Effects of Global Warming on Climate Change

International Journal of Excellence in Environmental Management
ISSN: 1993-8675
Vol.4, Issue 1, 2024

Fatima Mohammed Alawadhi

HBMSU, Dubai, UAE.
Email: 200113058@hbmsu.ac.ae

ABSTRACT

Global warming is and remains a global challenge. It is effect has worsened in the resent past and affects both developing and developed countries. While studies on global warming and climate change are widely documented, a significant number of people are yet to fully understand the implication of scientific evidence drawn on the subject. The following study seeks to assess the implication of climate change for the welfare of humans and the environment at large. Moreover, the study will contribute to knowledge development and making of informed policy decisions. The study is based on two main hypotheses; (1) That humans have a significant impact on global warming and climate. (2) Climate change has a significant negative impact on people, the environment and societal wellbeing. The researcher relied will use a mix research design approach. Both primary and secondary data will be used. Data collection will be administered online using a survey questionnaire. Qualitative data will be analyzed using thematic approach, while quantitative data will be analyzed using STATA, a statistical tool used for the process. A pilot study was conducted with a focus on three participants with a goal of assessing efficacy and reliability of the data collection tool. The researcher expects to obtain an in-depth understanding of the research problem which is key to addressing knowledge gap and policy implication.

Keywords: *Global warming, climate change, effects, greenhouse gases, greenhouse effect*

INTRODUCTION

Global warming is defined as “long-term heating of the earth’s climate system.” It is linked to human activities that can be traced back to the pre-industrial period. The leading cause of climate change is considered to be burning of fossil fuel, an issue that is linked to increased trapping of heat in the atmosphere. Nonetheless, most studies use the term “global warming” interchangeably with “climate change.” The two are distinct and imply different things. For instance, climate change includes natural and human activities contributing to warming of the earth’s surface. According to a report released by the Global Climate Change, human activities are considered to have increased average temperature on earth by about 1 degree Celsius (Global Climate Change para 1). Every decade, temperature in the global earth surface is estimated to increase by about 0.36^{o}C. A shared understanding from most studies is that human activities are the leading cause of global warming. Climate change alludes to “a long-term change in the average weather patterns” (Global Climate Change). Like global warming, recent studies have revealed that climate change is also linked to human activities. Nonetheless, the studies do not dispute the fact that natural processes can also result in climate change.

Climate change is caused by human made and natural factors. Example of human factors that contribute to the distress include fossil burning, deforestation, and faming among others. Natural causes include the high sun intensity, change in the earth’s orbit and circulation of the ocean (EPA). In recent years, the earth’s surface is experience rapid warming, an issue that cannot be explained by the natural causes. The issue explains why scientists are linking the phenomena to the greenhouse gases resulting from a wide range of human activities. However, some amount of greenhouse gases is essential for human survival as they help in trapping the heat within the atmosphere. Thus, they help keep the earth warm and in a state of equilibrium. Figure 1 below shows the link between global temperature and greenhouse gases. With increased global warming and greenhouse gas emissions, the earth is likely to experience a state of disequilibrium in the future. Since the period of industrial revolution, the amount of greenhouse gases released to the earth’s atmosphere has been on the rise. The issue explains the trend in rising global temperatures. In the past 30 years, the trend has worsened, an this can be shown by the growing accumulation of carbon dioxide in the atmosphere (EPA). Generally, climate change is a threat to humanity and biodiversity

