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Mechanisms for compensation for environmental damage to waste: "Insurance and compensation funds as a model

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Abstract:

This study aims to identify the damage caused by waste, especially environmental pollution, where the environment has become more vulnerable to pollution, especially with the increase of waste left by human activity as it leads to the creation of pollution in a direct or indirect way; it also highlights the most important mechanisms for compensation for environmental damage, whether Through state intervention or by resorting to insurance or by relying on compensation funds. Among the most important results reached is that waste poses a great danger to the environment and therefore the state is obligated to compensation; it is obliged to compensate for those damages that result from the installations and sites of the state, while the majority of modern legislation requires the presence of insurance or any other financial guarantee to compensate for environmental damage, and guarantee Compensating the affected people takes one of two forms, either through insurance or through compensation funds.

Keywords: *waste; environmental pollution; insurance; compensation funds.*

JEL Classification Codes*: G22; Q52;Q53*

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1. INTRODUCTION:

The problem of environmental pollution has emerged due to the significant increase in waste, which is often caused by humans either directly or indirectly. The environment is no longer able to renew its natural resources, nor is it capable of breaking down human waste and absorbing the refuse resulting from various human activities. This has led to an increase in environmental degradation and its scope, especially in light of the industrial and technological advancements that have resulted from the industrial revolution, significantly contributing to the issue of environmental pollution and exerting enormous pressures on the balance of the ecosystem.

Compensation is considered the most effective means of repairing environmental damage because the environment is a shared asset among members of society. Therefore, it is essential to adopt compensation mechanisms, whether by individuals or international organizations concerned with environmental protection, to achieve the public interest of humanity. Based on this premise, the issue of compensating for environmental damages has become a major concern, making it mandatory to hold accountable anyone who damages the environment and oblige them to repair the damage. From here, the following problem arises:

1.1 The Problem and Questions of the Study:

What are the mechanisms for compensating for environmental damages caused by waste?

The following questions branch from this:

- What are the most significant environmental damages caused by waste?

- How does the state contribute to compensation for environmental damages?

- What are the forms of compensation for environmental damages?

1.2 Hypothese of the Study:

Based on the problem and the sub-questions posed, the following hypothese can be formulated:

-Insurance and compensation funds are considered one of the most important mechanisms for compensating for environmental damages caused by waste.

- Weak integration between the international legal framework and legislations limits the effectiveness of environmental compensation.
- Aramco's experience reflects a mix of success and challenges compared to international models

1.3 Importance of the Study:

This study derives its significance from the increasing importance of the issue of waste and its impact on the environment at present, as it has become a topic of concern for both the public and private sectors. The importance of this study also lies in its focus on the

most important mechanisms for compensating for these damages through the study of insurance and compensation funds.

1.4Objectives of the Study:

Through this study, we aim to achieve several key objectives, including:

- Identifying pollution and the environmental damage it causes

- Highlighting insurance as a mechanism for compensating for waste damages

- Examining the role of compensation funds

1.5 Study Methodology:

This research adopts the descriptive–analytical approach, which combines the collection of data from primary and secondary sources with a critical examination of concepts and practices. The descriptive aspect is employed to present the main concepts related to environmental pollution, insurance, and compensation mechanisms, while the analytical aspect is used to assess the effectiveness of these mechanisms in the context of Saudi Aramco.

The study relies primarily on secondary sources, including academic books, peer-reviewed journal articles, official reports from international organizations (such as the United Nations Environment Programme, the World Bank, and the International Energy Agency), in addition to national legislation and corporate reports issued by Aramco. Where available, primary data such as official statistics and financial disclosures are also utilized.

To strengthen the empirical dimension, the research applies a case study method, focusing on Saudi Aramco as a representative model of a major oil company operating in a rentier economy undergoing structural reforms under Saudi Vision 2030. The rationale for selecting Aramco lies in its global significance, its substantial environmental footprint, and the availability of relevant data.

The analysis further incorporates a comparative perspective by contrasting Aramco's environmental compensation mechanisms with those of leading international oil companies (e.g., BP, ExxonMobil, TotalEnergies) in order to highlight similarities, differences, and lessons learned.

The research covers the period 2015–2025, coinciding with major environmental governance reforms in Saudi Arabia.

1.6Justification for Selecting Saudi Aramco:

The choice of Saudi Aramco as the case study is justified by several key considerations. First, the company represents the largest oil producer worldwide, which makes it a central actor in the global energy market and an important reference for studying environmental compensation mechanisms in the hydrocarbon sector. Second, due to the nature and scale of its petroleum activities, Aramco is exposed to significant environmental challenges, including oil spills, industrial emissions, and ecological degradation, which makes it a relevant case for examining compensation and remediation practices. Third, the company has developed

institutional frameworks and policies for environmental management and compensation, providing an opportunity to critically analyze their effectiveness. Finally, the availability of reliable data and reports concerning Aramco's operations facilitates the empirical assessment and ensures the feasibility of the research**.**

1.7 Structure of the Stud:

In order to answer the previous questions and address the main problem, we attempted to divide this study into the following axes:

- Pollution and the damages of waste, which includes defining pollution and the damages of environmental pollution due to waste; we also addressed the role of the state in compensating for environmental damages;

- Compensation for environmental damages, which includes insurance and compensation funds;

- Examples of insuranceEnvironmental Damage and Compensation Funds through the Experience of the English Insurance Market: "The Clarkson Document" and the International

Fund for Compensation for Oil Pollution Damage.

