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Analysis of the Risks of Stranded Assets in the Iraqi Oil Sector under Global Climate Change Policies: An Economic Assessment for the Period 2020-2040

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ABSTRACT

The economy of Iraq is oil based and more than 90 percent of the government revenues depend on the export of fossil fuel. Nevertheless, the nation has come to experience an increasing threat of stranded assets that are oil reserves and infrastructure that can either become obsolete or lose its value because of changing global climate regulations and the energy transformation. This paper evaluates the economic and environmental risk of such risks between 2020 and 2040. It uses both qualitative inputs of stakeholders and quantitative ones of Value at Risk (VaR) and scenario analysis to assess the financial susceptibility of oil assets in Iraq. The authors of the research list largest sources of asset stranding such as international climate treaties such as the Paris Agreement and the shift of the market toward renewable energy, water scarcity, political instability, and institutional flaws of Iraq. Based on the theoretical perspectives of the resource curse, Dutch Disease, and the resource curse theory, the paper presents how the Iraqi economic framework contributes to increasing the risks of fossil fuel reliance. To achieve the suggested direction of economic diversification, the paper suggests the following options: renewable energy, establishing a Sovereign Wealth Fund, reforming the education sector, and utilizing global climate finance. It also contrasts the situation in Iraq to what the other production oil countries have gone through and this will assist in any smooth transitions. Finally, the paper also highlights the fact that Iraq requires unlike approaches to adopting an economic approach to prevent massive financial and social upheavals. It offers a detailed roadmap that the policymakers will need in order to mitigate the risks of stranded assets and create a sustainable and climate-sensitive economy.

1. Introduction

The economy of Iraq is mostly based on oil that contributes close to 90 percent of the state revenues. This reliance helps to achieve growth but it is the one that can lead into the loss of assets as the trends of the world energy can change because of the climate change. The threat of stranded assets is a major one, i.e., investments, which lose their value due to any changes in the market or new regulations. A shift to sustainable energy poses a threat to the Iraqi economy that is based on oil.

The history of Iraq demonstrates the fact that nationalization and immediate increase in

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revenues became disposed of to the geopolitical tension and overestimation of production. These together with the international climate policies put its oil reserves at a risk unless Iraq diversifies by adopting sustainable practices. In addition to financial dependence, tighter regulations, aggravated water shortage, and unending conflicts are some of the causes of asset stranding.

The impacts of these pressures include threats to jobs and finances of governments, investors and local communities. Iraq does not plan to develop renewables or any other sector, such as tourism and agriculture, and the oil resources might run out of value within a short period.

The aging facilities and environmental problems such as gas flaring are also a problem to the country in terms of the infrastructure of oil. Although the recent production growth has been rife, the inefficient production and production targets continue to be a challenge.

The world climate policies are encouraging the reduction of emissions, and the economies that are oil-related, such as Iraq, have to learn rapidly. Lack of adaptation will expose it to a fall in the demand of fossil fuel.

This paper will attempt to tackle these interconnected issues through the case of stranded assets in the oil industry of Iraq. It suggests ways of changing economies in line with the global sustainability objectives. Value of stranded assets will be properly valued to measure the losses and make effective policies in this transition, [1] and [2].

2. Research Problem and Questions

The oil industry is undergoing extreme challenges in Iraq owing to a high dependence on the fossil fuel earnings and the increasing effects of climate change. The problem of stranded assets is a literal danger as the world shifts to greener solutions of energy by investing in assets that lose their value due to externalities in the environment. This is of special concern to Iraq whose more than 90 percent of the government revenues are oil revenues.

The primary issue is the impact of the effects of climate change and the worldwide attempt to cut consumption of fossil fuel on the economy of Iraq in the end. The increase in stricter policies of climate may decrease value of the oil reserves and not only to the antagonists of investments but also to the financial stability of the country overall. The policies also could interfere with employment and national expenditure, escalate social disparities, and create the possibility of political instability as oil reliance diminishes.

This paper addresses such questions: What motivates the asset stranding in the Iraqi oil business? What is the impacts of the current and future policies on climate on investment decisions? How can this be diversified with the economy, to reduce financial losses through the stranded assets?

The questions will help enhance the insights regarding the ways in which climate change will alter the economic environment of Iraq. The study also takes into consideration how the governance shall change in order to address these challenges. The aspect that is addressed through a theoretical framework is on the curse of resource curse so that as dependence on oil increases, the required economic reforms may not be achieved.

The objective of dealing with these points would eventually help to steer Iraq towards a more robust and mixed economy besides mitigating risks associated with the stranding of assets in its oil industry which is the backbone of the economy, [3] and [4].

3. Research Objectives

This study focuses on stranded assets within the oil sector of Iraq and the prospects of climate change and changing global energy policies on this industry. It points out several reasons that led to the occurrence of asset stranding, including the reliance of Iraq on the oil revenues, which comprise about 90% of the total government revenues, and increased

concerns related to climate. It is necessary to consider these factors in order to assess economic risks associated with the possible devaluation of assets.

The paper considers the existing methodologies to assess the financial impacts of stranded assets, through such tools as Value at Risk and scenario analysis. They assist in evaluating potential losses of oil reserves that can be rendered to be inaccessible due to different policies of climate. This assessment helps policy makers, investors as well as other stakeholders to make sense of their vulnerability to this kind of risks.

It also examines how the world global climate agreements have affected the Iraqi oil based economy such as the Paris Agreement. Such policies may disclose weak points in the industry that is already experiencing geopolitical approaches and infrastructure ageing.

The study explores how the Iraqi economy can be diversified beyond oil fuels through the research learning of the other oil producing countries that have managed to reorganize economically. It tries to find practical solutions to curb the stranded asset risks and create long-term flexibility.

The stakeholders develop qualitative data on the value loss associated with asset stranding, which is used to develop equitable transition advice towards the concerned communities.

Lastly, the project should construct a theoretical framework to find out the connection between the effect and impacts of climate and fiscal policy in Iraq. This framework will ensure that the areas of weaknesses are established and policy measures are recommended to alleviate the harm and promote sustainable growth.

All in all, the research aims to gain a better insight into the stranded assets of the oil market in Iraq and facilitate measures contributing to the national needs and international objectives of sustainability, [1], [3] and [5].

4. Research Methodology and Nature

The article on stranded assets in Iraqi oil industry is a qualitative and quantitative study using these research approaches to discover the effect of climate change and global energy policy change. It analyses issues associated with stranding of assets, by applying interviews, and focus groups based on the opinions of government officials, industry professionals as well as the communities living near the asset facility. Such discussions can unlock the determinants of asset stranding in question and can give financial evaluation some reality.

Economic modeling on the quantitative side is done to evaluate the financial risks associated with potentially useless oil reserves. Such methods as Value at risk are used to estimate the potential loss, and scenario analysis can be compared to the business-as-usual and more severe climate policy. This indicates the way the budget and investments of Iraq can react to the changes in global policies.