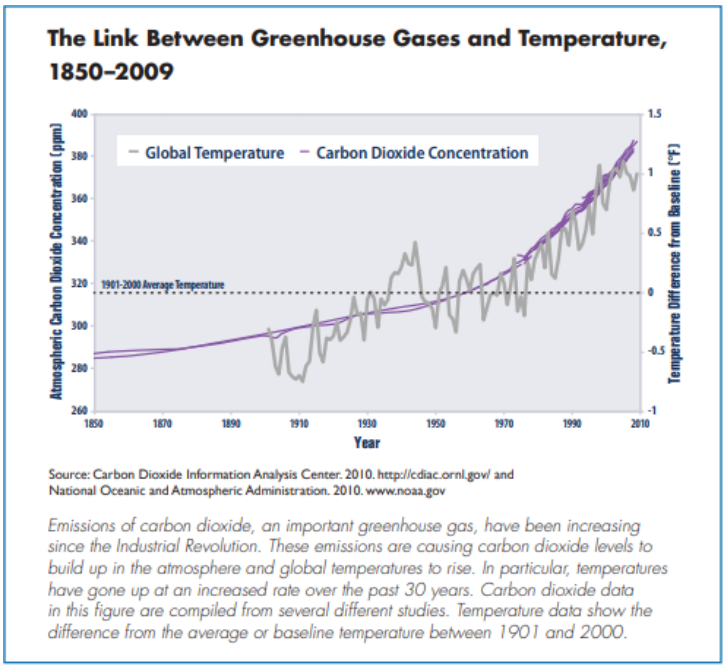


Figure 1: Trend in Global Warming (EPA)

Climate change is real and it is happening. The issue is considered a public concern in every country as it affects both developing and developed countries. EPA indicates that climate change has both positive and negative effects. However, the report warns that the benefits of climate change are only experienced in the short term. In the long-term, negative effects of climate change pose serious health and economic losses to people and the environment. In the last century, climate change has increased by 1.3 degrees Fahrenheit (^{o}F). In recent years, the rate is almost doubling. Evidence to support global climate change include rising temperatures, change in weather patterns, melting glaciers, rise in sea level, animal and plant species distinction and acidification of the oceans among others. With the present trend, global average temperatures is likely to double in the future, posing serious threat to human survival. By understanding the effect of global warming and how it triggers climate change, the study seeks to identify effective mitigation measures that can be used to contain the problem.

Problem Statement

Natural processes and human activities are linked to recent rise in global temperatures. However, human activities have been identified to have the largest effect on global warming and climate change in recent years. With increased burning of fossil fuel, the amount of greenhouse gases accumulating on the earth's surface is worrying. Mann indicated that although the topic of "global warming" and "climate change" continue to gain widespread recognition in recent years, attracting public outcry, there is a concern most of the threats posed by the recent changes are not well understood by the public (193). Majority of the people are not aware of the scientific effects of global warming. Therefore, to understand the effect of global warming and climate change, researchers need to recognize the science underlying the phenomena. National geographic report also reveals that the earth is warming from the North to South Pole. In the past one century, the global earth's temperatures have increased by 0.9^{o}C (National geographic para 1). The impact is more on the sensitive polar regions. The study warns that the impact of global warming is experienced currently. This can be explained by the melting of glaciers, shifting precipitation

patterns, rise in sea levels and animal migration. Although the effects of global warming are widely documented by scientists, the public is not well informed about the same. Also, while most studies focus on understanding the negative effects associated with global warming, none has strived to establish the positive impact of global warming. Understand the implication of global warming is key to effective management of the distress. Therefore, this study aims at filling the gap by raising awareness on the adverse effects of global warming. The following study seeks to assess the implication of climate change for the welfare of humans and the environment at large. The researcher will thus establish the link between global warming and climate change and how the issue can be contained. To achieve the study objective, the following research questions will be used.

a. **How do humans contribute to global warming and climate change?**
b. **What are the health implications of global warming?**
c. **What are the benefits of global warming?**
d. **What actions should be taken to slow or reduce global warming?**

Relevance and Importance of the Research

Goal 13 of Sustainable Development Goals (SDGs) of 2030 calls for urgent actions to combat climate change. According to United Nations, 2019 remains as the year with the second warmest temperatures ever recorded in history. During the period, carbon dioxide and greenhouse gases are considered to have hit a record high. It is essential to note that climate change affects all countries across the globe. Like pandemics, global warming is disrupting national economies and compromising welfare of people. With the current pandemic (COVID-19), United Nations projects a 6% drop in greenhouse gas emission due to travel bans and significant reduction in economic slowdowns. Nonetheless, the positive outcome is temporary and the situation is likely to worsen during post-COVID-19 with full economic resumption and lifting of travel bans. To save lives and the environment from the adverse impact of climate change, there is a need to take urgent measures to reverse or slow global warming. Additionally, the Paris Agreement of 2015 focuses on global response to combat the threat of climate. The objective can be attained by reducing global temperature rise to below $2^{o}C$. Countries across the globe have enacted various measures to ensure that they work in collaboration to ensure that the goal is attained. Nonetheless, there are various obstacles that are limiting the process. As echoed by Mann, although literature on effects of global warming and climate change is well documented, the public is not well informed about the adverse effects of the threat. Additionally, the SDG 13 only calls for urgent action to be adopted to combat the threat without outlining an effective framework that can be used to address the problem. Therefore, the following study will contribute to literature development on the subject, contribute to increased awareness of the problem. Finding established by the researcher will be vital to policymakers, scientists and scholars. With the information, legislators across the globe will be in a position to design an effective model that can be utilized to help combat the distress, thus saving lives and the environment. Besides identifying gaps in literature, the study will focus on determining rate of climate change, examine available projections and recommend ways that people can adapt to the emerging changes. Also, this is an opportunity to link climate change and health, a strategy that will play a pivotal role in development of effective mitigations measures, especially with the emerging technologies.