1.8 Previous Studies:

- **Kadari Amal (2018) : "The Legal System for Ensuring Liability for Environmental Pollution** "Doctoral Thesis, Ahmed Draia University – Adrar

This study reviews the ability of traditional insurance rules to cover the risk of environmental pollution and discusses the optional and mandatory insurance models adopted by foreign companies. **One of the main conclusions reached** is that the general insurance rules are not suitable for the specific nature of the risk of environmental pollution; thus, foreign companies have developed ideal models for ensuring liability for this risk. However, these models have failed to adequately cover environmental damage, highlighting the need to complement the insurance mechanism with other techniques and mechanisms that ensure compensation for environmental damage.

-Salima Moshayed (2023): The Loss and Damage Compensation Fund as a Mechanism for Mitigating Environmental Damage; A contribution to the International Forum on International Law and Climate Change Challenges, University of Algiers 1.

The article discusses the definition of compensation funds, their advantages, the challenges they face, their financing, and the ways to distribute compensations to affected countries. It also discusses the establishment of a "Loss and Damage Fund" within the framework of the Climate Conference (COP27) to assist the countries most affected by climate change. One of the key findings of the article is that the specificity of environmental damage resulting from climate change has made compensating for damage under the general rules of civil liability face many difficulties, necessitating the creation of collective mechanisms represented by the Environmental Loss and Damage Fund. Compensation funds for environmental losses and damages are effective mechanisms that can

be relied upon to mitigate the severity of environmental damage, yet they face challenges that require the intervention of international financial institutions.

-Chen, Y., & Xie, Y. (2024). Environmental liability insurance, green innovation, and mediation effect study. ***Frontiers in Environmental Science***

This study reviews the impact of environmental damage insurance on corporate environmental innovation, focusing on polluting industries. Through a three-party game model involving the government, the company, and the insurance company, the study shows that the refusal of insurance companies to provide coverage may drive companies to adopt green innovation as a strategy to reduce environmental risks. The results also indicate that obtaining insurance against environmental damage contributes to enhancing companies' capacity for green innovation by alleviating financial constraints. **Study results**:
- When an insurance company refuses to provide coverage to a company due to its weak environmental commitment, it prompts that company to improve its environmental practices and adopt green innovation to reduce future risks and costs.
- Having insurance against environmental damage helps companies overcome financial constraints, allowing for better investment in green technology and environmental innovation.

- United Nations Economic and Social Commission for Western Asia (UN-ESCWA) : (2025)Mainstreaming a Circular Economy in the Arab Region: Guidelines for a Cross-sectoral Transition :

This study provides a strategic roadmap for Arab countries to shift from a linear economy (produce–consume–dispose) towards a circular economy that minimizes waste, maximizes resource efficiency, and supports sustainability. The guidelines emphasize mainstreaming circular practices into national policies, involving stakeholders, and aligning with the UN Sustainable Development Goals (SDGs).

The report specifically targets eight Arab countries: Bahrain, Egypt, Jordan, Lebanon, Morocco, Oman, Saudi Arabia, and the United Arab Emirates . One of the most important findings of this study :

-Need for Transition: systems in the Arab region are under strain, with high waste generation rates and limited recycling.

-A circular approach is essential for reducing environmental damage, improving resilience, and supporting sustainable growth.

1.8 Research Gap:

Despite the efforts made in previous studies, they have largely focused on the legal and environmental aspects without delving into insurance documents in detail. What distinguishes this study from previous ones is its attention to the economic aspect with a case study of an Arab company, whereas previous studies concentrated on foreign countries, particularly European ones.

2.Pollution and Waste Damage:

The assault on and damage to the environment are actions that have accompanied humans since ancient times. However, they have not had the same impact and results as they do today, especially since the onset of the Industrial Revolution. The advent of tremendous technological advancements across various fields has made the environment increasingly susceptible to pollution, with industrial pollution posing a serious threat to both the surroundings and nature, particularly in major urban centers. Consequently, the problems arising from industrial pollution are no longer solely of a legal nature; they now encompass social, technical, economic, and financial dimensions (Bouflega;2016 ;p28)

2.1Definition of Pollution: There are several definitions of pollution; some of them are presented below:

"Pollution is defined as any change in the natural properties of water, air, or soil that renders them unsuitable for intended uses by introducing foreign substances or increasing the quantities of certain existing substances beyond their natural limits, leading to harmful results on everything within the environmental medium."(Pasha;1983p78)

Additionally, one definition from the 1965 report of the United Nations Economic and Social Council states: "Pollution is the change that occurs due to the direct or indirect effects of human activities on the composition of the medium, disrupting some uses or activities that could have been performed under the natural conditions of that medium."(Salama;1997;21)

According to Algerian law, it is defined as: "Any direct or indirect change to the environment caused by any action that results or may result in a harmful condition affecting the health and safety of humans, plants, and animals. .. "The air, atmosphere, water, land, and collective and individual properties."(Law 10/03;p09)

Most definitions regarding pollution have centered on the element of human activity as it leads to pollution either directly or indirectly. However, some argue that focusing solely on human activity as a cause of pollution is not tenable, as pollution may also arise from sources beyond human control, such as natural factors like volcanoes, earthquakes, and forest fires.

