



Awareness levels of the dynamics of the climate change risk impacts: Evidence from Africa, Eastern Asia and emerging countries

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ABSTRACT

Climate change affects individuals and business organisations. This study examines individuals and organisations' levels of awareness of the effects of climate change and their responses to climatic changes. It also establishes awareness of the predominant effects of climate change risks in Africa and Eastern Asia. This study was descriptive research using surveys and fact-finding enquiries of different kinds. Using a purposive sampling method, one hundred five (105) participants were selected from more than 25 countries from Africa, Asia and other emerging countries for the study. The results indicate that, on average, many people are aware of the effects and gravity of climate change. A non-parametric test of the significance of climate change's impact on financial performance yielded a hypothetical mean above the threshold of 3, a P value of less than 0.05 at a 104 df. The results indicate that climate change adversely affects individuals, organisations and communities. The findings show that communities are relatively aware of the impacts of climate change and can quantify the losses in financial terms, at least as an estimate. It indicates that the level of awareness of individuals and organisations is satisfactory. The findings on vulnerability and exposure indicated that people are aware of climate change and its effects on individuals, organisations and communities. The results reveal that it is easy to manage climate change risks using techniques developed by local and international authorities. Governments, especially in Africa, must respond fervently to demands for climate change mitigations.

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Introduction

Climate change is the shift in climate patterns mainly caused by greenhouse gas emissions from natural systems and human activities (Fawzy et al., 2020; Whitmarsh & Capstick, 2018). The effects of climate change are major world concerns for most environmental experts (Weber, 2015, 2016). Climate Change is subject to uncertainty (Whittington, 2012). Climate change affects individuals and business organisations like predators attacking an animal of prey. It is sudden and may leave the victim in panic when actually the danger has been gradually approaching for a long time (Barrucand, Giraldo & Canziani, 2017; Castells-Quintana, Lopez-Urbe & McDermott, 2018). The prey may not be aware that the predator is slowly approaching undercover. Climate is a condition over a long period, the scourge and opportunities arising from climate change come in gradually. It is a slow change in the long-term climate trend (Hong, Li & Xu, 2019; Jurgilevich, Rasanen, Groundstroem & Juhola, 2017). The problem here is that while many efforts are put forth to manage climate change, the success or failure of the efforts depends on how well people at all levels know about climate change. As much research is done on gravity and its effects not so much have been done on awareness of climate change from the basic levels. Because of the misinformation about climate change, Lahsen and Ribot (2022) reported that politicians may blame climate change effects when it is a poor investment in sanity checks such as flood controls and lack of conservation.

This study is important because awareness data on climate change will help human systems to accommodate climatic changes. Hence, understanding the magnitude of the adaptation challenge at a global scale is essential (Berrang-Ford, Ford & Paterson, 2011; De

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Matos, Da Cunha, Pires & Do Couto-Santos, 2020). It may be difficult to see the gradual climate changes of a region because everyone will know the average or typical weather over a long period. For this reason, using continuous variables and trends when measuring the effects of climate risk must be more accurate (Santos & Bakhshoodeh, 2021; Javadi & Masum, 2021).

Hong, Li and Xu (2019) noted that the natural disasters magnified by climate change could cause significant disruption to firms' production process and seriously damage their profits. Despite the gradual nature of climate changes, the rate at which consequences change forth is prompt. The results come from natural disasters sustained and prepared for explosion over time (Huynh, Nguyen & Truong, 2020; Lesk, Rowhani & Ramankutty, 2016). As many are investing in climate change issues, some regions still need to take a proactive approach to climate change risk management.

The best way to manage the effects of climate change is to anticipate measure and respond to the risks arising from the climate dynamics. This study examined individuals' and organisations' levels of awareness of the effects of climate change and their responses to climatic changes. It also establishes awareness of the predominant effects of climate change risks in some African and emerging countries. The study addresses the research question, "What is the level of awareness of the predominant effects of climate change risks in Africa and other emerging countries?" The discussions in the remaining part of the paper focus on the literature review, hypothesis formulation, methodology, data analysis, conclusions, recommendations and the implications of findings for practice.

Literature Review

A review of relevant literature is presented in this section. The significant areas of review include climate change patterns across the globe, individual and organisation interest in climate change, levels of exposure and vulnerability, awareness levels previously assessed, response to climate change risks, and challenges in measuring climate change response across regions.

Climate theory

Karimi, Valizadeh, Karami and Bijani (2021) identified the hazards-based approach to climate change as the assessment of adaptation to climate change undertaken through predictions made in the field of climate change and designed on the basis of various scenarios, as well as the assessments of future climate change trend by considering current climate risks. All this can only be done if people are aware of the local prevailing climate change impacts over time and across the globe.

