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https://doi.org/10.33995/wu2023.2.4
data wpływu: 25.10.2022
data akceptacji: 18.07.2023

Green products in the insurance market

The decarbonization of economy and, more specifically, the widespread deployment of systems that produce energy from renewable sources require substantial insurance cover, as such a transition process contains the seeds of new individual and systemic risks. The new regulations in Europe, aimed at creating incentives for transition to green economy, with the changes in consumer preferences, support the demand for insurance products tied to the sector of renewable energy, energy efficiency and sustainable mobility. They are seeking at building up an appropriate institutional environment to push the demand for green insurance products. Faced with this challenge, the purpose of this article is to present green insurance products, review the legislative foundations and summarize the weaknesses that have emerged in the creation and management of such innovative products.

Keywords: green finance, insurance products, sustainability.

1. Introduction

Many innovations have contributed to the improvement of lives of people around the world by raising standards of living and well-being and ensuring an increase in average life expectancy (for instance, worldwide mortality has decreased by about 9 per cent per decade over 1950–2015[1]). It would then be possible to affirm that the condition announced in Article 25.1. of The Universal Declaration of Human Rights (UDHR) is partly met by the evolution of our societies, especially from the second half of the

1. *World Mortality Report 2015-Highlights,* United Nations, Department of Economic and Social Affairs, Population Division, 2017. https://www.un-ilibrary.org/content/books/9789210578561 (07.08.2022).

20th century.[2] However, it is important to note that this evolution has been extremely dependent on the intensive use of non-renewable or partially renewable natural resources, most of which were (and still are) fossil resources (such as natural gas, oil, etc.) or required the large-scale use of resources (water) and had a very high potential to harm the environment and mankind (such as nuclear power). Intensive use of such resources is causing the climate change and depletion of resources and obviously threatens the future of our societies.

Such an evolution has its (high) price that was defined by the United Nations Brundtland Report (1987) as "failures of development" and „failures in the management of our human environment".[3] Natural resources (oil, gas, forests, water, etc.) are being exhausted at the same time as the world population is growing at an exponential rate. In the current economic and social models of evolution, the gap between our needs and the capacity of resources to meet those needs is widening every year, tending to a point of no return in terms of pollution, warming, drought and adverse weather. Since the 1970s, humans have consumed more resources than in all previous history: "The U.S. consumed 57% more materials in 2000 than in 1975; the global increase was even higher".[4] This obviously threatens the improvement of living standards of populations by reducing the quality of life. Natural disasters, which are at least partly due to human activities, damage the material and social environment and prevent large sections of the population from having access to decent housing, food and jobs. The satisfaction of Article 25.1 of the UDHR, quoted above, is becoming more and more difficult to ensure and calls for radical solutions as a matter of urgency (often called "transition process" or "sustainable development goals").

Such concerns lie in five interrelated areas that need to be managed in the 21st century to halt the gap – population, capital, food, non-renewable resources and pollution. The immediate answer is related to responsible use of natural resources, the next steps are linked with social problems (like poverty) and governance (for instance, corruption). The current new stage of economic development gets the logo "net-zero economy"[5] to underline the incentives toward a low carbon emission. To date, the growing threat of a "doomsday" draws attention of the "new (green) generation" consumers toward green products and the necessary society-level economic changes. The green generation seems to be inclined to go green and adopt strategies and choices that are environment-friendly through the consumption of products more sustainable and less polluting.

The approach to achieve sustainable goals has resulted in ideological changes regarding the financial industry. Previous economic models did not consider the concerns related to environment and resource depletion due to economic activities (limited natural resources, CO2 constraints or

2. The Universal Declaration of Human Rights (UDHR), proclaimed by the United Nations General Assembly in Paris on 10 December 1948 (General Assembly resolution 217 A) as a common standard of achievements for all peoples and all nations, sets out, in Article 25 1. that "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control."
3. *Our Common Future*. United Nations, 1987, Report of the World Commission on Environment and Development. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf (01.07.2022).
4. *Sustainable Materials Management: The Road Ahead*, U.S. EPA 2009. https://www.epa.gov/sites/default/files/2015–09/documents/vision2.pdf (01.07.2022).
5. One of the main steps toward net-zero economy is the use of low-carbon electricity, bioenergy hydrogen and hydrogen-based fuels instead or together with fossil fuel.

other factors that underlie sustainability). The transition to sustainability has gradually shifted the focus from short-term profit toward long-term (sustainable) value creation (LTVC).[6]