Pollution that justifies legal intervention for its mitigation and assigns liability for its damages must encompass a set of elements as follows:(Salama;1997;p23)

- A change must occur in the environment or ecological medium. This change begins with a disruption of the inherent or natural balance among the elements and components of the environment, evidenced by the disappearance of some elements, their reduced quantity, or the impact on the quality or properties of these elements. Humans do not create elements that do not exist in nature; rather, they alter the existing conditions of the environment.

- There must be an external influence behind this change, exerting its effects in a direct or indirect manner. This is often manifested in human activities such as industrial and commercial operations, nuclear explosions, and the disposal of chemical waste and pesticides of all kinds.

- This change in the environment or ecological medium must result in harm or detrimental effects on humans, living organisms, and inanimate objects. The critical aspect is the outcome of human activities, which must be harmful to the environment, reflecting this damage onto humans, living beings, and non-living entities.

2.2 Environmental Damage from Waste Pollution: Waste poses a significant threat to the environment, emerging from numerous sources and taking various forms, whether liquid, solid, sludge, or gas. The most considerable harm occurs during storage, transportation, and treatment, or any alterations made to it. For instance, some waste accumulates over water, subsequently leaching into groundwater layers and reaching living organisms through consumption. Additionally, waste in landfills adversely affects residents living nearby. The following outlines the environmental damage caused by waste according to the type of harm it inflicts:(Bouflega;2016;p51)

Table 1: Summary of Environmental Waste Hazards

Type of Waste Hazard	Description	Key Impacts
Toxic Waste	Harmful regardless of quantity; prolonged exposure leads to chronic illness, cancer, or death. Alters biological/environmental characteristics.	Mutation, illnesses, cancer, death
Reactive Waste	Chemically unstable; reacts with air or water, forming toxic vapors or causing explosions.	Fires, toxic vapors, explosions
Infectious Waste	Generated from hospitals, clinics, labs (e.g., needles, bandages).	Causes infectious diseases, health risks
Radioactive Waste	Persists for thousands of years; does not decompose quickly.	Long-term radiation harm to humans and environment

Source : **Prepared by the researcher based on**

- Bouflega Abdel Rahman; Civil Liability for Environmental Damage; Doctoral Thesis; Faculty of Law; University of Tlemcen; 2016;p51

Any activity that harms the environment or violates its components renders the perpetrator legally responsible for their damaging actions against environmental resources. Notably, the specificity of environmental damages presents several challenges in determining the basis of liability in this area and the adequacy of these bases to cover all environmental damages.(Mohideen;2001;p91) Furthermore, environmental harm refers to the damage that affects the environment itself, which cannot be compensated or repaired except by restoring the environment to its original state prior to the harm. Consequently, maintaining a clean

environment is a fundamental right for those affected, and environmental damage not only represents a decrease in the financial value of the environment but also diminishes the interests and financial value of those who interact with and benefit from the environment(Hadi; Ghassan;2017;p355)

As for the Algerian legislator, it has referred to indirect damages in the Environmental Protection Law 03-10 regarding environmental damages through Article 37 of this law, which grants environmental defense associations the right to compensation for both direct and indirect damages concerning incidents that harm collective interests aimed at safeguarding them.

2.3 The Role of the State in Compensating Environmental Damages: The state and its bodies, at all levels and functions, are obligated to compensate those affected by environmental damages that are supposed to be caused by individuals affiliated with the state. It is required to compensate for damages resulting from facilities and sites owned by the state, whether privately owned, such as buildings and land, or publicly owned, such as rivers, seas, streets, and similar types of public ownership. It is thus obliged to compensate for any damages that occur as a result of its role in causing such damages.

The reality is that the matter of state intervention for compensation has been addressed in detail by jurisprudence.There is a trend adopted by several jurists that asserts the state should not intervene to compensate the harmed party through the investment project, supporting this view with various legal, jurisprudential,and practical arguments.However, there is another jurisprudential trend that opposes the first, advocating for the necessity of state intervention in compensation. Proponents of this approach present arguments contrary to those of the first trend, asserting that the principle of equality among members of society, which all states advocate, necessitates that every harmed party receives the compensation due to them for the damages incurred, regardless of excuses such as the insolvency of the party responsible for the harm or the lack of awareness by public authorities. In line with the principle of equality, it is the state's obligation to compensate the harmed party, after which it can apply the general rules regarding legal solutions by substituting itself in the claim against the responsible party or seeking out the liable party to demand reimbursement for what it has paid(Salam; Mursi;2007;p87)

3.Compensation for Environmental Damages:

Most modern legislations require the existence of insurance or any other financial guarantees for compensating environmental damages. The Lugano Convention stipulates that having a financial guarantee is a mandatory condition, leaving the determination of this guarantee to the domestic laws of the member states of the convention. Ensuring compensation for the harmed parties takes one of two forms, either through insurance or through compensation funds.

3.1 Insurance for Environmental Pollution Damages: Before discussing insurance for environmental pollution damages, we will first familiarize ourselves with insurance and its prominent role in the economy, after which we will present the key points related to insurance

for pollution damages. Insurance is one of the means to confront risk; without the existence of risk, insurance would not exist.

3.1.1 Definition of Insurance: There are multiple definitions of insurance, including the following definition:

Insurance: "It is an agreement under which the first party (the insurer) commits to pay the second party (the insured) or the beneficiary for whom the insurance was stipulated a sum of money, income, annuity, or any other financial compensation (the Sum Insured) in the event of an accident or the occurrence of the risk specified in the contract, in exchange for a premium or any other payment made by the insured to the insurer."(Law 06/04).

