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Assessing Dubai's Economic Resilience: A Study on the Influence of Rainfall on GDP Growth

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Abstract— The escalating costs associated with floods globally have become a pressing concern. In April 2024, Dubai experienced rainfall, leading to instability across various sectors and highlighting the necessity for a deeper comprehension of the repercussions of flooding on society. This research aims to investigate how rainfall impacts growth in Dubai. The primary goal is to determine the effects of rainfall on GDP growth. At the same time, the secondary objective involves examining economic sectors such as tourism, inflation, real estate, construction and housing markets. It delves into the evidence of rain occurrences in these sectors and their implications. This study analyzes the effects of this weather event on critical economic sectors using AIEEA (Artificial Intelligence Enhanced Economic Analysis). This concept combines AI-driven research and economic analysis to offer insights into sustainable impacts.

Index Terms— Economics, Natural Hazard, Economic Growth, Economic loss, Economic Instability, Climate Change, Climate Adaptation, Climate Resilience, Renewable Energy

I. INTRODUCTION

The size of the storm was astonishing, with the National Meteorological Center reporting that the United Arab Emirates had the heaviest rainfall since 1949, with over 250 mm per day [1]. This is more than the annual rainfall in the country. A similar situation occurred on March 8, 2016, when Dubai received 240 mm of rain in just a few hours. Forecasters such as the Global Flood Awareness System (GLOFAS) and the European Water Forecasting (ECMWF) have successfully predicted floods and heavy rainfall in the past. In the future, warmer climates will have more precipitation, and the atmosphere will be better able to hold moisture.[2].Climate change will increase the frequency of heavy rain from large storms due to increased winds.[3]. The impact of this complex challenge will be mentioned in the following sections. Hypothesis 1: Does Dubai have the necessary mechanisms to effectively handle challenges like recent floods? Hypothesis 2: Can the heavy rainfall cause significant economic loss or disruption in Dubai's major industries?

II. METHODOLOGY

This study used Qualitative Research. Secondary resources like journals, websites, newspaper articles, and ministry reports were used to find the impact and solutions needed to combat such devastation in the future. This study also analyzed the effects of this weather event on critical economic sectors using AIEAIEEA (Artificial Intelligence Enhanced Economic Analysis). This concept combines AAI-driven research and economic analysis to offer in-depth insights into sustainable impacts.

III. FINDINGS

A. Impact on Currency Exchange Rates

The heavy rains had an impact on currency exchange rates on the UAE dirham (AED), which is tied to the dollar. The AED's stability saw fluctuations as investors reacted to long-term economic uncertainties. Nevertheless, the Central Bank of UAE has implemented measures to uphold currency stability and prevent fluctuations.[5]. On the other hand, foreign currencies from neighboring GCC countries experienced a slight weakening as investors sought refuge in secure assets amidst economic instability.[6] Al Khoury and Hafez's study shed light on the correlation between climate-induced challenges and currency volatility within the Persian Gulf Cooperation Council region. The effects of factors on stability, as highlighted by Al Khoury and Hafez, are crucial to consider[6].

B. Impact on Tourism

Severe rainfall and subsequent flooding impacted the tourism industry in Dubai and the UAE. The heavy rainfall led to the closure of tourist sites, airports, and hotels, resulting in trip cancellations and revenue loss. Tourist arrivals saw a decline of 15% year-on-year in the UAE. The damages were worsened by infrastructure destruction hindering visitors' access to attractions. The negative publicity after the floods temporarily diminished Dubai's appeal as a tourist hotspot[7].

C. Impact on Real Estate and Construction

The real estate market in Dubai faced immediate and long-term challenges due to extreme weather conditions. Short-term effects included project delays, property damage and a temporary slowdown in property transactions. Experts anticipate lasting impacts that may necessitate changes in investment strategies[8]. The floods harmed Dubai's estate and construction sectors, requiring extensive repairs and reconstruction of damaged infrastructure such as roads, bridges and buildings.

Property values decreased in areas impacted by floods due to concerns about flood risks. Additionally, the interruption of construction projects caused delays, resulting in setbacks for developers and contractors. Al Khouri and Hafez's study shed light on how susceptible Dubai's coastal developments are to climate-related dangers, underscoring the necessity for resilient urban planning and infrastructure. The Dubai Land Ministry reported a 2 3% decline in real estate prices in affected regions as investors reassessed the risks associated with climate-related incidents[9]. Moreover, research by Smith and Brown on real estate markets stresses the increasing importance of climate resilience when evaluating real estate values and making investment choices.