LITERATURE REVIEW

Climate change is no longer a prediction, it is a reality. It is happening everywhere, and its effects is felt by everyone. Global temperatures have been rising. Since 1880s, the 25 warmest years have occurred in the past three decades (Wang and Chameides 1). Scientists have drawn conclusions that the rise in greenhouse gas accumulation on the earths surface is linked to human activities. The main activities contributing to the problem include burning of fossil fuels, and deforestation. Also, the studies have shown the ability of the greenhouse gases to trap heat. Nonetheless, Wang and Chameides warns that scientists are yet to ascertain how much of the recent warming is linked to human activities (1). However, majority of the scientists affirm that the primary cause of global warming in the last five decades was human activities. Also, a shared understanding for most scholars is that global warming has major impacts on ecosystems and global societies. This section is a review of existing literature and aims to examine the effects of global warming and climate change. The section is structured into various sections based on the research questions.

Definition of Key Terms

- Global warming – "Increase in the earth's average surface temperatures since the industrial revolution, primarily due to the emission of greenhouse gases from the burning of fossil fuels and land use change" (Leiserowitz, A., et al. 6)
- Climate Change – "long-term change on the earth's climate's including temperature changes, precipitation and wind patterns over a period of several decades or longer." (Leiserowitz, A., et al. 6)
- Environment – natural landscape including non-human features, processes and characteristics. However, the term has different definition, thus posing varied implication to scholars. The World Health Organization (WHO) defines the term environment as "all the physical, biological and chemical factors that are external to a person, and all the related behaviors" (22).
- Greenhouse Gases – gases known to trap heat in the atmosphere and contributes to increased warming of the planet earth. Example includes carbon dioxide, nitrous oxide, methane and ozone among others.
- Greenhouse effect – natural processes renowned to warm the earth's surface.

Background

Global warming and climate change are two words that are used interchangeably by most people. Scholars have a varied understanding of the concepts, especially climate change definition. Global warming alludes the phenomenon of rising average surface temperatures on the planet, usually over a long period between one to two decades (Mann 193). Definition of climate change also integrates "surface temperatures," only that it also features other issues such as precipitation, ocean currents and winds. This implies that global warming is just a single component of climate change as will be demonstrated throughout the paper. Mann also established that climate change is composed of two major aspects; human (anthropogenic) and natural cause. The anthropogenic aspect can be traced back to the industrial period, generally the last two centuries. On the other hand, the natural component is also considered to have an influence in both the past and the current variability. Unlike climate change, global warming is linked to the anthropogenic component only.

Energy Balance

Energy balance and average surface temperature on the planet earth have a strong, positive correlation. This is because the average temperatures are directly influenced by the balance between incoming and outgoing sources of energy/radiation. According to Wake, the climate system is considered as a result of the net imbalance linked to outgoing longwave radiation (758).

Also, positive values are an implication that climate system is absorbing energy, an issue that results in global warming. Nonetheless, the study cites lack of sufficient literature on energy imbalance for enhanced understanding of the climate system. The incoming energy is usually from solar radiation. However, this form of energy takes different forms (Wild et al. 601). Part of it takes the form of visible light. Scientists have established that a large portion of incoming radiation energy appears as ultraviolet radiation. Also, a percentage of the incoming energy is absorbed by the molecules in the atmosphere, which explains the blue sky. Therefore, the incoming radiation is characterized by both visible and invisible radiations. On the other hand, the outgoing radiation is very different. The wavelengths are relatively longer, invisible and falls outside the band of visible light. The heating resulting from the energy source is because of the infra-red rays. It is essential to note that 30% of the incoming solar radiation is reflected back to the atmosphere by the clouds. However, the reflective capacity is influenced by various issues such as ice cover and clouds. The remaining portion is absorbed by the earth surface, clouds and the atmosphere as well. To maintain equilibrium, Mann maintains that the earth surface and the atmosphere have to collectively emit same amount of radiation as received from the sun. The radiation from the earth's surface will, however, be inform of invisible and infrared radiations. NASA also share similar sentiments that the planet is trying to maintain a balance. Nonetheless, human activities are causing imbalance in energy flow. Human activities are perceived to contribute to the problem in two major ways; (1) they contribute to accumulation of greenhouse gases. Greenhouse gases absorb radiation, thus contributing to global warming. (2) Secondly, human activities contribute to depletion of aerosols, which play a crucial role in reflecting radiation. Therefore, more radiations are considered to penetrate into the earth's surface. Human activities are thus renowned to cause imbalance as it makes majority of the heat to be trapped within the atmosphere.