Climate Change Patterns Across the Globe

Different regions throughout the world have unique distributions of climate change effects. The interhemispheric imbalance between the North Atlantic and the Southern Ocean that ocean warming climate models projected has been mostly validated in the high latitudes (Xie, 2020; Stouffer & Manabe, 2017). This pattern is the outcome of the pole-to-pole deep ocean overturning circulation. Tropical storm statistics and the impact of El Nio in distant areas, including western North America, are modulated by the strong relationship between the ocean warming trend and atmospheric convection and circulation in the tropics (Marshall et al., 2014; Xie, 2020). The causes may be either natural or human-triggered. Natural systems include forest fires, earthquakes, oceans, permafrost, wetlands, mud volcanoes and volcanoes (Clar & Steurer, 2019; Yue & Gao, 2018). Human activities are predominantly related to energy production, industrial activities and those related to forestry, land use and land-use change (Edenhofer et al., 2014; Hamilton, Fischer, Guikema & Keppel-Aleks, 2018).

Temperatures are high in tropical regions. Although climate sensitivity is often perceived as a constant inherent to a particular model, it changes over time when an ocean surface warming pattern changes due to the heat exchange between the surface and deep oceans, especially in the southern oceans (Bryan, Manabe & Spelman, 1988). From this, we see that climate change has effects of ocean warming, wild winds, changing rain patterns, and high temperatures in the tropics, the poles and temperate regions (Wang, Xie, Tokinaga, Liu & Kosaka, 2016; Xie et al., 2010). Due to changing radiative forcing (greenhouse gases and aerosols) and unforced internal variability, this warming pattern impact underscores the difficulties in calculating climate sensitivity from observational measurements.

Individual, Organisation and Government Interests in Climate Change

Individuals and organisations play significant roles in climate change (Barrucand, Giraldo & Canziani, 2017; Flottum, Gjerstad & Skiple, 2021; Tvinnereim et al., 2017). Climate change involves several aspects of life and business, including lifestyle and politics (Flottum, et al., 2021; Langaas, Kjersti & Oyvind, 2020; Tvinnereim et al., 2017). Strategies for reducing the negative impacts of climate change reduction, especially the human-triggered factors, include conventional mitigation measures, harmful emissions, and radiative forcing geoengineering (Fawzy et al., 2020; Edenhofer et al., 2014).

There are increasing government and organisational policies to protect the environment and promote climate change education (Monroe, Plate, Oxarart, Bowers & Chaves, 2019; Clar & Steurer, 2019). However, the level of interest in climate change varies depending on the sector, region and country's specific interest (Clar & Steurer, 2019; Noble et al., 2014; Fichter et al., 2010; Adger, Arnell & Tompkins, 2005). Many western countries, including the United Kingdom, adopted a Climate Change Act in 2008, which required its subsidiary territories to adopt a national adaptation strategy. This later became the British strategy for managing climate

change risks in 2013, focusing on the sectors identified as most vulnerable in a Climate Change Risk Assessment (Clar & Steurer, 2019).

Indigenous Knowledge, Awareness and Response to Climate Change Risks

Makondo and Thomas (2018) noted that implementing climate change response programmes for adaptation and resilience is anchored on western scientific knowledge, which they argued has led to a tendency to disregard indigenous knowledge as it is considered unimportant in this process. Many researchers advocate local methods of climate change management (Townsend, Moola & Craig, 2020; Zentner, Kecinski, Letourneau & Davidson, 2019). The traditional African knowledge of environmental change sometimes called the Indigenous Knowledge (IK), may be as old as the society itself, with local knowledge transmitted from one generation to the next (Makondo & Thomas, 2018; Speranza, Kiteme, Ambenje, Wiesmann & Makali, 2010).

Indigenous knowledge is neither singular nor universal but a voluminous, diverse and highly localised source of wisdom (Makondo & Thomas, 2018; Speranza et al., 2010; Nyong, Adesina & Osman Elasha, 2007). Due to the vulnerability of indigenous communities, indigenous knowledge should be integrated into climate change policies and implementation. It is also necessary to ensure climate change awareness in agriculture and among farmers (Altea, 2020; De Matos et al., 2020). This will help farmers to build adaptive capacity, increase resilience, diversify cropping systems, and reduce vulnerability in farming activities globally, including Africa and Eastern Asia (Dang, Li, Nuberg & Bruwer, 2019; Asfaw, McCarthy, Lipper, Arslan & Cattaneo, 2016; Maponya, Mpandeli & Oduniyi, 2013). According to Cramer et al. (2018), recent rapid climate change has worsened existing environmental concerns in the Mediterranean Basin caused by a combination of changes in land use, increased pollution, and decreased biodiversity. Current change and future scenarios consistently indicate significant and growing hazards in five broad and interrelated impacts: water, ecosystems, food, health, and security (Cramer et al., 2018).

