314] Reinsurance plays a very important role, as it takes on part of the risk from insurance companies in exchange for premiums, thus reducing their exposure to risks and ensuring stability in the event of major damage.[315]

1.1. Improvement and democratization of insurance for comprehensive protection against climate risks

The catastrophic consequences arising from climate change require a comprehensive approach to risk management, considering that individual

[309] Swiss Re (2020). *Biodiversity and Ecosystem Services: A business case for re/insurance.* Zürich: Swiss Re

[310] Kunreuther, H. (2006). Disaster mitigation and insurance: Learning from Katrina. *The Annals of the American Academy of Political and Social Science, 604*(1), pp. 208-227.

[311] Linnerooth-Bayer, J., & Hochrainer-Stigler, S. (2015). Financial instruments for disaster risk management and climate change adaptation. *Climatic Change, 133*(1), pp. 85-100.

[312] Mills (2005), op. cit.

[313] Linnerooth-Bayer & Mechler (2009), op. cit.

[314] Suminski, S., Bouwer, L. M., & Linnerooth-Bayer, J. (2016) How insurance can support climate resilience. *Nature Climate Change, 6*, pp. 333-334.

[315] Swiss Re (2016). Strategic reinsurance and insurance: the increasing trend of customised solutions. *Sigma*, *5*(2016), Zürich: Swiss Re

insurers and the private insurance market cannot always independently provide adequate protection. This involves cooperation between the public and private sectors, the use of different levels and forms of insurance, and the continuous improvement and democratization of insurance pools that provide protection against catastrophic risks.[316] Such an approach enables more efficient protection for all segments of society, promoting social and ecological sustainability. The state plays a significant role through regulations, subsidies, support for the insurance market, and investment in technology and infrastructure development.

Catastrophic risk insurance pools represent key mechanisms for providing broader social protection against climate risks, especially in regions with a high risk of disasters, where the demand for insurance is significant, but individual insurance companies may not be prepared to take on all the risk.[317] The issue of their prevalence, accessibility to the population, improvement, and democratization of these forms of insurance is related to different levels and forms of insurance used for managing risks from harmful events caused by climate change.

Promoting innovative insurance products, such as microinsurance and parametric insurance, with other obligatory systems of participation can improve and democratize catastrophic risk insurance pools.[318] These products enable broad participation of the population, especially poor and vulnerable communities, offering basic protection to those who cannot afford traditional insurance products.[319] Microinsurance is tailored to protect poor and vulnerable communities most affected by climate change, offering lower premiums and smaller coverage but providing basic protection. Parametric insurance, a type of insurance that pays out based on agreed parameters (e.g., precipitation levels or wind strength) instead of actual losses, can also be useful for managing risks from climate change, as payouts can be quickly executed after a harmful event.[320]

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[316] Surminski, S. (2013). Private-sector adaptation to climate risk. *Nature Climate Change*, *3*(11), pp. 943-945.

[317] Kunreuther, H. (2008). Reducing Losses from Catastrophic Risks through Long-Term Insurance and Mitigation. *Social Research, 75*(3), pp. 905-930.

[318] Churchill, C., & Matul, M. (2012). *Protecting the poor: A microinsurance compendium* (Vol. 2). Geneva: International Labour Organization

[319] Hess, U., & Hazell, P. (2016). *Innovations and Emerging Trends in Agricultural Insurance.* Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

[320] Clarke, D. J., & Dercon, S. (2016). *Dull disasters? How planning ahead will make a difference.* Oxford University Press.

Catastrophic risk insurance pools have become more common over the last few decades, particularly in countries hardest hit by climate change and natural disasters. Joint funds are established to enable insurance companies to distribute risks among themselves, allowing coverage for risks that individual insurers could not cover independently.[321] However, their prevalence and availability vary considerably depending on the region and country. In some countries, such pools are already well-established and provide protection for a large number of people, while in others, they are still underdeveloped or even entirely absent.

An example of successful reliance on regional risk insurance pools are the Caribbean and Pacific island countries, which use CCRIF SPC (Caribbean Catastrophe Risk Insurance Facility) and PCRAFI (Pacific Catastrophe Risk Assessment and Financing Initiative) for protection against climate risks. When Hurricanes Irma and Maria hit the Caribbean in September 2017, CCRIF SPC paid out $29.6 million to six countries within 15 days. Dominica received an additional $19 million through a World Bank project for disaster risk reduction.[322] In 2015, Cyclone Pam devastated Vanuatu, leaving a third of the population homeless and causing damage exceeding 60% of the GDP. The government received $2 million from insurance purchased through the PCRAFI program within a week.[323] Regional insurance pools like CCRIF SPC and PCRAFI demonstrate how international cooperation and joint funds can enhance protection against catastrophic risks and support sustainable development in vulnerable countries.