Studies conducted on energy balance have established that humans play a huge role in development of radiative forcing. The issue is considered to have a direct impact on the earth's energy balance, thus causing climate change in the long-term (Mikhaylov n.p.). However, besides the study conducted by NASA, no other has been conducted to establish how human activities contribute to radiative forcing of earth with a focus on global observation (NASA n.p.). Therefore, this is an area that requires further study. With more studies in the area, researchers will establish the impact of aerosols and greenhouse gases on climate change.

Greenhouse Effect

Greenhouse gases have both positive and negative impact on the globe. As mentioned by Mann, without greenhouse gases, the earth would be inhabitable because of extreme cold. Therefore, greenhouse effect explains the earth warming, especially the lower part of the atmosphere. It is essential to note that greenhouse gases absorb infra-red radiations emitted from the earth's surface (Kweku et al. 1). Consequently, not all the remaining 70% of the energy is released back to space. Additionally, the greenhouse gases emit all the energy absorbed in all directions; both upwards and downwards. Therefore, more heat is released to the lower part of the atmosphere. For equilibrium to be reached, the earth has to release more than 70% of the initial radiation from the sun, an aspect that causes rise in surface temperatures. The concept is referred to as the atmospheric greenhouse effect (Koll and Cronin 10293). A shared understanding from most scholars is that greenhouse gases play a huge role towards warming of the earth's surface.

Greenhouse effect results from two broad areas; natural and human. The former can be the natural occurrence of greenhouse gases such as carbon dioxide, nitrous oxide, and methane in the atmosphere. Besides the naturally occurring greenhouses gases, human activities are associated

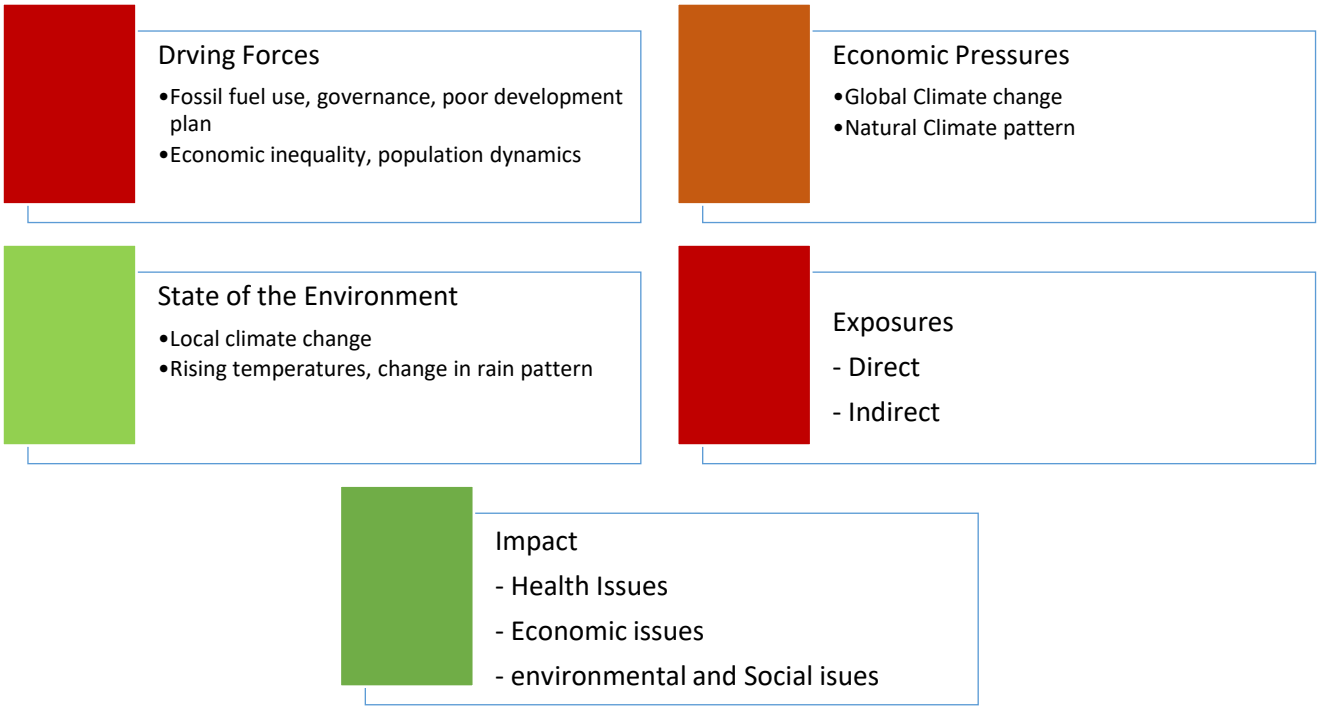
with accumulation of greenhouse gases. A large percentage of this greenhouse gases are emitted from burning of fossil fuels. Agriculture is considered among the lead source of greenhouses accumulating on the earth's atmosphere. According to Qiao, it is considered as the world second largest producer of the gases (722). Although studies have a different perception on the causes of greenhouse gases, human remains as the widely renowned cause of global warming.