Levels of Exposure and Vulnerability to Climate Change Financial Risks

The dynamics of climate change effects

The economic impact of climate change is complex and significant, especially in reducing firms' expenditure on greenhouse gas emissions (Tol, 2018, 2019). Climate change affects individuals and nations in terms of financial resilience, leading to deviations in operations and performance. Hence, the scientific community's fundamental components concern ecosystems' capacity to respond to climate change impacts, events and issues (He & Silliman, 2019; Baho et al., 2017; Cumming & Peterson, 2017). The impacts of climate change on economic development include large-scale biodiversity loss and low-probability and high-impact scenarios (Barrucand et al., 2017; Lukwale & Sife, 2017). Understanding climate risk is crucial for effective adaptation action, and some assessment methodologies have emerged (Tol, 2019; Jurgilevich et al., 2017). According to Selormey, Dome, Osse and Logan (2019), climate change is a development challenge globally. According to the African Union and the United Nations, Africa is most vulnerable to its consequences (Selormey et al., 2019). Discussions on climate change effects are presented below.

Snowpack

The mountain snowpack makes up a key component of surface water resources, provides crucial storage of winter precipitation and serves as necessary, regionally integrated indicators of climate variability and change (Stewart, 2009; Mote, Hamlet, Clark & Lettenmaier, 2005). Climate change has caused continued warming and increasingly higher elevations and results in declines in snowpack accumulation and melt that cannot be offset by winter precipitation increases and variations in dates of melt across different regions (Carroll, 2022; Gauthier, Anchukaitis & Coulthard, 2022; Evan & Eisenman, 2021).

Melting glaciers

Glaciers primarily found in mountains and highland areas are natural stores and regulators of water supply to rivers, which, in turn, provide water for domestic and industrial consumption, energy generation and irrigation. Glacier ice covers about 10% of the Earth's surface and stores 69% of freshwater but is subjected to high temperatures and warming (Shahgedanova, 2021; Laghari, 2013). Due to global warming, ice cover is decreasing in this region, as for most glaciers in the world. In a period of 6 years (from 2003 to 2009), Himalayan glaciers lost an estimated 174 gigatonnes of water through melting glaciers with massive planetary health of the Himalayan region in lenses of social, economic and environmental areas (Pan, Li & Watanabe, 2022; Talukder, 2021; Laghari, 2013). This is expected to be worse after 13 years from that estimate.

Shrinking Sea Ice

Sea ice is often found in the arctic circle with nearby areas, and the decline in the floating sea ice cover in the Arctic is one of the most striking manifestations of climate change (Stroeve & Notz, 2018; Wang et al., 2018). Like melting glaciers, the climate change effects on the sea-ice cover fast declining, and changes to the timing of sea-ice break-up and freeze-up is an urgent economic, social, and scientific concern (Wang et al., 2018; Serreze & Meier, 2019).

Thawing permafrost

Permafrost is the permanently frozen ground that underlies much of the Arctic land surface; hence, its melting is known as thawing permafrost (Van Huissteden, 2020). The past 20 years of research and interest in the thawing permafrost reveal that at least a quarter

of some parts of nearby places arctic that has been continuous permafrost will degrade in the next fifty years and may completely disappear by the end of the 21st century (Gauthier, Anchukaitis & Coulthard, 2022). The extent of this thaw creates concern for the settlements nearby, especially for the industries, and the threatening sustainability of other activities due to ground instability (Street, 2020).

Changing Snow Patterns

In mountain ecosystems, snow cover is a key regulator, and a shift in the snow-free season brought on by global warming can significantly affect ecosystem dynamics (Everett, Huntington & Pfirman, 2014). Shifting snow patterns can severely impact the richness and distribution of alpine plant life. Changes in snow patterns in the Arctic affect how the ecosystem and hydro-systems work (Bennett, et al., 2019; Randin, et al., 2015). Changes in snow characteristics in this part of the world have a cascading impact on permafrost, ecology, and biology, with feedback between atmospheric moisture, sea ice, and albedo being particularly prominent. The Arctic cryosphere demonstrates the multiple connections between variations in atmospheric moisture transport, sea ice conditions, and soil and air temperatures with the lower latitudes where alterations in high-elevation snowpacks are mostly caused by temperature changes (Diodato, Bertolin & Bellocchi, 2020; Bennett, et al., 2019; Randin, et al., 2015).

Increased Ocean Acidity and Warmer Oceans

The acidity of the oceans due to climate change is an alarming phenomenon in the lenses of revealed statistics. Barker and Ridgwell (2012) reported that the ocean absorbed about 30% of the CO₂ generated by human activity. Carbon dioxide is transformed into carbonic acid when the water absorbs it. The amount of carbonic acid in the water was insufficient to tip the ecosystem's equilibrium before the Industrial Revolution. However, the environment has been irreparably altered by more than a century of unregulated carbon emissions (Barker & Ridgwell, 2012). The concentration of hydrogen ions increases by around 30% for every shift of 0.11 in pH. The atmospheric warming in the oceans causes less evaporative cooling (Jewett & Romanou, 2017; Barker & Ridgwell, 2012; Trenberth, 2007).

