ISSN: 2538-2152; ECOPERSIA 2023;11(1):65-81.

Role of the Insurance Industry in the Perception of Climate Change Impacts and the Development of Insurance Products in Iran

ARTICLEINFO

Article Type
Original Research

Author
Asma Hamzeh, , *Ph.D.*[1]
Mohammad Reza Farzaneh, *Ph.D.*[2]
Faezeh Banimostafaarab, *M.Sc.*[3]
Mohammad Javad Khordadi, *Ph.D.*[4]

How to cite this article
Hamzeh A., Farzaneh MR., Banimostafaarab F., Khordadi MJ. Role of the Insurance Industry in the Perception of Climate Change Impacts and the Development of Insurance Products in Iran. ECOPERSIA 2023;11(1): 65-81
DOR:
20.1001.1.23222700.2023.11.1.6.6

[1] Assistant Professor, Insurance Research Center, Tehran, Iran
[2] Research Group of Environmental Engineering and Pollution Monitoring, Research Center for Environment and Sustainable Development, RCESD, Department of Environment, Tehran, Islamic Republic of Iran
[3] M.Sc. in Financial Mathematics, Allameh Tabataba'i University, Tehran, Iran
[4] Ph.D. in Water Engineering, Ferdowsi University of Mashhad, Mashhad, Iran

**** Correspondence***
Address: Insurance Research Center, 43, West Sarv Ave., Kaj Sq., Saadat Abad, Tehran, Iran
Post Code: 1998758513
Phone: +98-21-22084084- ext. 129
Fax: +98-21-22081088
E-mail: hamze2006@yahoo.com

Article History
Received: December 18, 2022
Accepted: January 22, 2023
Published: February 15, 2023

ABSTRACT

Aims: Iran is one of the regions affected by climate change and its consequences. Knowledge of impacts and damages of natural and climatic disasters, besides the development of related insurance products, are among the factors that play a significant role in a better understanding of climatic threats and climate change adaptation and mitigation. Therefore, this research was carried out in order to examine the status of Iran's insurance industry in understanding the effects of climate change and developing related insurance products.

Materials & Methods: The research method for this paper is applied research that consists of documentary studies and mixed exploratory studies in terms of the research strategy. In order to examine the international experiences of the world insurance industry in the field of climate change, library studies were used, and to examine the current situation of the Iranian insurance industry in understanding the phenomenon of climate change and insurance products, a questionnaire was used.

Findings: Evidence of climate change and insurance products used in selected developed and developing countries were first studied, and then the questionnaire results were analyzed. Findings show the deep and extensive attention of the insurance industry to the phenomenon of climate change, the need for requirements such as providing detailed statistical analyzes of the number of damages and effects caused by the occurrence of climate change, clarifying the harmful effects of climate change on profitability, considering environmental issues and biological changes in the macro policies of the country, creating fundamental thinking and attitude regarding climate change in the country. So far, a comprehensive analysis of Iran's insurance industry's understanding of climate change and the use of various insurance products has yet to be done. This research was done to solve this research gap so that its results will be a guide for the insurance industry managers.

Conclusion: The results indicate that some insurance companies in Iran have accepted the climate change phenomena by observing the intuitive effects of climate change and its impact on the company's activities. In addition, climate change has increased customer demand for some insurance products, and the consequences of climate change have caused the need to develop and upgrade the products and use new insurance products.

Keywords: Climate risks; International experiences; Risk management; Insurance companies.

CITATION LINKS

[1] Yousefi Maleksha ... [2] CEA (b). Tacklin ... [3] CRED. Disasters ... [4] NAIC (a). The Po ... [5] UNFCCC. Adoption ... [6] IAIS.Issues Pape ... [7] Farzaneh M., Zam ... [8] Damavandi A., Ha ... [9] Grimaldi A., Jav ... [10] CEA (a). Tacklin ... [11] Bruce N. The Imp ... [12] Botzen W. W., Va ... [13] Ranger N., Surmi ... [14] Quinto C. Insura ... [15] Scheel I., Ferki ... [16] Ford D., Ashton ... [17] Scherer N. Insur ... [18] Olya H., Alipour ... [19] Nnadi F. N., Chi ... [20] EIOPA. Non-life ... [21] Hermann A., Köfe ... [22] Farzaneh M., Ham ... [23] Shiravand H., Ha ... [24] Shahbazi K., Kho ... [25] NAIC (b). Climat ... [26] UNEP FI. Insurin ... [27] Abeygunawardena ... [28] Harrabin R. UK a ... [29] Le Den X., Perss ... [30] Voysey A., Surmi ... [31] Porrini D., Schw ... [32] Faggian P. Impac ... [33] Spano D., Mereu ... [34] Walkowicz T. Ita ... [35] Wilkinson C. Ita ... [36] Urlini F. Natura ... [37] Wee V., Molle L. ... [38] National Climate ... [39] French C. C. Ame ... [40] Schwarze R., Wag ... [41] Vanbreda Risk., ... [42] Giron E., Coninx ... [43] OECD. OECD Envir ... [44] World Bank Group ... [45] Gurenko E., Lest ... [46] Des Assurances C ... [47] PCS. Public and ... [48] Rahman H. A. Cli ... [49] Prabhakar S.V.R. ... [50] J.M. Pulhin (Eds ... [51] Muhamat A. A., J ... [52] Kamel H. AIG Mal ... [53] Wilkins M. The N ... [54] Cummins J. Promo ... [55] Financial Servic ... [56] Sandberg E., Øk ... [57] Jametti M., von ... [58] Sato M., Seki M. ... [59] Swiss Re. A Hist ... [60] Prabhakar S. V., ... [61] World Bank Group ... [62] Mills E. A globa ... [63] Gatzert N., Reic ... [64] Horn D. P., Brow ... [65] Ozaki M. Disaste ... [66] Bhuiyan M. H., H ... [67] Climate Change M ... [68] OIC. National Ca ... [69] Artemis (a). Tha ... [70] World Bank Group ... [71] Campillo G., Mul ... [72] Evans (b), S. Ha ... [73] World Bank Group ... [74] Evans (a) S. Mad ... [75] Artemis (b). Mor ... [76] Troy B. Insuranc ... [77] World Bank Group ... [78] Kong F., Sun S. ... [79] Baumgartner L., ... [80] Parry J. E. Clim ... [81] Nzau V. M. Insur ... [82] Swain M. Crop in ... [83] Matheswaran K. A ... [84] Bjerge B., Trifk

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Introduction

Climate change is one of the world's most critical challenges. It can have severe consequences for human beings' social, economic, agricultural, and environmental infrastructure [1]. Climate change is any specific change in the expected patterns of average weather conditions that occur over a long period in a particular region or for the entire global climate. It affects various climatic and non-climatic components, and different industries will not be immune from its consequences. The insurance industry is also directly affected by climate change. The most obvious impact of climate change on the insurance industry is the increase in claims expenditure. Climate change will directly impact claims across a remarkable number of insurance business lines, including property, crop, livestock, business interruption, motor, and health. On the other hand, the insurance industry is also facing other indirect effects that will challenge its profitability and business model [2]. Investigation of the natural disasters occurring in 2021 at the continental level shows that Asia has suffered the most damage, with 40% of all-natural disasters, 49% of the total number of deaths, and 66% of the total number of people affected. Although the number of deaths and people affected in 2021 was lower than the 2001-2020 average, the number of disasters and the extent of economic losses have increased. Figure 1. shows the top 10 natural disasters which caused the most economic losses from 2001-2021 [3].