D. Impact on Tourism and Travel

The heavy rainfall in Dubai had repercussions on the tourism sector, causing travel disruptions, cancellations, and a temporary decline in tourist arrivals [10]. The downpour in 2024 resulted in a 7% reduction in passenger traffic at Dubai International Airport compared to the period in 2023. Furthermore, the floods led to the closure of tourist spots, leading to a drop in visitor numbers.

E. Impact on Infrastructure and Services

The primary issue identified revolves around sewage facilities in the city, which have contributed to flooding[11]. The temporary closure of Dubai Airport has limited transportation options, like the metro, buses, taxis, and Uber, which are sometimes rendered unavailable in the city. This situation has hindered mobility and had significant economic and social repercussions.

IV. RECOMMENDATIONS

The recent heavy rainfall in Dubai during April 2024 has underscored the urgent need to address the risks associated with climate change. The immediate effects on currency exchange, real estate, and tourism are already noticeable, and the long-term outcomes will be determined by the city's ability to adapt and invest in infrastructure. Therefore, it is of utmost importance for the Dubai government to prioritize actions.

Climate change, primarily driven by warming and other environmental factors, is a global challenge that requires collective action. Human activities, such as burning fossil fuels, engaging in deforestation, and participating in industrial processes, actively contribute to releasing harmful greenhouse gases into the atmosphere. It is imperative that we recognize the impacts of these actions and take meaningful steps to mitigate their effects. They are contributing to rising temperatures and humidity levels, potentially intensifying storms and extreme weather events. The implications of warming and climate change extend beyond the environment and impact economies and societies worldwide. Addressing these challenges necessitates collaboration, development practices, and effective measures to reduce greenhouse gas emissions. Governments must take steps to curb these emissions, mitigate their effects on the climate, and combat warming.

It is the collective responsibility of governments, industries, research centres, education institutions, and the community to collaborate in research to shift towards energy and combat climate change. Developing clean energy technologies is crucial for reducing greenhouse gas emissions and addressing warming. This collaborative effort is key to the country’s success in the fight against climate change.

Additionally, it is essential to prepare for and adapt to the impacts of climate change through climate adaptation measures. Conservation of resources and building climate resilience are also priorities. Future challenges include integrating climate engineering with development. In response to rainfall, the United Arab Emirates government has issued warnings urging employees to work from home unless necessary. This comprehensive approach aims to reduce risks.

Addressing climate change challenges is crucial for development and requires policies that consider social, economic, and political factors[12].

Governments must conduct risk assessments to identify and evaluate community and infrastructure threats. Effective communication ensures safety during severe weather events, emphasizing the need for timely information dissemination and preparedness measures[13].

Adaptation strategies and Proactive measures are vital to combat effects of climate change. Establishing warning systems with monitoring capabilities can aid in predicting weather conditions and facilitating timely responses to mitigate risks.

Given the vulnerability of the UAE to weather patterns, enhancing preparedness efforts remains a critical priority. In general, it is vital to have a plan of action to address challenges proactively, as highlighted by Al Kaili [14]. This approach does not benefit efforts against climate change. It also makes practical sense. Another critical lesson is the necessity of preparing for weather events of time. This involves outlining evacuation routes, establishing family and emergency response protocols and creating communication strategies.[15It is crucial to assemble an emergency kit containing essentials like water, food, first aid supplies and flashlights, as these items are vital during disasters. By implementing strategies for mitigation and adaptation, we can enhance flood responses and minimize long-term damages to residents and infrastructure ecosystems.

Furthermore, investing in infrastructure is not just a necessity, but a potential game-changer in the fight against climate change. It holds the potential to pave the way for a future characterized by thriving economies, healthy ecosystems, and vibrant communities. There is a pressing need to construct and maintain drainage systems that prevent water accumulation and flooding during storms. Techniques such as rainwater harvesting devices, storage pumps, and permeable surfaces can help manage rainwater effectively while enhancing water infiltration processes. Building infrastructure that can withstand extreme weather conditions is imperative. Infrastructure planning must incorporate climate risk assessments to identify weaknesses and prioritize measures. According to [16]Moschini, integrating climate risk management into infrastructure planning and design is crucial for enhancing resilience and safeguarding economic progress. This source underscores the importance of looking beyond engineering considerations and taking into account the economic, social, and environmental systems when preparing for the impacts of climate change.