Rising Sea Levels and Wilder weather

As a result of glacial melt, the sea level rise has quadrupled from 1.8 millimetres per year throughout the 20th century to about 3.4 millimetres per year in recent years (Griggs, 2021; Saintilan, 2020). The likely effects of this increasing rate of rise on coastal mangrove forests, a tropical ecosystem of crucial importance for coastal protection (Lamont, 2020; Lindsey, 2020). In wilder weather, summers are warm, dry, and largely clear, whereas the winters are brief, cold, snowy, and partially overcast (Stroeve & Notz, 2018). The temperature seldom drops below 8°F or rises beyond 100°F throughout the year, often fluctuating between 23°F and 93°F (Stroeve & Notz, 2018).

Disease controls

There is growing concern that climate change will alter the distribution and burden of vector-borne diseases, potentially reversing the gains of control programmes and increasing the threat of emerging diseases. Climate and several other factors affect infectious diseases nonlinearly (Semenza & Paz, 2021; Lafferty, 2009). Moreover, there are latitudinal, altitudinal, seasonal, and interannual associations between climate and disease (Semenza & Paz, 2021; Lafferty, 2009). In most parts of Africa, it is projected that other virus-based diseases could replace malaria due to climate change (Semenza & Paz, 2021; Mordecai, et al., 2020).

Hence, physicians must know how climate variability affects health outcomes and understand that long-term climate change may exacerbate climate-sensitive health problems (Haines & Patz, 2004; Mordecai, et al., 2020). Long-term climate change effects which influence climate-sensitive health issues include vector-borne, water and food-borne diseases; an increase in acute and chronic respiratory conditions such as asthma and allergies; and heat-related and extreme weather-related morbidity and mortality (Clayton, Manning, Krygman & Speiser, 2017; Watts, et al., 2017; Costello, et al., 2009).

Droughts and Changing Rain patterns

Lower precipitation in the subtropics and greater evaporative demand increase the vapour pressure deficit under warmer temperatures, greenhouse gas (GHG)-induced global warming may cause more droughts and increase surface aridity in the twenty-first century (Cook, Mankin & Anchukaitis, 2018). Climate change-induced drought and changes in rain patterns influence agricultural practices (Durodola, 2019; Cook, Mankin & Anchukaitis, 2018).

Higher Temperatures

High-temperature stresses are the most critical constraint among climate-triggered events (Evan & Eisenman, 2021; Stouffer & Manabe, 2017; Xie et al., 2010). About 50% of yield losses are caused by drought and heat stresses, and high temperatures and more rain help improve wetlands' role as carbon sinks (Gaur et al., 2013, Salimi, Almuktar & Scholz, 2021).

Hypothesis Formulation

The understated hypothesis was formulated for this study given the above literature review.

Ho: The level of awareness of the effects of climatic change risks is low and insignificant in Southern Africa and other emerging countries.

Research and Methodology

The target population consisted of individuals actively involved in economic activity, either working individually or for an organisation in Africa or any emerging country. The emerging countries in this context include India, Indonesia, Mongolia, and others that have emerged from the developing stage.

Using a purposive sampling method, one hundred five (105) research participants were selected from more than 25 countries from Africa, Asia and many other emerging countries for the study. While this size was relatively smaller compared to the population size, the diversity of the sample selection afforded a representative picture of what is happening in these regions on climate change. Participants were briefed on the research to ensure they were aware of the study and its implication.

This study was descriptive research using surveys and fact-finding enquiries of different kinds. Kothari (2004) explained that the primary purpose of descriptive research is the description of the state of affairs as it exists at present. The main characteristic of this method is that the researcher has no control over the variables; he can only report what is happening.

Variables

The main pillars in the measures of climate awareness as the dependent variable were defined in terms of knowledge of the consequences of climate change in the regions, the implications of climate change on financial performance, and many other elements mentioned in the results section.

Hypothesis testing

Megastat software was used to examine the data and determine the statistical significance, relationship, and causation of the variables. In this instance, a cross-tabulation of variables was tested using Chisquare, and a mean value was determined below which data pattern observations were evaluated. The results of the data, as shown in the figures and tables, are provided in the next section.

Analysis and Findings

The results of the study are presented in this section starting with the demographic description of the data before considering the variables of interest on climate change awareness.

Demographic Characteristics

This section gives an overview of the respondents' characteristics in terms of gender, employment status, region and sector of their economic activity.

Respondent's Gender

Figure 1 shows the participants' gender.

