SIT Graduate Institute/SIT Study Abroad
SIT Digital Collections

Capstone Collection | SIT Graduate Institute

December 2020

COVID-19's Impact on Climate Change Research and Institutional Resilience in Higher Education in Vermont and Tanzania

Stephanie Clement

Follow this and additional works at: https://digitalcollections.sit.edu/capstones

 Part of the African Studies Commons, Community-Based Research Commons, Environmental Studies Commons, and the Higher Education Commons

Recommended Citation

Clement, Stephanie, "COVID-19's Impact on Climate Change Research and Institutional Resilience in Higher Education in Vermont and Tanzania" (2020). *Capstone Collection*. 3225.
https://digitalcollections.sit.edu/capstones/3225

This Thesis (Open Access) is brought to you for free and open access by the SIT Graduate Institute at SIT Digital Collections. It has been accepted for inclusion in Capstone Collection by an authorized administrator of SIT Digital Collections. For more information, please contact digitalcollections@sit.edu.

COVID-19's Impact on Climate Change Research and Institutional Resilience in Higher Education in Vermont and Tanzania

Stephanie Clement

Capstone Advisor: Dr Katharina Kreppel

A capstone paper submitted in partial fulfillment of the 15 requirements for a Master of Arts in Climate Change and Global Sustainability at SIT Graduate Institute, USA.

3 August, 2020

Table of Contents

ACKNOWLEDGEMENTS

Writing this capstone was not a solo journey. I would like to extend my gratitude to all my friends, who offered words of encouragement and gave me support throughout the whole process. A big thank you to my mother for taking care of some of my basic needs when I was knee-deep in research and interviewing and writing. This paper would not have been possible without all of the coffees, pies, laughs, and encouragement from them. Much gratitude to all of them for helping me keep a balance.

In addition, I would like to thank Dr Richard Walz and Dr Katharina Kreppel for advising me, meeting with me, editing drafts, reaching out to contacts, and providing support and feedback throughout this process. Staying up late, meeting early, making sure they made time even with spotty internet and virtual meetings and flexing to my time schedule, they provided me with the professional guidance necessary to complete this paper. I thank them for their continued guidance and support throughout this.

Finally I would like to thank the participants who took time out of what has been a bizarre and busy summer to offer their insights that are the foundation of this paper's analysis. This time has been stressful for everyone, and especially those who work in higher education. Thus their valuable input and their time was greatly appreciated, and I thank them for their generosity.

Abstract

The COVID-19 pandemic impacts all sectors of society. It is necessary to understand how higher education institutions (HEIs) react to, adapt to, and build resilience in the face of such a crisis. HEIs around the world shifted how they deliver education to their students and struggled to adapt to a changing economy. Yet, there is little information on how HEIs bolster their resilience to exogenous shocks, like the coronavirus. This study assesses how the COVID-19 crisis impacted institutional resilience and climate change research at four HEIs: the University of Vermont (UVM) and Vermont Law School (VLS) in Vermont, United States of America, and the University of Dar es Salaam (UDSM) and the Nelson Mandela African Institution of Science and Technology (NM-AIST) in Tanzania, East Africa. Resilience in HEIs during COVID-19 provides insight into how such institutions may fare when faced with other crises, like climate change. Furthermore, the current crisis provides evidence of how these institutions can mitigate the effects of crises in the future. In this project, the focus of assessment is resilience related to community and funding in HEIs. Twenty interviews conducted with faculty, staff, and administrators at four institutions indicate that climate change research will continue at HEIs; however, there is concern, especially at institutions in Tanzania, about external funding. While each university differed in its decisions for the continued education of students, the two HEIs in Vermont independently turned to hybrid and online education, while the two institutions in Tanzania continued in-person classes based on a government order. The school most resilient to the COVID-19 shock was VLS. The other three HEIs made incremental changes to ensure educational services and research going forward. The project recommends four strategies to bolster institutional resilience at HEIs: institutions should act as independent communities and universities should strive to diversify their funding sources, guarantee faculty and staff members a voice in decision-making, and create flexible emergency plans disseminated across their institution. If acted on, the lessons learned by HEIs during the COVID-19 crisis can strengthen institutional resilience to other exogenous shocks, like climate change.

INTRODUCTION

These are unprecedented times. This is a phrase that has been heard for months as the global pandemic of COVID-19 has taken the world by storm, infecting millions, upsetting global supply chains, stressing hospitals, shutting down economies, and taking the lives of thousands of people. The world has not seen a pandemic like this in the modern era. The global response has revealed much about human and environmental resilience on many different levels. Thus it is important for researchers to understand how this pandemic affects societies, including its impact on higher education institutions (HEIs). This capstone project examines how COVID-19 has impacted HEI resilience and climate change research in order to provide recommendations on how HEIs can bolster their resilience when faced with external shocks like the coronavirus pandemic.

Objectives

The aim of this study was to examine COVID-19's impact on HEIs. First, it assesses the impact of the coronavirus pandemic on climate change research in terms of prioritization of types research, funding, and resource allocation. Next, the study assesses how the pandemic affects HEI resilience. This was done by analyzing the existing frameworks on resilience in HEIs and applying them to this unparalleled pandemic. Interviews with faculty and staff members provided deeper insight into this assessment to analyze what their points of view say about their institutions' resilience and note disparities that arise in their concerns and perceptions. Third, the study compares these findings across different academic communities - two in the US and two in Tanzania. A cross-cultural comparison between one developed country and one developing country provides unique perspectives as to attitudes, actions, and priorities in each country as it addresses the double shocks of climate change and coronavirus. In sum, the overall arch of the

inquiry focused upon the three themes of climate change research, coronavirus, and institutional resilience are examined in four higher education institutions: two in Vermont and two in Tanzania. Understanding reactions and adaptations to the coronavirus pandemic in HEIs is useful to be able to build resilience in these HEIs to this and future shocks that they might encounter and continue the important research on climate change that they do.

BACKGROUND

Within the realm of climate change and sustainability, there are several important themes that arise, one of which is resilience. A prominent word within the literature surrounding the coronavirus pandemic and within the field of climate change, "resilience" occupies an important role in planning for the future and surviving external shocks. This is especially true for foundational institutions such as those of higher education. As leaders in climate change research and action, and often acting as pillars of strength and solidarity within the communities they reside, HEIs are essential institutions for innovation, knowledge, and stability (Storms *et al*., 2019). HEIs are inextricably linked with the communities they find themselves in. They are essential for community employment, culture, and knowledge sharing (Storms *et al*., 2019). They also occupy an important place in sustainability research and literature: often HEIs are centers of new research and innovation about climate change (Storms *et al*., 2019). HEIs are essential institutions for learning about, adapting to, and mitigating climate change, and that role does not diminish when faced with exogenous shocks like the coronavirus.