There is also the study of the overall impact of the global climate policies on the economies that depend on oil such as the Iraqi one. It focuses on the need to be adaptive and constantly keep track of such policies as they transform. The theoretical framework is based on such notions as the resource curse and Dutch Disease to understand the dependence of Iraq on oil revenues in the context of the market and climate changes. This facilitates stakeholder knowledge as well as the economic diversification opportunity analyses.

The study will be reliable because the analysis of the qualitative interviews and the quantitative data are triangulated to show the influence of the stranded assets on different groups in the Iraqi economy and society. Moreover, it discusses viable measures of the economic change through the experience of the other oil-exporting nations, taking into consideration the political and social scenario of Iraq.

Using in-depth qualitative feedback with solid quantitative analysis, the study will fill the gap about the impacts of modifying climate policies

to increase stranded asset risks and how the Iraq economy can be coupled to mitigate such risks, [1] and [3].

The most vulnerable to any weather conditions and the most risky reserves will be regarded as unexploited (Level 5). There are moderate and high risk (Level 34) in infrastructure and the fields during the development stage particularly those that are related to expansion plans. The current producing fields become less risky (Level 2) when they are cheap and close to the export centers.

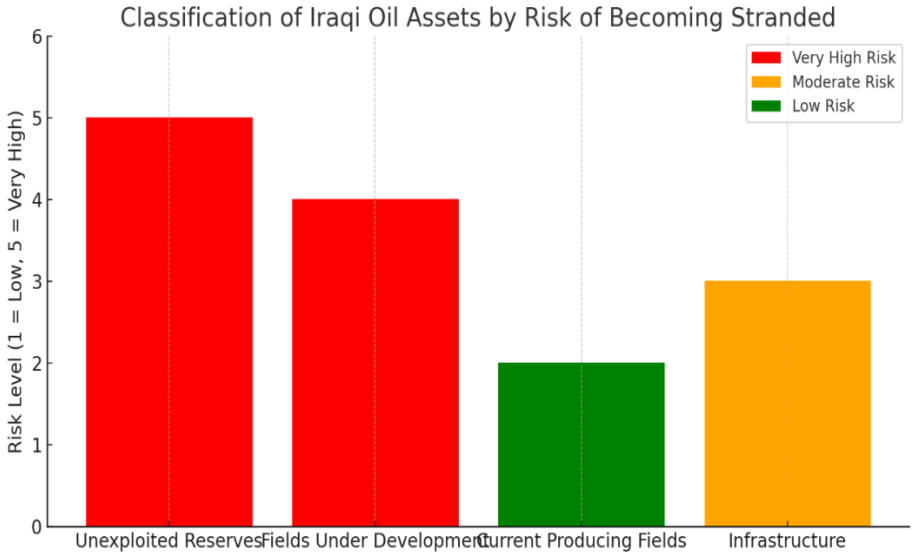

Figure 1. Classification of Iraqi oil assets by risk of becoming stranded.

5. Theoretical Conceptual Framework

The theoretical framework in explaining the stranded assets in the Iraqi oil industry is a combination of the economic theory, environmental policy, and institutional analysis. In the middle of this is resource dependence. The availability of natural resources by countries is usually seen to create problems with the economy such as the resource curse. This causes underdevelopment and stagnation in such nations because they depend on a specific sector such as oil and their economies are at the risk of getting affected by forces in the market.

Dutch disease theory applies as well under this case. Once an oil boom ensues, then it leads to currency appreciation and this renders other sectors such as manufacturing and agriculture less competitive. This has not helped in diversification and sustainable growth in Iraq. With the rise in the national income due to the oil revenues, industries that do not heavily rely on oil have a hard time competing both locally and abroad. This unbalance exposes unhealthy reliance on the fluctuating oil market in the world.

Rentier state theory is another theory that justifies the case of Iraq. Accountability and the democratic institutions are undermined by the overdependence of the state on the resources revenues. States receive greater amounts of resource rents than taxes and this, in turn, means that the states will be less interested in interacting with citizens or in investing in the general development. This cycle makes it a dependency that makes it difficult to reform institutions and fight corruption.

Climate change adds urgency. The situation in the world is becoming low-carbon in its energy and more stringent in relation to emissions, which poses a threat to the oil resources of

Iraq. The low concern of the fossil fuel demand puts financial doubt in place and leaves assets marooned. This provides an intricate interdependence between international climate policy and the economy of Iraq, and further oil investments will be dangerous.

The point is that in Iraq, there is an overlap of economic and institutional trends and the transforming environmental realities. These links are crucial in explaining how stranded assets can be solved and reforms advocated helping us have a more sustainable economy, [6].

Hotelling Rule:

$$P_t - C = (P_0 - C) \cdot e^{rt} \quad (1)$$

Where:
P_t : Net price at time t
C : Marginal extraction cost
r : Interest rate
t : Time
This rule explains why holding oil in the ground is only rational if prices rise faster than interest earnings.

Net Present Value (NPV) of Oil Field:

$$NPV = \sum_{t=0}^{T} \frac{(P_t - C_t) \cdot Q_t}{(1+d)^t} \quad (2)$$

Where:
P_t : Price per barrel at time t
C_t : Production cost
Q_t : Volume sold
d : Discount rate
Used to estimate future value of reserves under uncertain scenarios.

Carbon Budget Constraint:

$$\sum_{i=1}^{N} E_i \leq CB \quad (3)$$

Where:
E_i : Emissions from oil field i
CB : Global carbon budget
If Iraq's reserves exceed the allowable carbon emissions under IPCC goals, they become economically stranded.

6. The Concept of Stranded Assets: Evolution, Types, and Drivers

6.1. Definition of Stranded Assets

Stranded assets are an investment, facilities or an asset that initially was thought to have a lot of value, but now because of external pressures, they lose its economic value hence its unpredictable losses or devaluation. This problem is commonly due to the changes in market trends, technological innovations, modification of regulations and social attitude transformations. Stranded assets have become a pressing issue to industries that highly rely on fossil fuels in as far as climate change is concerned. With the world working harder to reduce carbon emissions and adopt cleaner energy sources, they put the assets such as oil reserves, and the infrastructure tied to them at risk of becoming outdated, or, alternatively, of becoming dramatically less valuable.

The concept of stranded assets became popular because the growing consciousness of the environment issues raised more money on the risks of climate policy. These threats manifest themselves in a number of forms: the stricter regulation of emissions, altering customer demands towards renewable energy sources, switching investment priorities. These are some of the reasons why likely the assets of fossil fuels will cease to be sources of profits and become costly expenses.

On its part, stranded assets are largely made up of deposits of fossil fuel that are not being used at all, but they are still carried on the financial statements. This fact poses significant problems to investors and governments particularly oil dependent countries such as Iraq. In these locations, the intensive dependence on oil dictates not only a budget but it also puts the economy at risk of mounting dangers, with world policies on energy going in the direction of decarbonize.