1. Gender		
	frequency	percent
Male	56	53.3
Female	49	46.7
	105	100.0

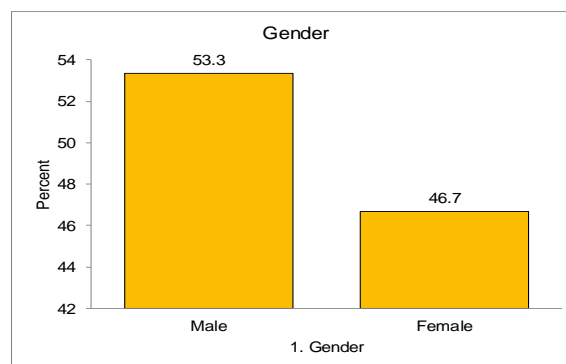


Figure 1: Participants Gender

Figure 1 shows that 53.3% of the respondents were males, and 46.7 % were females. This implies that more than half of the respondents (53%) were male. This gender distribution pattern was necessary to ensure that a fair share of each gender is involved in determining the situational variables under study.

Region

Figure 2 shows the regions of the participants.

2. Nationality		
	<i>frequency</i>	<i>percent</i>
Southern Africa	74	70.5
East Africa	14	13.3
West Africa	7	6.7
Middle East	9	8.6
Others	1	1.0
	105	100.0

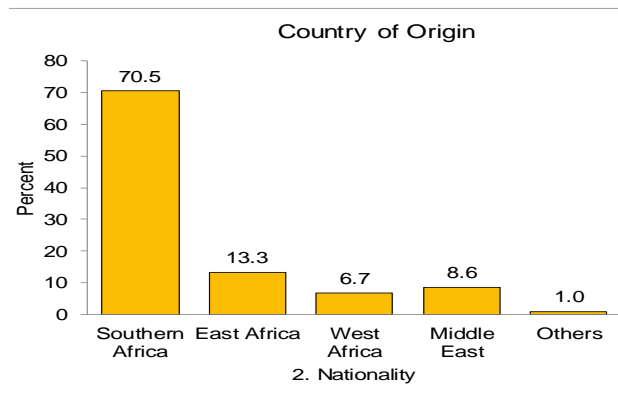


Figure 2: Participants Nationality

Figure 2 shows that the target groups in southern Africa accounted for 70.5% of the total respondents, with the others coming from east African countries (13.3%), less than a tenth (6.7%) from West Africa, 8.5% from Middle east and a 1% from others including Australia. These outliers acted as controls for the targeted regions' pattern.

Employment Status

Figure 3 shows the participant’s employment status.

It was established that 75.2% of the participants were in employment, 17.1% were not in employment, 6.7% were in employment and doing other businesses, and 1% were partly in employment. This implies that most of the participants (75.2%) were employed. This is good as employed participants' have a broader scope of the effects of climate change, thereby enhancing the quality of the data collected for the study.

3. Are you in employment?		
	<i>frequency</i>	<i>percent</i>
Yes	79	75.2
No	18	17.1
Partially	1	1.0
Employed + Business	7	6.7
	105	100.0

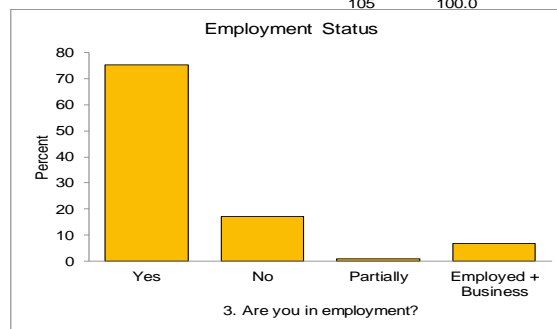


Figure 3: Participants Employment and Business Status

Sector

Figure 4 shows the participants’ sector.

4. Sector of Your Employing Organisation or Personal Business		
	frequency	percent
Financial Services	18	17.1
Education	8	7.6
Construction and Engineering	12	11.4
Agriculture	14	13.3
Health	8	7.6
Others	45	42.9
	105	100.0

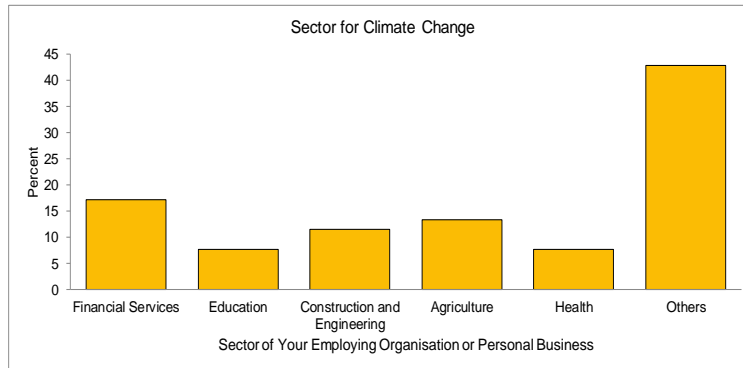


Figure 4: Participants Sector

Figure 4 shows that 17.1% of the participants work in the financial sector, 7.6 % in the education sector, 11.4% in the construction and engineering sector, 13.3 in the agricultural sector, 7.6% in the health sector, and 42.9% in other sectors. This shows that the participants engaged in work in a wide range of sectors, thereby ensuring that the data collected for those studies is robust, encompassing opinions from broad sectors.