The Algerian legislator defines the insurance contract as: "A contract whereby the insurer is obliged to pay the insured or the beneficiary for whom the insurance was stipulated a sum of money, income, or any other financial compensation in the event of an accident or the occurrence of the risk specified in the contract, in exchange for a premium or any other payment made by the insured to the insurer."(Jamila;2012;p160)

3.1.2 Types of Insurance Contracts: The insurance contract is divided into three main groups:

Table 2: Types of Insurance Contracts

Type of Insurance	Description
Terrestrial Insurance Contract	Covers risks threatening individuals or property on land. Includes property insurance and personal insurance.
Aerial Insurance Contract	Covers transportation risks conducted by aircraft, including damages to the aircraft itself, its cargo, and injuries to passengers.
Marine Insurance Contract	Covers damage caused by maritime risks. Includes cargo insurance and coverage against maritime accidents.

Source : Prepared by the researcher based on

- Ahmad Salah Atiya; Accounting for Insurance Companies; University Publishing House; Alexandria; 2007;p13

3.2.2 Importance of Insurance: Insurance activities play a significant role in achieving social stability for community members by providing safety and reassurance against any misfortunes or crises. Social stability is a result of economic stability, which arises from compensating the insured for their losses, or part of them, when damage occurs

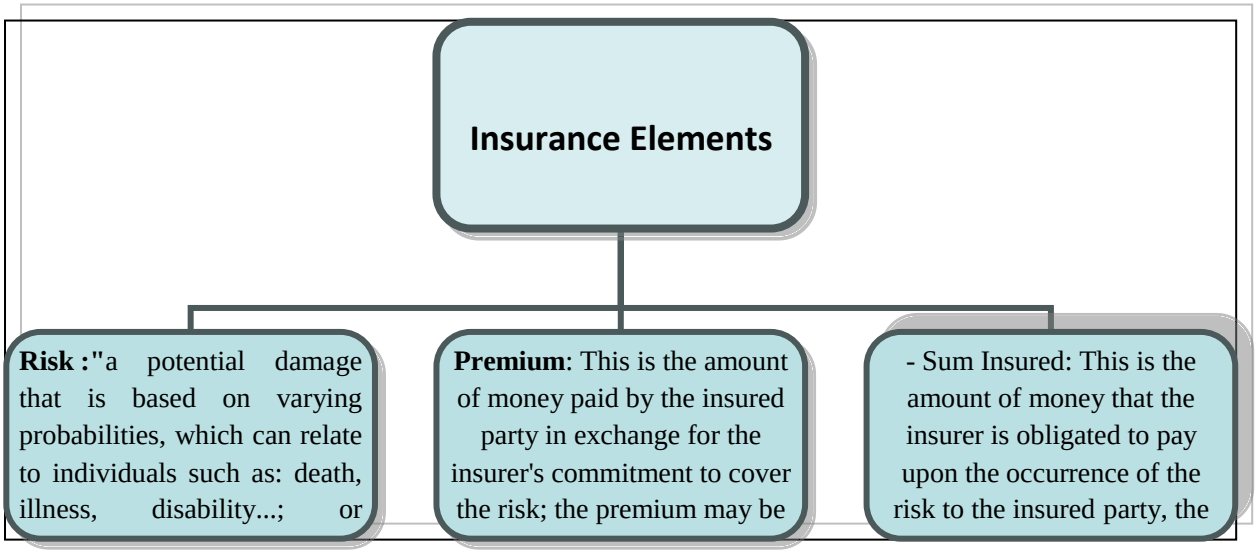
Insurance, in all its forms, plays a crucial role in achieving economic growth and progress for society as a whole, as it establishes the foundations of social and economic stability for individuals within the community.

On the other hand, insurance plays a vital role in aggregating national savings and then reinvesting them in investment projects related to the community's development and economic prosperity plans.

Additionally, insurance significantly contributes to managing the risks faced by various means of production in production enterprises, thereby relieving these productive units of the

burden of risk management, allowing administrators and technicians to focus solely on managing their operations.

3.1.3 Insurance Elements: These elements consist of risk; premium; and sum insured.



Source : Prepared by the researcher based on

- Jadidi Miraj, Introduction to the Study of Algerian Insurance Law, 5th ed., National Institute of University Publications, 2007;p47
- Mohamed Rafiq Al-Masri, Insurance and Risk Management, Dar Al-Zahrahan, Jordan, 1999,p26
-. Youssefi Nour Eddin; Compensation for Environmental Damage; Qasdi Merbah University, Ouargla: https://revues.univ-ouargla.dz/index.php/numero-03-2010-dafatir,

- Insurance Against Pollution Risk:

A pollution incident, for the purpose of insurance against the risks arising from it, is defined in the Environmental Risk Insurance Policy issued by the pollution insurance consortium "Assurpol" as: "the emission, release, discharge, or leakage of any pollutants, whether in solid, liquid, gaseous, thermal forms, or irritants and sensitizers, or pollutants directly from the insured location into or on the land, air, or any watercourses or bodies of water, provided that the leakage, emission, or discharge results in environmental damage. This entire leakage, whether sudden or gradual from the insured location, is considered a single pollution incident."(Youssefi;2010;p03)

Insurance against pollution risk is directly or indirectly connected to the majority of insurance types. This is evident in property insurance, where coverage also includes property losses arising from environmental pollution. An example of this is damage to equipment due to water pollution or harmful gases. Additionally, in life insurance, public health is affected, particularly in cities, due to air and water pollution; however, insurers often find it difficult to attribute such illnesses to environmental pollution, as the causes are frequently obscure and unclear.