Understanding the meaning of the stranded assets is essential to the stakeholders who will have to negotiate among the changes that will occur in the future due to the climate efforts. Once the assets have been stuck, it frequently trickles down to the rest of the economy: there

is the possibility of increasing government debt, and changes in fiscal policies will have to be introduced as traditional resource exploitation goes dry.

Relentless dangers of asset stranding have prompted policymakers and companies to take proactive measures on the reduction of fossil fuel dependency. This could include increased investment in renewable energy or support of new sectors that can be used to counter any possible loss.

Simply put, knowing that stranded assets are a complicated phenomenon is the right choice to hedge against any economic shock in the future and develop financial policies that will work well in the new energy world, [2], [7], [8], and [9].

6.2. Historical Context of Stranded Assets in Oil Sector

The concept of stranded assets in oil has undergone a transformation in terms of the changes in economic, environmental, and other geopolitical conditions. The oil industry has experienced significant stages in such countries as Iraq particularly under the government. The introduction of the oil industry as a national industry by Iraq in 1972 was an attempt to control its assets. This was initially a financial crisis as the nation lost international skills and production lowered. However, the earnings of oil exports in Iraq were significantly boosted in two years.

The fear of becoming trapped in oil assets had increased in the early 2000 years when climate change became a concern in the world. The fossil fuel storehouses appeared as risky zones in terms of finance with new international policies in order to reduce carbon emissions. This opportunity came with challenges and opportunities of its own to oil rich nations like Iraq. The Club operation since long ago that oil demand would continue increasing was broken by climate treaties that demanded reduced dependence on fossil fuels.

The situation of Iraq is representative of most of the oil producing countries. Following the instability that ensued after the invasion in 2003 by the U.S. led, there were high hopes of expediency in the rebound of oil production. According to reports made internationally it was expected that Iraq would be one of the largest producers of oil by the year 2020. Nevertheless, because of persistent fighting, ruined infrastructures, and currently the threat of increasing such directly related to climate-related stranding of their assets, these hopes have not been fulfilled.

With the current global energy policies being cognitive of its climatic targets, many of the previously assumed safe investments have since been questioned regarding their future. These turbulent prospects of the fossil fuels subject Iraq to the possibility of losing the value of its oil reserves without a rapid adjustment. This realization of stranded assets points out the existing urgency that Iraq and most such nations should seek alternative economic directions other than oil to develop resiliency as the global energy environment changes, [1], [7] and [9].

Visual Map of Iraqi Oil Fields sub-categorizes them as those of low cost producing oil field (low risk) and undeveloped remote reserves (high risk), with specific concern made with the infrastructures (pipelines and terminals), which could be influenced by changes in demand.

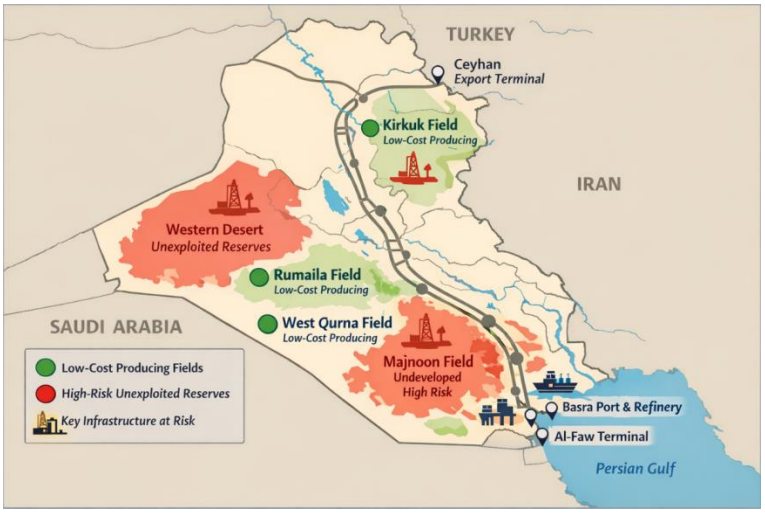

Figure 2. Visual Map of Iraqi Oil Fields divides them into low-cost producing oil field (low risk) and undeveloped remote reserves (high risk).

6.3. Drivers Leading to Stranding in Iraq

The oil sector is a serious challenge in Iraq that may lead to a decline in the value of assets. The nation is very dependent on the oil incomes as it adds approximately 90 percent of the government revenues. Such reliance exposes Iraq to the risk since the world is on the way towards renewable energy and nothing about fossil fuels. As long as Iraq persists in the advancement of fossil fuel production without coming to another alternative, it stands to lose assets that could soon become redundant because of the policies regarding climate change.

The unstable economy of Iraq is aggravated by climate change that brings shortage of water and elevates temperature. These are issues that are a threat to farming and economic stability, particularly in poorer areas where less water is accessed. The effects caused by climate changes may either lead to less demand of Iraqi oil locally or internationally as the markets adjust.

The future and values of assets in oil sector will depend on government policies. The regulations restricting carbon emissions or favoring less harmful technologies can decrease the profits on oil reserves or even make them unsustainable earlier. The regulations demonstrate a trend in the world to have tougher measures on fossil fuels in an effort to contain climate change.

The market forces also influence the oil outlook of Iraq. The future economic perspective of oil economies is being questioned by progress in clean energy and shifting opinions of people. Fossil fuel projects are becoming risky in the eyes of investors and this could result into a decline in financing as well as early depreciation of assets.

There is further difficulty due to geopolitical instability. Unrest would interfere with production of oil and fail to attract foreign investment that is vital to the industry. The political instabilities or wars also make recovery after the conflict complicated because of the unpredictability of the global energy markets.

Altogether, Iraq faces a system of complicated economic, environmental, regulatory and political challenges. The oil industry must also instigate a desperate adjustment in the level of strategy that will enable it to keep in place within a distinctive global energy market, [2], [3], [7], [8], [10] and [11].

7. Theory of the Economic Value of Non-Renewable Natural Assets

7.1. Economic Valuation Methods

The economic methods of valuing stranded assets are important in relating the financial implications of climate change on the industries of fossil fuel and particularly on the

oil sector of Iraq. These techniques assist in the determination of the losses that can be incurred in case of failure on the profitability of investments that might be caused by insensitivities in the market trend or regulatory measures in an effort to reduce carbon emissions.

The Value at Risk (VaR) is one of the widely used approaches. It estimates the possibility of a decline in the asset values in light of adverse situations. As an illustration, literature that uses VaR in big oil and gas companies estimates the unburnable reserves by analyzing the production cost prevailing in the industry. The study demonstrates that even a minor reduction in oil demand will reduce the equity values by 40 to 60 percent due to stranded assets. This shows how risky the investors are when they may underrate the effect of future climate regulations on the fossil fuel markets.

Scenario analysis is also very informative. It deliberates the present lines of investment against the alternative options that are satisfying robust climatic objectives. Research into the impact of various policy arrangements on the value of assets, analysts gain an idea of what economic outcomes can emerge when the rules are varied.