Climate change may have extensive consequences in different sectors of insurance companies. Also, climate risks will significantly impact the capacity of financial institutions, including insurers, to run businesses. Insurers increasingly realize that climate change will have significant consequences for the sector. The insurance sector can play a vital role in implementing and promoting adaptation policies that limit the risks. New climatic conditions give rise to new losses. Climate change can provide new profitable business opportunities, such as providing insurance products for technologies and projects to reduce greenhouse gas emissions [4,5]. The range of climate risks is one of the significant factors that directly increases the complexity of the insurance industry's susceptibility to climate change. Climate risks can be categorized into the following risks [6]:

- **Physical risks:** Risks that arise from the increase of damage and losses caused by physical phenomena related to the climate change trends (i.e., changing weather patterns, rising sea levels) and natural disasters, and include the real effects of climate change, such as the secondary effects of the primary hazards (like storm surges)
- **Transition risks:** Risks that arise from disruptions and sudden shifts associated with moving toward a low-carbon economy and include changes in policies, credit effects, and changes in market rules, technologies, and priorities.
- **Liability risks:** The risk of climate-related claims based on liability policies and direct claims against insurers due to the lack of proper management of climate risks.

The above risks may impose new risks such as underwriting, market, investment, strategic, operational, and credit to the insurers in business and performance [7]. Examining the statistics related to the number and trends of natural disasters worldwide shows that one of the most important effects of climate change is the change in the intensity of limited values , such as floods, frosts, and droughts [8]. Insurers should adapt their business models to climate change and must not underestimate the true threat of climate change. Because the effects of this phenomenon are systemic and likely to put pressure on local economies and catastrophically cause market failure that affects both consumers and

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

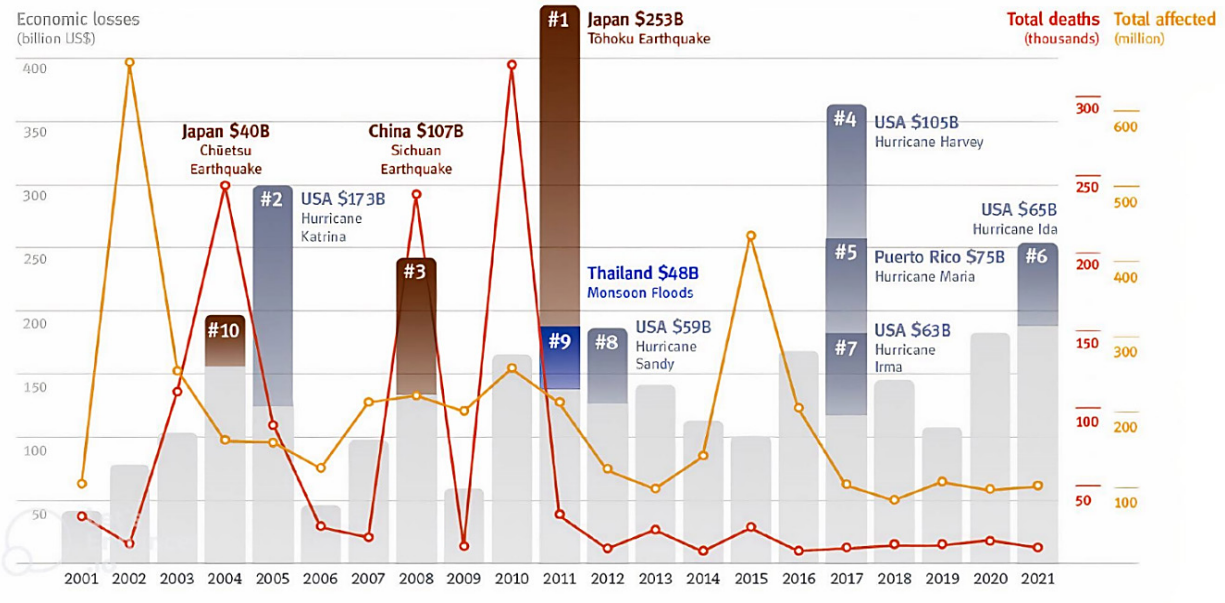

Figure 1) Top 10 Economic losses and disaster trends (2001-2021). [3]

insurers and makes insuring certain risks for them impossible [9]. In addition, the insurance industry has developed a range of products and services to reduce the exposure of global consumers and businesses to climate risks. In some countries, compulsory insurance for natural disasters or incentives to purchase related insurance products helps to increase integration and, thus, insurability [10]. According to the mentioned contents, Iran's insurance industry's understanding of climate change and related insurance products is investigated in this research. So far, no complete research has been done to investigate this issue in Iran's insurance industry. Nevertheless, the research related to the subject will be briefly reviewed in the following. Bruce et al. (2007) presented the challenges and opportunities of climate change on different business lines of non-life insurers. They examined the strategies that insurance companies should consider in dealing with climate change [11]. The National Association of Insurance Commission (NAIC) (2008) examined the effects of climate change on property, liability, life, and health insurance. It also discussed the role of climate change risk in the investment of insurance companies and the behavior of policyholders, the need to assess climate change risks by insurance regulators, and the role of the US government in climate change risk management [4]. The European Insurance and Reinsurance Federation (CEA) (2009) conducted a comprehensive study on the impact of 14 natural risks on the EU member states. It first classified the insurance industry's approaches to dealing with climate change. Then, it showed that natural hazards have different impacts on various insurance products, including property engineering, marine, agriculture, motor, aviation, life and health, and liability insurance over 5-30 years [10]. Botzen et al. (2010) examined the impacts of climate change on the insurance industry and proposed several strategies to cope with and adapt to increased risks [12]. Ranger and Surminski (2011) investigated the impact of climate change on economic growth; willingness to pay for insurance public policies and regulations; insurability of the risk of natural disasters; and new opportunities related to adaptation measures and reduction of greenhouse gas emissions [13]. Quinto (2011) investigated the strategies of the insurance industry in Germany, France, Spain, Switzerland, and the USA against climate change

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

risks and examined the systems for protecting buildings against destruction and damages by climate change [14]. Scheel et al. (2013) developed a Bayesian hierarchical statistical approach to predict the insurance losses of weather events at a local geographic scale [15]. Ford et al. (2019) provided warnings about climate risks and described the relationship between the role of life insurance actuaries and the consequences of climate change. They also examined the regulatory and disclosure aspects of climate change risk, risk management frameworks, and the use of models [16]. Scherer (2020) investigated the goals and characteristics of regional catastrophe risk funds against climate change and provided a detailed description of the aims of the tools, their design, and their activity at the technical level [17]. Olya et al. (2019) proposed a tourism climate insurance product to manage the risk of climate change and reduce the vulnerability of tourists during adverse climatic events [18]. Nnadi et al. (2013) described the importance of agriculture in developing countries and showed how agricultural insurance could enhance risk management activities [19]. European Insurance and Occupational Pensions Authority (EIOPA) (2021) presented climate-smart insurance products developed by the California Department of Insurance (CDI) database, already available to consumers and businesses, as well as information available on companies websites. More than half of these products belong to green buildings & equipment and renewable energies [20]. Hermann, Köferl, & Mairhöfer (2016) introduced catastrophe bonds and weather derivatives as climate risk transfer products [21]. Farzaneh et al. (2018) investigated the insurance industry's roadmap in dealing with climate change with an integrated approach based on "adaptation-prevention." Then, they presented relevant shreds of evidence to pay attention to the perceptual and operational aspects of the issues[22].Damavandi and Hamzeh (2019) examined the concepts of drought and its relationship with climate change; impacts, vulnerability, characteristics, and management of drought risk with the insurance industry approach; indicators of droughts, and their application in insurance risk calculation; as well as the climate change impacts at the global and national level [8]. Shiravand et al. (2019) investigated the occurrence of storms in the world and Iran with a climate change risk management approach in the insurance industry. They also explained the climate change concepts, the opportunities and challenges of climate change for the insurance industry, and the types of storms and their losses [23]. Also, considering the impact of climate change on the severity and frequency of natural disasters, Shahbazi et al. (2022) investigated the effects of climate change on the occurrence of dust storms in Kermanshah province, Iran [24].

