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**Study of The Impacts of Desertification
on Economic aspect in The Kingdom of Saudi
Arabia
(PROPOSAL)**

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■ Introduction

The United Nations Convention defines desertification as land degradation in area, semi-arid, and dry sub-humid areas. The definition further recognizes human and climatic variations as the major contributing factors to the phenomenon. According to the existing statistics, drylands cover about 41% of the Earth's surface and support the livelihood of more than 38% of the global population. The United Nations Convention to Combat Desertification estimated that about 36 by 10^6 km² of land surface was desertification, presenting a major threat to livelihoods (Feng et al., 2019). In the arid and semi-arid regions such as the Middle East and northwestern China. Cheng et al. (2018) argued that desertification affects most dryland countries and still expanding across many parts of the world amidst the rising threats of climate change, population growth, rural poverty, and food security. The UN estimated that drought and desertification cause an estimated annual loss of 120,000 square kilometers of land globally, making it a major problem worth exploring. The continued loss of arable land exposes global population to high poverty due to low productivity.

Land degradation through soil erosion and desertification is a major socio-economic issue that affects both the livelihood and economic conditions of a society. Several studies have attempted to explore the concept and its economic consequences. Salvati, Zitti, and Ceccarelli (2008) identified desertification as a complex phenomenon that reduces soil fertility, lowering economic growth. Tokbergenova, Nyussupova, Arslan, and Kiyassova (2018) also highlighted desertification as one of the major problems affecting societies. According to Malek (2018), an estimated 3.2 billion people across the world experience the negative effects of land degradation. The report also demonstrates that about 143 million people could migrate from their communities due to water scarcity and reduced crop productivity. More reports indicate that about 70 to 90 percent of the population in the Arabian Peninsula is at threat of the adverse effects of desertification. Therefore, it calls for an understanding of some of the economic effects of the phenomenon on the global population. The effects on the socio-economic well-being of communities make it an interesting topic to exploit and establish the effects and some of the mitigation strategies.

Desertification influences the socio-economic and agricultural activities in societies, threatening economic growth and development. It is becoming a major problem in most parts of the world, threatening the long-term sustainability of societies. The degradation of land in arid, semi-arid, and dry sub-humid areas arises from climatic changes and human activities as the main driving forces. Some of the direct factors responsible for desertification are

deforestation, water erosion, salinization, and wind erosion. It results in a significant loss of biodiversity that depends on the land and water resources for their livelihood. The economic consequences of these practices extend to different sectors including agriculture, tourism, and international trade, which are critical components of economic growth.

The Kingdom of Saudi Arabia (KSA) is one of Middle Eastern countries with increasing desertification. According to Malek (2018), arable land in these regions is increasingly turning into deserts threatening the livelihood of the population. It affects food security, socioeconomic stability, economic development, and biodiversity. Current reports highlight KSA as a predominantly arid and semi-arid country with no rivers while the daily per capita water use remains high (Sayl et al., 2021). The low vegetation cover in the country exposes it to more climate change problems, further threatening the population's well-being. Therefore, based on the significant desertification risks in the KSA, the study will exploit some of the potential economic consequences of the phenomenon that inform the mitigation strategies at different governance levels.

One of the main motivations of exploring the topic is the significant increase in desertification in KSA over the past three decades. The economic consequences also make it an interesting area to examine. Desertification also creates water shortages hindering proper agriculture, particularly in the gulf. It is also a threat to sustainable tourism and economic development in these countries. Climatic conditions such as reduced precipitation, increased temperature, and drought are some of the major causes of desertification in areas with forests, grasslands, and sparse vegetation (Alrwis et al., 2021). The overall significant decline in precipitation and increased temperature arises from the increased carbon emissions that result in global warming and climate (Sayl et al., 2021). It creates unpredictable weather patterns that encourage drought and desertification in these areas. Desertification exposes land to significant economic and environmental damages (Tokbergenova et al., 2018). Reduced crop yields, pasture productivity, and decline in livestock and export potential of agriculture (Tokbergenova et al., 2018). Although countries such as the KSA hardly engage in agriculture, desertification is a major threat to reduced economic prosperity in other areas such as tourism (Alrwis et al., 2021). The reduced crop and livestock yield implies that the country will record a significant fall in agricultural exports (Alrwis et al., 2021).