The new regulations and the public policies implemented in Europe[7], aimed at creating incentives for transition to a green economy along with the changes in consumer preferences, are supporting the demand for insurance products tied to the sector of renewable energy, energy efficiency and sustainable mobility. The decarbonization of the economy and, more specifically, the widespread deployment of systems that produce energy from renewable sources require substantial insurance cover in the face of new risks. Indeed, insurance sector, as a risk manager, plays a crucial role in the transition process since its activities (investments, underwriting, financial and insurance advisory services, etc.) are obviously related to other (real and financial) sectors' activities and may contribute to generating positive or negative outcomes concerning environmental concerns. The latter is a real source of threats and opportunities for the insurance sector and the whole economy since financial activities and environmental issues are highly dependent on each other. Bolton et al. (2020) argue that climate change may be a source of financial instability and leads to "green swan" events (systemic crisis phenomena) as environmental deterioration has catastrophic effects on all human activities in an irreversible, non-linear and uncontrollable way.[8] Such dynamics increases individual and systemic risks and calls for a new role that the insurance sector could (should) play in the transformation of market dynamics toward a greener society. Along this line, a number of insurance companies are involved in the transition process through the reduction of the carbon footprints of their activities, the improvement of their underwriting capabilities, and the increase of climate disclosure.[9]

Concerning such an evolution, the purpose of this article is to present green insurance products, review the legislative foundations and summarize the weaknesses that have emerged in the creation and management of such innovative products. This is preliminary research that shows the scope of the linkages between the insurance sector and sustainable (green) transition processes.

2. Theoretical background of green financial products

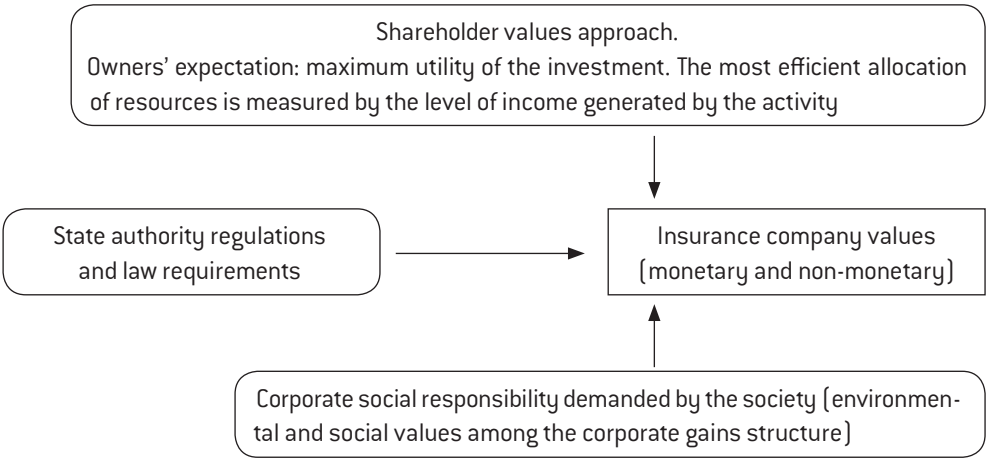
The terms „green finance" and "green insurance" have not yet received a clear theoretical background that could be used for the complex explanation of this new phenomenon of transition. The appearance of green finance as an emerging assets class has also been established due to an unprecedented and continuing increasing engagement of the financial industry along with the political

6. Schoenmaker D., Schramade W., *Principles of sustainable finance*, Oxford University Press, Oxford 2019.
7. See, for instance, the European Green Deal and the related regulatory taxonomy in progress (https://ec.europa.eu/info/strategy/priorities-2019–2024/european-green-deal_en)
8. Bolton P., Despres M., Pereira Da Silva L.A., Samama F., and Svartzman R., *The green swan. Central banking and financial stability in the age of climate change*. Bank for International Settlements, January 2020. https://www.bis.org/publ/othp31.pdf (08.06.2022)
9. Surminski S., *Climate Change and the Insurance Industry: Managing Risk in a Risky Time*, „Journal of International Affairs", 09.06.2020. https://gjia.georgetown.edu/2020/06/09/climate-change-and-the-insurance-industry-managing-risk-in-a-risky-time/ (15.07.2022)

and societal debate surrounding the need for an environmental transition.[10] During the previous decades, environmental problems were placed in the risk management areas (like deseases and natural catastrophes) that motivated the study of their consequences, randomness and localization to answer the question "How do we influence environmental changes?". In the financial sector, it was the domain of the insurance branch. The deeper interfusion of the environmental ("green") aspect into financial activity stimulated the evolution of the research questions shifting the focus from the financing of consequences to financing the environment mitigations/adaptation process. Current issues found the reflection in the form of double materiality where companies started to wonder what would be the influence of climate mitigation/adaptation activities on their business performance? The debate on the sustainable and financial development clarified two separate parties with different interests: public (that is interested in the sustainable evolution) and corporate (that is concerned about the influence of mitigation/adaptation actions on the business performance of companies). In some areas, interests converge as they may gather the expectations of shareholders and society (stakeholders).