3.1.4 Insurability of Pollution Risks: For a risk to be insurable, it must meet certain technical conditions: it should be frequent and measurable, broadly distributed among insured parties, and allow for the determination of appropriate premiums. However, environmental pollution risks rarely satisfy these conditions. Pollution events are often catastrophic, large in scale, and difficult to group into homogeneous categories, making statistical assessment unreliable. When such risks occur, they may cause widespread or simultaneous damages,

preventing the basic insurance principle of risk distribution. Moreover, the potential compensation costs are unpredictable and extremely high, which complicates coverage under traditional insurance methods. As a result, addressing pollution risks often requires alternative mechanisms such as reinsurance or securitization, highlighting their limited insurability.(Qaich;2018;p136)

The risks of pollution fundamentally align with the technical foundations of insurance, although they necessitate alterations and developments in these conditions to suit the specific nature of such risks. It is preferable for insurance against environmental pollution risks to be mandatory, as it provides certain advantages, including ensuring compensation for the affected parties and protecting them from the risk of insolvency of the responsible party. Furthermore, it facilitates judges' ability to mandate compensation from the responsible party, regardless of the amount, because there is a financially solvent entity involved. Additionally, in cases of non-mandatory insurance, the majority of companies responsible for pollution will likely prefer to save the funds they might pay to insurance companies, leading to severe damage to the environment.

Many researchers and experts believe that insurance may not be able to cope with large environmental disasters and cannot provide an ideal solution when such disasters occur; thus, they seek to find more reliable alternatives, including the concept of compensation funds.

4.Compensation Funds: The establishment of environmental damage compensation funds aims to compensate those affected in cases where they do not receive compensation. It also seeks to distribute industrial risks among all participants engaging in activities that cause pollution, bearing all pollution damages in the absence of mandatory insurance. This scenario can lead to their rapid bankruptcy due to the enormous losses resulting from environmental pollution.

4.1 Definition of Compensation Funds: The definitions attributed to compensation funds are varied and diverse due to the multiple forms they can take. Some legal scholars define them as "any system within an organization, union, or association of individuals linked by a common profession, occupation, or any other social relationship, which is established without capital and funded by contributions or similar means, with the aim of providing or arranging for its members or beneficiaries insurance rights in the form of compensations, periodic pensions, or specific financial benefits." Alternatively, these funds can also be described as "a system that undertakes insurance operations against risks typically not covered by insurance companies or those managed directly by the government." It is evident from the preceding definitions that compensation funds serve as a complement to insurance principles rather than a replacement, as these funds play a supportive role in situations where the insurance system is unable to provide equitable compensation for victims.(Laroussi ; Ben Mehra;2012;p62)

4.2 Financing Methods for Environmental Compensation Funds: The issue of financing the fund is one of the most significant aspects, as the effectiveness of the guarantee fund as a complementary compensation mechanism to the insurance system depends on the financial solvency of the fund and its ability to pay the substantial compensation amounts owed to victims of environmental damage. In this regard, environmental compensation funds are financed in various ways; some are funded solely through contributions from industrialists in specific sectors who produce a particular type of pollution and operate in designated areas. For instance, the Dutch fund established in 1972 to compensate victims of air pollution is financed through a tax levied on activities that generate pollution, and it is managed by the

Dutch Ministry of Health. In Sweden, fees are imposed on activities that may harm the environment based on the nature and size of the facility.

and is deposited into a fund that compensates individuals for damages; excluding damages that affect the environment. The same applies to the American Superfund, which is financed through a tax imposed on polluting companies, particularly crude oil and chemical firms. It is also funded through a general pollution fee levied on all American companies. These funds can be financed by contributions from both polluting industrialists and the government, as well as associations or unions representing individuals at risk of pollution..(Qaich;2018;p137)

4.3 Compensation funds have numerous benefits and advantages, including It is explained in the following table. :

Table 3: Summary of Compensation Funds

Aspect	Summary
Purpose	Avoids litigation delays; ensures compensation despite polluter insolvency
Protection Scope	Compensates victims; restores environment; protects public interest
Legal Basis	Environmental rights linked to public interest; harm = tangible damage
System Type	Collective financial security covering catastrophic pollution risks
Independence from Legality	Applies regardless of legality, intention, or severity of pollution
Special Advantage	Covers uninsurable damages; supports restoration of natural sites
When Applied	Used when damages exceed insurance coverage limits
International Reference	e.g., Lugano Agreement links limits to national laws
Practical Benefits	Ensures full victim compensation; avoids slow litigation; polluters contribute

Source : Prepared by the researcher based on

-. Youssefi Nour Eddin; Compensation for Environmental Damage; Qasdi Merbah University, Ouargla: https://revues.univ-ouargla.dz/index.php/numero-03-2010-dafatir,p06

- Bouflega Abdel Rahman; Civil Liability for Environmental Damage; Doctoral Thesis; Faculty of Law; University of Tlemcen; 2016;p297