The main issue that the study will address is the economic impact of desertification in the KSA. Over the past three decades, KSA has experienced a significant deterioration of arable land through land degradation processes such as soil erosion and desertification. Coupled with

the effects of climate change, desertification is presenting a significant impact on the country's economic wellbeing. From reduced agricultural productivity to disruption of biodiversity, that affects tourism, uncontrolled desertification could threaten the economic stability of the country. Although KSA is heavily dependent on oil and natural gas resources, the depletion of these resources in future may require a shift in focus to agriculture and tourism. However, this may come at a time when the country's arable land is depleted due to desertification. The research will address the economic impact of desertification in KSA. The sub-problems that the study will seek to address will include the extent to which desertification is affecting agriculture, tourism and international trade, as major export components.

The study will also address some of the underlying drivers of desertification in the KSA such as soil erosion, climate change, and saltation. My research will focus on how human and economic activities such as urbanization and exploration of natural gas and oil in KSA is contributing to desertification. Based on the drivers, the study will also examine the extent to which the current mitigation and adaptation approaches are effective in addressing the problem. The KSA government is adopting mechanisms to combat the growing desertification in the country and curb some of the adverse economic consequences. The research will propose more strategies that the government and other stakeholders could adopt to promote resilience.

The increasing desertification in KSA is posing a significant economic threat to the country. From reduced agricultural productivity to declining tourism, it could significantly affect the economic competitiveness of the country in the region. An examination of the economic impacts will be significant in understanding the extent to which desertification could threaten the GDP growth and global economic competitiveness. The study will also make significant contribution towards the growing literature on economic consequences of desertification. Although there have been past attempts to examine the economic effects of desertification, few of these studies have focused on the KSA. The research will add to the general science field of land degradation and related processes such as climate change and soil erosion. The topic is more relevant at this time when climate change concerns are occupying global research space and governments seeking ways of protecting their resources.

■ Research problem

Based on the introduction, the research problem of interest in the current study will be that there are significant impacts of desertification on various aspects of the KSA with the main being its economy. Research on the economic consequences of desertification in arid areas such as the KSA remains inconclusive. While desertification will increase erosion and drought, the economic consequences such as reduced GDP growth, increased unemployment rates, and reduced exports remain inconclusive. Most of the existing studies focus on the indirect social influence of desertification on economies with little attention to economic factors. The study will address this gap by exploring some of the economic influences such as reduced agricultural productivity, increased unemployment rates, reduced export value, and low GDP among other key economic indicators related to agriculture. The study will extend the existing research to explore some of the economic consequences of the phenomenon and the mitigation strategies that the KSA government could adopt to limit the effects on its economic progress.

Question:

What are the economic impacts of desertification in the Kingdom of Saudi Arabia? And how does it affect local and global economies?

Sub-Questions:

- What are some sectors of how desertification has impacted local economies?
- How does desertification affect regional economies and tourism sectors?
- What are the underlying drivers of desertification? And how to evaluate the effectiveness of current mitigation and adaptation approaches?
- What are the recommended sustainable strategies for combating desertification and promoting resilience in affected regions?

■ Research importance and objectives

The study will make an important contribution to the growing research on the effects of desertification. While most of the existing studies have focused on the social and health impact, there is a gap in the economic effects. The research will identify some of the direct and indirect economic consequences, informing the sustainable strategies the KSA government could adopt to mitigate it and promote resilience in the affected areas. The study will also be important in understanding the underlying drivers of desertification and evaluating the effectiveness of the existing adaptation and mitigation approaches. The findings will help various government stakeholders to understand the weaknesses of the existing mitigation strategies and formulate the best techniques that yield the desired outcomes. The research will focus on addressing the following specific research objectives.

1. To analyze the economic harmful points of desertification, including effects on regional economies and tourism sectors.
2. To identify the underlying drivers of desertification and evaluate the effectiveness of current mitigation and adaptation approaches.
3. To propose sustainable strategies for combating desertification and promoting resilience in affected regions.

■ Research Hypothesis

Null hypothesis: There is no significant relationship between desertification and the country's economy.

Alternative hypothesis: There is a significant relationship between desertification and the country's economy.