To explain the new phenomenon of green financial products, academics employ theories from different areas, in particular corporate management, business ethics, finance, ecology, etc. Approaches on sustainable finance are mostly based on the concepts of business ethics (theory of corporate social responsibility and stakeholder theory). As a result, there is no single theory that could explain "green" insurance. In our opinion, multithreading of the process of interfuse between environmental and insurance areas requires consideration of different theories: the theory of corporate social responsibility, neoclassical ownership theory of the firm (shareholder theory developed by Freedman, the concept of insurance premium (adequate to the risk) and public regulation theory that imposes limitations or requirements.

Fig.1. Factors that influence the insurer's values



Source: Compiled by the Authors

10. Berrou R., Dessertine P., Migliorelli M., *An Overview of Green Finance*, in: *The Rise of Green Finance in Europe*, eds. M. Migliorelli, P. Dessertine, Palgrave Studies in Impact Finance 2019, p. 4.

In Figure 1 we present the inputs of each approach to the development of the concept of sustainable finance. State authority regulations and law requirements put limitations and shape the values of insurance companies through directives, guidelines, suggestions, etc. With regards to sustainable products, it calls the fiduciary duty of the insurers. The traditional stakeholder theory reflects a fundamental goal of the private company, that is maximum profits. However, it does not respond to the evolution of social expectations. In his critical approach to the neoclassical economics, M. Clark (1916) stated that society was functioning according to "the economics of irresponsibility". He then remarked that narrowing the understanding of responsibility to the man-to-man level only would be "an anachronism".[11] The common law was built on the idea of private responsibility (in the case of the industrial accidents, the problem was settled after the guilty person was identified) or zero responsibility (the insurance company or state pays the compensation for injured persons). Clark stressed the necessity of transformation from the economics of irresponsibility to the economics of responsibility and called the laissez-faire economics as irresponsible.

In the business area, the new specific term "corporate social responsibility" is used to show that responsibility to the environment and people is among companies' main values.

The corporate social responsibility paradigm has become one of the most influential in the field of sustainability management research. In the face of climate changes, there is a society-wide discussion today about the need to change the corporate business models, shifting it from the only-high-profit-seeking to a sustainable-balanced-existence. By investing money in the business, shareholders expect to get high dividends (maximum utility of the investment). Modern economic policies are more oriented toward sustainability issues and have redirected the debate toward guiding economic activities according to their compliance with sustainability goals. Obviously, the management of companies is under pressure from investors and society as they must create profits and meet the expectations of investors. Simultaneously, they must consider the new rules and constraints related to sustainability issues. However, since businesses are also considered accountable for variuos economic and civil responsibilities as part of their daily operations, the field of business ethics has expanded correspondingly.[12] This "new" ideology rests on the philosophical theory of the social responsibility of business.

During the last decades, the supporters of business responsibility have focused their attention on the financial sector. The main reason for this shift was the process of global financialization and the increasing role of financial corporations compared to other sectors. Although these corporations seek to achieve maximum profits for their shareholders, currently they are "invited" to shift their business models toward sustainability.

The increasing role of private financial institutions in the process of transferring financial resources to productive activities puts high pressure on their business models. As a result, financial institutions can also influence the financial opportunities of sustainable transformation. Banks and insurers create policies and financial products that can be favorable (or unfavorable) for environment-friendly transition in other sectors (for example, credit to buy renewable equipment) or unfavourable for unsustainable activities (for instance, of insurance cover for coal mining companies,

11. Clark M., *„The Changing Basis of Economic Responsibility"*, *Journal of Political Economy*, 1916 vol. 24 No. 3, pp. 209–229.