The review of the above research on the understanding of the effects of climate change and the development of insurance products shows that the researchers need to pay more attention to the situation of Iran's insurance industry in this field. This paper examines these two factors.

Material & Methods

The research method of this paper is applied research, which in terms of research strategy, includes documentary studies and mixed exploratory studies. The library studies method was used to provide an overview of the damage caused by climate change and the experiences of developed and developing countries. In order to identify the status of Iran's insurance industry in the public perception of the effects of climate change and the development of related insurance products, the method of field study and distribution of questionnaires was used. For this purpose, NAIC climate risk disclosure and UNEP FI global surveys were studied

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

to design the relevant questionnaire, items, components, and analytical methods.

NAIC climate risk disclosure survey review

NAIC Climate Risk Disclosure Survey Guidance Reporting, presented in 2020, has taken into account the dimensions related to questioning based on the exposure of the American insurance industry to climate change. This report has defined the general framework of the survey from the insurance companies in the US. This action started in 2010 and measures the exposure level of insurers in dealing with climate change with a survey process. The eight items in this survey are as follows [25]:

- Plans to assess the mitigation of greenhouse gas emissions.
- Climate change policy concerning risk management and investment management.
- They were identifying climate change-related risks and their impact on business, including financial implications.
- Identifying current or anticipated risks that climate change poses to the company.
- Considering the climate change impacts on the company's investment portfolio.
- Providing incentives for policyholders to reduce the losses caused by climate change-influenced events.
- Engaging key constituencies on the topic of climate change.
- Taking actions to manage climate change-related risk.

UNEP FI survey review

The 2013 UNEP FI survey aims to provide information on how insurance is used to assist countries most vulnerable to climate change loss and damage. The respondents include a wide range of countries and organizations, and the questions are categorized into the eight following items [26]:

- Convincing about the happening of climate change.
- Relevance of climate change to insurers' risk management activities.
- How companies respond to climate-related risks in their core activities.
- Climate risk insurance products.
- Using insurance-linked securities.
- Engagement between survey participants and stakeholders in risk management and risk transfer activities relative to climate change.
- Benefits and cost solutions for building climate resilience.
- Governmental actions to develop and strengthen the insurance industry in dealing with climate change.

To design the questionnaire, the questions about the general perception of the climate change impacts and the development of insurance products were used in the above surveys. The results are shown in Table 1:

Designing questionnaire questions

The questionnaire has been designed by using the results of global surveys and expert opinions to investigate the current condition of Iran's insurance industry in the general perception of the climate change impacts and development of insurance products. The selection of the respondents was purposeful and non-probable, and the basis for selecting them was their deep understanding of the subject and their involvement in the climate change risk management process. The number of answers was 35 people selected by Snowball sampling.

To test reliability, Cronbach's alpha coefficient was calculated in SPSS. It was equal to an acceptable value of 0.80. To determine the validity, 14 experts assessed the questions. Lawshe's Content Validity Ratio (CVR) and the Content Validity Index (CVI) were equal to acceptable values of 0.92 and 0.95, respectively, and the validity is also confirmed. The questionnaire is presented in Table 2:

Findings

Given the increasing exacerbation of climate change, paying attention to the experiences of the developed and developing countries is significant in the general perception of climate change impacts and using related insur-

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Table 1) The results of international surveys. [25,26]

Survey	Perception of the climate change impacts	Development of the insurance products
NAIC climate risk disclosure	-Where in the structure of the company is climate risk addressed?	-How may climate change shift customer demand for products? -Which business segments or products are most exposed to climate-related risks?
UNEP FI	-Overall, is your company convinced that climate change is happening? -Which factors influenced your company to believe that climate change is happening or not?	-What types of risk transfer/insurance products are your company providing for climate-related risks? a) Traditional indemnity-based insurance (where loss assessment is based on the actual loss incurred) b) Index-based insurance (where loss assessment is based on an index, such as the amount of rainfall or wind speed) -Is your company using insurance-linked securities as an alternative way to diversify peak climate-related exposures (e.g., issuance of catastrophe bonds that transfer risks to the capital markets)?

Table 2) Explanation of questionnaire questions.

Code	Question
Demographic characteristics	
Q1	Gender Options: Female/Male
Q2	Education level Options: Dip./Assoc. Deg./ B.Sc./M.Sc./Ph.D.
Q3	What is your current job title in the insurance industry?
Q4	What is the name of your insurance company/institution?
Q5	How much experience do you have in the insurance industry? Options: Less than 5 years/ 5-10 years/ 10-15 years/ 15-20 years/ More than 20 years
General Perception of Climate Change Impacts	
Q6	Is your company convinced that climate change is happening? Options: Yes/No
Q7	Which factors influenced your company to believe that climate change is happening or not? Such as published scientific reports, including annual reports on climate change, examining damage statistics due to climate change.
Q8	Which sector in your company's organizational structure is responsible for dealing with climate change risk? Such as risk manager unit, planning, development manager, and technical deputy.
Q9	Does your company use climate scenario (IPCC scenarios) analysis in its strategy? Options: Yes/No
Development of Insurance Products	
Q10	Does climate change shift customer demand for products? Options: Yes/No
Q11	Are any types of insurance products provided in your company exposed to climate change risks? Options: Yes/No
Q12	What types of insurance products are your company providing for climate-related risks? Options: Traditional indemnity-based insurance /Index-based insurance (parametric insurance, microinsurance)/ Weather derivatives (options, swaps, catastrophe bonds, insurance-linked securities)/ Green insurance/ Crop insurance/ Takaful insurance/ Forecast insurance/Other (name the product)
Q13	What new products are used in your company due to the consequences of climate change?
Q14	Which of the company's current products need to be developed and upgraded due to the consequences of climate change?