Based on the hypothesis, the research will involve economic conditions (GDP growth, GDP, unemployment rates) as the dependent variable while the desertification measures such as percentage of dryland cover will be the independent variable. A correlational and t-test will help establish the type and strength of relationship between the variables.

■ Literature review

Major Drivers of Desertification

Desertification remains a major ecological and environmental problem in most parts of the world. Various scholars have explored the concept of desertification, its driving factors, mitigation measures, and socio-economic impact on societies. Jiang et al. (2019) identified human and climatic factors as the major drivers of desertification. According to the authors, climatic conditions such as reduced precipitation, increased temperature, and drought are some of the major causes of desertification in areas with forests, grasslands, and sparse vegetation. The overall significant decline in precipitation and increased temperature arise from the increased carbon emissions that result in global warming and climate. It creates unpredictable weather patterns that encourage drought and desertification in these areas. However, in areas with sparse vegetation, Jiang et al. (2019) argued that human activities were the major drivers of desertification. In regions such as Central Asia and the Middle East where there is significant exploration of oil and natural gas, there are major activities geared towards resource exploitation, resulting in damage to existing vegetation.

According to Kirkby (2021), climate change and global warming will continue to increase aridity in most parts of the world. Climate change will result in low rainfall, intensifying abandonment of farmland and threatening afforestation (Kirkby, 2021). The author argued that human activities are continuously modifying climate change, threatening environmental sustainability. Kirkby (2021) further introduced the concept of land desertion as a cause of desertification and climate change. According to the author, the perception of greater prosperity in other regions makes people migrate, increasing competition for scarce resources and encouraging encroachment into productive lands. The migration pressure due to expanding arid and semi-arid lands threatens environmental sustainability as households encroach into forests, resulting in deforestation and desertification. Jiang et al. (2019) also identified large-scale human migrations and free markets converting to planned economies can lead to desertification. The authors also viewed human activities from the perspectives of changes in agricultural practices and anthropogenic disturbances. Changes such as the expansion of irrigated agriculture often lead to shrinking lakes and increased irrigation water (Jiang et al., 2019). Besides, the abandonment of distant pastures, the collapse of animal husbandry, and the abandonment of extensive croplands are also changes in human lifestyles that are making major contributions toward desertification (Jiang et al., 2019).

Han, Wang, Chen, Xiang, Ling, Li, and Wang (2021) also analyzed the driving factors of desertification using a geographic detector model. Some of the driving forces identified in the study include meteorological, human, and environmental. According to Han et al. (2021), meteorological factors such as evaporation, temperature changes, wind speed, and precipitation cause significant effects on desertification. Increased temperatures and reduced precipitation due to climate change result in reduced rainfall that causes desertification. Han et al. (2021) argued that these climatic conditions result in sparse vegetation, especially in basin areas, making desertification control a challenge. Although increased temperature triggers high precipitation, it has negative effects in arid and semi-arid regions. Moreover, Han et al. (2021) highlighted topographical factors such as distance from water sources and soil as major contributors to desertification as they influence vegetation distribution. Finally, other human activities such as excessive reclamation, overgrazing, and extensive resource development through mining and exploration of oil and gas will have a major impact on vegetation.

These studies cover important aspects of contributing factors to desertification, which will help identify the underlying drivers of desertification and the effectiveness of current mitigation and adaptation approaches, which is one of the objectives addressed in the current study. My research will expand on the driving forces identified in past studies, focusing more on human and climatic factors.

Economic Impact of Desertification

Desertification presents major economic consequences that if left unchecked could threaten the economic sustainability of societies. These effects extend to various sectors of the economy such as agriculture and tourism, negatively affecting the economic growth of societies. Cheng, Lu, Wu, Yin, Bao, and Gong (2018) discussed some of the costs of desertification in China. According to the authors, it lowers economic growth due to the reduction in land productivity. The declining agricultural productivity implies that society will not sustain its needs, lowering nutritional levels and increasing poverty rates (Cheng et al., 2018). From loss of arable land area to loss of plant nutrients and soil organic carbon, and reduction in effective rooting depth, the decline in agricultural productivity will hinder economic growth for societies that heavily depend on agriculture.