12. Sharma G., Verma M., Shahbaz M., Gupta M., Chopra R., *Transitioning green finance from theory to practice for renewable Energy development*, „Renewable Energy", 2022 vol 195, pp. 554 – 565.

discouraging polluting activities, etc.). Therefore, the finance theory and practice were complemented by the new concept of green finance.[13] Green finance is characterized by mitigation and adaptation goals. It is specifically applied to climate change related activities: mitigation financial flows refer to investments in projects and programs that contribute to reducing or avoiding greenhouse gas emissions (GHGs), whereas adaptation financial flows refer to investments that are directed toward reducing the vulnerability of goods and persons to the effects of climate change.[14]

Facing a new challenge on the financial sector, institutions have started to create and offer innovative financial products that rely on sustainable components. According to the Von Neumann and Morgernstern (1947) utility theorem, consumers usually buy products and services by maximizing the expected value of their utility function.[15] In the past decades, morality and ethics (moral satisfaction) have integrated into the model of utility.[16] In the new model, the responsible investors face two types of benefits and costs: financial and moral (ethical) ones. Currently, this leads to the question if *ceteris paribus*, all consumers choose products that are perceived to be better for the environment when they recognize the same product characteristics. It is worth reminding the results of the research on the demand factors of the green financial products that was made in 2020 in Hungary: "In the demand for financial products, people find green considerations important, but these are not the most important considerations for them. In the population's financial decisions, economic aspects (risk, yield, transparency of the product) are much more important than ecological aspect."[17]

3. Legal background of green financial products

The development of a sustainable financing policy has its origins in the general movement in favour of sustainable development within the European Union. In 1992 *United Nations Conference on Environment and Development* in Rio de Janeiro elaborated a strategic document called "Agenda 21". Agenda 21 clearly mentioned that changes into the sustainability would create additional costs, especially for the developing economies.[18] It also underlined **the role of financial institutions** in the air pollution management and their possibility of emission control for mobile and stationary sources. It considered the need of promotion and improvement of the rural financial networks that use investment capital resources raised locally.

13. In academic papers different „hybrid" terms that connect finance and sustainability: „sustainable finance", „environmental finance", „carbon finance", climate finance",
14. Höhne N., Khosla S., Fekete H., Gilbert A. *Mapping of Green Finance Delivered by IDFC Members in 2011*. Frankfurt: IDFC 2012. http://www.idfc.org/Downloads/Publications/01_green_finance_mappings/ IDFC_Green_Finance_Mapping_Report_2012_06–14–12.pdf (17.08.2022)
15. Neumann J., Morgenstern O., *Theory of Games and Economic Behavior*. Princeton, NJ: Princeton University Press 1947.
16. Levitt S. D., List A.J., *What do Laboratory Experiments Measuring Social Preferences Reveal About the Real World?*", „Journal of Economic Perspectives", 2007 No. 21 (2), pp. 153–174.
17. Bethlendi A., Póra A., *Household Green Finances: Demand in Focus*, „Pubic Finance Quarterly", 2021 No. 3, p. 334.
18. *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations (1987). United Nations Conference on Environment & Development, Rio de Janerio, Brazil, 3 to 14 June 1992. https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf (07.08.2022)

In 2015, the 21st Session of the Conference of the Parties (COP21/CMP1) declared the Paris Agreement, a universal agreement whose aim was to reduce global carbon dioxide (CO2) emissions in net terms by 45% (compared to 2010 levels) by 2030, and to reach net zero globally by around 2050, to achieve a 1.5 degree temperature goal with no or limited overshoot. Deep reductions in non-CO2 emissions (such as methane) would also be required. Even remaining below 2 degrees seems to be a challenge; global CO2 emissions are expected to reach net zero around 2075 in most of the scenarios envisaged by the IPCC, and reductions in emissions other then CO2 are of a similar scale to those in the scenarios for achieving the 1.5 degree objective. Paris Agreement: *"Invites* the non-Party stakeholders referred to in paragraph 134 [*auth. – Ecivil society, the private sector,* ***financial institutions****, cities and other subnational authorities*] above to scale up their efforts and support actions to reduce emissions and/or to build resilience and decrease vulnerability to the adverse effects of climate change".[19] After 2016, the EU legislation officially started to use the specific term: **"sustainable finance (investment)"** to show the linkages between finance and sustainability. The European Commission then defines sustainable finance as "…the process of taking **environmental, social and governance (ESG) considerations** into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects". [20] As we may see, the focus was put on the investment activities without specifying any type of financial service.

In the EU's policy context, sustainable finance is intended to support economic growth while reducing pressures on the environment and considering social and governance aspects. Sustainable finance also encompasses transparency regarding **risks related to ESG factors** that may impact the financial system, and the mitigation of such risks through the appropriate governance of financial and corporate actors. For the period 2019–2024, the European Commission announced 6 priorities for the global development in line with the previous strategies. Among other things, these priorities include the European Green Deal (growth strategy aiming to make Europe the first climate-neutral continent by 2050). This initiative covers different areas. Within the links of the financial area with sustainable transformation, the main idea deals with channeling private investment into the transition to a climate-neutral, climate-resilient, resource-efficient, and fair economy as a complement to public investment in favor of transition.