Awareness of the Effects of Climate Change Risks

The awareness of the effect of climate change was measured under four variables based on (1) knowledge of prevalent effects of climate change (2) Interest in climate change (3) ability to estimate the exposure and vulnerability and (4) climate change impact on financial performance.

Measuring Awareness based on Prevalent Effects of Climate Change

Figure 5 shows the various climate change pattern as submitted by the respondents.

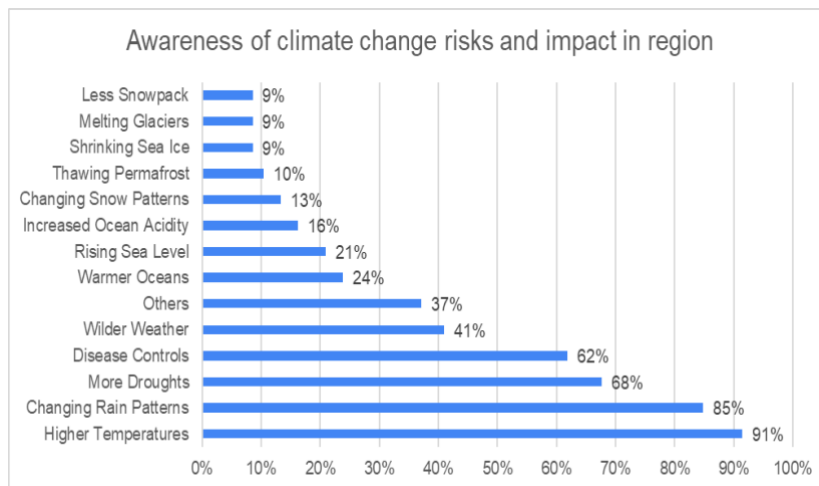


Figure 5: Prevalent climate change effects in the area – self-rating

Figure 5 shows that 9% experienced climate change effects in fewer snowpacks, 9% had melting glaciers, and 9% experienced shrinking sea ice. One-tenth of the participants (10%) reported that they experience thawing permafrost, 13% have seen a general change in snow patterns, 16% experience increased ocean acidity, 24% are warmer oceans, and 21% are affected by rising sea levels. The participants were requested to select all factors that applied to their areas. 41% cited wilder weather as being prevalent due to climate change, 62% attributed disease control challenges to climate change, 68% reported more droughts, 85% experienced changing rain patterns and 91% higher temperatures. Almost half of the participants (41%) affirmed that there are several other effects of climate change not included in the research instruments in terms of impacts of climate change vulnerability.

The results indicated that the significant dynamics of climate change are common to almost all the regions of the world, including higher temperatures, changing patterns of rain, droughts, new diseases and challenges in controlling them. Climate change has also brought about cold and violent weather.

Measuring Awareness based on Interest in Climate Change Risks

Figure 6 shows the results of individual interest in climate change risks.

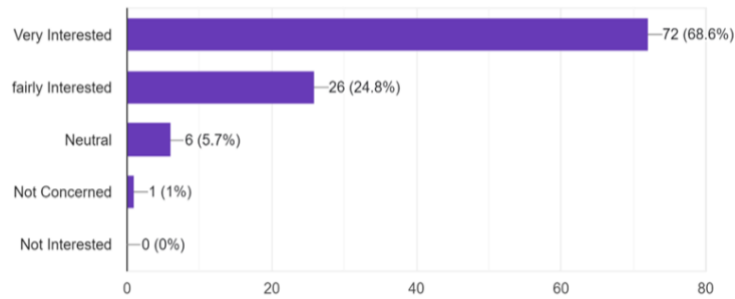


Figure 6: Participants’ Interest in Climate Change Risks

Figure 6 shows that 68% of the total respondents were very interested in climate change issues and risk exposures, 24.8% were fairly interested, 5.7% were lukewarm to climate change and took no position, and 1% were not concerned. All respondents affirmed that they are interested in climate change risks. This suggests that the extent of the climate change risks has increased people's interest in Africa and Eastern Asia. Climate change awareness campaigns do not start from scratch but at a point where the target communities have the basic knowledge. This implies that many people know about emerging risks associated with the climate system.

Measuring Awareness based on Vulnerability and Exposures to Climate Change Risk

Figure 7 shows the results of individuals and organisations rating vulnerable and exposed to climate change risks. The vulnerability implied the extent to which the individual or an organisation was susceptible to climate change risks and the inability to cope with its adverse effects. Exposure measured the degree to which the nature of the business was affected by climate change effects.