Conceptual/Theoretical Framework

Global warming and climate change are caused by many factors. Although various studies have been conducted on global warming, Freie University reports that nature and cause of climate change are yet to be understood adequately. Several theories have been developed to help explain the phenomenon. For instance, the Milankovitch Theories and the Astronomical theory explain the relation between the sun and the earth (Knežević 17). Milankovitch sought to assess the cause of the ice ages. Therefore, the proponent believes that orbital forcing is centered on the astronomical mechanisms, an issue that leads to insolation. Milankovitch maintained that people live in cycles. The proponents argue that global warming is not uniform across the globe. Instead, it is expected to vary geographically across different regions. Also, the study recognizes that global warming is expected to vary across seasons. Because of the variations, the temperature gradients is expected to change wind patterns, an issue that has a trickle down impact on the precipitation process. However, it is essential to note that the theories do not give detailed information about the localized changes, an area that calls for further study (Freie University n.p.). The shift in the interior of the continents is expected to change agricultural production cycles as well. The change in global warming and climate is directly linked to human activities such as fossil fuel burning. Consequently, billions of tones of greenhouse gases are released to the earth's atmosphere.

Theorists have a different understand on the cause and effect of global warming. While scholara consider human to be the lead cause of global warming, others think otherwise. Bio-thermostat for instance insists that rising temperatures and high accumulation of CO_2 in the atmosphere are perceived to lead to biological and chemicals. The response causes a cooling effect, thus working like a natural thermostat. The Cloud formation and albedo Theory, on the hand, affirms that clouds play a pivotal role in the earth's radiation budget. Therefore, the changes in Earth's albedo across different geographical regions is likely to trigger global warming (Mueller et al. 2305). The study revealed that change in formation and albedo of clouds helps lower or eliminate the warming effect resulting from greenhouse effect. The Ocean Current Theory, also does not link climate change to human activities. Instead, the proponent believes that variations in global temperatures is as a result of slow-down of ocean's Thermohaline Circulation. Nonetheless, all theories center on human and naturally occurring processes as the cause of climate change and global warming.

The following study assumes that climate change/global warming has an impact on health, individuals and social wellbeing. Therefore, legislators and other stakeholders involved in policy development have to introduce effective tools to help mitigate against the adverse effects of the threat. The impacts are known to vary widely with short and long-term impact on the people.



Hypothesis

- **Hypothesis 1: Human have a significant impact on global warming and climate change.**
- **Hypothesis 2: Climate change has significant negative impact on people, the environment and societal wellbeing.**

The two hypotheses are based on the idea of climate change. While the first hypotheses seek to examine human contribution to climate change, the second hypothesis aims at understanding the impact. As established in the theoretical review, some of the theorists are against the idea that humans play a role in climate change. The research outcome will thus play a huge role in further development of the identified theories.