Furthermore, a systems framework proposed the need for a national-level approach to assessing climate risks to infrastructure.[17] This framework advocates considering both shifts, such as increasing temperatures, and extreme weather events, like floods when evaluating infrastructure vulnerability. Therefore, fostering climate resilience in areas becomes paramount.

Construction firms must focus on creating structures and transportation networks that can withstand rainfall and floods while adhering to environmental regulations. It is essential that all major projects undergo environmental impact assessments, including flood risk evaluations and necessary mitigation measures.

Additionally, it is crucial to allocate funds from both regional sources towards climate change research to identify strategies to mitigate its effects. For instance, increased funding is required to advance energy technologies, such as renewable energy, nuclear power,[18] carbon capture and storage energy efficiency, industrial electrification, transportation, buildings, and the creation of low-carbon and zero-carbon fuels like green hydrogen and green ammonia, to decrease carbon emissions.[19]

Forestry and reforestation also play vital roles. Developing materials such as biochar or soil carbon storage that capture CO2 is essential. These are a few strategies for addressing climate change that will be essential moving forward.

Last but not least, it is crucial to establish awareness programs. Community resilience in the face of weather events must be considered. The government should educate community members on risk alert systems, emergency preparedness measures and where to seek assistance during and after disasters.

V. SUMMARY

The study found that to deal with the consequences of rainfall, Dubai requires a comprehensive approach that addresses immediate disaster response and long-term climate adaptation. Valuable lessons include monitoring systems and early warning mechanisms, creating emergency strategies, investing in infrastructure that can withstand climate challenges, and promoting cooperation among government entities, businesses and local communities. By enhancing climate resilience, Dubai can safeguard its development and ensure a sustainable future for its residents and enterprises. Hence, it was found that Dubai does not have the necessary mechanisms to handle challenges like recent floods effectively, and it was proved that the heavy rainfall did cause significant economic loss or disruption in Dubai's major industries. The recent floods in Dubai had far-reaching effects on various aspects of society, the economy, and the environment. The extensive damage caused to infrastructure, such as roads and buildings, resulted in economic losses from cleanup and restoration expenses.

Moreover, this event could have lasting impacts on tourism and investment, both crucial components of Dubai's economy. The flooding led to the displacement of individuals, highlighting existing social and economic inequalities while also stressing emergency response systems and disaster preparedness measures.

VI. CONCLUSION

The key findings of the study can be concluded as follows.

Firstly, flooding impacts GDP in the year of the disaster; secondly, it damages infrastructure, causes vehicle destruction, and causes economic setbacks. Dubai needs a risk management system to handle incidents. To tackle this challenge, the government needs to take an approach that combines planning, climate change adaptation and responding to disasters. This involves shifting towards energy sources, enhancing systems for reporting disasters, setting up warning mechanisms, and constructing infrastructure that can withstand floods[20,21]. It is also crucial for manufacturers to consider programs. Moreover, there is a call for efforts and collaboration to enhance resilience against climate change and safeguard cities and communities' economies from the growing risks posed by weather conditions [22,23,24,25].

Notably, the government has already unveiled plans to invest significantly in upgrading infrastructure to mitigate disasters. This investment is not only anticipated to generate employment opportunities but also to spur growth in the manufacturing and engineering sectors, thereby positively impacting the economy. Furthermore, Dubai Electricity and Water Authority (DEWA) faced service issues in areas necessitating a reassessment of its coordination protocol[26]. Scholars like Al Mutairi argue that infrastructure plays a role in planning, particularly in regions impacted by climate change[27].

Dubai's strong position as a tourist destination indicates that the tourism industry is set for a rebound, especially with the government taking an active role in revitalizing and promoting affected areas. A report from the World Travel and Tourism Council echoes this sentiment, highlighting that while climate events may have short-term impacts, implementing recovery strategies is vital for sustaining long-term tourism growth.

1) papers submitted for publication must provide sufficient information to allow readers to perform similar experiments or calculations and use the reported results. Although not everything need be disclosed, a paper must contain new, useable, and fully described information. For example, a specimen's chemical composition need not be reported if the main purpose of a paper is to introduce a new measurement technique. Authors should expect to be challenged by reviewers if the results are not supported by adequate data and critical details.

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