In 2017, the Task Force on Climate-related Financial Disclosures (*"TCFD"*) offered recommendations for a consistent approach to disclosure of material climate-related risks to be used by companies when providing information to lenders, insurers, investors and other stakeholders to enable them to consider and decide whether the financial product meets the „green" criteria.[21]

In 2018, a high-level expert group on sustainable finance set up recommendations to identify ways to "re-connect" the financial sector with the real economy and support the transition to green financial products. It is worth mentioning that the main elements of the recommendations directly influence the quality and structure of innovative financial products through [22]:

19. *Adoption of the Paris Agreement*. United Nations 2015. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (01.08.2022)
20. https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en (01.08.2022)
21. *Recommendations of the Task Force on Climate-related Financial Disclosures,* Task Force on Climate-related Financial Disclosures 2017. https://www.fsb-tcfd.org/ (15.07.2022)
22. *Sustainable Finance: High-Level Expert Group delivers roadmap for greener and cleaner economy*. https://ec.europa.eu/commission/presscorner/detail/en/IP_18_542 (15.07.2022)

- a "taxonomy" of the assets that gives the market a clear idea of what is "sustainable",
- clarification of the obligations of investors for achieving a more sustainable financial system,
- better disclosure by financial institutions and companies of the way in which sustainability is taken into account in their decision-making process,
- an EU-wide label for green investment funds,
- a European standard for green bonds.

In 2022, the first delegated act on sustainable activities for climate change mitigation and adaptation of the objectives of the EU Taxonomy ("Climate Delegated Act") was approved. It includes a set of technical screening criteria to define which activities can contribute substantially to two of the environmental objectives under the Taxonomy Regulation: climate change adaptation and climate change mitigation. This Delegated Act covers the economic activities of roughly 40% of listed companies, in sectors responsible for almost 80% of direct greenhouse gas emissions in Europe. It includes sectors such as energy, forestry, manufacturing, transport, and buildings.[23]

4. Types of green insurance products and their limitations

Consistently with actuarial risk principles (measure the risk, manage the risk, consider the context, and describe the system), insurers can contribute to climate adaptation and mitigation as investors and risk managers in different ways by applying their data about carbon-risk, risk assessment capacity to incentivize policyholders to mitigate insured risks via risk-based pricing and contractual terms, and by allocating capital into assets with green features. As risk managers, insurers can influence and correct policyholders risk behavior through an underwriting strategy. The TCFD (2017) maintains that investors, companies and financial intermediaries should consider their longer-term strategies and the most efficient allocation of capital in order to adequately factor in climate-related risks that require sufficient information. This means that long-term investors need adequate information on how (financial and real sector) companies are preparing for a lower-carbon economy.

To accelerate the insurance industry's response to the challenges of climate risk mitigation and the transition to net zero, the University of Cambridge Institute for Sustainable Leadership, in cooperation with Deloitte, proposes nine key priority areas in innovative insurance policy to support climate mitigation [24]:

1. Enabling and incentivizing low carbon choices.
2. Mainstreaming the encouragement of climate mitigation through efficient and resilient reinstatement.
3. Implementing environmentally sustainable claims servicing.
4. Enabling capital flow toward green solutions through risk transfer solutions.
5. Creating removal-based carbon offsets through natural capital protection.

23. *EU taxonomy: Complementary Climate Delegated Act to accelerate decarbonisation,* Directorate-General for Financial Stability, Financial Services and Capital Markets Union. https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en (12.08.2022)
24. *Climate product innovation within the insurance sector,* The Cambridge Institute for Sustainability Leadership. https://www.cisl.cam.ac.uk/files/climatewise_climate_product_innovation.pdf (17.06.2022)

6. Scaling emerging and existing low carbon and net-negative technologies and start-ups.
7. Supporting the sustainable decommissioning of carbon-intensive assets.
8. Developing risk advisory services to support clients' climate mitigation understanding and approaches.
9. Developing solutions for reducing climate liability and environmental litigation.