Public-private partnerships (PPPs) are crucial. These models involve establishing a special entity that provides insurance against catastrophic risks.[324] Such partnerships usually arise due to the inability of the private sector to provide adequate protection independently or when additional financial support from the state is required. National-level examples show that the insurance industry already plays a significant role in managing climate change risks. Some of the most successful PPP cases include the Earthquake Commission (EQC) in New Zealand, Flood Re in the United Kingdom, California Earthquake Authority (CEA) in the United States, Japan Earthquake

[321] Cummins, J. D., & Mahul, O. (2009). *Catastrophe risk financing in developing countries: principles for public intervention.* Washington, DC: The World Bank

[322] GFDRR (2017). *What Makes Catastrophe Risk Pool Work.* Washington DC: World Bank, GFDRR (retrieved May 2, 2023 from https://www.gfdrr.org/en/feature-story/what-makes-catastrophe-risk-pools-work)

[323] Ibid.

[324] Kočović, J., Koprivica, M., & Tešić, N. (2018). Savremeni modeli upravljanja rizicima prirodnih katastrofa. *Novi Ekonomist: Journal of Economic Theory and Practice, 12*(1), pp. 14-21.

Reinsurance (JER) in Japan, Caisse Centrale de Réassurance (CCR) in France, and Consorcio de Compensación de Seguros (CCS) in Spain. These examples illustrate how the insurance industry collaborates with governments to develop specialized insurance programs for specific climate change-related risks. Establishing such partnerships enables the sharing of risks between insurance companies and the public sector, resulting in a more stable basis for risk coverage, broader coverage, and financial support in the event of a disaster.

Due to the high exposure to risks of earthquakes, volcanic eruptions, and tsunamis, New Zealand established the Earthquake Commission (EQC), a state organization that provides insurance for homeowners. This model allows access to natural disaster insurance for a broader population and improves the resilience of communities to climate change-related disasters and geological risks.[325]

In 2016, the United Kingdom established Flood Re as a global public-private partnership (PPP) aimed at providing reinsurance to private insurers. Initiated by a consortium of the industry and government, its goal is to address accessibility, universal coverage, and risk reduction from floods.[326] The United States has the California Earthquake Authority (CEA), an organization founded in 1996 as a PPP between insurance companies and the Californian government. CEA provides earthquake insurance for California residents and contributes to the stability of the insurance market in case of natural disasters.[327]
In Japan, the Japan Earthquake Reinsurance (JER) was established in 1996 as a public-private partnership between the Japanese government and insurance companies to provide earthquake insurance for Japanese residents. JER acts as a reinsurer for insurance companies, taking on part of the risk in exchange for premiums. Earthquake insurance in Japan is organized as an optional addition to fire insurance, which covers residential buildings and/or personal property, and cannot be purchased separately.[328]

[325] Earthquake Commission (n.d.). About EQC (retrieved May 3, 2023 from https://www.eqc.govt.nz/about-eqc)

[326] Flood Re (2018). Securing a Future of Affordable Flood Insurance (retrieved May 3, 2023 from www.floodre.co.uk)

[327] California Earthquake Authority (n.d.). About CEA (retrieved May 3, 2023 from https://www.earthquakeauthority.com/About-CEA)

[328] Japan Earthquake Reinsurance Co. Ltd. (n.d.). About JER (retrieved May 3, 2023 from https://www.nihonjishin.co.jp/disclosure.html#archive-tab-content-3)

Examples of countries using national insurance to manage climate risks include France and Spain. In France, Caisse Centrale de Réassurance (CCR)[329] deals with the reinsurance of natural disasters, while in Spain, Consorcio de Compensación de Seguros (CCS)[330] provides mandatory coverage for catastrophes in certain industries. Although these examples do not represent typical public-private partnerships, they contain elements of cooperation between the public and private sectors in insuring risks that are otherwise difficult to cover in the market.