5. Examples of Environmental Damage Insurance and Compensation Funds:

5.1 Examples of Insurance: Despite the challenges faced by insurance companies in addressing and covering environmental damages—due to the difficulty of quantifying such damages in many cases on one hand, and their inability to adapt to the traditional technical and legal foundations of the insurance system on the other hand—some insurance companies in certain European countries have responded to requests for coverage of such damages within the framework of specific insurance models that attempted to cover the escalating risks of pollution. Among these models is the English insurance market's experience known as the "Clarkson Policy.".(Bouflega;2016;p299)

The English Insurance Market Experience: "The Clarkson Policy" is considered a revolution in the conventional insurance system; it is the first policy that explicitly deviates from conventional insurance principles and follows modern foundations in liability insurance. Furthermore, this policy has abandoned the traditional distinction between accidental and non-accidental pollution. The content of this policy is limited to defining and analyzing various perceived pollution models and determining which ones are insurable or excluded; it includes a schedule of premium rates for each type or form of this pollution in accordance with the size of the risk. The policy identifies pollution models as follows:.(Bouflega;2016;p300)

Intentional Pollution: Defined as pollution resulting from intent or gross negligence in adhering to the regulations and guidelines required to protect the environment;

- Accidental Pollution: Pollution that arises from an unexpected and sudden cause;

- Residual Pollution: Pollution that occurs from the release of pollutants within permissible limits and was unavoidable despite rigorous adherence to monitoring or control;

- Concurrent Pollution: Pollution resulting from discharges that are not permitted to coincide or the prohibited combination of materials that are themselves within permissible limits;

- Latent Pollution: This refers to the release of materials whose harmfulness was not known at the time of emission, with such harmfulness only coming to light following scientific investigation of its detrimental effects. This document encompasses all previous pollution models except for intentional pollution, as it contradicts ethical considerations. Insurers within this system must not provide assistance for intentional unlawful acts, and coverage must be denied where the project's administration has full awareness of the harm caused by its project. The document covers compensations for which the insured will be legally liable due to bodily injuries, material damages, or violations of any legally protected rights that arise from hazards associated with the discharge of any solid, liquid, or gaseous substances; disposal, release, storage, or leakage; or any form of environmental pollution. It also includes expenses incurred to remove or clean the materials from the insured's premises. The coverage amount specified in this document is three million GBP for a catastrophe or for the entire year of coverage..(Laroussi ; Ben Mehra;2012;p74)

5.2 Examples of Compensation Funds:

International Fund for Compensation for Oil Pollution Damage: The international community established the first international fund for compensation for oil pollution damage under the 1971 Fund Convention, which supplements the liability regime established by the Brussels Convention of 1969, amended in 1976, 1984, and 1992. The 1971 Fund Convention acts as an extension of the 1969 Liability Convention due to the similarity in their scope of application, consistently referring back to the provisions of the latter (1969 Convention). As such, there is a complementary and close relationship between the two conventions, which are considered a single block, as the parties to the 1969 Convention have the right to become parties to the 1971 Convention, and its effectiveness is linked to that of the former

It does not contain liability rules but includes rules for compensation. The 1971 Fund Convention aims to utilize the proceeds of this fund to cover the costs associated with cleaning up and removing the effects of oil pollution and compensating for damages. Article 4 of the Convention stipulates that: "The Fund shall pay compensation to any person who suffers damage caused by pollution and who cannot obtain full and adequate compensation under the 1969 Liability Convention; this includes reasonable costs incurred to minimize the damage."

Consequently, the Fund is responsible for paying compensation to states and private entities when compensation amounts cannot be recovered from the shipowner, such as in cases where the owner is exempt from liability under the 1969 Convention. Additionally, in cases where the compensation amount exceeds the maximum liability of the shipowner, the total amount paid by both the shipowner and the Fund for a single incident must not exceed $30 million. The same amount is paid solely by the Fund in scenarios where the shipowner is not liable. The financial contributions to the Fund come from companies and individuals who receive more than 150,000 tons of crude oil and fuel transported by sea annually. The scope and objective of the International Oil Pollution Compensation Fund is to provide compensation for pollution damage to the extent that the legal protection under the Brussels Convention is insufficient or inadequate.

Below is a presentation of some figures and statistics related to compensation funds for environmental damage resulting from pollution and waste

Table 4: Global Examples of Environmental Compensation Funds for Waste-Related Damages

Region / Country	Time Period	Number of Cases / Incidents	Compensation or Costs	Notes	Sources
China	~2018–2025	≈ 55,100 environmental compensation cases	≈ CNY 33 billion (≈ USD 4.6 billion)	Covers soil, water, forest, and solid waste pollution cases	China Daily, 2025
China (solid waste–related, 2019)	2019	945 cases	≈ CNY 2.9 billion punitive damages	Includes illegal solid waste dumping	Ministry of Ecology and Environment, China, 2020
European Union	2007–2013	≈ 1,230 cases under the ELD	≈ €179.5 million (142 cases with cost data); average ≈ €1.26 million/case	Excluding large accidents, average ≈ €354k/case	European Court of Auditors, 2021
Canada	2014–2020	Various awards under multiple acts	≈ CAD 207 million (Environmental Damages Fund)	Revenues from fines, court orders, voluntary payments	Government of Canada, 2020

Source : **Prepared by the researcher based on**

-China Daily– Report on environmental damage compensation cases in China. (2025)

-Ministry of Ecology and Environment, China– Data on punitive damages from solid waste dumping cases. (2020)