Existing literature on climate change research and institutional resilience within higher education is scarce. However knowledge about institutional or organizational resilience is important both in that it is linked closely with community resilience and it is an indicator of

adaptability to exogenous shocks (Dalziel & McManus, 2004 in Lee *et al*., 2013). Resilience studies will be increasingly important as societies face growing pressures from threats such as climate change and the coronavirus. Humans can learn from present impacts to adapt to and mitigate future threats.

This study was conducted at a unique time in human history. The coronavirus pandemic has shifted many priorities for many countries, organizations, and individuals around the world, and created a new normal in which many people and institutions have had to pivot, restructure, and make decisions quickly to ensure their well-being while taking steps to respond adequately to the pandemic. This study was conducted in the United States, but interviews and research were done remotely, as much of the working and educational world has turned online. This capstone project examined the intersection between climate change research, the coronavirus, and institutional resilience. It is necessary to understand the background about each of these three topics independently, before analyzing their intersections.

COVID-19

Coronaviruses (CoVs) are RNA viruses that were discovered in the 1960s. They have been more actively part of global health discussions since the SARS (Severe Acute Respiratory Syndrome) outbreak in 2002 (Ashour *et al*., 2020). Prior to this outbreak, human CoVs generally caused mild illness and symptoms, and have often been regarded as irritating rather than a major cause for concern (Ashour *et al*., 2020). However, the SARS CoV was of a different origin - an animal origin - and thus produced severe illness and death in infected humans (Ashour *et al*., 2020). CoVs of animal origin are called zoonotic pathogens. Since the 2002 SARS outbreak, there has been one other zoonotic CoV outbreak, MERS (Middle East Respiratory Syndrome), in 2012, and now the novel CoV, SARS-CoV-2 (Ashour *et al*., 2020).

The novel coronavirus, also known as COVID-19, first appeared in China in November of 2019, and by February of 2020, it had spread all over the world, infecting over 16 million people, leading to lockdowns, quarantines, and pressure on health systems as the world economy shrank (Johns Hopkins, 2020). With no vaccine, governments around the world enacted various orders to slow the spread of the disease including mandatory lockdowns, social distancing, quarantines, mask-wearing, and other measures. Some governments, like in Vermont in the U.S., mandated public mask-wearing, barred elective surgeries, and closed businesses and schools. Professional meetings across sectors turned virtual, and higher education degrees are completed remotely. In many developing countries like Tanzania, however, with an economy reliant on manual labour and less capable health systems to absorb the shock of this pandemic, work has continued normally. Moreover, the country, which took initial measures to address the disease, has decided to act so that the economy did not collapse.

This crisis throws the extreme disparities and inequities around the world and within countries, cities, towns, and communities into relief. Lay-offs and furloughs are commonplace, rendering "non-essential" workers out of work. Some universities have also closed to physical attendance, sending students home, and scrambling to put lectures, assignments, and grades online to try to ensure students a quality education. Students without access to accessible, reliable, and free internet are often left behind. For many universities, this is a substantial challenge unlike any they have faced before.

Climate Change

Climate change is an ongoing crisis linked to anthropogenic activity (NASA.gov, 2020). Human activities have released excess amounts of carbon dioxide (CO_2) and other greenhouse gases (GHGs) into the atmosphere at increasing rates since the middle twentieth century, which

has led to levels of CO_2 in the atmosphere not experienced for millennia (NASA.gov, 2020). Changing the composition of the Earth's atmosphere has consequences. Carbon dioxide is a GHG that traps heat and thus contributes to warming the earth (NRC, 2006 in NASA.gov, 2020).

Incremental increases to Earth's temperature have disproportionate impacts on many different ecosystems and weather patterns upon which humans rely. For instance, since the late nineteenth century, the global temperature has risen about 1℃ (Celsius), which has cascading effects on weather around the world. These impacts include increased temperatures and acidity of the oceans (due to ocean water's absorption of CO_2), the shrinking size of ice caps and glaciers, desertification, decreased snow cover, the increased frequency of extreme weather events (such as hurricanes/cyclones), and sea level rise (IPCC, 2018; NASA.gov, 2020). Human activities such as fossil fuel combustion, deforestation, agriculture, and land use change (LUC) release GHGs into the atmosphere, degrade the land, and contribute to global climate change (IPCC, 2019).

Much of our knowledge about climate change and its effects arises from the work of research institutions including HEIs. Higher education institutions around the world have taken the initiative to model behavior for climate mitigation, and have acted as leaders in sustainability and climate education (Dyers & Andrews, 2011). They have formed networks to take on climate change mitigation challenges, integrated climate change into university curricula, joined with organizations and communities for on-the-ground action, and produced research on many different aspects of climate change (Dyers & Andrews, 2011; Ross, 2020). They are thus essential players in the discussion and action around climate change.

Both Tanzania and Vermont are and will continue to be impacted by climate change. In Tanzania, concerns of rural livelihoods and disease epidemics are at the forefront, with the

majority of the rural population dependent on agriculture for their well-being (Forshey *et al.*, 2019). Tanzania is already experiencing higher temperatures overall, with increasingly varied rainfall patterns throughout the country, which leads to unreliable agricultural output (Luhunga *et al*., 2018). In addition, warming oceans and sea level rise threaten Tanzania's fisheries and ocean-based livelihoods, especially in areas such as Zanzibar (Makame, 2013). Overall, efforts to address climate change in Tanzania are focused on livelihood adaptation and alternative energy. In Vermont, the impacts of climate change are also already being seen: increases in extreme heat days in the summer, increases in tick-borne diseases, and water quality issues have plagued the state, with expectations of increased impact in the future (healthvermont.gov, 2020). The focus in Vermont is to change policies to better address emissions reductions, clean energy, and weatherproofing of homes (healthvermont.gov, 2020). The two countries thus focus on different aspects of climate change: the U.S. on policy and energy, and Tanzania on adaptation and livelihoods

Resilience

Three important topics arose during the COVID-19 pandemic that are also applicable to climate change: adaptation, vulnerability, and resilience. These topics are foundational to discussions about the long-term impacts of the pandemic. Chief among these topics and of greatest relevance to this paper is "resilience". Often defined as "the ability to bounce back or to overcome adversity", this word has been used during the COVID-19 pandemic as an expression of hope, a focus of study, and a grounding topic as societies around the world suffered from the impact of this disease (McCubbin, 2001). To understand resilience in HEIs is to narrow the focus of resilience and resilience studies in literature to hone in on communities and institutions rather than ecosystems, infrastructure, or psychology.

For the COVID-19 pandemic, it is clear that there are several components of community and institutional resilience that are important, including the ability to adapt, or, adjust to suit a new circumstance. The global response to the COVID-19 pandemic provides insight into how communities will respond to another crisis of global scale: climate change. It highlights the factors within societies that increase resilience, and throws into relief those that decrease it.