These numerical tools are usually used to supplement qualitative methods. In workshops and interviews with experts, the stakeholders express their opinions regarding the risks associated with assets becoming stranded. This sophisticated method takes into account such variables as investor mood and market behavior that could not be anticipated by numbers only.

Some of the innovative ways are to develop sector-specific indices to quantify the stranding risks in the different fossil fuel industries. With the help of such indices, the levels of vulnerability are easily measured and can enable a policy maker to make decisions that are more informed as well as an investor.

Finally, there is the macroeconomic models that provide further insights. They include stranded assets in the list of variables that can change on a change of policies and market trends. This generalized method of modeling explains the way climate risks are combined with general economics, which gives insight into long-term investments.

The combination of all these approaches to valuation gives the economic interest of the Iraq oil industry a brighter image as it becomes involved in the future under the influence of climate change and changes in the energy markets, [7] and [12].

7.2. Implications for Stakeholders

The stranded assets within the oil industry of Iraq have far-reaching impacts on various organizations such as the government institutions, individuals' investors, the locals as well as the financial institutions. These are assets whose value is diminished by external influences, thus posing a huge risk, particularly to the economies that are highly dependent on the revenues of the fossil fuel such as that of Iraq.

This poses serious problems to the government because oil contributes close to 90 percent of the governmental revenue. In case of stranded oil assets, the revenues of governments decrease. Such a cut constrains taxpayer money in social services and infrastructure development. In the event carbon policies increase the restrictions on the extraction and use of fossil fuels, the situation of Iraqi economy might deteriorate, depressing the activity in the critical sphere even more.

There are also challenging stranded asset risks that face the attention of the private investors. Due to climate policies that are going towards a greener power, fossil fuel may prove less and less profitable to invest in or even become useless. The financial markets may require soaring risk premiums and the cost of capital should rise as a result, on projects associated with fossil fuels. The changing rules and fluctuating commodity prices are also causing market volatility, which is another dimension of uncertainty to investors who are looking at this segment.

The local communities are also losers. The resulting loss in the viability of oil reserves may result in loss of direct employment in industries that are associated with fossil fuels thereby expanding social inequalities in addition to straining the social resources of the population in terms of social support. The already weakened ones might be the most impacted as they experience economic strain with rising environmental strains upon them.

The process to leave oil dependency is something all the stakeholders will need to act in sync. Governments must collaborate with investors and communities through developing strategies that ensure that the economy remains stable though embracing sustainability. The changes in policy should foster diversification, investing in renewable energy and advance the use of prudent models of handling the available oil reserves.

Financial institutions also play a significant position. They are able to impact on the result by borrowing and investing decisions. Such clear information, which is presented in a transparent way, on the environmental risks associated with fossil fuels, will help all the people make more intelligent decisions regarding the management of these assets. Increasing the level of climate-related financial disclosure will help enhance investor confidence and contribute to the emergence of more clean forms of energy.

Finally, the issue of the stranded assets in the oil industry in Iraq requires aggressive cooperation. This type of the teamwork can alleviate social and economic pressures and create a more resilient economy moving in line with global climate priorities, [9], [11], [13], [14] and [15].

Figure 3 simulates the fiscal crisis of Iraq with the climate stress factor, with a decrease of oil revenue by an average of 35 to 10 percent of the GDP, and an increase in the government spending by almost half of the GDP through salaries, subsidies and debt service. What we have got is a growing fiscal deficit of more than 40 percent GDP in 2050, which points to ineffectively sustainable deficits and the strain of borrowing or printing money.

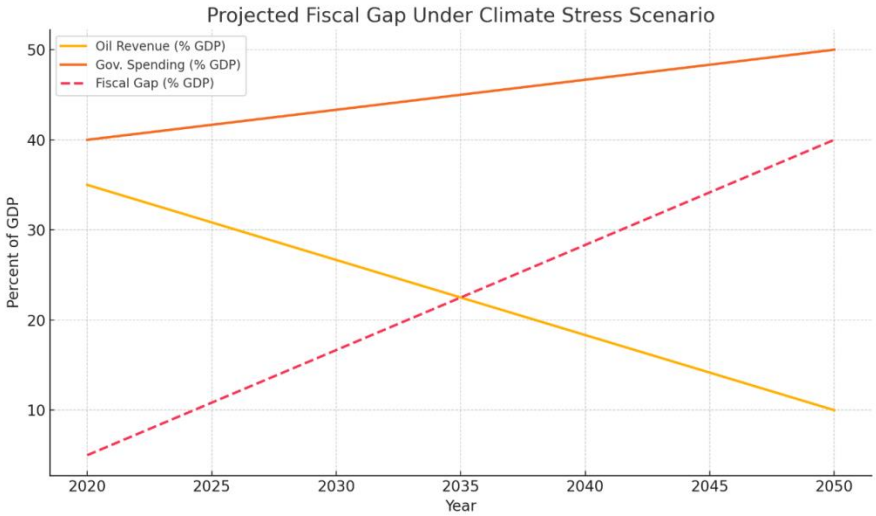

Figure 3. Projected fiscal gap under climate stress scenario.

8. Climate Change Concepts and Global Energy Policies

8.1. Overview of Global Climate Policies

Global climate policies have reported significant changes in the past decades triggered by the increased interest in climate change as a serious global problem. The Paris Agreement of 2015 and adopted by most countries, including Iraq in 2021, aims at ensuring that global warming is kept significantly below 2 degrees Celsius above the pre-industrial temperature. According to this treaty, countries are expected to establish and

report their Nationally Determined Contributions (NDCs), which will include all the plans made by each country to reduce their emission of greenhouse gas as well as adapt to climatic changes.

International cooperation among nations is supported by such efforts as the United Nations Sustainable Development Goals (SDGs), developed as a part of the international community alongside the Paris Agreement. Such frameworks would respond to the problems facing the environment and also promote economic growth and the reduction of poverty. Governments are becoming aware of the world that failing to act on climate will be a havoc to economies. The Stern Review indicates that inaction explains why the world will soon experience high declines for GDP, and thus early actions are the moral and economic imperative. This only increases pressure on countries to adopt low carbon development and to make financial flows conform to these objectives.

The developed countries have offered to assist the developing countries using funds like the Green Climate Fund (GCF) that funds projects that aim at addressing climate change and mitigation. The example of Iraq has indicated that it has been favorable towards getting funding amounted to 10 billion dollars of this fund as a way of addressing the effects of climate and ensuring sustainable development.

Simultaneously, there is increased focus on socio-economic kind of climate policy catharsis. The transition to the non-fossil fuel is associated with severe risks to the countries relying on oil revenues. Stranded assets- the investments that made their way to depreciation with the changes in the market conditions that are more rigorous concerning climate regulation- is the very fact that threatens the economies such as the one in Iraq.

Largely, many countries find it hard to balance between short-term economic requirements and long-term environmental objectives. The issue is not only on emission reduction but also on maintaining energy security and addressing on the public debt during reduced incomes of fossil fuels.