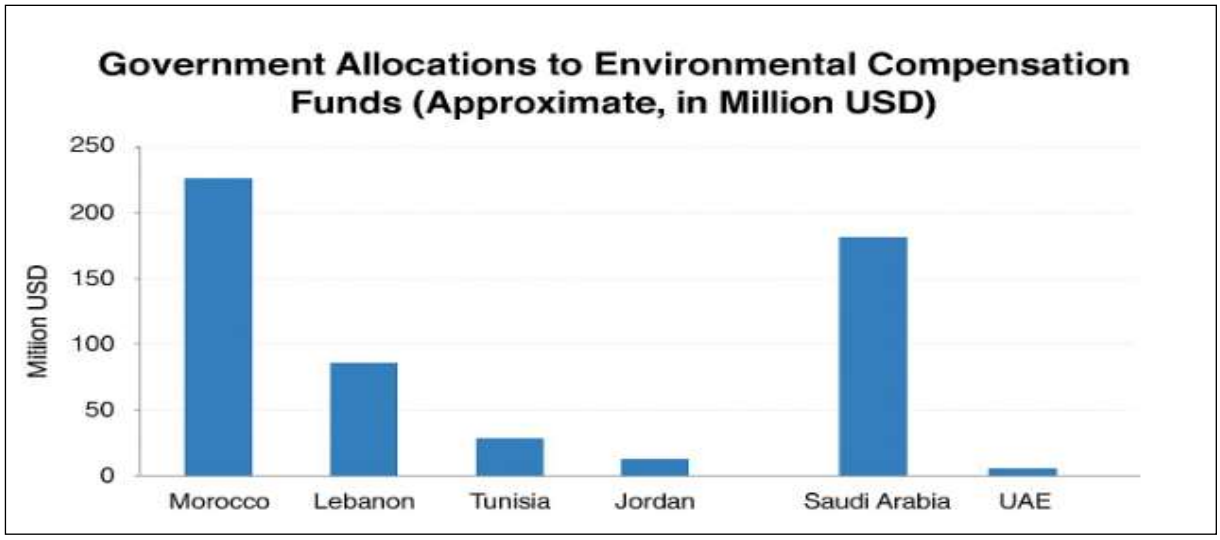
-European Court of Auditors– Special report on the Environmental Liability Directive (ELD) and compensation cases in the EU. (2021)

-Government of Canada – Environmental Damages Fund (EDF) official report and financial data. (2020)

5.3 Case Study of Saudi Aramco:

Saudi Aramco is one of the leading global companies in the oil and gas sector and is considered one of the largest energy companies in the world in terms of production and revenue. It plays a pioneering role in enhancing environmental security and addressing the environmental damage caused by its activities.

5.3.1Amounts Allocated to Environmental Compensation Funds in Arab Countries: Before discussing the Saudi experience, we present below the amounts allocated to environmental compensation funds in some Arab countries :



Source : Prepared by the researcher based on

- World Bank Program for Waste Management, 2024.
- Lebanon Financing Facility (multi-donor funds post-Beirut explosion).2024
-Fund for Agricultural Disaster Compensation ; tunisia 2024
- Jordan Environment Fund (projects financed since 2009/2024).

The bar chart highlights a clear disparity in the scale of environmental compensation funds across Arab countries. Morocco ranks highest, with approximately USD 250 million allocated through World Bank–supported waste management programs, reflecting a strong partnership between international institutions and domestic policy frameworks. Saudi Arabia follows with an estimated USD 200 million, channelled directly into its Environment Fund established in 2019, signaling a strategic, long-term commitment to environmental sustainability.

In contrast, Lebanon (≈ USD 100 million) and Jordan (≈ USD 50 million) present more modest allocations. In Lebanon, financing has been primarily crisis-driven, such as multi-donor contributions after the Beirut port explosion, suggesting the absence of a sustainable funding mechanism. Jordan's Environment Fund, operational since 2009, has focused on project-based financing, yet remains dependent on relatively limited resources compared to Morocco and Saudi Arabia.

Tunisia shows comparatively lower allocations (≈ USD 10 million), mostly directed toward agricultural disaster compensation rather than comprehensive waste management or industrial pollution mitigation. Meanwhile, Algeria, Egypt, and the UAE are known to have environmental funds or related mechanisms, but the absence of consolidated financial reporting reflects limited transparency or fragmented policy implementation.

Overall, the distribution reveals imbalances in environmental governance across the Arab region. Some countries—particularly Morocco and Saudi Arabia—are advancing structured financing mechanisms, while others remain reliant on ad hoc or donor-driven contributions. The lack of reliable data in several states underscores the urgent need for greater transparency, standardized reporting, and the institutionalization of environmental compensation funds to address the growing challenge of waste-related damages**.**

5.3.2. Company Definition:

Saudi Aramco, established in 1933 and headquartered in Dhahran, is not only the world's largest oil company but also a key actor in the global energy governance landscape. Its specialization in crude oil exploration, refining, and gas production positions it at the center of both economic growth and environmental controversies. With an estimated 70,000 employees in 2023, the company represents a strategic pillar of Saudi Arabia's Vision 2030, especially after its historic IPO in 2019, which reflected a shift toward financial transparency and partial market liberalization. .(www.aramco.com)

From a governance perspective, the company's listing on the Saudi stock exchange symbolizes an effort to align corporate practices with international standards of accountability and shareholder oversight. However, its reliance on hydrocarbon activities raises questions about the long-term compatibility between its economic model and global commitments to energy transition and sustainability**.**