Fundamentally, resilience "embodies a vision of healthy individuals and thriving communities" (Wulff *et al*., 2015). Stripped down of its complexities, "resilience" consists of three components: 1) absorbing capacity or persistence, in other words the ability to take on an exogenous shock, 2) the buffering or adaptive capacity in other words how the impact of the shock is moderated through incremental adjustments, and 3) the response to the shock or transformative capacity (Keim, 2008; Béné *et al*., 2012 in Sturgess, 2016, p. 8). For communities, this resilience depends on the individuals within the community and how they react both as individuals and as a collective. To be resilient, communities must "promote [...] sustainable and long-term well-being […] in the face of adversity and disaster" (Wulff *et al*., 2015). Put another way by Roy *et al*., (2020):

> Among the three capacities, absorptive capacity is deigned as the capacity of change that a system can undergo while still retaining its function and structure (Jeans *et al*. 2016). Meanwhile, adaptive capacity is understood as the capacity of learning, combining experiences and knowledge, and making an adjustment to drivers (Béné *et al*. 2012). Transformative capacity refers to the creation of a new system by creating a fundamental change to its characteristics and actions when the initial state is unbearable anymore (O'Connell *et al*. 2015).

Institutional resilience is connected to community resilience. To study institutional resilience requires recognition of the leaders involved and their decision-making, the institution's adaptability, flexibility, and creativity, and its proactivity and unity in the face of crisis (Resilient

Organizations Ltd., 2020). It is important that institutions bolster their resilience in times of crisis so they operate efficiently and responsibly over time (Fisher, 2017).

HEIs in Vermont

A small state in the heart of New England, Vermont is known for its autumn leaves, maple syrup, progressive politics, and Ben and Jerry's ice cream. However, there's more to the state than sweets and leaf-peepers. Vermont and its people have been active in climate change movements and sustainability from early on. In addition, Vermont has many alternative energy companies, and has an activist past with politically progressive Senator Bernie Sanders. Vermonters also take pride in their wilderness spaces, as indicated in the state's nickname: the "Green Mountain State". With the smallest economy in the U.S. and poor job growth outlooks, the state's economy is largely reliant on the service sector and tourism (forbes.com, 2019; Morrissey & Sanford, 2020).

The city of Burlington is located in northeast Vermont along the shores of Lake Champlain in New England, U.S.. With approximately 45,000 residents, Burlington is Vermont's largest city, and hosts the University of Vermont (UVM). It has been progressive in terms of climate action in the past. For instance, in 2016 Burlington became the first city to run entirely on renewable energy (Woodward, 2016). The city is also working toward net zero energy by 2030. UVM is an important institution in Burlington. More than 1,000 graduate and doctoral students are registered at the university. The institution has a well-known medical school linked to the University Hospital. UVM has been active on topics such as climate change, environment, and sustainability, with an independent Office of Sustainability and many degrees focused on environmental health and climate change. As a public research institution, historically it has highlighted agriculture and the environment, and hosts The Gund Institute for Environment

(formerly, The Gund Institute of Environmental Economics), where prominent academic and environmental economist Robert Costanza first asserted his valuation of ecosystem services.

A second institution of higher education in Vermont is the Vermont Law School (VLS). Located in South Royalton, Vermont, VLS is known throughout the state and country as an excellent institution for studying various forms of law. With a specialization in climate change law, VLS was the first institution in the U.S. to offer an environmental law degree (Participant 1, 23 June 2020; vermontlaw.edu, 2020). Established in the 1970s, and some of the campus architecture date back to the 1800s, the private school has over 400 students pursuing their Juris Doctor degree and another 200 students registered for Masters and LLM degrees (vermontlaw.edu, 2020). VLS has many environmental foci in their curriculum, including environmental justice, environmental crimes, land conservation law, global energy law, and food impact litigation (vermontlaw.edu, 2020).

The current COVID-19 pandemic substantially impacted the state of Vermont. Since the origin of the pandemic, the state's focus has shifted from economic and societal engagement to a strong public health focus. It is yet to be determined what this shift means for UVM and VLS as they react to changed circumstances.

HEIs in Tanzania

Situated in Eastern Africa on the Indian Ocean, Tanzania is a country known for its wildlife, which draws tourists from around the world. Approximately 20% of the country's revenue is generated by tourism, which has all but ceased during the COVID-19 pandemic (Chiteji *et al*., 2020). Approximately 40% of the workforce is engaged in agricultural activity and 66% of the population lives in rural areas (Chiteji *et al*., 2020).

Arusha is located in the northern part of mainland Tanzania near the country's second tallest mountain: Mount Meru. The Great Rift Valley is located in this region, which is a hotspot for safari tourism and wildlife conservation. Surrounded by conservation areas and national parks, Arusha is an urban center with more than 400,000 residents. The city has hosted several climate change conferences, including the 2013 Africa Climate Change Conference and the 2020 Climate Action Network Annual Strategy Meeting (cantz.or.tz, 2020). Arusha has a prominent university and research center: Nelson Mandela African Institution of Science and Technology (NM-AIST). This institution is involved with several projects focused on climate change, including eco-village, adaptation, and resilience-based projects.

Another extremely prominent institution in Tanzania is the University of Dar es Salaam (UDSM), located on the coast of Tanzania in its highest populated city, Dar es Salaam. As the economic capital of the country, Dar es Salaam is an important center for shipping, trade, fishing and foreign tourists (cia.gov, 2020). UDSM is a public school, and an educational leader in the East African region known for its research and academics. With over 5,000 graduate students, and a total student body of approximately 28,000, the school is an important fixture in the academic community of Africa (udsm.ac.tz, 2020). UDSM has a Center for Climate Change Studies, offers Master's and doctoral degrees. It produces "high quality climate change research" and partners with different organizations to implement climate change research and projects (udsm.ac.tz, 2020).

While Tanzania saw an early outbreak of COVID-19 infections, with many tourists travelling to and from the country and a large Chinese workforce and strong business ties to China, the country decided not to update its infection numbers publically. Public health interventions were not put into full effect (dw.com, 2020). The country has come under scrutiny

of the World Health Organization, and since 29 April, 2020 it has not updated its numbers of coronavirus cases (tz.usembassy.gov, 2020). With encouragement from President Magufuli, many people continue to work and gather for prayer (dw.com, 2020). The first COVID-19 case was detected in Arusha, the home of one of the institutions in this study. The country as a whole takes a unique approach to addressing the pandemic, as it has continued business and declared the country "coronavirus free". The long-term impacts of these approaches to the country's universities and to climate change preparations has yet to be decided on.