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

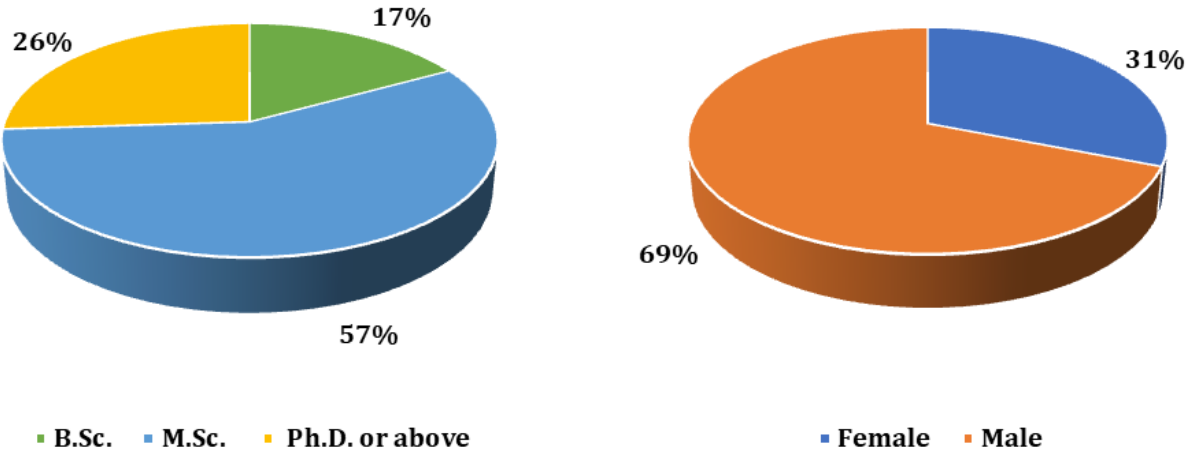

Figure 2) Demographic characteristics of the questionnaire.

ance products adapted to Iran. In developed and developing countries, there is a significant difference in insurance coverage and the human and economic burden of natural disaster damages. The developing countries that seek to adapt to the consequences of climate change on time face particular problems such as limited access to capital, poor access to technology, and lack of government programs [27]. The developed countries usually have the more adaptive capacity, including technology and economic tools, to bear the costs. Therefore, before entering into the analysis of the questionnaire results, Table 3 studied the general perception of the effects of climate change and related insurance products in developed and developing countries.

Questionnaire Data Analysis

Demographic characteristics (Q1 to Q5)

In the analysis of the questionnaire data, demographic characteristics such as gender, education level, insurance company/institution, job title, and work experience in the insurance industry were first examined. One person from each insurance company completes the questionnaire, on average. The results show that 31% of the respondents were female, and 69% were male. In addition, 17% of people have a B.Sc. degree, 57% have an M.Sc. degree, 26% have a Ph.D. degree or above, 11% have less than 5, 31% have 5 to 10, 23% have 10 to 15, 6% have 15 to 20 and 29% have 20 years work experience in the insurance industry. Also, 9% of the respondents are CEOs, 20% are department heads, 14% are managers, 28% are experts, 17% are deputies, 6% are consultants, and 6% are researchers of insurance companies. The results are shown in Figure 2.

The general perception of climate change impacts (Q6 to Q9)

Analysis of the results of question Q6

In examining the general perception of climate change impacts, one should first investigate whether insurance companies have accepted the occurrence of the phenomenon or not. According to Figure 3, most insurance companies in Iran are convinced that climate change is happening.

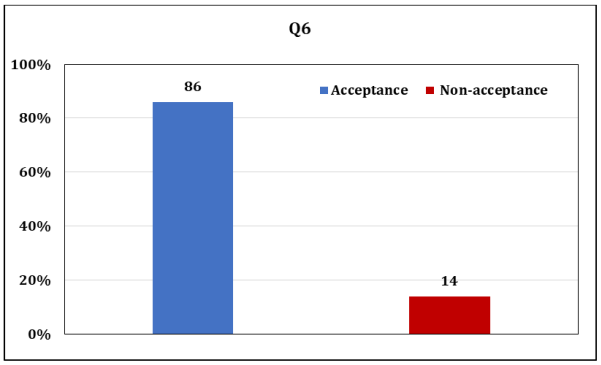

Figure 3) The results of insurance companies' acceptance or non-acceptance of climate change.

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Table 3) The experiences of selected developed and developing countries.

Country	Evidence of Climate Change	Related Insurance Products	References
UK	Soil erosion, diseases, pests, floods and storms, reduced water quality, increased summer mortality due to hot weather	-Natural disaster insurance -Digital flood maps - Energy certification products for buildings -Power Plant Insurance -Public liability cover - Flood reinsurance -Flood and storm catastrophe bonds and weather derivatives	[28-31]
Italy	Increased temperature, heat waves, heavy rainfall, floods, extreme heat periods, and increased cardiovascular and respiratory diseases due to air pollution.	-National Solidarity Fund (NSF) and Co-reinsurance pool - Optional household insurance for storms and hails. - Building insurance against earthquakes and floods. - Catastrophe bonds for severe weather risks	[29, 31, 32-36]
Belgium	The unprecedented rise in temperature, increase in damage to the insured property due to severe or frequent weather events	- Disaster fund - Compulsory coverage for natural hazards - Comprehensive weather insurance - Property insurance - Microinsurance - Weather derivatives and catastrophe bonds	[37-42]
Turkey	Increase in average temperature, increase in sea level in the Mediterranean and the Black Sea regions, and heat waves, floods, landslides, storms, and forest fires.	- Turkish Catastrophe Insurance Pool - Environmental insurance - Industry Loss Warranty (ILW) - Collateralized reinsurance - Catastrophe bonds	[43-48]
Malaysia	Occurrence of floods, droughts, landslides, earthquakes; degradation of natural resources, infrastructure, and environment; sea level rise, reduced crop yields; decreased water availability	-Coverage for wooden house - Providing 13 types of protection under one policy in AIG Malaysia's SME insurance plan - Green Takaful insurance for car, building, and global adverse weather	[44, 48-51]
Australia	Occurrence of floods, tropical storms, forest fires, and hails	- Development of insurance products for mitigating greenhouse gas emissions - Multiple peril crop insurance (MPCI)	[52-54]
France	Increasing the frequency and intensity of heat waves, increasing the risk of forest fires, flooding	-Barnier Fund - Caisse Centrale de Réassurance (CCR) - Comprehensive insurance cover for natural hazards	[31, 55, 56]
Japan	An increase in temperature and impact on the ecological system, sea levels, public health, and other aspects of human life, increased rainfall, floods, and mud	- Earthquake reinsurance - Weather derivatives - Crop insurance - Ecosystem renovation and restoration loan to encourage homeowners to install solar panels	[57-59]

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Table 3) The experiences of selected developed and developing countries.

Country	Evidence of Climate Change	Related Insurance Products	References
Bulgaria	An increase in temperature and frequency of climate-related events, including flash floods, droughts, heavy rainfalls, storms, heat, and cold waves.	- National catastrophe insurance pool and the European Union Solidarity Fund - Parametric insurance - Catastrophe bonds and weather derivatives - Automobile insurance - Flood liability	[60]
USA	Intensification of natural hazards such as floods, storms, lightning, hails, wind storms, ice storms, droughts, and health consequences.	- Compulsory storm insurance -Paying specific attention to flood and earthquake insurance	[60-63]
Bangladesh	An increase in temperature and rainfall, increase in duration, magnitude, and frequency of natural hazards such as floods	- Flood microinsurance - Flood and storm parametric insurance - Green insurance (green bonds and securities)	[44, 64, 65]
Thailand	An increase in temperature, coastal erosions, floods, and droughts	- National Catastrophe Insurance Fund (NCIF) - Property insurance for business interruption losses - Natural disaster insurance for automobile, personal accident, and crop - Parametric catastrophe insurance - Weather index-based insurance	[66-68]
Colombia	An increase in temperature and precipitation, shrinking of natural glaciers, and increased probability of extreme El Nino events, earthquakes, droughts, and storms	- Insurance of public assets: 4G roads insurance -Climate-sensitive Insurance -CAT BOND/Pacific Alliance initiative -World Bank Cat DDO - Parametric insurance for earthquakes, floods, and landslides	[69-71]
Morocco	An increase in temperature, an increase in the occurrence of extreme weather events such as storms, sudden floods, droughts, and desertification	- CAT DDO - Drought parametric insurance - Agriculture insurance, including hail insurance and multiple-risk climate insurance	[72-75]
China	An increase in temperature, river, and coastal floods, droughts, tropical cyclones	-Agriculture insurance - Weather index insurance - Life and property insurance -Green Insurance -Microinsurance of inclusive finance	[76, 77]
Kenya	An increase in temperature, droughts, seasonal floods, and landslides	- Drought insurance - Health microinsurance - Yield-indexed insurance in the agriculture sector	[78-80]
India	An increase in temperature, an increase in heat waves, the occurrence of landslides and severe floods	-Crop Insurance -Flood index Insurance - Weather index-based insurance	[81-83]