National and regional initiatives, including public-private partnerships and the insurance industry, play a crucial role in managing climate change risks. In the future, it is necessary to improve and expand these programs to increase the protection of populations from climate risks and enhance community resilience to the effects of climate change. Diverse approaches in collaboration between governments and insurance companies contribute to the availability and accessibility of insurance for catastrophic risks, thereby strengthening resilience to climate change, geological disasters, and other natural hazards. Innovative approaches enable the expansion of insurance schemes on a global level, including developing countries that are often the most affected by climate change.[331] Such models encourage the development and improvement of insurance products tailored to specific needs and risks, increasing protection and support for affected communities.[332]

Governments, insurance companies, and other relevant institutions worldwide should adopt various strategies to improve the management of climate change risks. Through a combination of individual policies, insurance pools, reinsurance, public-private partnerships, microinsurance, parametric insurance, and government intervention, the insurance industry can play a crucial role in protecting communities and individuals from the harmful consequences of climate change.

[329] https://www.ccr.fr

[330] https://www.consorseguros.es/web/inicio

[331] Linnerooth-Bayer, J., Surminski, S., Bouwer, L. M., Noy, I., Mechler, R. (2019). Insurance as a Response to Loss and Damage? *Loss and Damage from Climate Change. Climate Risk Management, Policy and Governance,* Mechler, R., Bouwer, L., Schinko, T., Surminski, S., Linnerooth-Bayer, J. (eds.), Springer

[332] Surminski, S., & Oramas-Dorta, D. (2014). Flood insurance schemes and climate adaptation in developing countries. *International Journal of Disaster Risk Reduction, 7,* pp 154-164.

Continuous improvement of insurance mechanisms and collaboration with various stakeholders, including government institutions, insurance companies, reinsurers, and risk-exposed communities, are necessary to achieve the availability and efficiency of climate risk insurance.[333] Additionally, investing in research and development of innovative products and technologies enables a better understanding and assessment of risks, as well as adaptability to climate change. Raising awareness of insurance products and their benefits is also essential to encourage greater participation in insurance programs.

There are several key aspects to improving these insurance mechanisms. Firstly, expanding the availability of these products geographically and among different socio-economic layers.[334] Secondly, improving accessibility for a wide range of users, including microinsurance.[335] Increasing the flexibility of insurance, enhancing collaboration between the public and private sectors, improving regulations and policies, and integrating climate risks into planning all contribute to more efficient protection from climate change and catastrophic risks for all social strata.[336] Implementing this comprehensive approach enables broader availability and democratization of catastrophic risk insurance pools, towards the „insurance socialization" to provide a better protection against climate change and catastrophic risks for all segments of society.

1.2. The role in mitigating climate risks and facing the challenges of contemporary capitalism

Climate change brings numerous challenges for the insurance sector as well. The increased frequency and intensity of natural disasters may lead to higher claims for compensation than initially anticipated, which increases the risks for insurers, their liquidity, and solvency.[337] Additionally, due to climate change

[333] Suminski et al. (2016), op. cit.

[334] Kunreuther (2006), op. cit.

[335] Churchill & Matul (2012), op. cit.

[336] IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. *Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press; Botzen, W. J., & van den Bergh, J. C. (2008). Insurance against climate change and flooding in the Netherlands: Present, future, and comparison with other countries. *Risk Analysis, 28*(2), pp. 413-426; Munich Re (2020). Natural catastrophes and climate risks (retrieved May 4, 2023 from https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters.html)

[337] Surminski et al. (2016), op. cit.

and weather conditions exacerbated by nonlinear effects and feedback loops, accelerating temperature increases, past losses become unreliable as a basis for assessing future losses. Climate change also affects the distribution and correlation of risks between different regions and countries, thereby reducing the possibility of diversifying the insurance portfolio.[338] In light of these challenges, the insurance industry must adapt to the new circumstances and innovate to provide appropriate solutions that protect citizens and businesses from the consequences of climate change. Moreover, insurers should seize opportunities to promote sustainable development.

The insurance industry, managing approximately $44 trillion in assets globally,[339] represents a significant player in investments supporting the transition to a low-carbon economy. Thanks to their expertise in risk management, insurers are well-positioned to contribute to understanding climate change and sustainable development. Through their substantial investments, insurers send the right signals to the investment community and specific companies they invest in, financing projects such as solar farms, wind turbines, or forest restoration. On the other hand, the availability of insurance for high-risk projects instills confidence in investors when it comes to green investments.