RESEARCH QUESTION

The global pandemic of COVID-19 has impacted all sectors of society, and especially vulnerable populations. Over 600,000 people have died from the disease, and cases in many places continue to increase (jhu.edu, 2020). Businesses have had to close their doors, meetings have turned virtual, and unemployment in some countries has reached record highs (Clarke, 2020). Some higher education institutions have had to close their doors to their students to reduce the spread of the virus. Other HEIs instead turned to online classes, virtual graduation ceremonies, and optimistic messages to current and future students. The messaging from many of these institutions is clear: we want our students to continue learning. Yet the economic downturn resulting from the pandemic also impacted higher education institutions (HEIs) that now cannot necessarily rely on previous funding sources to finance their research and pay employee salaries, especially in developing countries. While in the U.S. there are several federal- and state-led financial initiatives to ensure continued living wages and work for HEI employees, the same is not the case in Tanzania. Much of the funding for faculty and staff members of HEIs

in Tanzania is sourced from donor countries, and during the coronavirus pandemic, many donor countries are focused on their own financial priorities nationally.

Amidst all this uncertainty, I investigated how these HEIs have responded to the pandemic. How flexible were these institutions? How were they able to adjust expectations, teaching models, research priorities, and funding in light of the exogenous shock? In light of their resilience during COVID-19, how had the pandemic influenced HEIs' work on another crisis: climate change. To me, this was the focus of my research, and I wanted to compare these responses across countries and institutions in order to determine how HEIs could use their experience during COVID-19 to improve their resilience to exogenous shocks in the future.

As a student whose education was directly impacted by the COVID-19 crisis, I wondered how other educational institutions responded, organizationally and academically. Therefore, it was decided to examine how this pandemic tested institutional resilience and continued prioritization of climate change research. The literature is scarce on this topic, as the pandemic is an ongoing issue. As a result, I chose to interview employees at each of the four HEIs researched. Individual narratives are essential to communication on how reactions and adaptations are perceived and enacted. Interviews with those directly affected by institutional policy changes was essential to complete this study. By highlighting cases from two countries - one "developed" and one "developing" - the project provides a unique comparison to develop further resilience work. Thus, the core question became, "How has COVID-19 impacted climate change research and institutional resilience in higher education institutions in Vermont and Tanzania?"

METHODOLOGY

Several different methods were employed in this study to assess the impact of coronavirus on HEIs: literature review, semi-structured interviews, and qualitative analysis through the Grounded Theory analysis technique, which analyzes methodically collected qualitative data to form theories (Glaser & Strauss, 1967).

Research Design and Rationale

The project is qualitative in nature. By interviewing participants and conducting a literature review, I sought to analyze perceptions of higher education faculty and staff members on climate change research and institutional resilience and compare their responses across institutions and countries. The inclusion of countries representative of both "developing" and "developed" areas provided insight into unique responses to a common threat of the coronavirus based on the national priorities and economic capabilities of each country. In addition, by asking about the coronavirus pandemic and its effects on research and institutional resilience, this project gauged responses to the impacts of the crisis on both individuals and HEIs.

Selection of Participants and Sites

HEIs were selected based on their type (research university, public, private, etc.), the amount of climate change work that is being done at the institutions, and their locations. With a base in Vermont and sufficient contacts at UVM and VLS, a convenience sampling approach was chosen. The two HEIs represent prestigious institutions in the state and UVM is a public institution, and VLS is private. In addition, having studied in Tanzania, I decided to take this unique opportunity to compare HEIs in a "developed" and "developing" country. UDSM and NM-AIST were selected for similar reasons of size, funding, and research. The comparison between the two countries represents differences between responses and perceptions in the

developed world and the developing world to the coronavirus pandemic, which allows for comparison of interventions and their subsequent impacts. This study can inform policy and future resilience-building strategies.

When selecting interviewees, both faculty members and administrative staff were engaged. Interviewees were chosen in two ways: through online research, and through a snowball sampling method. Typically, more employees at HEIs were reached through referrals from already interviewed participants. Gender representation was planned to be as equal as possible, and thus reach-outs were made to a similar number of men and women.

Faculty contacted had research projects or taught classes related to climate change. Climate change research was selected as a key characteristic for interviewees because resilience and mitigation tactics are at the core and align too with resilience important for the coronavirus. In addition, unlike some other subjects, climate change is pervasive: it impacts all sectors of society and therefore there are many subjects of study that integrate it. Faculty members selected specialized in natural resources, environmental sciences and law, land use, wildlife conservation and biodiversity, agro-ecology, adaptation, and other topics. Faculty and staff members working in such a wide range of subjects provided a diverse perspective on institutional responses.

For the project, administrative staff were selected based on their position within the institutions. Those who had a good understanding of finances at their institution, and who likely had knowledge about their institution's response to the current coronavirus pandemic, were preferentially chosen. This group of interviewees included deans, associate deans, directors, and financial aid and payroll administrators. In addition, administrative staff who understood the research component at their school were contacted, and could speak to both how the school

responded and how research around climate change was impacted. These staff were generally research or grant administrators.

Throughout this report, participants are kept anonymous, but their quotes are cited as "Participant", followed by their order in the interview process (first, second, third, etc.). This strategy enables anonymity while it supplies for direct quotes from interviews. Before each interview, informed, written consent was provided by all study participants.

Data Collection

For this project, data was collected over a one month period. First, I conducted a thorough review of published articles, unpublished documents, and websites in order to gain an understanding of the up-to-date HEI responses to the coronavirus pandemic. This provided insight into how not only the universities were responding, but also how they were communicating with a larger university audience about their response. The pandemic was an ongoing phenomenon, so these sources provided up-to-date information HEI responses in a dynamic environment. This strategy was useful in tracking the changes in the responses throughout the research period.

Second, a literature review was conducted in order to provide a more in-depth conceptual and theoretical background focused on resilience, coronavirus, climate change, and higher education. Google Scholar searches yielded information and studies on the aforementioned topics, and provided professional, peer reviewed data upon which to base background knowledge and understanding.

Finally, semi-structured interviews were conducted from 23 June to 20 July 2020, with 20 total members of faculty and staff from the HEIs. Interviews collected information and perspectives about how the universities responded to the current pandemic. These interviews

were conducted through Zoom, Microsoft Teams, WhatsApp, phone, email, and during face-to-face meetings. Two separate sets of interview questions were used: one for faculty members, (which focused mainly on their research), and one for staff, (which discussed broader resilience and impacts on the institution), (see Interview Questions in Appendix). Follow-up or clarification questions were asked as needed during the interview. The pandemic provided a unique situation during which to conduct research and so survey data collection (with the exception of one in-person interview) was done remotely. If travel had been allowed, on-the-ground observations of institutional responses could have been made and integrated. In addition, there are limitations to conducting remote interviews in that body language and gestures are lost, especially when communicating with participants from very different backgrounds and cultures.