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Summarizing the results indicates that the evidence of climate change acceptance by insurance companies includes the following:
1. The increase in the occurrence and severity of natural disasters in the country, the occurrence of frequent and extensive floods, the intensification of incidents such as landslides, fires in forests and pastures, the occurrence of drought, lack of water in various provinces of the country in recent years, the warming of the earth, temperature changes in some areas that this has led to an increase in the payment of losses by insurance companies. Also, other intuitive factors can be mentioned to review the rates and conditions of policies, create restrictions on accepting or not accepting relevant risks, including fire risks, engineering and civil liability in high-risk organizations, the visible impact on property insurance, and presentation of new mortality tables in life insurance by the supervisory body.
2. Observing the impact on the company's measures: examining the climate change effects in insurance company meetings, including risk committee meetings and imparting approvals to technical and reinsurance units, defining projects for climate change risks, presenting executive plans at the policy and operational level, considering the basics of risk management principals in developing the design of new products, the general and private conditions of the insurance policy, as well as the basics of rate determination to deal with the climate change risk, the review of sidecar securities to transfer natural disasters risks to the capital market, the issuance of fire insurance with the coverage of additional risks such as storms and floods for policyholders collectively (village, town, city) and increasing the growth of these requests.

Among the reasons given by the respondents for not accepting the occurrence of climate change by the insurance companies, it can be pointed out that there is no coherent research and no executive plan in this field.

Analysis of the results of question Q7

The reasons for accepting climate change by insurance companies are categorized as follows:
1. Published scientific reports, including annual reports on climate change and risk assessment, media, and published news about the climate change effects.
2. The climate change effects on catastrophic events and the analysis of losses statistics: increase in the occurrence of natural disasters, including earthquakes, devastating floods, and forest fires in Iran and the world, increase in the occurrence of industrial events and human-caused hazards, increase in environmental pollution, decrease in precipitation in cold seasons and vice versa, lack of water and drying of lakes, loss of animal species, increase in dust, sudden changes in temperature, which leads to increased damage and growing costs and thus affects the underwriting performance of insurance companies.

Also, the following reasons are effective in the non-acceptance of insurance companies regarding the occurrence of climate change:
1. Failure to consider environmental issues and biological changes in the macro-policies of the country.
2. Failure to provide accurate statistical analyses of the amount of damage and impacts of climate change and failure to clarify the harmful effects of climate change on profitability.

Analysis of the results of question Q8

According to the results, in most insurance companies, risk managers and technical managers investigate the climate change risk in the company's organizational structure. Some units, such as future studies, reinsurance, planning, and development, are also involved. In addition, in some companies, no specific section is defined or predicted for

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

investigating the climate change risk in the company's organizational structure.

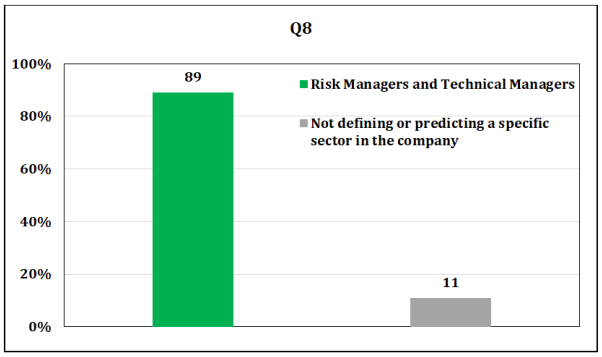

Figure 4) The results of the examination of the relevant department in the company's organizational structure in dealing with the risk of climate change.

Analysis of the results of question Q9

Figure 5. indicates that about one-third of the insurance companies in Iran use climate scenario analysis in their strategy, and the others do not use these analyses either or have no information about them. However, about 17% of the companies that do not use climate scenario analysis mentioned that they seek to use them in their plans and adapt them to Iran's climate conditions.

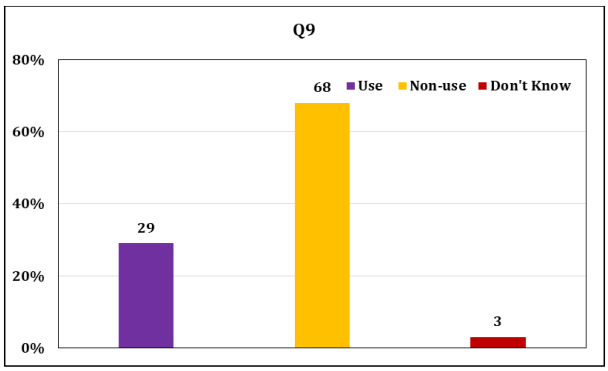

Figure 5) The investigation results of the company's use of the analysis of climate scenarios.

Some companies use climate scenario analysis for the necessary weather forecasts and reports and diversifying insurance plans. One of the insurance companies stated that it used climate scenarios in formulating the company's strategic document. Also, it desires to cooperate with the Internet of Things (IoT) companies due to the dangers caused by the increase in temperature and the possibility of spreading fire. Due to the increase in greenhouse gas emissions and its impact on people's health, the company is trying to consider microinsurance policies for climate change risks and provide coverage in this regard. Another company strategy is to consider the risk caused by climatic phenomena when issuing fire insurance and other insurance policies.

The reasons for not using climate scenarios by insurance companies are the need for more awareness about the scenarios and, as a result, the lack of analysis through them. Also, some respondents need clarification about the appropriateness of these scenarios with the climatic conditions of Iran.

The development of insurance products (Q10 to Q14)

Analysis of the results of question Q10

The results of the climate change impact on customer demand for products show that most insurance companies believe climate change will shift demand and generally increase customer demand for some products.

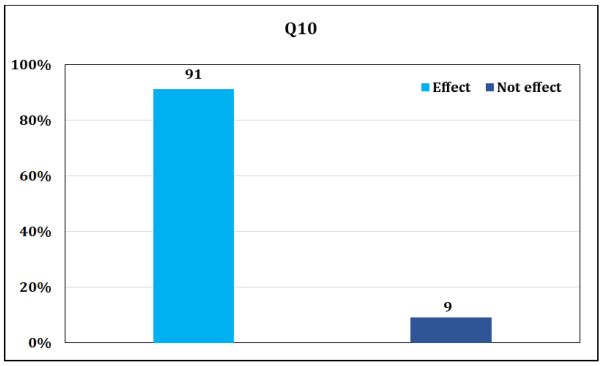

Figure 6) The results of investigating the impact of climate change on customer demand for products.