Gaps in Existing Knowledge

While literature on the cause and impact of climate change is well documented, the review of literature has identified several areas that call for further studies. First, the scientific evidence on cause and impact of climate change is unknown to the public. Secondly, the area of earth's energy balance has limited literature. Thirdly, recent research considers radiative forcing to be influenced by humans, only one study has been conducted to ascertain the statement. Also, recent reports have revealed that the nature and cause of climate change is vaguely understood. Finally, existing theories on climate change have contradicting views. Therefore, unless the identified gaps are addressed, developing effective mitigation measures to eliminate or slow climate change will remain a problem.

DESIGNS AND METHODS

This study sought to understand the effect of climate change and global warming. Understand the underlying cause of the phenomena is assumed to by the researcher as an essential step towards resolving the problem. While most of the studies consider climate change to be as a result of both human and natural processes, some theorists argue differently. This is the methodology section and outlines or the processes and tools used in conducting the study.

Research Design

Research design is considered as the set of tools or processes followed when carrying out a study. The present study seeks to understand the human and natural causes of climate change and its implication. To respond to the research question, the researcher requires in-depth data. The proposed research design for the study will the mixed approach. Mixed research design includes a combination of both qualitative and quantitative research. As aforementioned, the primary reason for using the approach is to attain in-depth understanding of the problem. Besides, use of qualitative research design will help in obtaining the human aspect.

Methods and Sources

This study will use both primary and secondary sources of data. Primary data will be collected through survey questionnaire that will be administered online. The approach was preferred because of convenience given the restrictions imposed with the present pandemic. Additionally, it is common, allows collection of quality data, relatively cheap and gives researchers an opportunity to obtain data from participants of different geographical regions. The study will target a wide range of stakeholders involved in climate change management and those impacted by the same. Target groups include industry experts; legislators, environmental officers, scholars in the field of environmental science and general public. However, potential participants have to be over 18 years and come or should have stayed in the study for a period not less than one year. For key informants, the potential participants will be purposely selected. Choice of the method was informed by the fact that the respondents have to be people that are well informed about the research topic. Qualitative data will be analyzed using thematic analysis approach. Quantitative data on the other hand will be analyzed scientifically using statistical tools such as STATA. The tools were preferred to help establish relationship between various variables identified for the study.

Ethics

Ethics is an integral part of any research, especially when humans are involved. Research ethics is pivotal in enhancing study credibility. Also, the concept ensures that researchers adhere to the set standards when conducting a study. To adhere to ethical regulation, potential participants were sent consent forms in advance. Additionally, the individuals were guaranteed of their safety and confidentiality. The researcher also sought permission from relevant bodies before starting the research.

Pilot study is a preliminary research. The main rationale for conducting a pilot study is to establish whether key component for the research had been captured. Besides helping in assessment of the study feasibility, it is an opportunity to assess reliability and effectiveness of the data collection tools. For the present study, a survey questionnaire was used to assess reliability and validity of the data collection tools. For the pilot study, three participants were purposely selected. All the three individuals are attached to the ministry of environment and are well informed about the issue of global warming and climate change. The participants were sent a consent form two weeks prior

to the research. Individuals wishing to participate in the pilot study were required to sign the forms as a demonstration of the commitment and part of ethical requirement.

Data Analysis

The data analysis was performed using qualitative techniques. Of the three participants, two were males and they all had at least two years of working experience. This implies that the individuals had a good knowledge about the issue of global warming and climate change. All the three participants revealed that global warming is happening and that they have seen signs. Also, they revealed further that in recent years, the earth has been experiencing extremely high temperatures. With regard to weather patterns, some of the respondents felt that weather has changed significantly while others indicated that not much change has been realized. Overly, globally warming was identified as a concern warranting urgent action to reverse the trend. With regard to cause of global warming, two of the respondents shared that humans play a huge role (76-100%) in contributing to the problem. However, one of the respondents felt that humans do not play a huge role in the process. However, all respondents raised their concerns about rising temperatures in the past decade. Of all the factors contributing to global warming, greenhouse gases and sun were of concern.

The researcher also assessed the causes and impact of climate change. Participants revealed that climate change is as a result of both humans and natural occurring processes. Effects of climate change mentioned by the participants included rising temperatures, change in weather patterns, health effects and rising sea levels. All the respondents indicated that they are not aware of any climate change awareness campaign. However, the argued that the campaign is necessary to help the public understand the problem and engage in responsible behavior to protect the environment. Also, only two reveled that the government has enacted effective measures to mitigate against the adverse effects of global warming.