Large insurance companies, such as Allianz, AXA, Swiss Re, Zurich Insurance, and Aviva, recognize the importance of environmentally sustainable development and actively invest in initiatives addressing climate change. Their efforts include investments in renewable energy sources, like Allianz's investment portfolio with over 90 wind parks and solar power plants worldwide[340], green bonds[341], decarbonization of investment portfolios[342],

[338] European Central Bank (2023). Policy options to reduce the climate insurance protection gap. *Discussion Paper.* Frankfurt: ECB, EIOPA

[339] International Association of Insurance Supervisors (2022). *2022 Global Insurance Market Report.* Basel: IAIS

[340] Allianz (2022). Sustainability Report 2022 (retrieved May 4, 2023 from https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/sustainability/documents/Allianz_Group_Sustainability_Report_2022-web.pdf)

[341] AXA (2021). AXA announced the successful placement of Euro 1 billion of subordinated green bonds due 2041 (retrieved May 4, 2023 from https://www.axa.com/en/press/press-releases/axa-announced-the-successful-placement-of-Euro-1-billion-of-subordinated-green-bonds-due-2041)

[342] Swiss Re (n.d.). Swiss Re's roadmap to a net-zero investment portfolio (retrieved May 4, 2023 from https://www.swissre.com/sustainability/stories/responsible-investments-swiss-re-net-zero-investment-portfolio.html)

nature conservation[343], and development of climate risk assessment tools such as Aviva's "Climate VaR" tool[344]. All these initiatives together contribute to reducing carbon emissions and promoting sustainable development in the insurance industry.

The role of insurers in the transition to a low-carbon economy is based on leadership in pricing, modeling, and providing protection against natural catastrophe risks[345]. Insurers and reinsurers actively participate in initiatives to establish sustainable financial frameworks, with the aim of mobilizing a greater volume of investments towards more sustainable placements. One example is Swiss Re, which has set a goal to make its investment portfolio fully carbon-neutral by 2050. They have large databases of claims and can finance research focused on addressing climate risks. The previously mentioned Aviva tool "Climate VaR" helps investors better understand the climate risks associated with their investment portfolios, using its extensive database of damages caused by climate change.

Insurers are experts in measuring and managing risks, with an obligation to spread knowledge about new risks. Their expertise in risk modeling and data analysis, which enables the quantification of potential harmful events in the future, sets them apart from other institutions. Accurate measurement and modeling of risks[346] are key to adequate risk assessment, as unmeasured risks represent hazards that cannot be controlled. For example, insurance companies like Swiss Re and Munich Re use sophisticated risk models to assess potential damages from natural disasters such as floods, earthquakes, and storms. These models enable insurers to better understand the risks to be covered, as well as to develop innovative insurance products tailored to the specific needs of clients.

Efficiency in risk measurement helps in better understanding the importance of preventive measures and timely implementation of adaptation and mitigation processes. This is particularly important for areas prone to frequent catastrophic

[343] Zurich (2022). *Insurance Group Biodiversity Report 2022* (retrieved May 4, 2023 from https://www.zurich.com/en/sustainability/planet/nature-and-biodiversity)

[344] Aviva (2022). Aviva Climate-Ready Index - Results, Analysis and Methodology (retrieved May 5, 2023 from https://www.aviva.com/sustainability/climateready)

[345] Golnaraghi, M. (2021). *Climate Change Risk Assessment for the Insurance Industry*. Geneva: The Geneva Association

[346] Tešić, N., & Paunović, M. (2018). Possibilities of Measuring Catastrophic Risks. *Insurance in the Post-crisis Era*. Kočović, J., Jovanović Gavrilović, B., Boričić, B., Radović Marković, M. (eds.), Belgrade: Faculty of Economics, University of Belgrade

events, such as coastal areas of island countries. Preventive measures may include the construction of defensive structures and levees, as well as promoting the growth of mangrove vegetation that protects against destructive winds, hurricanes, tsunamis, and floods.[347]

In the event of disasters, insurers play a crucial role in the process of rebuilding damaged property. In addition to paying insured damages, insurers can, in collaboration with urban planners and regulators, contribute to the reconstruction of buildings in a way that makes them more resilient to future disasters. This approach leads to an additional contribution of insurers to environmentally sustainable development, through innovations in insurance products as a result of climate change.