Data Analysis

Qualitative responses from semi-structured interviews were analyzed using Grounded Theory analysis, grouping responses according to recurring themes and forming conclusions (Glaser and Strauss, 1967). Coding involved manually processing interview transcripts to find themes, patterns, and code words. These words were quantified to determine their frequency and to confirm patterns that existed throughout the interviews. The outcomes provide further research questions and provide overarching perceptions in HEIs. The outcomes provide further details about how the institutions compared between and among members of faculty and staff and countries.

ETHICAL CONCERNS AND LIMITATIONS TO THE STUDY

The study occurred during a global pandemic. The nature of working had changed across societies. Many people were and are working from home, where they have virtual meetings

online, conduct research remotely, and hold classes on Zoom. During this study there was a minor concern of exacerbating pre-existing stress and anxiety with regards to discussing the effects of the pandemic and its impacts on the faculty and staff members and their institutions. Continued discussion of an external stressor, such as coronavirus, may increase feelings of stress and anxiety. However, during the interviews, several participants explicitly described the discussion and interview as "therapeutic", thus dispelling some of the concerns around inducing further stress and anxiety.

In addition, as a student in higher education, I recognize my position as potentially having bias in terms of having been impacted by upheaval at my own institution and having to pivot learning. Personal experience and perceptions of how my institution reacted to the coronavirus pandemic did not play into data from the four HEIs in this study, as the aim of the study is to understand faculty and staff member perceptions within specific institutions.

There were a disproportionate number of women participants who responded to interview requests, and who completed an interview (see Tables 1-3 in Appendix). While reach-outs were made to a similar number of men and women (both faculty and staff members), women answered the requests at a higher ratio (13 women to seven men). The sample size was 20 total participants. While multiple individuals were contacted at each institution, approximately 40% overall agreed to sit for an interview for this project. Given time and other limitations during a time of COVID-19, this was the number of participants that could be reached and scheduled for interviews. In addition, sending surveys via email could have been an alternative way to reach a wider audience; however literature shows that response rates to email surveys without follow-up is generally very low (Fincham, 2008).

There was a higher proportion of participants from the University of Vermont (a total of eight) compared to the other HEIs in the study, which allowed for a greater understanding of UVM as an institution. Vermont Law School had only two participants (one staff and one faculty member), which provided a limited understanding of perceptions of institutional resilience and research at that institution. In addition, almost all interviews conducted with participants in Vermont were done via video call (and one in person), which provided deeper insights into the nuances of participants' responses that were not available for many of the Tanzanian participants due to audio-only connections because of poor internet connectivity. Furthermore, cultural differences and linguistic barriers between Tanzanian English and my U.S. English accounted for some disparate answers to questions that had to be reworded. Finally, the pandemic was an ongoing issue during the time of the study, and responses to it changed over time. Interviews occurred during the course of four weeks. Thus this project provides a snapshot in time of the responses of HEIs during June and July of 2020.

FINDINGS AND DISCUSSION

The primary objective of this study was to seek perspectives of faculty and staff members at four HEIs, two each in a "developing" country and a "developed" country in order to gauge institutional resilience to the coronavirus pandemic, and compare responses across institutions and countries. The findings can then be used to inform institutional responses to other exogenous shocks in the future, such as climate change.

Three main topics linked to the primary research question were highlighted during interviews: climate change research, the coronavirus, and resilience. Within the climate change research primary topic, subthemes of disruption of research, perceptions of continued research,

and research funding were identified. For the coronavirus topic, subthemes of disruption due to the virus, institutions' reactions, and funding changes were identified. Finally, within the topic of resilience, absorbing capacity, adaptive capacity, and transformative capacity were the main subthemes, focusing on community and financial resilience.

Climate change and other exogenous shocks pose great risks for HEIs. Yet HEIs are among the most active institutions when it comes to addressing climate change. Moreover, they are likely to be greatly affected by exogenous impacts (Storms *et al.*, 2019). Without - or with reduced - research programs, information, and action by HEIs, efforts to address and mitigate climate change impacts will be diminished.

Resilience has not been well studied in HEIs. There is a dearth of overall literature, especially related to more recent exogenous shocks. Resilience "doesn't come with a specific roadmap and a universal set of steps to follow" (Second Nature, n.d. in Storms *et al*., 2019, p. 189). Resilience, in general, has been studied in many different ways, including in human behaviors, communities, ecosystems, and institutions. In order to determine how HEIs responded to COVID-19, it was necessary to narrow the field of resilience studies and have a framework for examination. The framework used emphasizes financial and community resilience, as outlined in work by Storms *et al*. (2019) on creating master plans for higher education, based on their absorptive, adaptive, and transformative capacities (Béné *et al*., 2012).

Financial resilience to the impacts of the coronavirus is determined by assessing the use of finances, the funding available, changes in funding and budget use, budget cuts, lay-offs, furloughs, and the reallocation of money. Diversifying funding streams improves HEI resilience, whereas relying upon one or two funding streams to keep the institution afloat tends to lead to more devastating effects from exogenous shocks (Storms *et al*., 2019).

One finding in a recent national survey in the United States indicated that mental barriers were a significant factor that impacted success in higher education (stradaeducation.org, 2020). This is an important indicator of the power of attitude, outlook, community, collaboration, and optimism toward the institution and colleagues. Promoting techniques that build community and acceptance, decrease stress, and increase social support advances resilience in individuals and in communities, and are essential in dealing with external stressors and adapting to new circumstances (Polizzi *et al.*, 2020). When determining resilience in higher education institutions, it is important to examine attitudes about the educational community as an essential aspect of understanding an institution's capacity to adapt and transform in light of the pandemic.

Finally, resilience was determined in interviews by recognizing for this research through three different attributes mentioned previously: absorbing capacity, adaptive capacity, and transformative capacity. Together, the presence of these three attributes designates an institution with high resilience. Interviews were analyzed for degree of resilience at the institution with these three attributes in mind, and with corresponding key words associated with each attribute.

Vermont and COVID-19

Currently, the United States has some of the highest numbers of coronavirus cases in the world, and likely has two to 13 times more cases than what is reported (nytimes.com, 2020). While testing in the country is ubiquitous, economic stimulus is the priority for many states and for the federal government. Thus mandatory mask-wearing is implemented on a city-by-city basis. In Vermont, the caseload is the lowest in the country with 1366 total cases and 56 deaths by mid-July, 2020 (Vermont Health Department, 2020). In mid-July 2020, the state was the first in the country to go without a death related to COVID-19 for 30 days (Board, 2020). The

governor has press conferences three times a week to discuss measures relating to the virus, and plans about how Vermont will respond in the near future.