Within this context, the Climate Investment Plan (CIP) in Iraq aims at integrating climate concerns into the investment decisions and encourage the transfer of innovation and technology. This is a strategic action to diversify the economy other than depending on oil, and realize the difficulties caused by changes in climate and sustainability of growth, [16], [17], and [18].

8.2. Impact on Oil-Dependent Economies

Climate change influences the economies that rely on oil in many ways making it a challenge on the fundamental basis of financial systems. The oil affluent countries such as Iraq are threatened not only to their energy industries but also to their economy in general. As the world intensifies its fight to reduce the emission of greenhouse gases, these countries must re-examine their policies and seek other alternatives other than fossil fuels to power the economy.

The economy of Iraq has been greatly dependent on oil revenues to spur growth. However, over-dependence on oil exposes the nation to the world prices that fluctuate and the stringent environmental regulations. With the international treaties urging the governments to reduce the consumption of fossil fuel, the oil revenue of Iraq might be severely affected. To add to that, climate change is likely to reduce water availability, which might complicate and increase the cost of oil production.

The lack of water is also directly related to the pressure of climatic conditions in oil economies due to the interest of water in the extraction of oil. Droughts are complicated by the increase of temperature and the scorching conditions that put the farming population under a threat and burn water resources necessary to operate oil. The fact that Iraq is surrounded by disputes relating to sharing of water among the neighboring countries makes the situation even trickier to use the resources wisely.

The social aspect is also to be considered. Climate stress has a tendency of increasing inequalities. As an example, extreme weather conditions and the shift in climate patterns harm the agricultural communities due to the undermined food security. The process of switching to cleaner energy requires substantial investment in renewable energy; many of the oil-dependent countries do not have the infrastructure or the financial assets to make the conversion process smooth.

Due to this the climate change leaves shocks on the various sectors of these economies, causing the social tensions and political issues. With the changing mood of the population towards environmental concerns instead of coal reliance, governments have no easy options to follow the external movements and domestic demands.

Oil-reliant countries must move very fast in the precarious scenario whereby their future policies and policies on the environment are subject to continual change. An early move to mitigate the risks and immerse in alternative economic growth that will not be heavily dependent on fossil fuels is critical to a stable future, [3], [19], [20] and [21].

A sovereign debt risk map would indicate what might go awry because of credit downgrades and a flow diagram of a social contract would indicate what goes awry with the loss of oil to create a social conflict.

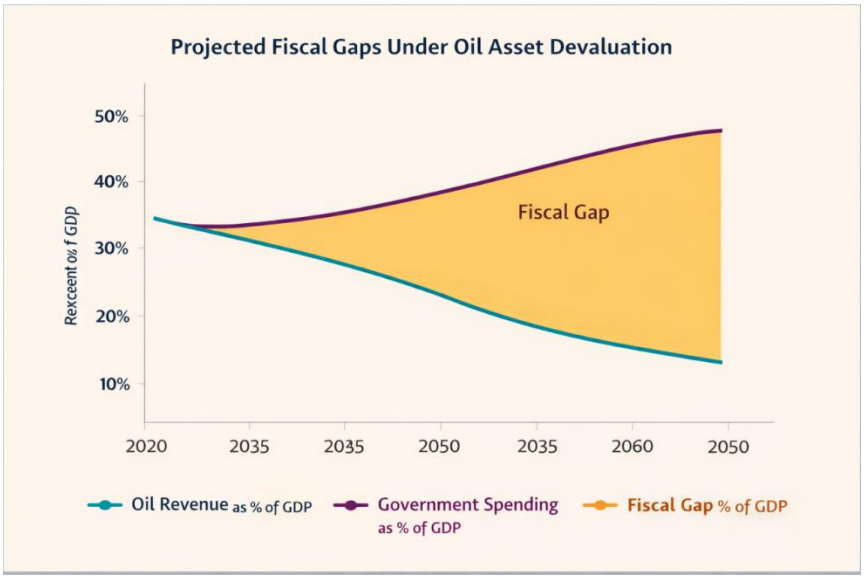

Figure 4. Projected fiscal gaps under oil asset devaluation.

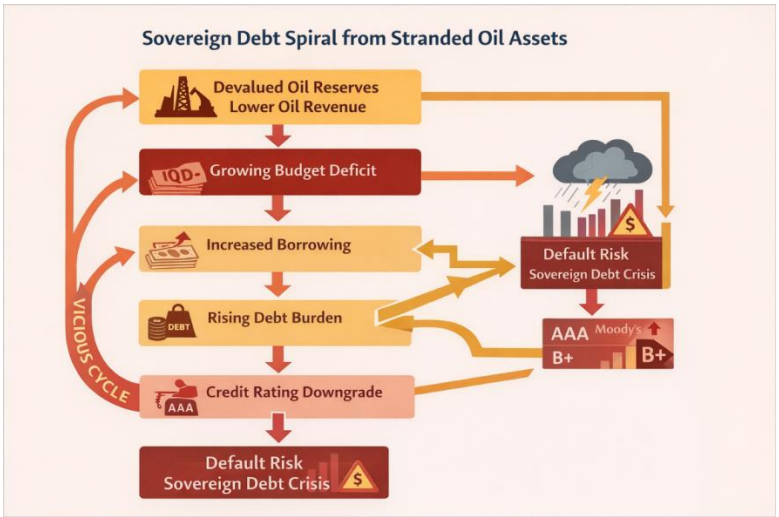

Figure 5. Sovereign debt spiral from stranded oil assets.

This flowchart indicates the causal relationships of a reduction in oil revenues in Iraq that would lead to budget deficits, reduction in government services and jobs, increase in unemployment among youth as well as supporting demonstrations and crisis of legitimacy that would undermine the position of the state.

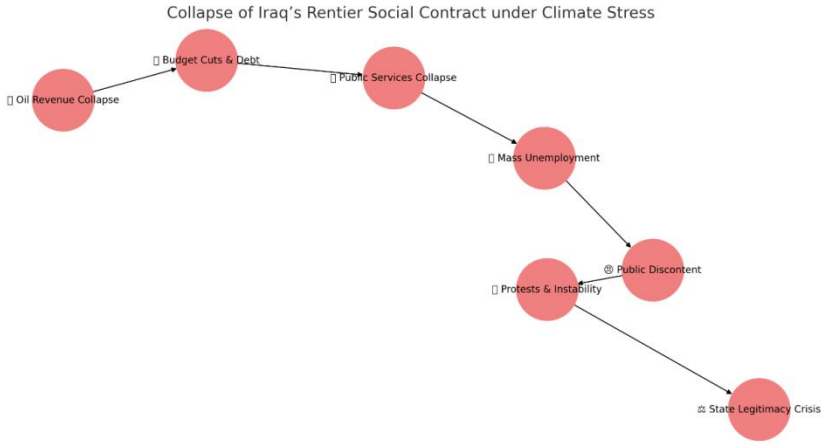

Figure 6. Collapse of Iraq's rentier social contract under climate stress.