Desertification increases the susceptibility of arable land to soil erosion, significantly causing poor economic growth (Cheng et al., 2018). In an estimate of the economic loss of desertification in China, Cheng et al. (2018) reported that the country loses about CNY 54.1

annually. Economically, reduced agricultural productivity results in low GDP. Governments may also increase their investments in productive alternatives, shifting focus from other areas that could drive overall economic growth (Albati, 2023). According to scholars, the indirect costs of desertification may include damage to human health by sand-dust storms and property. For example, they estimated the cost of siltation at CNY 1,639 million for river courses and CNY 500 for reservoirs. It may generate major costs associated with transportation due to damages to railway and highway facilities. The costs and financial losses due to desertification present major economic consequences to communities and governments.

Tokbergenova, Nyussupova, Arslan, and Kiyassova (2018) identified erosion as one of the most dangerous forms of land degradation, resulting in soil destruction and blowing off the top layer of productive agricultural land. Desertification exposes land to significant economic and environmental damages (Tokbergenova et al., 2018). According to the authors, reduced crop yields, pasture productivity, and decline in livestock and export potential of agriculture (Tokbergenova et al., 2018). Although countries such as the KSA hardly engage in agriculture, desertification is a major threat to reduced economic prosperity in other areas such as tourism. The reduced crop and livestock yield implies that the country will record a significant fall in agricultural exports. The effect is the overall economic progress of a country. Desertification causes water shortages through the cessation of flooding and lowering of groundwater levels. The increased saline land area also lowers livestock productivity per capita. Since agriculture is a major export component for some countries, it results in negative economic impact and poor living conditions of a population. Tokbergenova et al. (2018) further state that there is an increasing reorientation of farms, negatively affecting the economic growth of emerging economies.

In a study of the impact of climate change on desertification, Albati (2023) argues that it significantly affects economic activities with some of the most arid areas recording significant decline in investors and tourism. These countries have reported notable economic growth and the exploitation of the resources. From water shortages to damage to agricultural land, the deterioration of agricultural land yield significant economic consequences that lowers the GDP. The reduction in productive land implies that few people will get employment in agricultural lands. The effect is high unemployment rates that trigger poor economic progress in a country.

Desertification also presents major economic effects on the tourist sector. In countries that rely on tourism as a major source of GDP, desertification will have a major effect on the tourist destination. An increase in desertification threatens the existence of biodiversity of flora and

fauna, which are major tourism resources. Besides, it also has a direct impact on water levels and snowpack, making a country less attractive to tourists. Forests will suffer the direct negative effects of tourism through deforestation. The loss of flora and fauna lowers the contribution of the tourism sector towards economic development. It may also hinder the effective exploitation of oil and natural gas in countries such as Saudi Arabia, which is heavily dependent on resources for economic progress. The reduction in oil exploitation due to desertification will result in a significant fall in the overall GDP of a country.

In the first part of the 20th century, KSA engaged in extensive oil exploration that encouraged urban development and population increase. The increased urbanization intensified land degradation in rural Saudi Arabia (Barth, 1999). According to Barth (1999), desertification led to a drastic reduction of species diversity, negatively affecting tourism, which was a major source of government revenue in the KSA. Salih, Hassaballa and Ganawa (2021) argued that desertification has significantly affected the Al-Ahsa Oasis that is dominated by date palms. As a main source of income for local farmers, the reduction in date palms in the region due to desertification negatively affects the economic status of the population. Murshed (2022) argued that desertification in the KSA reduces the country's agricultural output, resulting in slow economic growth.

Strategies for Combating Desertification

Qi et al. (2020) identified government leadership, technological support, and legislation as some of the common ways of combating desertification. The authors recommended the establishment of control policies and systems for the safety of biological and geographical safety. The government also plays an important role in formulating national actions that protect and restore ecological environments for sustainable economic growth. The legal protection of natural resources is a function of good governance leadership (Feng et al., 2019). Afforestation is yet another strategy that could help countries protect their biodiversity and generate notable economic benefits. Through afforestation, a country increases the percentage of land under plant cover, resulting in increased rainfall and moderate temperatures that support agricultural productivity (Feng et al., 2019). Increased plant cover also implies a high attractiveness of biodiversity, encouraging tourism. Feng et al. (2019) proposed the fencing of grassland to prevent grazing and exclude livestock. The approach protects arable farmland from excessive erosion that leads to degradation and negative effects such as climate change and reduced agricultural productivity. Barth (1999) recommended

education and community involvement as necessary processes in limiting degradation and its effects on the KSA's economy.