Although it is doing well in terms of its coronavirus caseload, the state is impacted by the virus. The HEIs in Vermont are dependent on student tuition payments. The loss of students and in-person activity due to the pandemic has damaged some universities' financial health in the short-term (Associated Press, 2020). However, both institutions in this study are compliant with the measures set forth by the Vermont legislature and continue to individually adapt to the evolving situation, while remaining economic powerhouses for their communities.

University of Vermont

University of Vermont (UVM) has been greatly impacted by the COVID-19 pandemic. The institution is still working to understand its future, including its education delivery and its ability to continue as a research institution. Faculty and staff members interviewed generally have faith in the continuation of the school, although there is concern as to the degree of turmoil the school will face, and what its "new normal" will be. Throughout the interview process, plans and reactions to the pandemic at UVM continued to change, and thus are a snapshot during the summer of 2020.

UVM and Climate Change Research

An initial search on UVM's websites led me to its Office of Sustainability. This office commits the university to higher sustainability standards, and specifically outlines sustainability goals for the institution for 2025. Climate action appears on its own separate page, which lays out the institution's climate action plan for public access. The university places great importance on climate change and environmental research and has multiple environmentally-oriented departments, and initiatives. The faculty members involved are often lecturers in multiple

different fields with climate change as a sub-theme of their research. The importance of environment and climate at UVM has continued even during the pandemic: as of the end of July 2020, the school solidified its environmental leadership status and its commitment to environmental issues and climate change research with a unanimous decision to divest a large portion of its endowment from fossil fuels (Duffort, 2020).

Climate change-related research is funded by multiple sources at UVM depending on the faculty member's affiliations, grants, and core department.. There are two main departments at UVM represented in this project's interviews: the Rubenstein School for the Environment, and the Gund Institute for the Environment. Funding for climate research was a main concern for many interviewees. The political landscape was mentioned as a concern for continued funding for climate research in 75% of the interviews. Interviewees noted that climate change research may not be funded in the same way in the future based upon the federal administration in power in the U.S. Indeed, one participant mentioned, with "the federal government going the way it is, it's hard to imagine finding enough funding" to do climate research (Participant 10, 2 July 2020). This statement was confirmed when another participant stated, "The political climate will impact what I do," (Participant 18, 13 July 2020). Sixty three percent of participants at UVM discussed pivoting research foci in order to make research more relevant to gain funding. For instance, one faculty member "tries to stay current" and "evolve and adapt research programs [...] so they stay relevant" in order to gain access to funding (Participant 2, 25 June 2020). This was demonstrated by five participants who discussed specific research proposals or projects that they had altered to make relevant to the coronavirus funding streaming in from different available sources (Participant 2, 25 June 2020; Participant 4, 26 June 2020; Participant 9, 1 July 2020; Participant 12, 8 July 2020; Participant 18, 13 July 2020).

Perceptions of the likelihood of continued research in climate change-related fields was generally positive. Although there was disruption to such research, field work, and travel abroad - and even within the state - for study, the overwhelming majority of participants (75%) believed that their research, and climate change research in general, was going to continue prominently into the future, even if it had to adapt to become more relevant to gain funding. In particular, one participant mentioned that the school was "trying to get as many academic units on campus to collaborate" including the medical school to make research as relevant as possible and be able to continue climate research (Participant 16, 9 July 2020). Another interviewee was optimistic that researchers at the university "will take advantage of the opportunity with a standstill in the environment to document the changes and capitalize on this," (Participant 7, 30 June 2020).

UVM and Coronavirus

Coronavirus has been extremely disruptive to the status quo at UVM. One hundred percent of participants mentioned a disruption of sorts, including moving courses to online delivery, campus shutdowns, greater social media interactions, telework, layoffs, budget cuts, pay cuts, reallocation of funding, and other cultural and institutional changes and shifts. The COVID-19 pandemic has upended the way that the university delivers classes, and UVM is quickly putting together contingency plans for school in the autumn. These plans have changed almost on a weekly basis, but the school has ultimately decided to have a hybrid delivery of classes with most students returning to the institution in the fall, under new guidelines (UVM, 2020). The school's ability to be flexible in the way that it delivers class and prepares to deliver class - a hybrid model with part online and part in-person classes - as well as reaching out to more potential in-state students bodes well for the university's continuation and resilience in response to the pandemic (Participant 2, 25 June 2020; Participant 7, 30 June 2020).

As Vermont's third-largest employer, UVM and its attached medical center (UVMMC) is an important economic institution for the city of Burlington, and for the entire state of Vermont (Choi & Loftus, 17 April, 2020). Though UVM is a public school, it does not receive a significant proportion of its funds from the State of Vermont (Participant 2, 25 June 2020; Participant 7, 30 June 2020). Except for the Gund Institute, which is a solely graduate institution, there is a general reliance on undergraduate tuition, and especially out-of-state tuition. To this point, the latter brought in 51% of the institution's total revenue in 2020 (Participant 2, 25 June 2020; Participant 12, 8 July 2020; Participant 18, 13 July 2020; UVM, 2020).

Being highly dependent on tuition with a small endowment and little state funding (at 11% of its total revenue), UVM is financially very vulnerable to exogenous shocks such as COVID-19 (UVM, 2020). The school has made significant cuts to faculty and staff members, enacted a hiring freeze, furloughed and fired many temporary staff, and cut pay for a large proportion of other employees. However, graduated pay cuts have only been to non-unionized and temporary staff, thus throwing into relief inequities in funding distribution and spurring criticism from faculty members, staff, students, and the greater community (Duffort, 2020; Participant 2, 25 June 2020). After receiving approximately $7 million from the federal CARES act, the university has used over half of the funds to reimburse students rather than ensure pay for staff and faculty members and minimize furloughs (Duffort, 2020). In addition, UVM will allot an estimated $8.7 million for coronavirus-related expenses (Duffort, 2020).

UVM and Resilience

The institution has never been through a shock "quite so disruptive in terms of abruptness and the degree to which things have been disrupted" (Participant 12, 8 July 2020). Indeed, this shock has been deemed unique. Only one interviewee from UVM discussed a standing

emergency plan being followed “exactly the way” it ought to be followed in response to the crisis (Participant 7, 30 June 2020).

By depending on one main source of funding, the school is exposed to damage unless it diversifies its funding sources. Being dependent on undergraduate, out-of-state tuition from students creates a volatile situation in which enrollment dictates financial stability.