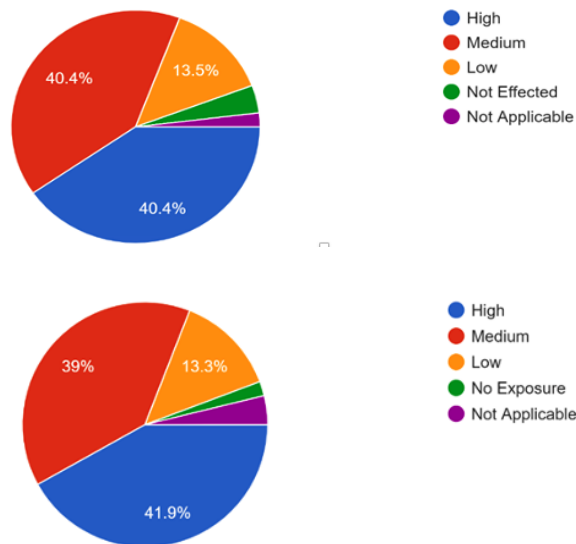


Figure 7: Vulnerability and Exposure to Climate Change

The results indicated that the respondents were highly exposed to climate change. Figure 7 shows that 40.4% of the participants reported that they sustained a high level of vulnerability, 40.4% was medium level, 13.5% low risk, 4.5% said they are not affected, and 1.2% said climate change effects do not apply to them. 41.9% of the participants reported that they sustained a high level of exposure to climate change risks, 39% had a medium exposure, 13.3% had a low-risk exposure, 2.6% said they are not affected, and 3.2% said climate change effects do not apply to them.

Vulnerable individuals and organisations were also exposed, and most fell into these categories. The climate change effects are therefore increasing, affecting many businesses.

Hypothesis Testing

A non-parametric test of chi-square was used in the Megastat system. Rather than a cross-tabulation between two variables, only a single variable was used and subjected to a hypothetical threshold mean value. The four anchor rating values for this test ranged from 1 – 4, where respondents were to state if climate change has affected them financially on the net effect, whether as individuals or as an organisation. Now the only time the responses can be from 1 to 3 is when someone is consciously aware of the effects.

Hence the hypothesised value for the test at 95% certainty was placed at less than 4. The value 4 was for those not sure and not aware of any climate change effects. Hence, the choices from 1 - 3 qualified the respondent awareness and 4 implies they are not aware or sure.

The null hypothesis was stated, addressing the financial content of the variable based on the following decision rule.

Decision Rule: Reject null (P value is <0.05) and accept the alternative hypothesis

Ho: The level of awareness of the effects of climatic change risks is low and insignificant in Southern Africa and other emerging countries.

Table 1: The Chi-square test on the Hypothesised mean value

Hypothesis Test: Mean vs. Hypothesized Value	
4.000	(Less than) hypothesized value
1.914	The net effect of the climate change dynamics on your firm financial performance?
1.186	std. dev.
0.116	std. error
105	n
104	df
-18.02	t
4.52e ⁻³⁴	p-value (one-tailed, lower)
1.685	confidence interval 95.% lower
2.144	confidence interval 95.% upper
0.229	half-width

Note: The net effect of CCD on financial performance Four Point Anchor Rating: Negative Effect 1; Positive Effect 2; No Effect 3; Not Sure 4

There is significant evidence with 95% certainty that people are adequately aware of the predominant effects of climate change risks in Southern Africa and other emerging countries.

The hypothesis test shows that the economic effect of climate change is significant, and participants reported that climate change affects them either positively or negatively or with no effect. A response of not sure (indifference) meant that the respondent was unaware of the predominant effects of climate change risks, as shown in Table 1.

Discussions

The results have revealed the firm position of the awareness levels measured in terms of the knowledge of prevalent climate change risks in the region, the individual interest, the vulnerability and exposure, and the climate change impact on financial performance.

Knowledge of Local Prevalent Climate Change Risks

The match confirms that both individual and organisational groupings are fully aware of the effects of climate change prevalent in their area. The patterns agree with the literature on the distribution of climate change effects in different regions (Xie, 2020; Marshall et al., 2014; Bryan, Manabe & Spelman, 1988). Most participants in Southern Africa and other African countries indicated that climate change is visibly in irregular temperature changes, rain patterns, and droughts. Countries outside the region, such as Indonesia, only reported the snow and sea effects. This consistency in geographical patterns indicates that there is adequate awareness, and what matters is the response efforts.

Most respondents highlighted the most prevalent effects of climate change over a long time, as shown in Figure 5. The hypothesis test had a 1.9 value on adverse performance effects against the hypothesised value of 4 for lack of awareness. The statistical significance qualified the awareness levels of climate change's positive and adverse effects. The findings on awareness of the dual effects of climate change on financial performance concur with previous studies about the double effects of climate change, where it

is stated that in the near term, the effects of climate change may very well be favourable. The long-term effects, however, outweigh the short-term benefits, and between the lower and the higher altitude regions (Portner et al., 2022; Ng, 2018; Tol, 2018).