The majority of the respondents believed that, in general, the increase in the severity and frequency of climatic events and the risks and damages caused by climate change draw the attention of more policyholders to

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

related insurance products, including all-risk, fire, flood, earthquake, subsidence policies or supplemental health insurance.

Analysis of the results of question Q11

Summarizing the results regarding the exposure of the types of insurance products providing for climate change risks indicates that the majority of insurance companies believe that all types of insurance products are exposed to climate change risks.

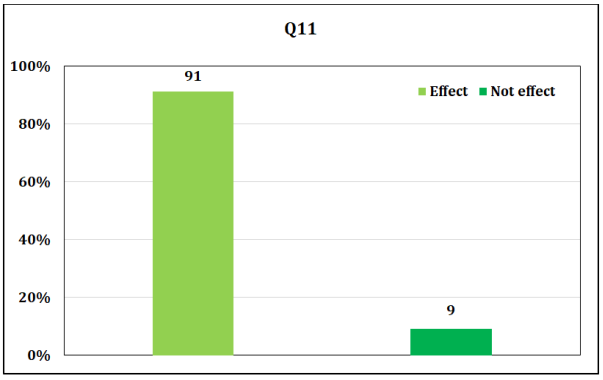

Figure 7) The results of investigating the impact of climate change on all insurance products offered in the company.

In general, the respondents believe that all types of insurance products, especially engineering, energy, fire, liability, life, health, property, accidents, group accidents, cargo, contractor, and installation, are exposed to climate change risks.

Analysis of the results of question Q12

Examining the results of products provided by insurance companies to cover climate change risks shows that 86% of the insurance companies provide products to cover climate change risks. The results are represented in Table 4:

Analysis of the results of question Q13

The consequences of climate change have led to the use of new insurance products. 60% of the respondents named a new or a supplementary product in their company that is used due to the consequences of climate change, and 29% stated that they will not use a new product and may modify the current products. Furthermore, 11% needed to have information about it.

The products used by insurance companies are as follows:

Natural disaster fund;

insurance-linked securities;

credit policy;

index-based insurance and weather derivatives;

Table 4) Types of insurance products used for climate change risks.

Product	Usage percentage
Traditional indemnity-based insurance	74
Index-based insurance (parametric insurance and microinsurance)	26
Weather derivatives (options, swaps, catastrophe bonds (CATs), securities)	9
Green insurance	-
Crop insurance	14
Takaful insurance	-
Forecast insurance	3
Other insurance products: a)Business interruption parametric insurance for pandemics b) Hull insurance	3 3

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

products designed based on artificial intelligence, IoT, and other digital technologies; crop insurance;
supplement fire coverage and create variety and expansion in them
and business interruption parametric insurance for pandemics.
Generally, most insurance companies cover climate risks in the existing related insurance policies or redesign current products according to climate change risks.

Analysis of the results of question Q14

The consequences of climate change have led to the need to develop and upgrade the current products of insurance companies. The results show that 86% of insurance companies believe that the development and improvement of current products in the company is necessary due to the consequences of climate change, of which 31% have mentioned the need to develop and improve all of their company's products. In addition, 3% of insurance companies believe that there is no need to develop and upgrade their products, and 11% need more information about it.
The insurance products mentioned by the respondents include fire and substantial risks (especially residential houses and factories); liability; engineering (all-risk insurance); parametric insurance for natural disasters such as floods, storms, rainfall, and earthquakes; reinsurance coverage of natural disasters; health; life; group accidents; cargo; construction; and implementation insurance.

Discussion

The deep and extensive attention of the insurance industry to the phenomenon of climate change, the need for requirements such as providing detailed statistical analyzes of the number of damages and effects caused by the occurrence of climate change, clarifying the harmful effects of climate change on profitability, considering environmental issues and biological changes in the macro policies of the country, creating fundamental thinking and attitude regarding climate change in the country.
Also, the issue of empowering the employees of insurance companies and training the expert force should be taken into the attention of the insurance industry as a requirement in climate change risk management because this issue was emphasized both in the results of the questionnaire and the country studies. The presence of a dedicated person or team in insurance companies responsible for climate change risk management is significant, considering the need for strategic climate change management to monitor and evaluate the opportunities and challenges created in the strengths and weaknesses of the company. In addition to empowerment and training, it is necessary to formulate and implement programs to evaluate, reduce or alleviate the emission of greenhouse gases by insurance companies to consider Iran's placement in the seventh rank of greenhouse gas-producing countries in the world in 2022. Regular and re-evaluation programs of risks related to climate change and response to related risks in insurance companies should be taken into consideration, considering that Iran is among the top 10 countries in the world in terms of occurrence of natural disasters that, in the study of Quinto (2011), strategies and protection systems of the insurance industry against climate change were also investigated. The communication of insurance companies with market participants and stakeholders involved in climate risk management and providing insurance products and services also help to manage these risks more effectively. In the last two decades around the world, special attention has been paid to the discussion of natural disaster modeling as well as risk models and damage estimation, which has led to a better understanding and

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

continuous measurement of natural disasters and their effects, which should also be considered in Iran, which in various studies including Scheel et al. (2013) mentioned these models. In addition to the mentioned cases, the expansion of insurance products related to climate change is also necessary for the insurance industry to adapt to its effects, in the studies of Olya et al. (2019); Hermann, Köferl, & Mairhöfer (2016) and European Insurance and Occupational Pensions Authority (EIOPA) (2021) mentioned several products.

Conclusions

Existing natural factors in different centuries and human activities that show a significant trend during the last half-century have led to climate change. The visualization of the possible future conditions shows that global warming and the subsequent increase in the intensity of natural hazards in the coming decades will significantly increase the economic losses caused by climate disasters. In some parts of the world, drought, forest fires, and floods will increase intensity due to the permanent dry weather conditions, increased rainfall, and rising sea levels. Iran is not immune from these natural hazards. The insurance industry has a specific exposure to the evidence impacts of climate change. Better awareness and perception of these impacts will help the insurance industry better understand climate threats and find solutions. Also, it has a long history of managing weather risks such as hurricanes, storms, and floods in changing environmental conditions and has provided solutions such as developing insurance products to deal with climate change impacts, which is also a significant step toward climate change adaptation and mitigation. Therefore, the insurance industry's attention to the general perception of climate change impacts and the development of insurance products is crucial. In this research, by examining the international experiences of selected developed and developing countries, it was shown that due to the different economic-social-ecological conditions of the countries, their different susceptibility to natural and climatic hazards, as well as the difference in the characteristics of the insurance industry, there is a different scope in the general perception of the climate change impacts and the development of insurance products. To conclude, these two factors are described in the context of the specific conditions of each country. On the other hand, international experiences can better outline the general perception of the climate change impacts and the development of related products in Iran. The analyses of the general perception of the climate change impacts showed that most of the insurance companies had accepted the phenomenon of climate change in Iran through scientific forecasts, published reports, and observed noticeable changes in the weather conditions of the country, the increase in the frequency and intensity of natural disasters in recent years and as a result the increase in paid losses that have affected the underwriting process. However, few have planned measures and strategies to manage this phenomenon. The deep and extensive attention of the insurance industry to this issue requires requirements such as providing detailed statistical analyzes of the number of damages and impacts caused by the occurrence of climate change, clarifying the harmful climate change impacts on profitability, considering environmental and biological changes issues in the macro policies of the country, creating fundamental thinking and attitude regarding climate change in the country and conducting research in this field. In addition, it was shown that risk managers and technical managers of insurance companies are the most involved units in climate change risk management.