The University of Vermont adapted to its changed circumstances quickly, although its responses were devastating to many staff, faculty members, and students. By the time the project’s interviews were conducted in June and July 2020, the school had already moved to online classes, closed down the campus and non-essential buildings, cancelled meetings, research, and travel plans, and was in the process of assessing finances for reopening. Its absorptive capacity was fairly low and was mentioned in all of the relevant interviews when participants noted the upheaval of adjusting to the pandemic though large numbers of furloughs, lay-offs, pay-cuts, and the losses of staff, students, and faculty members. Eighty percent of administrative participants mentioned the existence of emergency plans having been created several years ago, but is now being altered “on the fly” (Participant 7, 30 June 2020; Participant 9, 1 July 2020; Participant 10, 2 July 2020; Participant 12, 8 July 2020). Their effectiveness was questioned, as this shock is unprecedented. The same percentage of administrative participants mentioned the university’s utter unpreparedness for a shock like coronavirus, but that the response was fairly quick and reactive. However, the administration and the school is continuously learning and reassessing their actions by following state guidelines and creating their own so that they can have a “phased approach” to reopening the university, its campus, and housing (Participant 16, 9 July 2020; UVM, 2020).

Perceptions of leadership varied among the participants but trended positive. An important part of organizational resilience, leaders steer institutions through crises, they boost morale, and they make decisions to maintain or boost the institution's adaptive capacity (Resilient Organizations, 2020). Positive attitudes were pervasive at UVM despite worry, concern, and frustration among community members, and even a lawsuit against the university in early July (Goodman, 2020). "[My work] is highly relevant and funders are definitely going to want to fund me," joked one participant when asked if funders will continue to recognize the relevance of his research in light of coronavirus (Participant 2, 25 June 2020). While said in jest, the positivity in this statement around the continuation of climate change-related research was pervasive across interviews, despite misgivings and concerns over a shrinking university budget, the relevance of current work to existing grants, and the political landscape for funding research. Despite the extreme upheavals at UVM and the general anxiety and ambiguity over the future of the school and research in general, positivity reigned. These attitudes and community connections that will play a part in the school's ability to adapt to changed circumstances.

Vermont Law School

An initial examination of Vermont Law School (VLS)'s website offered a basic understanding of how the institution has responded to the novel coronavirus pandemic. What was not immediately apparent online was the ways in which its climate change work was being impacted. Given the very small sample size of interviews, they offered a limited view into what the institution did with regards to climate change research, the coronavirus, and resilience.

VLS and Climate Change

Vermont Law School is a leading institution on environmental law in the U.S. As such, it has many different concentrations of study for students, including climate change. When

discussing how the institution's work on climate change had been affected by the coronavirus crisis, one participant stated that "the crisis hasn't affected [...] the act of research" because most of the research was done online (Participant 1, 23 June 2020). In this way, VLS has been able to work through the crisis and continue research in a way that UVM could not.

During the crisis, faculty members were not allowed to travel, which is often a part of climate change work and research (Participant 1, 23 June 2020). However, perceptions of continued climate change work at VLS were positive, with one participant declaring, "Funding from every conceivable quarter will be increasing" due to the urgency of climate change (Participant 1, 23 June 2020). This confidence in the importance of climate change work at VLS was pervasive, and, because the school is a leader in environmental law, a priority. Students have carried on with their internships virtually, and projects and research about climate change are expected to be unchanged for the foreseeable future (Participant 11, 8 July 2020).

VLS and Coronavirus

The institution was immediately responsive to the COVID-19 crisis and implemented Vermont's State of Emergency. A privately funded institution, VLS was able to create a COVID-19 Hardship Fund to which anyone was able to donate. This Fund is available to students, faculty members, and staff who experience financial hardship as a result of the COVID-19 pandemic. It provides up to $1,000 per person to applicants (vermontlaw.edu, 2020).

The school saved some money by eliminating travel expenses for faculty members (Participant 1, 23 June 2020). In addition, some funds were also saved on utilities spending as buildings went offline. These were incremental gains (Participant 1, 23 June 2020). The school is fundraising as well as it can and lobbying for state funding (Participant 11, 8 July 2020).

VLS responded quickly to the crisis and closed its doors to students in mid-March (vermontlaw.edu, 2020). By 9 March, 2020, a Coronavirus Task Force was "meeting daily to discuss guidelines and implement recommendations made by the government and public health agencies" (vermontlaw.edu, 2020). The physical campus was shut down, although many students remained in the town and were able to continue to access online resources and books that the library staff worked to make available in a safe and secure way (Participant 11, 8 July 2020). Unlike many other institutions in the state, VLS decided to move entirely online for the fall semester in order to maintain safety for students, faculty, and staff until they deem that the campus is safe to open again (vermontlaw.edu, 2020). The concern with this is that the perceived value of a degree might drop. Enrollment could suffer as a result (Participant 1, 23 June 2020). However, the coronavirus might just be the catalyst that launches a "fundamental change in the way that higher education is delivered in law schools" (Participant 1, 23 June 2020). In fact, one participant said, this "may be the natural evolution of higher education delivery" (Participant 1, 23 June 2020).

VLS and Resilience

Vermont Law School absorbed the shock of the pandemic quite well. Like UVM, it closed its doors to students, but unlike UVM it did not immediately lay off staff or faculty members or implement salary cuts. Staff cuts were mentioned by one participant, but no information was located on this topic online or verified in the other interview (Participant 1, 23 June 2020). In fact, employment is expected "at least through this academic year" although beyond that is unclear (Participant 11, 8 July 2020).

One participant also mentioned previous experiences with funding issues at the school, during which there were restructurings of the institution in 2013 and 2018, faculty member loss,

and pay cuts that lasted an entire year (Hongoltz-Hetling, 2020; Participant 11, 8 July 2020). Afterwards, the school was able to get back on track. It also has had online programs for approximately 10 years, which inspired a transition that "was not as painful a transition" as the participant thought it might be (Participant 11, 8 July 2020).

Being a small institution reliant on tuition estimated as 73% of total revenue in the most recent annual report, the loss of even a few students would be devastating for the school (VLS, 2017). Another 20% of the school's revenue is from grants, gifts, and its endowment (VLS, 2017). The institution, unlike other institutions in Vermont, does not provide student housing, and thus does not rely on revenue from housing fees (Duffort, 2020). Despite the potential loss of students in the fall, there has been a temporary increase in available funds, with the campus shut down and travel restrictions in place for faculty and staff members (Participant 1, 23 June 2020). The school received CARES Act funding from the federal government, and is lobbying for state funding to prepare for any future funding impacts due to potentially low student enrollment (Participant 11, 8 July 2020). The school is trying to fundraise and look for new revenue-producing areas to continue its work toward a new status quo (Participant 11, 8 July 2020). Through this information from websites and interviews, VLS seems to be resilient in the short-term to economic shocks from COVID-19. Currently they seek alternative funding, draw upon their donor base, and integrate federal stimulus dollars.