Implication and Contribution to Knowledge

The scientific causes and effects of global warming and climate change are not adequately understood by the public. For instance, the study identifies lack of climate change awareness campaign to be a challenge. Therefore, the present study strives to address the gap by contributing to knowledge development on the subject. Conducting the study will help create new insight on the problem, which is vital in development of effective mitigation measures. Moreover, information obtained from the research will be used to inform policy development.

Practical Implication

The goal SDG 13 calls for urgent action by governments and different groups of stakeholders across the globe to help combat the issue of climate. Scientific evidence has proved that global warming and climate change have adverse impact on the environment and humanity. Therefore, information obtained from this study will help sensitize on the issue and also contribute on development of informed policy decision.

Theoretical Implications

As established from the literature review, there are three schools of thought on climate change. The first school of thought believes that human is the main cause of climate change. The second assumes that human do not play any role and the problem is linked to naturally occurring process.

The final group hold that climate change is a combination of both human and natural forces. Therefore, conducting the study will theoretical development. it will be an opportunity to choose the school of thought to support with evidence.

References

EPA, “Climate Change Science Facts.” *epa.gov*, <Climate Change Science Facts (epa.gov)> July 23, 2021

Freie University, “Geo-Learning e-learning in the Environment Geosciences.” < https://www.geo.fu-berlin.de/en/v/geolearning/gr_climate_change/climate_change/theories/index.html >

Global Climate Change, “Overview: Weather, Global Warming and Climate Change.” *Global Climate Change*, <Global Warming vs. Climate Change | Resources – Climate Change: Vital Signs of the Planet (nasa.gov)> July 23, 2021.

Knežević, Zoran. "Milutin Milanković and the astronomical theory of climate changes." *Europhysics News* 41.3 (2010): 17-20.

Koll, Daniel DB, and Timothy W. Cronin. "Earth’s outgoing longwave radiation linear due to H2O greenhouse effect." *Proceedings of the National Academy of Sciences* 115.41 (2018): 10293-10298.

Kweku, D. W., Bismark, O., Maxwell, A., Desmond, K. A., Danso, K. B., Oti-Mensah, E. A., ... & Adormaa, B. B. (2017). Greenhouse effect: Greenhouse gases and their impact on global warming. *Journal of Scientific research and reports*, 1-9.

Leiserowitz, A., et al. "What’s in a name? Global warming versus climate change." *Yale Project on Climate Change Communication and George Mason University Center for Climate Change Communication* (2014).

Mann, Michael E. "Do global warming and climate change represent a serious threat to our welfare and environment?" *Social Philosophy and Policy* 26.2 (2009): 193-230.

Mikhaylov, Alexey, et al. "Global climate change and greenhouse effect." *Entrepreneurship and Sustainability Issues* 7.4 (2020): 2897.

Mueller, Richard, et al. "The role of the effective cloud albedo for climate monitoring and analysis." *Remote Sensing* 3.11 (2011): 2305-2320.

NASA, “Direct Observations Confirm that Humans are Throwing Earth’s Energy Budget off Balance.” *Global Climate Change*. March 25, 2021 < https://climate.nasa.gov/news/3072/direct-observations-confirm-that-humans-are-throwing-earths-energy-budget-off-balance/ >

National geographic, “Effects of Global Warming.” *National Geographic*, < Global warming and climate change effects: information and facts (nationalgeographic.com) > July 23, 2021

Qiao, Hui, et al. "The greenhouse effect of the agriculture-economic growth-renewable energy nexus: evidence from G20 countries." *Science of the Total Environment* 671 (2019): 722-731.

United Nations, “Goal 13: Take Urgent Action to Combat Climate Change and its Impacts.” United Nations, < Climate Change – United Nations Sustainable Development >

Wake, Bronwyn. "Earth's energy balance." *Nature Climate Change* 4.9 (2014): 758-758.

Wang, James, and Bill Chameides. *Global warming's increasingly visible impacts*. Environmental Defense, 2005.

Wild, Martin, et al. "The Global Energy Balance Archive (GEBA) version 2017: A database for worldwide measured surface energy fluxes." *Earth System Science Data* 9.2 (2017): 601-613.

World Health Organization. "What is the Environment in the Context of Health." (2018)