The concept of net zero underwriting builds on the established need for "climate-ready" insurance products, defined by Icebreaker One's Standard for Environment, Risk and Insurance (SERI) program, as products that: "incentivize certain behaviors in the business models of the companies and individual buying insurance. This includes the incorporation of net zero objectives and outcomes into their business model and operations and demonstrating greater resilience and adaptation in response to climate and environmental risks."[25]

Climate change affects insurance in two key ways: first, through insurance policies covering losses like property damage after hurricanes; second, through changes in the sectors and business models it underwrites. Furthermore, insurers are affected as large-scale institutional investors. They have significant shares in various economies, companies, infrastructure and real estate that are, or will be, affected by various risks that can directly influence the ability of assets to generate long-term value. As regards the insurance product portfolio, companies modify the existing products or create new products with green components to meet the long-term expectations of society and handle radical changes in progress (Table 1):

Table 1. Classification of the green insurance products

Criteria	Description
Path of the sustainable innovation	• environmentally sustainable behavior of insured person during the period of insurance coverage (insurance premium follows the carbon risk, deductibles), • environmentally sustainable preventive requirements before signing the insurance contracts, • environmentally sustainable claims management after loss realization, • environmentally sustainable investments of the own assets of insurance company, • environmentally sustainable investments with regard to life insurance policy (correlated with the behavioral character).
Innovativeness of the insurance product	• new sustainable insurance solutions: sustainable insurance solutions are products and services that directly address environmental risks and opportunities within the transition process, • insurance solutions with a sustainability component: standard insurance products with additional environmental benefits.
Character of the materiality influence	• mitigation (insurance companies create products that are directed to the prevention of the causes of climate changes. For example, insurance policy that enhances less energy consumption). Mitigation effect of the insurance product is easier to measure, mostly it has fast return and individual character (like decrease of energy consumption of the insured building), • adaptation (insurance companies include conditions or exclusions in their insurance policy to reflect the climate change effects. For example, weather index insurance in the agricultural sector[26]), • transition to a circular economy (conditions in the insurance policy that enhance the use of recyclable materials to repair the damaged items).

Source: Compiled by the Authors

25. *Incentivising climate-ready behaviours in the insurance industry*. Icebreaker One 2020, October 15. https://icebreakerone.org/2020/10/15/incentivising-climate-ready-behaviours-in-the-insurance-industry/ (10.08.2022)
26. Timilsina G., *Financing Climate Change Adaptation: International Initiatives*, „Sustainability", 2021 vol. 13, p. 17.

One mechanism to stimulate policyholders to adopt sustainable behavior is the use of risk-based premiums and deductibles, assuming that the premiums should reflect the actual risk a policyholder is exposed to. If the risk rises, the price or deductible must also increase adequately. The price of insurance, the contractual terms and the conditions under which insurance is offered, are generally strong signals about the risk. Access to Big Data about the carbon emission allows insurers for greater customization of product design, more accuracy in pricing that leads to greater transparency for the policyholders. The volume of data and the potential for this to explode with the advent of 5G mobile-network technology, the development of AI, and the deployment of sensors will allow for real-time risk assessment. This leads to more innovative financial products, in particular based on parametric solutions. The latter, in turn, offer the potential for climate-ready financial products with insurance offering incentivization to mitigate and be resilient to climate change.

To be classified as a green (sustainable) financial solution, a product or service must fulfil at least three criteria in the definition of the sustainable solutions:

1. Support the development of a technology or market focusing on the environment (e.g. renewable energy, environmental goods and services, green infrastructure). Reduce the client's exposure to financial (risk reduction) and/or regulatory risks (e.g. CO2 regulations, environmental pollution liability).
2. Conservation or mitigation of at least one of the following: natural resources, biodiversity, environment or climate change (e.g. encouraging or rewarding environmentally responsible behaviour that improves energy efficiency or avoids pollution).
3. Protection against environmental risks and adaptation to climate change impacts by managing clients' risks (e.g. weather risks) and/or increasing risk awareness and/or providing incentives for reducing risk exposure.

Insurers can raise awareness and accelerate demand for low-carbon products, through their policy options and pricing. These techniques have been widely developed in the personal insurance sector but few have been explored in the commercial field. Examples of the industry climate mitigation in the reinstatement process to date are largely centred around home insurance policies and commercial property insurance. It is worth mentioning that there is no official ready-to-use list or catalogue of green insurance products. Partly, Deloitte collected and categorised such green products from the data of insurers (Table 2.)

Table 2. Types of green insurance products for private and corporate clients

Line	Product	Description
Private	**Green Property Rebuilding**	Eco upgrade after a covered loss, this type of coverage pays for the following: – replacing damaged property and applying modernization measures to buildings; – environmentally-friendly or more energy-efficient building materials for repairs; – more energy-efficient equipment or appliances.
	Warranty insurance/ Property Renewable Energy Reimbursement	A homeowner who uses an alternative-energy system (photovoltaic) in the case of a power outage. It may provide indemnification for: 1) loss of income generated from selling surplus energy to the local energy company, 2) extra costs to purchase replacement electricity, 3) utility or governmental fees for inspections, re-connections or permits when the homeowner's alternative energy system is brought back online.
	Renewable energy insurance	Customized coverage to build renewable energy facilities, such as photovoltaic, solar thermal, biomass and geothermal installations.