■ Research Methodology

Research Methods: In testing the hypothesis of whether a significant relationship exists between desertification and Saudi Arabia's economy, the research will use a mixed research design. The research design will involve both Historical and Descriptive research methods. Under the historical research methods, the study will utilize past literature published about the economic consequences of desertification. The research will focus on the literature published within the last 10 years to help understand other authors' arguments on the topic. The qualitative research method will also involve a review of the literature to help readers understand the concept of desertification, economic consequences, key drivers, effectiveness of the current mitigation strategies, and the most sustainable strategies that can help modern societies become resilient towards the phenomenon.

The study will also rely on descriptive research methods, such as Correlative studies that includes collecting data on the two variables desertification and economic growth. The United Nations Convention to Combat Desertification publishes data on various parameters for desertification such as dryland cover and loss of arable land. These statistics will show a view of Saudi Arabia's desertification for the last 10 years. Besides, the economic variables such as GDP and GDP growth rate will provide an ideal measure of the economic progress of the countries. The research will employ descriptive and correlational designs to test the relationship between desertification and KSA's economic condition or growth. A t-test will also help establish the statistical significance of the relationship.

In addition, Survey studies that include collecting data by using survey that studies the impacts of desertification on the main aspect which is Economy, then zoom in the secondary aspect that are related and correlated to KSA's economy.

Data Sources: The research will rely on secondary sources as the main sources of data for both the literature under review and secondary data on desertification and GDP growth. The United Nations Convention to Combat Desertification will provide a useful source of data on various parameters for desertification. Besides, the World Bank will provide important data about KSA's economic condition over the last 10 years.

Study Population and Sample Selection: The population of interest in the study is the Kingdom of Saudi Arabia. The specific sample under investigation will be the desertification trends for the last 10 years. The period is sufficient for understanding the extent to which KSA is experiencing desertification and the direct impact on its economy.

For the survey will use Simple Random samples to ensure every citizen in The Kingdom of Saudi Arabia has an equal chance of being selected for filling the survey. Moreover, the simple random sampling helps to ensure that the sample represents the larger population accurately, and allows for the statistical methods to make inferences about the population based on the characteristics observed in the sample. Overall, simple random sampling is a widely used sampling method in surveys because it provides a fair and unbiased approach to selecting a representative sample from a population, allowing for valid generalizations and statistical inferences.

■ Research Structure

The research will include seven chapters that are:

Chapter1: Overview of study/ Introduction (Abstract in both languages, Introduction, Research problem, Research importance and objectives, Research Hypothesis, Research Methodology and Research Limitation)

Chapter2: Theoretical Framework and Literature reviews about the research topic (The impacts of desertification on Economy aspect in The Kingdom of Saudi Arabia)

Chapter3: Research Model & Developing Research Hypotheses that used in the research with full explanation.

Chapter4: Research Methodology which is about the research design, Approach and the sampling.

Chapter5: Statistical Analysis and Research Findings; this chapter includes a description of the important results, and presented as tables and graphs with an explanation of the results.

Chapter6: Finding discussion

Chapter7: Conclusion, limitations, Recommendations, also the Summary and References.

■ Research Limitation

One of the major limitations that may arise during the research is limited publications on the topic of desertification and its economic influence. The economic impact of desertification is a new area of research with most of the past studies focusing on the indirect effects. The limited secondary publications may limit an understanding of the concept. It will limit the number of studies reviewed in the qualitative research, resulting in inconclusive results since it is an ongoing area of research. Moreover, the sample period of 10 years may also be a limitation in the current research because of limited data. Desertification is a continuing phenomenon with growing statistics. The focus on the specific period between 2012 and 2022 may leave out important data outside of the sample frame, negatively affecting the validity and reliability of the findings from the study. Finally, the study objectives may also limit the scope of the research. Although it is good to have a narrow view of the subject, it presents the risk of ignoring other important factors that directly contribute to desertification.

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