Individual Interest in Climate Change

Interest in climate change varies depending on individuals and organisations' specific factors. For example, an individual's interest in climate change significantly influences his/her attitude towards climate change risk management. About four out of five individuals are interested in climate change risks and their effects in their area or communities. This finding agrees with previous studies on individuals' interests and climate change issues (Barrucand, Giraldo & Canziani, 2017; Tvinnereim et al., 2017). Furthermore, the findings are consistent with the 'individual response efficacy' to climate change, which contends that efforts to increase individual efficacy beliefs about climate change through explicit instruction or laws would enhance the climate-friendly environment, but which has generally failed in tests (Hornsey, Chapman & Oelrichs, 2021; Sparkman, Howe & Walton, 2021; Gifford, 2011).

The Vulnerability and Exposure to Climate Change Risks

At both organisation and individual levels, the results indicate that awareness of the effects of climate change has increased, as individuals know what is at stake and organisations are exposed to business changes due to change in climate risks. This appreciation of the vulnerability levels that vary with the nature and level of economic activity explains why adaptability is the talk of the day by most organisations and the emergence of new diseases (Mordecai et al., 2020; Jurgilevich et al., 2017).

This underlined the extent of vulnerability levels matched the findings by Thomas et al. (2019), who reported that populations are not uniformly vulnerable to climate change. The reasons for vulnerability are mainly social and economic, not merely a matter of different exposure to climate-related and environmental hazards. It takes an individual or organisation to be aware of what and how climate change affects them, a concept called the psychological response to climate change effects or behavioural adaptation (Clayton, 2020; Hamilton et al., 2018).

Conclusion

The study has shown that communities are relatively aware of the impacts of climate change and can quantify the losses in financial terms, at least as an estimate. The findings indicate that the level of awareness of individuals and organisations is satisfactory. The findings on vulnerability and exposure indicated that people are aware of climate change and its effects on individuals, organisations and communities. This implies that it is easy for some people and communities to embrace measures to manage climate change risks. Over 78% of the participants are followers of climate change dynamics with interest, and such people would easily cooperate with devised measures that need public support. It is recommended that agencies regulating and monitoring climate change must be effective in managing climate change risks. The environment is fertile for support and implementation of measures.

The research findings reveal five significant areas of action points based on the facts about climate change. These action points are recommended for individuals, families, organisations, governments and international organisations. Recommendations are presented below.

Individuals

The primary and fundamental unit of the climate change environmental effects is individuals. The individuals must respond to measures devised by local and international authorities. The individuals' awareness levels, especially with the established interest, must be used to take individual responsibility.

Families

The fundamental component of the community is the family, and family dynamics greatly influence climate change (Lawson et al., 2019). The conversations and inculcating knowledge of climate change into household members and the rules given to children shape the generation of climate change-conscious people. It is recommended that parental behaviours and interest in creating awareness of climate change should be made available to children through videos, radio and media news channels. It is recommended that the interest in climate change that has to be managed at the societal level must be tied to family efforts.

Organisations

The significant contributors to man-made or human-triggered climate change are the organisations involved in various economic activities. Organisations can only devise a policy or procedure with a climate change awareness system and interest. It is recommended that the financial impacts of climate change in organisations in terms of the level of awareness and climatic change policies.

Governments

The sovereign states are recommended to spearhead climate change awareness programmes to sustain the existing climate-concerned citizens. The governments must respond to this awareness level of climate change and demonstrate a political and economic will to manage climate change risks prevalent in the region. The support for green energy, regulations and demand for compliance from organisations on climate change rules will sustain climate change awareness and mitigation against the effects.

International Climate Change Research based Organisations

There are many organisations formed at the global level aimed at fighting climate change risks. The level of climate change interest and awareness levels does not guarantee a successful fight against it. However, climatic risk management measures must be customised to meet the vulnerability of individuals, organisations and communities. It is recommended that such globally based organisations sponsor the indigenous knowledge (IK) peculiar to the areas rather than imposing one method for all climate change management systems.

There seems to be lip service attached to the fight against climate change in African countries; hence, a good position of the efforts taken is urgent. There is overwhelming evidence of satisfactory climate change awareness calling for a desperate need to establish the levels of response to climate change by the governments in these countries and the challenges faced. There is also a gap in the climate change impacts on various sectors of the economy to establish if some sectors are more vulnerable to climate change effects than others. The authors are in the process of contributing the research work towards these suggested areas and must be supplemented by other researchers in similar or different contexts.

The study findings have implications for individuals, organisations and sovereign governments. To the individuals, the research finding will help them appreciate the need to be aware of the climate change risks, the patterns prevalent in their areas/communities, and act appropriately to manage the emerging climate change risks. To the organisations, the results help them appreciate their role in the series of climate change battles. The financial performance is rated negative, and governments will impose rules and regulations mostly on firms to mitigate the impacts of climate change. Hence, organisations must understand the need to have a double-edged approach to climate change, anticipating losses that they are aware of and receiving rules from the authorities who are becoming increasingly interested in climate change effects.

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