Private	**Property Loss Mitigation Device Discount**	Premium credits are offered to homeowners who install mitigation devices meeting IBHS fortified standards or choose storm-resistant construction techniques in catastrophe-prone areas. An example is window shutters to protect homes during severe storms.
	Pay As You Drive/ Low Mileage Discount	Automobile insurance products inherently give incentives to drive less which leads to less pollution that may be contributing to fight global warming. These programs provide a customer with personalized automobile insurance rates (and hence savings) based on how well and how much they drive. Companies offer a special motor insurance tariff for customers that hold an annual public transportation pass.
	Fuel Efficient /Low Emission Vehicle Discount	Premium discounts for "green" or low emission vehicles (electric, hybrid, gas-powered vehicles) which emit less greenhouse gases than standard vehicles.
Corporative	**Upgrade to Green Commercial Fleets**	An option to upgrade the company's fleet to hybrid vehicles for new vehicle replacement as part of an endorsement to the policy.
	Insurance for Renewable Energy Projects	Coverage for companies in the renewable industry (for example solar, wind, hydraulic) to help them in managing risk, defending against lawsuits and protecting assets.
	Insurance for Renewable Energy Property, Equipment and Loss of Use	Replacement cost coverage for equipment with more efficient equivalents. Equipment currently in operation, under construction or newly purchased can be added to the policy.
	Insurance for Green Building	Help customers to build sustainably by evaluating designs and specifications for new structures and suggesting ways to ensure high-quality construction and exceptional loss prevention. Buildings with green certificates, e.g. energy efficient, solar or earth-sheltered, can contribute to risk mitigation by reducing greenhouse gases emission.
	Energy Savings Insurance	Provide a backstop for energy savings guarantees given by energy service companies. An insurer pays any shortfall in energy savings below a pre-agreed baseline over the term of the policy, typically in the 5–10 year range.
	Insurance for Carbon Capture & Storage/ Emission Reduction Projects	Cover for organizations involved in the capture and storage of large volumes of carbon dioxide and other greenhouse gases.
	Green Building Coverage Against Adverse Publicity	Coverage provides protection when a green building experiences adverse publicity. It gains to assist in restoring a company's reputation.
	Political Risk Insurance for Carbon-Trading	Project sponsors, investors, and lenders are given financial protection from risks arising from governmental interference, embargo, license cancellation, war and political violence which could interrupt the production, certification and delivery of carbon credits.
	Pollution liability insurance	Covers loss associated with an existing or new pollution event. Green remediation includes the increase in costs for following standards, products, methods and processes for improving the environment, increasing energy efficiency and enhancing safety and property protection; costs attributable to apply green techniques, which operate to minimize waste generation, reduce energy consumption, or conserve natural resources in the execution of a cleanup.

Source: compilation of the Author based on Zona R., Roll K., Law Z., *Sustainable/ Green Insurance Products*, Casualty Actuarial Society *E-Forum*, Winter 2014. https://www.casact.org/sites/default/files/database/forum_14wforum_zona_roll_law.pdf (17.06.2022)

The development of insurance products with climate-change mitigation or with adaptation of sustainable characteristics is framed by limitations. The core of the insurance business is the continuousness of claims data and clear information about the objects that are taken under insurance

cover. The transition toward sustainable (green, net carbon) existence has not been well studied since it is usually based on engineering innovations and implementations of new solutions with uncertain results. This makes green insurance products very risky for an insurance company, that is why there is no a wide range of products in the market. Furthermore, there is a lack of data about the efficiency of such insurance products, making any objective assessment difficult, if not impossible. For the sake of simplicity, we summarize the major limitations in the area of green insurance products as follows:

1. Changes that might be considered "sustainable" or "green" – such as substituting high-carbon construction materials (e.g. steel, cement) with nature-based but more combustible alternatives (e.g. wood), or buildings designed with features such as grass roofs with solar panels – can increase fire load and increase the likelihood of combustion triggers, thus increasing insurance pricing and/or requiring changes in insurance policy terms and conditions.
2. Data: the problem with the risk estimation for the low-carbon innovations (carbon capture storage) is the lack of loss histories. Enough loss histories give the insurer information for the risk modelling that is the basis for insurance premium calculation. Current insurance data have focused on climate resilience rather than climate change mitigation. To enable net zero insurance, there is a data gap for the industry to understand how to bring emissions into consideration in their underwriting process.