Such figure suggests that the reform investments in the field of strategy reform in Iraq and renewable energy and fiscal reform can be enormous variables to reduce vulnerability. Realizing that Iraq is unstable, even a 1 to 5 percent GDP investment in reform can decrease the vulnerability to above 50 times before 2050, however achieving this aspect is only possible on the condition that a reform of the nation is done and on reforming the nation there is also increased resilience to the stranded asset risk.

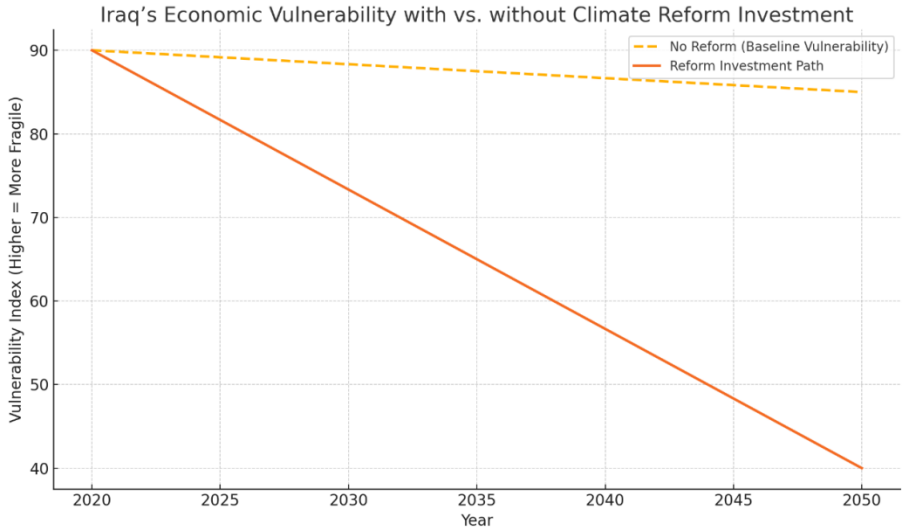

Figure 7. Iraq's economic vulnerability with vs. without climate reform investment.

9. The Iraqi Oil Economy in the Context of Climate Change

9.1. Current State of the Iraqi Oil Sector

The oil industry remains to be one of the keystones of the national economy and it has a lot of influence on the fiscal health and development perspective. Even though Iraq is

one of the largest oil suppliers globally, political instability, poor governance and reliance on volatile oil prices have retarded economic growth. The country almost doubled its oil production in the past decade, which established the country as a major player in the world market. Iraq was provider of approximately a fifth of the incremental world oil supply by 2025.

Nevertheless, the increased output has not contributed to the expansion of the overall economy and improved standards of living of the majority of Iraqis. Trying to depend on oil as its basis, the government budget income is approximately 85% hydrocarbon driven and the finances are prone to external shocks, as well as, oil swings. High dependence on oil also stifles the move to have an economic diversity and creation of other sectors other than the petroleum industry.

The energy system in Iraq is confronted with burning challenges. Refining capacity is pressing to be upgraded to cater to the local demand because a excessive amount of crude oil is being diverted to other refinery plants. In spite of the fact that gas capture has increased, which was the area that Iraq used to be weaker in, the sector still burns more gas than it sells demonstrating unutilized potential.

The government has very high targets, as it is expected to produce about nine million barrels a day in 2030. However, these aims are often sabotaged by inefficiencies in operation and corruption in the state institutions. To further complicate the situation, there is an issue of political power play in the region between the federal government of Baghdad and the Kurdistan Regional Government, and it becomes even more challenging to manage energy resources and share revenues.

There is also the risk of climate change whose impact is another threat to the economic future of Iraq. The increase in temperatures and the decrease in water resources puts pressure on agricultural industries whose survival is indirectly tied to the earnings of oil. The shift in the world to green policies in energy is at hand, and Iraq is in need of managing the shift. Meanwhile, it is attracting foreign investor to create resilience against the effects of climate and lessen its reliance on fossil fuels.

Iraq in a nutshell has a lot of potential given the presence of massive oil reservoirs and increased production, however there is need to address the structural problems to establish a sustainable economic development in the face of changing world energy patterns, [3], [17], [22], [23].

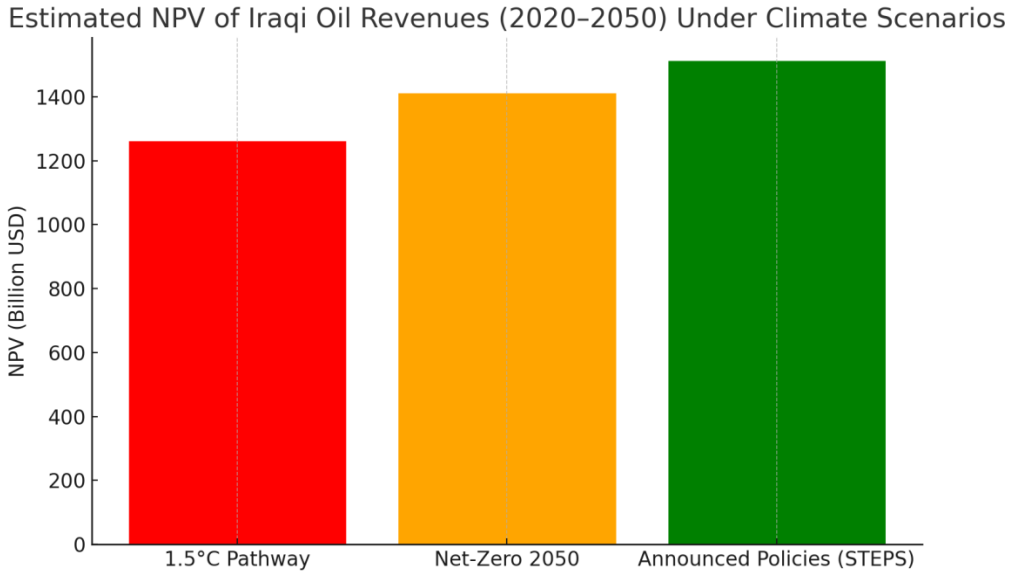

Figure 8. Estimated NPV of Iraqi oil revenues (2020-2050) under climate scenarios.

9.2. Vulnerabilities Exposed by Climate Change Policies

The oil industry in Iraq is vulnerable to tremendous threat of environmental changes and global energy dynamics due to climate change. The economy depends so much on fossil fuel income that any slump in the oil demand will deal a significant blow on the government income. The challenge of decarbonization is significant in numerous countries globally, and Iraq can face the risk of having assets stranded in the oil industry. Simultaneously, Iraq is one of the largest contributors to the greenhouse gas pollution in the region and this aggravates the environmental problems, which in turn contributes to uncertain economies.

The looming issue is the scarcity of water that has been aggravated by the climate policies and the fluctuation of the weather conditions. Increasing temperatures and unpredictable rainfall expose the agriculture sector, which is very critical in supporting the population by nourishing them and offering an opportunity to get employment. Desertification has been rife causing a reduction in the size of farmland thus straining crop production. Since a number of Iraqis rely on agricultural activities as their source of livelihood, a drop in production activity is likely to cause increased unemployment, particularly, to the unskilled workers.