5.3.3 Compensation for Environmental Damages at Saudi Aramco : It is explained in the following table :

Table5 Compensation for Environmental Damages at Saudi Aramco (2022)

Aspect	Summary
Incidents	12 hydrocarbon spills in 2022 (20% reduction vs. 2021).
Severity	Major spill in Riyadh: 8,335 barrels (97% of total volume), exposing operational vulnerabilities.
Risk Management	Improved monitoring and risk prevention noted, but large-scale incidents persist.
Environmental Impact	142,880 barrels spilled in 2022; significant ecological footprint from hydrocarbon extraction.
Systemic Issues	Recurrence of equipment failures and pipeline ruptures highlights weak infrastructure maintenance.
Corporate Responsibility	Raises concerns about responsibility, safety investments, and preventive strategies.
Performance Benchmarking	Compared with global oil majors: progress in response times, but ongoing challenges in spill reduction.
Broader Dilemma	Tension between short-term profitability and long-term sustainability within ESG frameworks.

Source : Prepared by the researcher based on

-(www.aleqt.com)

This table summarizes Saudi Aramco's environmental damage compensation record in 2022. Although the number of hydrocarbon spills declined by 20% compared to 2021, the severity of incidents remained significant, especially with a massive spill in Riyadh that accounted for nearly all of the total spilled volume.

The data reveal a paradox: while monitoring and risk prevention measures have improved, persistent large-scale incidents indicate structural vulnerabilities in company operations. The magnitude of spills underscores the ecological consequences and the limitations of reactive strategies, while repeated equipment and pipeline failures suggest systemic weaknesses in infrastructure.

From a corporate governance perspective, these incidents raise questions about responsibility, preventive investments, and environmental stewardship. Benchmarking against international oil majors shows that Aramco has made progress in response times, yet still struggles with reducing overall spill volumes. Ultimately, the case highlights the broader dilemma of balancing profitability with sustainability commitments under ESG frameworks.

5.3.4 Environmental Damage Insurance at Aramco :

Saudi Aramco is considered one of the leading companies globally in the energy sector, and it pays great attention to environmental risk management through comprehensive strategies that include insurance against environmental damage resulting from its activities.

- Insurance Coverage with **Walaa** Cooperative Insurance Company

In March 2023, Saudi Aramco signed a contract with Walaa Cooperative Insurance Company to provide comprehensive insurance coverage for energy products, properties, vehicles, marine products, and other products for one year. The value of the contract exceeded 15% of the total insurance premiums for the fiscal year 2022, reflecting the importance of this coverage in Aramco's environmental risk management strategies.

- The insurance policies adopted by Aramco include comprehensive coverage against potential environmental damages, such as hydrocarbon spills and pollution resulting from production operations. The company regularly assesses environmental risks and updates its insurance policies to keep pace with increasing environmental challenges.

- In the event of environmental incidents, Aramco collaborates with insurance companies to provide appropriate compensation and cover costs associated with environmental pollution. For example, in 2019, Aramco facilities were subjected to a sabotage attack that destroyed part of its production. The Saudi Minister of Energy clarified that insurance companies do not cover damages resulting from sabotage or wartime attacks, which necessitated government intervention to assess and address the losses

6. Conclusion:

The analysis of compensation mechanisms for environmental damages highlights both their necessity and their limitations. While compensation funds provide an essential safety net by ensuring victim recovery, protecting public interests, and addressing otherwise uninsurable damages, their effectiveness is often challenged by the scale and unpredictability of environmental risks.

The case of Saudi Aramco illustrates this paradox clearly. Despite progress in monitoring and prevention, large-scale hydrocarbon spills persist, exposing systemic weaknesses in infrastructure and corporate governance. The magnitude of damages, such as the 2022 Riyadh

spill, underscores the ecological and financial consequences that exceed conventional insurance frameworks.

- **Key Findings :**

- Compensation funds are crucial in addressing catastrophic damages, providing protection for victims, and covering risks that conventional insurance cannot manage
- Despite advances in monitoring and preventive measures, structural weaknesses such as equipment failures and pipeline ruptures continue to exacerbate risks.
- Aramco's record reflects both achievements in spill reduction and persistent challenges in maintaining sustainable environmental governance.
- International benchmarking reveals partial alignment with global standards but also highlights gaps in environmental stewardship.

- **Answer to Hypotheses :**

-The weak integration between the legal framework and environmental legislation indeed limits the effectiveness of compensation mechanisms. Fragmented regulations and inconsistent enforcement reduce the ability to ensure full accountability and equitable compensation.

-The Aramco experience reflects a mixed outcome: on one hand, it demonstrates progress in risk management and compensation practices; on the other, it reveals persistent challenges in infrastructure resilience, corporate responsibility, and alignment with best global practices.

- **Recommendations :**

- Strengthening Legal Frameworks: Harmonize environmental laws and compensation regulations at both national and international levels to ensure consistency, enforceability, and transparency.
- Enhancing Preventive Strategies: Shift the focus from reactive compensation to proactive investment in safety, monitoring, and infrastructure resilience.
- Promoting ESG Integration: Encourage companies like Aramco to fully embed Environmental, Social, and Governance (ESG) principles into corporate strategies to balance profitability with sustainability.
- International Cooperation: Develop global standards and cooperative mechanisms that ensure fair compensation and effective risk-sharing for transboundary environmental damages.
- Stakeholder Engagement: Involve civil society, regulators, and independent auditors in monitoring compliance to build public trust and ensure accountability**.**

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