   To better adapt the insurance products or service to the customer's need or behaviour, a significant amount of data is needed, like geolocation data, speeding data, miles driven, harsh braking, time of day, road type, etc. Data are fragmented, scattered, unsearchable and incomplete, many of them must go through bilateral contracts to access and some are simply inaccessible. Sustainable data is even more difficult to find and figure out how to use them. There are as well some concerns about the right to privacy and personal data protection while insurers collect information to define the coverage and the corresponding price for policyholders.
3. Additional costs: trying to mitigate and/or adapt to climate change could increase the costs by individualizing the client relationship (i.e. designing personalized and tailored insurance products and service offers based on consumers' behaviour linked to climate-related risks).
4. Greenwashing: using environmental protection as a marketing tool, the lack of common standards (labels, taxonomy) could induce greenwashing. Legislation is developing very dynamically, and companies need to organize special divisions to manage the transition processes within companies in order to comply with legislation.
5. Financial exclusion: some options might also imply higher costs for the policyholder. This might be a challenge for lower-income and vulnerable customers.
6. Shortage of sufficient knowledge and skills within the underwriting and actuarial areas. Especially, it is the problem in the fields of emerging low carbon technology, engineering or biochemistry for technical underwriting.
7. Natural disasters are highly unpredictable. This weakens the capacity of insurance companies to assess and quantify the likelihood of possible losses with sufficient accuracy. The insurers may then be reluctant to insure such risks without a very high premium that might prevent potential customers from buying such contracts.

Conclusion

The European insurance market is under the pressure of a global sustainable transformation trend. One of the main areas of the challenge to the sustainable goals is the "decarbonisation" of the insurance service. This goal must be achieved through the modernisation of the conditions of the current insurance offers or creation of new products. In the response to the sustainable shifts, a new term: "green insurance product", emerged. It reflects insurance policies (underwriting, premium calculation or claim handling process) directed to climate mitigation, adaptation or transition to a circular economy.

The purpose of the article was met: the "green" insurane products with the focus on the legislative foundations and weaknesses that have emerged in the creation and management of such innovative products were presented. Companies offer "green" insurance to both private and corporate clients. However, the focus is on two directions: property insurance and liability insurance. Within property insurance, the products have climate mitigation and adaptation features like an insurance for renewable equipment, rebuilding from green construction materials, low emission vehicle discounts, etc.

As this study sought to show, there are several paths that are used to make insurance products green: environmentally sustainable behaviour of an insured person during the period of insurance coverage (insurance premium follows the carbon risk, deductibles), environmentally sustainable preventive requirements before signing the insurance contracts, environmentally sustainable claims management after the loss realization, environmentally sustainable investments of the own assets of the insurance company, environmentally sustainable investments with regard to life insurance policy (correlated with the behavioral character).

It is worth mentioning that the transition process brings opportunities and challenges for insurance companies. Insurers must deal with the lack of loss data about renewable equipment and innovative low-carbon mechanisms that make risk prediction very complicated and unclear. For some "green" insurance products, insurers must store a huge amount of data that deal with cyber risk and the high risk of privacy breaches. The next problem is the rising cost of the individual insurance coverage that would be tailored for the clients concerning the level of their climate "perception". But this may also exclude some policyholders. Another major issue is the lack of qualified intersectional underwriters capable of assessing the specific risks associated with bioengineering, new modes of energy production, recycling, chemistry, etc. All these areas are opportunities because they offer new niches for the insurance cover, but simultaneously they contain high risks and are then a real challenge for the insurance industry with regard to their expected financial performance and sustainability.

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„Zielone" produkty na rynku ubezpieczeń

Dekarbonizacja gospodarki, a za tym idące upowszechnienie na szeroką skalę systemów produkujących energię ze źródeł odnawialnych, wymaga dopasowanej ochrony ubezpieczeniowej. Nowe regulacje w Europie mające na celu stworzenie zachęt do przejścia na zieloną gospodarkę, wraz ze zmianami preferencji konsumentów, wspierają popyt na produkty ubezpieczeniowe związane z sektorem energii odnawialnej, efektywności energetycznej i zrównoważonej mobilności. Na rynku ubezpieczeń pojawia się propozycja tak zwanych „zielonych" produktów ubezpieczeniowych, które zawierają elementy ukierunkowane na zapobieganie lub adaptacje do zmian klimatu. W związku z tym wyzwaniem, niniejszy artykuł ma na celu przedstawienie „zielonych" produktów ubezpieczeniowych wraz z omówieniem podstaw legislacyjnych oraz podsumowaniem wad, które pojawiły się w kontekście tworzenia i zarządzania tego typu innowacyjnymi produktami.Słowa kluczowe: zielone finanse, produkty ubezpieczeniowe, zrównoważony rozwój.

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