It is even complicated by geopolitical tensions. Iraq depends on the water on rivers that originate in its neighboring states such as Turkey and Iran, whereby up stream water consumption limits the downstream flow water. This diminishing supply does not only put the water security of Iraq at risk, it is also a fuel to possible conflicts over communal resources.

Political and social issues aggravate these vulnerabilities. Instabilities and years of conflict have undermined the institutions of Iraq and it is now difficult to react promptly when the climate pose a threat or implement climate adaptation strategies. The lack of justice in the system of governance is another issue that hinders an effective action. Within this context, climate change serves as gasoline on the already weak social divisions and instability, and putting a burden on government resources to deliver simple services and effectively manage resources.

With the oil revenues in Iraq reducing due to the global push in abandoning fossil fuels, the number of demands on jobs is increasing causing further strains on the social contracts. The country can only become stuck behind unless it invests quickly in adaptation and shifts towards a more diversified economy.

Iraq has to westernize by not just relying on oil but diversify to come up with sectors that can withstand the climatic shocks. Most of the role ought to be strengthening of institutions and the promoting of inclusive growth that will help to absorb the blows of changes that are caused by the environment and economy. It is only through these compounded issues that Iraq will be in a better position to seek a better and balanced course ahead, [3], [20], [21] and [23].

It has exit and transition policy pictorial choice trees of early abandonment of oil field, re-Investment opportunities such as renewable and sovereign wealth funds and choices of a controlled or uncontrolled decline versus breakdown.

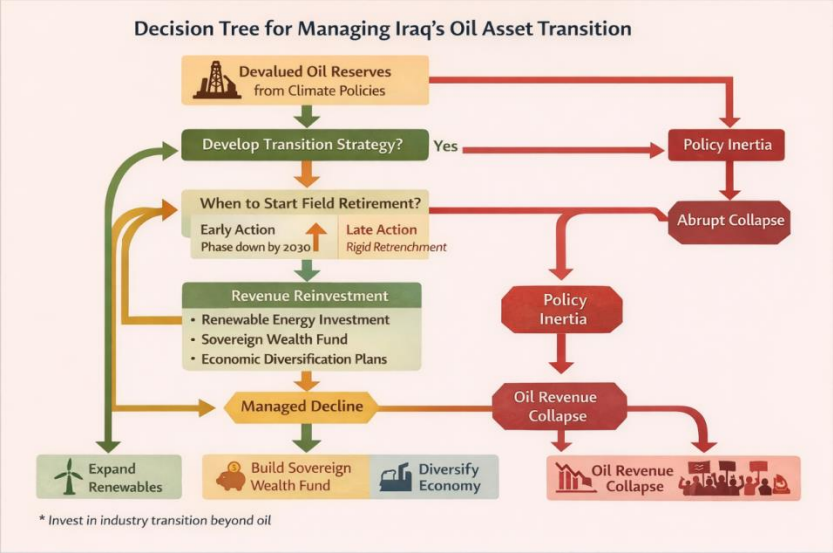

Figure 9. Decision tree for managing Iraq's oil asset transition.

10. General Features of the Iraqi Oil Economy

The economy of Iraq is also dependent on the oil sector with the revenues constituting approximately 90 percent of the government revenue and approximately 60 percent of the GDP in the country. The global oil prices are of particular interest to Iraq since it is highly dependent on them. The government budget pinches when demand is sluggish in time of economical de-acceleration. Though Iraq has a very old tradition of being one of the key players in the world energy markets, the country is meeting the challenges of old-fashioned infrastructure and the necessity to be modernized.

The country has the largest oil reserves in the world and is being one of the biggest producers. Nevertheless, it has massive challenges of increasing its production. Technology in aging, insufficient investment in refining and other environmental factors such as flaring of natural gas reduces the pace. Although Iraq has come far in capturing an increased amount of gas, Iraq continues to burn more than it sells thus demonstrating inefficiencies of the energy industry.

Other than oil, the Iraqi economy is poor in other aspects. Historical preoccupation with free-market policies ultimately suppressed the industrialization process such that agriculture and manufacturing have not been utilized to the expected capacity of raising GDP and to generate employment. Services now refer to 70 percent of the non-oil GDP in 2024, yet this change appears to be hurried. Decades are later taken by other countries to build robust service sectors having established a solid industrial base.

The issue of climate change already burdens the Iraqi economy that relies on the state of oil. The climate effects like water shortage jeopardize agriculture and the economy in general. Rising desert lands and upstream dams reduce water supply as well as arable land, which threatens food security. It is on this backdrop that Iraq is increasingly getting risky by clinging to fossil fuels because the world is shifting towards decarbonization.

Iraq must undertake strategic reforms in terms of energy management and economic management in order to mitigate these risks and achieve sustainable growth. Renewables are the way to go in order to alleviate reliance on oil and address environmental issues that might otherwise see precious resources stranded, [5], [6], [22] and [23].

11. Detailed Qualitative Assessment of Value Loss Implications

The oil industry in Iraq has some concerns because of the tightening of the climate policies, and the world goes towards the use of cleaner energy. The price of the massive oil deposits in Iraq is dropping with the danger of the significant losses of investors, not only to the oil investment companies but also to the government enterprises that peg the economy. These resources will not be profitable as soon as anticipated as the world demand reduces; it will be costly to extract fossil fuels.

The opposition of the individuals who have close connections with the oil sector also makes change complex because they put an emphasis on short-term gains and postponing the diversification of the economies and introducing green technologies. This delay may result in higher losses because the markets will punish the players that do not comply with the climate standards.

The social and economic stability is also at stake because of stranded assets. Losses in jobs through cut down in oil investment damage livelihoods and may lead to unrest. Economies reliant on oil are thrown into turmoil without proper planning on how to shift to other environmental friendly industries.

The declining demand and increasing carbon taxes will result in a fall in government revenues of oil exports. This decreasing may limit funds on basic services such as healthcare and education increasing social inequalities.

Iraq, in response, needs to intensify institutions and market policies that improve skills and innovation in other energy. It requires a real dedication between the official and nonofficial sectors to open assets management and find the way out of such impressions.

These risks are shared by other countries that are also oil dependent and they provide the lessons through their experience. The collaboration of energy transformation can assist Iraq to avoid errors and implement measures that minimize risks and promote the growth according to the global climate objectives.

Finally, Iraq should have integrated economic planning, flexible institutions and community involvement because it requires an equal and painless transition out of fossil fuels and into a more sustainable future, [7], [13] and [24].

12. Theoretical Discussion and Economic Foresight

The problem of stranded assets is a big issue in the face of climate action globally, particularly to such countries as Iraq, which highly rely on fossil fuels. These are investments made in the past that can be killed by new policies, development of new technology or by alteration of market demand. The existence of oil reserves and infrastructure is endangered in the oil industry of Iraq by the climate policies and increasing sustainability concerns.