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

Therefore, training and strengthening these two units regarding the climate change phenomenon is one of the other requirements. On the other hand, using the analysis of IPCC scenarios in the insurance companies' strategies has not yet become common. insurance companies should be more familiar with these scenarios and seek to adapt them to the country's climatic conditions. So, they can make effectual and helpful predictions about climate change and provide an appropriate solution to deal with it. The results of developing insurance products indicate that, in general, the majority of Iran's insurance companies believe that the increasing trend of risks and damages caused by climate change increases the policyholders' demand for relevant insurance products. Therefore, companies are expected to have a specific plan for developing insurance products related to climate change. In addition, climate change affects the activities, performance, and products of insurance companies, and considering that the majority of insurance companies believe that all the insurance products provided by their companies are exposed to climate risks, special attention should be paid to the development and promotion of these products and adapting them to climate risks. Concentrating on the products such as fire, energy, engineering, liability, health, and all-risk insurance policies should be prioritized because these products are the most exposed to climate risks. Also, it should remember that most companies cover the climate risks in their relevant existing insurance policies or redesign the current products according to the climate change risks and use traditional indemnity-based insurance. Index-based insurance, crop insurance, and weather derivatives have taken the next priorities, respectively.

Conflict of Interest

The author states that there is no conflict of interest.

Ethical Permissions

The author confirms that the research is conducted in line with all university, legal, and ethical standards.

Funding/Support

This study received no specific grant.

References

1. Yousefi Malekshah M., Ghazavi R., Sadatinejad S. J. Evaluating the Effect of Climate Changes on Runoff and Maximum Flood Discharge in the Dry Area (Case Study: Tehran-Karaj Basin). ECOPERSIA 2019; 7(4):211-221.
2. CEA (a). Tackling climate change: the vital contribution of insurers. Climate-ADAPT 2016; 1–64.
3. CRED. Disasters in numbers 2021. CRED 2022; 1-8.
4. NAIC (a). The Potential Impact of Climate Change on Insurance Regulation. NAIC 2008;1-26 .
5. UNFCCC. Adoption of the Paris Agreement. Decision FCCC/CP/2015/L.9. 2016; Retrieved from
6. IAIS.Issues Paper on Climate Change Risks to the Insurance Sector. International Association of Insurance Supervisors, IAIS 2018; 1–81.
7. Farzaneh M., Zamani B., Hamzeh A. Risks and solutions of the insurance industry in the face of climate change. Tehran: Insurance Research Center 2019.
8. Damavandi A., Hamzeh A. Investigating the impacts of climate change on the occurrence of droughts (from the past to the future) in the world and Iran (with an emphasis on drought risk zoning with the insurance industry approach). Tehran: Insurance Research Center 2019.
9. Grimaldi A., Javanmardian K., Pinner D., Samandari H., Strovink, K. Climate change, and P&C insurance: The threat and opportunity, McKinsey & Company 2020; 1–8.
10. CEA (b). Tackling climate change: The vital contribution of insurers. CEA 2009; 1-63.
11. Bruce N. The Impact of Climate Change on Non-life Insurance. Climate Change Working Party 2007; 1–17.
12. Botzen W. W., Van Den erg J. J., Bouwer L. M. Climate change and increased risk for the insurance sector: a global perspective and an assessment for the Netherlands. Nat. Hazards 2010; 52(3) 577–598.
13. Ranger N., Surminski S. A preliminary assessment of the impact of climate change on non-life insurance demand in the BRICS economies. CCCEP 2011; 1–23.
14. Quinto C. Insurance Systems in Times of Climate Change, Insurance of Buildings Against Natural Hazards. Springer, 2012.

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

15. Scheel I., Ferkingstad E., Frigessi A., Haug O., Hinnerichsen M., MezeHausken E. A Bayesian hierarchical model with spatial variable selection: the effect of weather on insurance claims. Appl. Stat. 2013; 62(1):85-100.
16. Ford D., Ashton B., Audley K., Qazvini M., Yuan Y., McLintock Y. A Practical Guide to Climate Change for Life Actuaries. Institute and Faculty of Actuaries 2019; 1–26.
17. Scherer N. Insuring against climate change: the emergence of regional catastrophe risk pools. Routledge 2020.
18. Olya H., Alipour H., Peyravi B., Dalir S. Tourism climate insurance: implications and prospects. Asia Pac. J. Tour. Res. 2019; 24 (4): 269–280.
19. Nnadi F. N., Chikaire J., Echetama J. A., Ihenacho R. A., Umunnakwe P. C., Utazi C. O. Agricultural insurance: A strategic tool for climate change adaptation in the agricultural sector. Net J. Agric. Sci. 2013; 1(1):1-9.
20. EIOPA. Non-life Underwriting and Pricing in Light of Climate Change. Frankfurt: EIOPA 2021.
21. Hermann A., Köferl P.,Mairhöfer J. P. Climate Risk Insurance: New Approaches and Schemes. ECON. RESEARCH (Working Paper) 2016; 1-22.
22. Farzaneh M., Hamzeh A., Hosseinpour Tehrani M., Fakhri M. An advance on the road map of the insurance industry in the face of climate change. Tehran: Insurance Research Center 2018.
23. Shiravand H., Hamzeh A., Alibakhshi Z. Investigating the occurrence of hurricanes in the world and Iran with the climate change risk management approach in the insurance industry. Tehran: Insurance Research Center 2019.
24. Shahbazi K., Khosroshahi M., Heshmati M., Saeeidy Z. Effects of climate change on dust storm occurrence in Kermanshah Province, Iran. ECOPERSIA 2022; 10(2):121-131.
25. NAIC (b). Climate Risk Disclosure Survey Guidance Reporting Year 2020. NAIC 2020; 1–2.
26. UNEP FI. Insuring Climate Resilience. UNEP FI 2013; 1–32.
27. Abeygunawardena P., Vyas Y., Knill P., Foy T., Harrold M., Steele P., Debois M. Poverty, and climate change. Part 1. Reducing the vulnerability of the poor through adaptation, Washington, D.C.: World Bank Group. 2003.
28. Harrabin R. UK already undergoing disruptive climate change, 2021.
29. Le Den X., Persson M., Benoist A., Hudson P., De Ruiter M., De Ruig L., Kuik O. Insurance of weather and climate-related disaster risk: Inventory and analysis of mechanisms to support damage prevention in the EU. Eur. Commiss. 2017; 1–196.
30. Voysey A., Surminski S., Leurig S., Spiegel A. 2009;
31. Porrini D., Schwarze R. Insurance models and European climate change policies: an assessment. Eur. J. Law Econ. 2014; 38(1):7–28.
32. Faggian P. Impacts of climate change in Italy. RSE. 2018; 1-20.
33. Spano D., Mereu V. Risk Analysis. Climate Change in Italy. CMCC. 2020; 1–19.
34. Walkowicz T. Italian NonLife incorporating climate change. 2021 Retrieved from Actuarial Post:
35. Wilkinson C. Italian insurer places $51 million cat bond for severe weather risks. 2019; Retrieved from
36. Urlini F. Natural disaster and insurance: Generali's position. Generali Group Magazine 2013; 1–50.
37. Wee V., Molle L., Materné J., Murphy A., Lamberts E., & Doucy, A. Belgium. Encyclopedia Britannica. 2021; Retrieved from https://www.britannica.com/place/Belgium
38. National Climate Commission. Belgian National Climate Change Adaptation Strategy. National Climate Commission 2010; 1-54.
39. French C. C. America on fire: climate change, wildfires & insuring natural catastrophes. U.C. Davis L. Rev. 2020; 1–69.
40. Schwarze R., Wagner G. Natural Hazards Insurance in Europe? Tailored Responses to Climate change Needed. 2009; 1–27.
41. Vanbreda Risk., Benefits. Comprehensive weather insurance: protection against natural disasters. 2021; Retrieved from
42. Giron E., Coninx I., Dewals B., Staes J., De Smet L., Joachain H. ADAPT-Towards an integrated decision tool for adaptation measures-Case study: floods. BELSPO 2006; 1–125.
43. OECD. OECD Environmental Performance Reviews: Turkey 2019. Paris: OECD Publishing 2019.
44. World Bank Group (b). Climate Change Knowledge Portal for Development Practitioners and Policy Makers. 2018:
45. Gurenko E., Lester R., Mahul O., Oguz Gonulal S. Earthquake Insurance in Turkey: History of the Turkish catastrophe Insurance Pool. World Bank publications 2006.
46. Des Assurances C. E. Tackling climate changes the vital contribution of insurers. Brussels: CEA. 2009; 1–64.
47. PCS. Public and Private: PCS Q2 2015 Catastrophe Bond Report. PCS. 2015; 1–10.
48. Rahman H. A. Climate change scenarios in Malaysia: Engaging the public. Int. J. Malay-Nusantara stud. 2018; 55–77.
49. Prabhakar S.V.R.K., D.S. Solomon., A. Abu-Bakar., J. Cummins, J.J. Pereira and
50. J.M. Pulhin (Eds.). Case Studies in Insurance Effectiveness: Some Insights into Costs and Benefits. South East Asia Disaster Prevention Research Institute (SEADPRI) 2017; 1–138.