Engagement of insurers in combating climate change and achieving sustainable development goals brings dual benefits: not only does it provide benefits for the broader society, but it also helps insurers reduce their risk exposure, ensuring long-term profitability and stability. Concrete examples of such engagement include Zurich Insurance, which has launched an initiative called "Zurich Forest" for the protection and restoration of forests worldwide. This project contributes to nature conservation, reducing CO2 emissions, and increasing community resilience to climate change.[348] Another example is AXA, which has set a goal to finance a targeted amount of 26 billion euros in green investments by 2023.[349] These projects not only help reduce greenhouse gas emissions, but also simultaneously help insurers reduce their exposure to climate change-related risks. Generally speaking, insurance can significantly contribute to the ecological aspect of sustainable development, through the implementation of various strategies and initiatives at both global and local levels.

In the context of global climate change and efforts to preserve the planet, the insurance sector can take on a key role in achieving environmentally sustainable development through innovations in its products. Numerous new solutions are emerging, such as "green" insurance, nature conservation insurance, parametric insurance, biodiversity protection insurance, renewable energy insurance, and the like.

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[347] Pennings, S. C., Glazner, R. M., Hughes, Z. J., Kominoski, J. S., & Armitage, A. R. (2021). Effects of mangrove cover on coastal erosion during a hurricane in Texas, USA. Ecology, 102(4):e03309.

[348] Zurich (n.d.). Zurich Forest Project (retrieved May 4, 2023 from https://www.zurich.com/en/about-us/sponsorship/zurich-forest)

[349] AXA (2023). 2023 Allocation & Impact Report (retrieved May 4, 2023 from https://www.axa.com/en/investor/sustainable-financing)

According to the Insurance Information Institute (III), environmentally conscious insurance products are grouped into three categories: green motor vehicle insurance, green home insurance, and green business insurance.[350] Some examples of insurance innovations in the category of more environmentally friendly vehicles are: premium discounts for hybrid vehicles; optional coverage allowing for hybrid vehicle replacement; premium discounts for alternative fuels (biodiesel, electricity, natural gas, hydrogen, or ethanol); "Pay-As-You-Drive" (PAYD) programs, which require the installation of a device for tracking kilometers traveled on the car, and others. PAYD offers policy discounts to drivers who travel fewer kilometers than average, considering that this reduces accidents, congestion, environmental pollution, and also saves consumer money.

Examples related to more sustainable homes and "green" business practices are: premium discounts for LEED[351]-certified homes; additional payments to property owners who recycle debris or replace old appliances with Energy Star machines, which consume much fewer kilowatts and meet an energy-efficient rating; policies that cover the installation of "green" construction systems and materials to replace standard ones after a loss; policies that enable "green-certified" reconstruction in case of a total loss, and others.

In combination with new technologies, some innovations like parametric insurance enable a more preventative approach to disasters. An example of such a product is a tool used in Africa, Africa RiskView, based on the Water Requirements Satisfaction Index (WRSI).[352] This model converts precipitation information, based on satellite imagery, into a spatial drought index, based on which payments are made. ARV allows countries to better understand and manage drought risks while simultaneously offering members the opportunity to develop their strategies and capacities for responding to droughts and other climate risks.

Insurance companies can influence urgent climate change mitigation measures through risk reduction incentives. Encouraging preventative measures can be

[350] Insurance Information Institute (2023). Green Insurance (retrieved May 4, 2023 from https://www.iii.org/article/green-insurance)

[351] LEED is an acronym for the green building rating system - Leadership in Energy and Environmental Design. It is a system developed by the U.S. Green Building Council, representing a recognized environmental standard in the construction world and having high standards for energy efficiency and sustainability.

[352] ARC (2016). Risk Models. Drought (retrieved May 4, 2023 from https://www.arc.int/ drought)

done through various financial programs and initiatives that reduce climate risks and promote sustainability.

Through their insurance decisions, insurers can also highlight the risks society takes on and encourage preventive actions to mitigate them. For example, insurers can set stricter criteria for obtaining insurance policies, such as certain energy efficiency standards, the implementation of sustainable practices in construction projects, or the adoption of measures to reduce the risk of natural disasters. Many global insurance companies have long begun the process of discontinuing insurance for some thermal coal-dependent industries to support emission reductions. Among them are Allianz, Swiss Re, Aviva, Zurich, and others. Allianz, for example, began limiting financing for coal-based business models in 2015, restricted investments in oil sands extraction in 2021, and introduced comprehensive guidelines for oil and gas in 2022, considered leading in the industry.[353]

As part of the International Campaign calling on insurance companies to divest from coal, oil, and gas, in line with the trajectory limiting global warming to 1.5°C, a report has been published since 2018, assessing the largest global fossil fuel insurers.[354] In the latest "Insure Our Future 2022" report, it was rated that Allianz, AXA, and Axis Capital are the best-ranked for their coal exit policies, while Aviva, Hannover Re, and Munich Re are at the top for excluding oil and gas.[355]

In addition to encouraging innovation in climate solutions, the insurance industry can help combat the pressures arising from modern capitalism by promoting sustainable practices and providing insurance protection to the most vulnerable members of society.