Learning about stranded assets implies writing about physical risks, such as damage caused by extreme weather, and transition risks, which are caused by changes in policy. The physical risks are direct because of their damaging nature, but transition risks have more relations to the economy of Iraq, which depends upon fossil fuels. The policies on emission cutting may decrease the value of oil assets drastically.

Stranded assets influence investors, businesses, and governments, and all of them have to assess financial risks that are related to climate. With an increase in carbon charge and control, fossil fuel deposits have a high likelihood of depreciating and losing value in the market. The fall in oil demand even moderately can lead to excessive falls in the oil company stock.

These risks are now seriously considered in the financial markets. The stranded assets are no longer a remote concern to many investors but a contemporary threat to the portfolio. This contributes to the transitions to the renewable energy and sustainable industries.

The future prospects of the country dictate that Iraq has to reduce its dependence on fossil fuels lest it suffer severe economic effects due to assets locked in the ground. The

policymakers are required to establish systems that foster a sustainable growth and the adoption of green technology. By so doing, the economy of Iraq would be better placed concerning climate objectives aimed at changing the global energy.

In addition, a problem brings up the issue of social fairness and national security. The only way to overcome these challenges will be through a concerted effort of governments, financial institutions and communities so that there is an inclusive and resilient transition, [7], [9] and [12].

13. Possible Alternatives for Economic Transformation

In the case of the oil industry in Iraq, the transition is necessary to stop the use of fossil fuels because of climate change and the worldwide change of energy towards clean energy. Banks on large-scale oil revenues run a risk of incurring stranded assets losses. Iraq needs to follow a wide-range strategy that will help it transform the economy.

Renewable energy is a good prospect in investment. Solar and wind energy is the center of interest of most countries with an aim of minimized carbon emission, and Iraq can do the same. Development of a robust renewable industry would reduce risk, provide employment and foster technological advancement.

Another important step is to create a Sovereign Wealth Fund. This fund would offer stability to the fluctuation of the oil market and fund projects in technology, agriculture and service sectors. It might also attract the flow of foreign investment and enhance infrastructure among the new industries.

It is important to build local skills by training and educating. Other training of workers on green technology sectors will assist in minimizing the loss of jobs due to less production of fossil fuels. Both the public and the private sectors should be promoted through government incentives to promote the development of workforce in line with the changing job market.

It is essential that there is cooperation between the government, businesses, and communities. Open discussion implies fair investments of new sectors and reasonable management of the available fossil fuel.

Assistance of climate objectives in national plans such as the Climate Investment Plan presents a connection between environmental accountability and the economic development. This plan encourages the investments in renewable and sustainable practices of water and agriculture in order to stimulate innovation and response to climate change.

Lastly, the policy of other oil-producing countries can be studied by Iraq. The country can use this knowledge to facilitate a smooth transition, and not lead to any social or political tension.

These measures will put Iraq on a new course where it is no longer reliant on fossil fuels but a diversified and sustainable economy that will not be affected by the changes in the world energy prices, [3] and [16].

14. Comparison with Experiences from Other Oil-Producing Countries

The issue of stranded assets in the oil sector in Iraq is a serious challenge that is in need of a lesson learnt by other oil producing states. An example of this is Kuwait that is largely dependent on oil, as it comprises over one-half of its GDP. Similar to Iraq, 90 percent of the government revenue in the country is through oil. The unsuccessful efforts to diversify Kuwait demonstrate how overreliance on fossil fuels is risky, particularly with the global climate policy that promotes the use of cleaner energy sources.

Both Kuwait and Iraq face threats in the move towards a decline in the global demand that is based on fossil fuels. The declining prices and competition endanger their oil revenues and it is thus an emergency to invest oil into long-term financial resources. This vulnerability

shows the susceptibility of these economies to fluctuations in the global energy conditions.

Conversely, Saudi Arabia and the United Arab Emirates do not only increase the production of oil but also invest in other sectors. The approach will cushion them against lost assets and equip them against changes in the energy markets. However, despite their problem of corruption and deterioration infrastructure, Iraq can take their lead and balance on the growth and the economic diversification of the country.

Another viewpoint is taken by the Latin American countries. Their less rigid institutions facilitate the movement toward the utilization of fossil fuels. There are diverse examples of such a touch of sustainability and tradition, Brazil, in particular, makes investments in renewables without losing dependence on fossil fuel. This would imply a direction whereby Iraq would integrate both new investments and sustainable operations to minimize events of future losses.

The emphasis on the necessity of involving all the stakeholders and modifying the policies can be traced to the emphasis of Europe on just transitions. The excellent governance and adaptable nature of the Chinese economy is an indication of how receptiveness to innovation assists in adapting to the changes of climate. Iraq can draw the lessons of these diverse experiences, developing options of sustainable, resilient development under the pressure of climate, [7], [25], [26] and [27].

15. Conclusions and Recommendations

This study reveals a point at which the Iraqi oil industry has reached a crossroad due to the change in energy policies of the world and climate change. It is important that policymakers realize that highly depending on oil income can pose significant risks of stranded assets, as it was mentioned above. The history of the country demonstrates the interconnection between the geopolitical conflict and the changes in climate and the economic future of the oil investments in Iraq. Then, a change of strategy to diversification is not only prudent, but it is crucial.

In order to meet the demand and needs of climate policy and shifting markets, this policy ought to develop a diversified economy that reduces oil dependency. As emphasized earlier, Iraq needs to get out of the rent-driven system into a sustainable system that is more conducive to innovation and open entry in new industries. This implies it should consider investing in renewable energy sources, which do not only assist in achieving envisioned climatic targets, but also create employment opportunities.

Establishing Sovereign Wealth Fund would help in safeguarding the economy against fluctuations in oil prices and ensure that the future generation will enjoy the fruits of the present prosperity. The visibility of the management of this fund shall increase the publicity confidence and make sure that money is directed to developing infrastructure and clean energy initiatives.

It is not less important to invite key players to the discussion table. Initiating discussions with the local communities, industry stakeholders as well as the civil society will establish mutual understanding and collaboration. Once the risks related to stranded assets are the subject of the conversation of all, the way out of fossil fuels will become more apparent and possible.

An Iraqi study in the energy field needs to focus on the energy policies that are based on the experience of other nations in the world in terms of managing fossil fuels. These studies will provide valuable insights on how other nations achieve such strategies that the Iraqi decision-makers can have more resources to develop voting policies.

The other chord in the music is funding. The economy of Iraq will be at risk when there is a lack of sufficient renouncing infrastructure investment or planning transition, as environmental pressure will continue to increase. International cooperation would be able to consolidate financial resources in the context of sustainable changes and address pressing social and economic issues.

In short, to be able to embrace the policies that would ensure the safety of environment and at the same time be economically robust is the way forward regarding the stability of Iraq. Reevaluating the issue of oil dependency and achieving diversification by developing effective rules and open-minded communication, Iraq will be able to meet the challenges of climate directly and open the opportunities to evolve.

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