[DOR: 20.1001.1.23222700.2023.11.1.6.6]

51. Muhamat A. A., Jaafar M. N., Basri M. F., Alwi S. S., Mainal S. A. Green takaful as a climate finance tool. J. Comput. Theor. Nanosci. 2017; 23(8):7670-7673.
52. Kamel H. AIG Malaysia: 80% of SMEs are underinsured against natural disasters. 2019.
53. Wilkins M. The Need for a Multi-Level Approach to Climate Change-An Australian Insurance Perspective. JSTOR.2010;35(2):336–348.
54. Cummins J. Promoting risk insurance and other risk management approaches in Australia: evaluating farmer perceptions and costs and benefits Research Report SEADPRIA 2017; 11–21.
55. Financial Services R. C. Natural Disaster Insurance Background Paper 20. Australian Government, Department of the Treasury (Australia), 2018; 1–16.
56. Sandberg E., Økland A., Inger L. Natural perils insurance and compensation arrangements in six countries. SINTEF Community (Klima 2050 Report No 21E) 2020; 1-78.
57. Jametti M., von Ungern-Sternberg T. Risk Selection in Natural Disaster Insurance-the Case of France. CESifo Working Paper 2006; 1–26.
58. Sato M., Seki M. Sustainable Business, Sustainable Planet— A Japanese Insurance Perspective. Geneva Pap Risk Insur. 2010; 35(1):325–335.
59. Swiss Re. A History of Insurance in Japan. Zurich: Swiss Re 2013; 1-62.
60. Prabhakar S. V., Pereira J. J., Pulhin J. M., Srinivasa Rao G., Scheyvens H., Cummins J. Effectiveness of Insurance for Disaster Risk Reduction and Climate Change Adaptation: Challenges and Opportunities. Hayama, Japan: Institute for Global Environmental Strategies (IGES) 2015; 1–4.
61. World Bank Group (a). Insurance against Climate Change: Financial Disaster Risk Management and Insurance Options for Climate Change Adaptation in Bulgaria. World bank group 2014; 1-47.
62. Mills E. A global review of insurance industry responses to climate change. Geneva Pap. JSTOR. 2009; 34(3):323–359.
63. Gatzert N., Reichel, P. Awareness of climate risks and opportunities: empirical evidence on determinants and value from the US and European insurance industry. Geneva Pap. Risk Insur. Issues Pract. 2022; 47(1):5-26.
64. Horn D. P., Brown J. T. Introduction to the national flood insurance program (NFIP). Congressional Research Service 2017; 1–36.
65. Ozaki M. Disaster Risk Financing in Bangladesh. Asian Development Bank 2016; 1–35.
66. Bhuiyan M. H., Hassan S., Darda M. A., Habib M. W., Hossain M. B. Government Initiatives for Green Development in Bangladesh. Preprints 2020
67. Climate Change Management & Coordination Division. Thailand Country Programme on Climate Change. Office of Natural Resources and Environmental Policy and Planning 2017; 1-16.
68. OIC. National Catastrophe Insurance Fund 2012. Office Of Insurance Commission 2012; 1–4.
69. Artemis (a). Thailand's Kasikornbank introduces parametric catastrophe insurance products 2012; Retrieved from Artemis:
70. World Bank Group (c). Climate Change Knowledge Portal for Development Practitioners and Policy Makers. 2021.
71. Campillo G., Mullan M., Vallejo L. Climate change adaptation and financial protection: synthesis of key findings from Colombia and Senegal. OECD Environment Working Papers. 2017; OECD Publishing, Paris.
72. Evans (b), S. Hannover Re & WTW to develop climate & cat covers for Medellín, Colombia. 2021; Retrieved from Artemis:
73. World Bank Group (d). Climate Risk Country Profile: Morocco. Washington DC: World Bank Group 2021; 1-36.
74. Evans (a) S. Madagascar & Morocco get World Bank Catastrophe Deferred Drawdown Options. 2019; Retrieved from Artemis:
75. Artemis (b). Morocco eyes launch of parametric drought insurance 2017; Retrieved from Artemis:
76. Troy B. Insurance and agricultural development: new dynamics in Algeria, Morocco, and Tunisia 2013; 1–6.
77. World Bank Group ., ADB. Climate Risk Country Profile. World Bank Group & ADB 2021; 1-28.
78. Kong F., Sun S. Better understanding the catastrophe risk in interconnection and comprehensive disaster risk defense capability, with special reference to China. Sustainability, 2021; 13(4):1–11.
79. Baumgartner L., Richards J. A. Insuring for a changing climate a review and reflection on CARE's experience with microinsurance. UK, CARE Climate Change. 2019; 1–40.
80. Parry J. E. Climate risks, vulnerability and governance in Kenya: A review. UNDP. 2012; 1–83.
81. Nzau V. M. Insuring against climate risk in Kenya. 2017.
82. Swain M. Crop insurance for adaptation to climate change in India. LSE 2014; 1–41.
83. Matheswaran K. A. Flood risk assessment in South Asia to prioritize flood index insurance applications in Bihar, India. Nat. Hazards Risk 2018; 10(1):26–48.
84. Bjerge B., Trifkovic, N. Extreme weather and demand for index insurance in rural India. Eur. Rev. Agric. Econ. 2018;45(3):397-431.

[DOR: 20.1001.1.23222700.2023.11.1.6.6]