Microinsurance products are designed to be affordable and tailored to the needs of the poor and vulnerable communities.[356] They provide protection against risks such as illness, loss of property, or income instability, thus contributing to poverty and inequality reduction. Examples of microinsurance include micro-

[353] Allianz (2023). Phasing Out of Fossil Fuels and Scaling Up Renewable Energy (retrieved May 5, 2023 from https://www.allianz.com/en/sustainability/climate-change/energy-guidelines.html)

[354] Insure Our Future (2023). The Sixth Annual Scorecard (retrieved May 4, 2023 from https://insure-our-future.com/scorecard/)

[355] Insure Our Future (2022). 2022 Scorecard on Insurance, Fossil Fuels and the Climate Emergency (retrieved May 4, 2023 from https://insure-our-future.com/scorecard/)

[356] Churchill & Matul (2012), op. cit.

health, micro-life, and micro-crop insurance. Thanks to microinsurance, marginalized groups and impoverished population categories strengthen financial security, which affects their greater economic stability and broader society. According to some research, between 179 and 377[357] million people from 30 countries had microinsurance coverage in 2020. This represents an increase compared to 2019 when microinsurance covered between 162 and 253 million people from 28 countries.[358]

Crop insurance for farmers and flood insurance for residents in vulnerable areas help reduce losses and support economic recovery after natural disasters, while simultaneously promoting sustainable resource management practices. Products covering the loss or damage of natural resources, such as forests, fish stocks, or biodiversity, can encourage better protection and management of natural resources, reducing over-exploitation and contributing to the preservation of natural resources. This reduces the likelihood that resource degradation could lead to loss of income and livelihoods, especially for those directly dependent on them.

From an economic perspective, insurance helps people avoid poverty and its vicious cycle, primarily through coverage of unexpected event costs, by strengthening their financial resilience. According to World Bank research, in line with available estimates of increased global poverty due to COVID-19, the number of people who could fall into poverty under climate change conditions ranges between 32 and 132 million, depending on the potential scenario of event development.[359] Insurance can also help reduce poverty by supporting the continuity of business operations, preserving jobs, and reducing the need for government benefits. By reducing risk for entrepreneurs and investors, insurance encourages the creation of new jobs and opportunities for individuals living in or on the brink of poverty. In this context, their role as institutional investors comes to the fore again, considering that as investors, insurers support economic development. By protecting public finances and resources for social

[357] The data is presented as a range because it is obtained based on insurance company reports on the number of people covered by each of their products. Since a certain client may possess multiple insurance products, the total number of people is presented as a range. The smaller number is based on the total number of people covered by the largest product line, while the larger number is based on the total number of people covered by all products.

[358] Merry, A. (2021). The Landscape of Microinsurance. Microinsurance Network (retrieved May 4, 2023 from https://microinsurancenetwork.org/)

[359] Jafino, B. A., Walsh, B., Rozenberg, J., & Hallegatte, S. (2020). Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030. *Policy Research Working Paper,* No. 9417. Washington, DC: The World Bank

programs and development initiatives, insurance helps maintain economic stability at the national level.

In summary, it can be concluded that the insurance industry plays a key role in mitigating climate risks and addressing the challenges of modern capitalism. By investing in sustainable projects such as solar parks and wind farms, it supports the transition to a low-carbon economy. Also, insurance socialization as eco-social provisioning system, shall promote product that solve and deals with social and environmental issues – before the insurance that deals with luxury protection. Their expertise enables a better understanding of climate change and the development of innovative products.

Insurers encourage preventive measures and risk reduction, contributing to broader social benefits and reducing their exposure to risks. In modern capitalism, the insurance industry protects the most vulnerable through the promotion of sustainable practices and the provision of protection, such as microinsurance and products for the protection of natural resources.