"Leadership is strong," said an interviewee when asked about the effects of COVID-19 on the school's leaders and community (Participant 11, 8 July 2020). With the immediate creation of a task force to discuss and act on issues arising from the coronavirus pandemic, the leadership in the school began to send out surveys to students, maintained open communication about decision-making, and had "community chats" to discuss the institution's future direction

(Participant 11, 8 July 2020). In addition, a strong mental health group has been active to assist individuals at the school to cope with the shock (Participant 11, 8 July 2020). The egalitarian and collaborative nature of communication in the school is appreciated by faculty members, staff, and students. Everyone is "helping each other out" and being flexible to different pedagogies and online education (Participant 1, 23 June 2020; Participant 11, 8 July 2020). Zoom meetings occurred regularly to discuss changes at the school, and faculty and staff members "thrash it out virtually" to come to conclusions as to how to respond to new challenges (Participant 1, 23 June 2020). Being a law school, arguments have to be strong and persuasive. Faculty hear each other out when making big decisions regarding the school (Participant 1, 23 June 2020). Collaboration nation-wide has increased as well, with members of VLS regularly meeting with members from other law schools across the country to discuss how to respond to the ongoing crisis (Participant 11, 8 July 2020).

Vermont Law School has solid adaptive and absorptive capacities to the coronavirus shock. It is working to transition itself to a new status quo. The collaborative community and its positive leaders play a pivotal role in the institution's resilience as the school adjusts to online education this fall. In addition, due to a previous lived experience of hardship and funding pressures, the institution was more prepared to absorb the shock of the coronavirus pandemic. As one participant said, "If you never experience something, it's not in your memory," and therefore you do not know how to adjust (Participant 1, 23 June 2020). Although the long-term is unclear, the school is ready to pivot if necessary. The optimism and collaboration at the institution will help it in its continued adaptation to COVID-19 impacts.

Tanzania and COVID-19

At the last release of case numbers on 29 April, 2020, Tanzania declared 509 total cases of coronavirus, including 21 deaths (bbc.com, 2020). Four labs in the country have the capacity to test for the virus, but only one in Dar es Salaam is permitted to do so (Participant 8, 1 July 2020). As of 8 June 2020, President Magufuli declared Tanzania coronavirus free, and the use of masks and sanitizer, while ongoing, has become much less prominent (bbc.com, 2020; Participant 19, 15 July 2020).

While the country did close its HEIs for three months from March to 1 June, it did not go into lockdown. The country opened its borders and allowed international flights to recommence. Despite this reopening, there has been a substantial impact on the HEIs studied for this project. Although both institutions have continued operations, the coronavirus did disrupt business as usual. However, the disruption will not be acute, but rather last longer than anticipated.

University of Dar es Salaam

With very little available online with regards to the University of Dar es Salaam (UDSM) and its response to the pandemic, interviews were an important window into the institution's reactions and resilience to the coronavirus. While the university had some similar reactions as Vermont institutions to the initial impact of COVID-19, there are some distinct differences in perceptions about the virus as well as how the university dealt with its impacts.

UDSM and Climate Change Research

According to all participants interviewed, research was at first cancelled, modified, or postponed at UDSM. During the initial months of the coronavirus, most foreign researchers and students returned to their home countries, and thus ceased on-the-ground work. Meetings were cancelled, and even in-country travel was limited (Participant 3, 26 June 2020). Due to

Tanzania's initial border closing and the fact that the country did not disclose its case numbers (nor test regularly), many countries that have research partnerships with Tanzania did not allow their researchers to return to East Africa. Some research has continued, with some of this project's participants collecting data for foreign researchers unable to revisit the country (Participant 3, 26 June 2020).

Concern over funding was a dominant theme in all the interviews conducted with faculty from UDSM. Sixty percent of participants emphasized the university's reliance on external or foreign funding for research without which climate change research would be drastically impacted (Participant 14, 9 July 2020; Participant 19, 15 July 2020; Participant 20, 20 July 2020). Although some research is funded by the government of Tanzania or generated by the institution itself through student fees and consultancies, one participant noted, "Research requires partnerships, and so not being able to come to Tanzania affects the performance of the projects" (Participant 20, 20 July 2020). The same participant expressed that "external funding is very important" and that there is uncertainty in "confirming or ascertaining where resources for research come from because donor countries keep changing policies" (Participant 20, 20 July 2020).

Despite this concern over external funding, the pervasive attitude among all participants was that research would continue. All participants agreed that research in climate change-related fields was important and necessary, and, if donors continued to provide funds, it would continue. A main concern was that research would be delayed and the equipment needed be less available (Participant 14, 9 July 2020). Yet, proposals are being written and much research continues (Participant 14, 9 July 2020). As mentioned previously, however, this research is contingent

upon continued funds, and if donors focus their efforts on the coronavirus in their own countries, there could be a severe impact to climate research and the Climate Center at UDSM.

UDSM and Coronavirus

The university closed in March 2020 and reopened 1 June 2020 to students. Faculty members and students are concerned about covering the subject matter in time, as the semesters are now compressed (Lugongo, 2020; Participant 19, 15 July 2020; Participant 20, 20 July 2020). As one participant said, "People are doing things like normal, but precautions are still in place" (Participant 3, 26 June 2020). However, initially, meetings, international trips, and other activities were cancelled because travel was limited and collaboration with foreign researchers transitioned to online.

Tanzania opened its borders and resumed operations, but there is still a "hangover" of the coronavirus (Participant 20, 20 July 2020). Fear is a pervasive emotion, and continues to be a limiting factor for many faculty and staff members: researchers who are interested in going into villages for their research are often met with suspicion as Dar es Salaam is considered a hotbed of the disease. Staff take care not to shake hands, practice social distancing, and hold virtual meetings from their individual offices (Participant 14, 9 July 2020). While the country did not have a lockdown, some people "locked down themselves" to keep themselves safe (Participant 3, 26 June 2020; Participant 14, 9 July 2020; Participant 17, 13 July 2020; Participant 19, 15 July 2020).

UDSM and Resilience

A reliance on external donors for research funding is an important part of how research occurs at UDSM, which places the school in a vulnerable state. If international funds are not available, the school cannot continue with its research in the same manner. As one participant

said, “Tanzania can’t stand alone to do research on its own; it is not developed enough,” (Participant 14, 9 July 2020). This places the continuity of research at UDSM in a difficult position, because it is expected to follow the country’s lead in continuing business as usual. The Government of Tanzania also financially supports research, such as solar PV, because of a desire to invest in alternative energy and install solar panels in all government buildings (Participant 14, 9 July 2020). Government grants comprised 58% of total revenue for the university in its most recent annual report (UDSM, 2018). Other income streams include student fees and external consultancies, which contribute to faculty and staff member salaries, research projects, maintenance, and other essential activities at the university (UDSM, 2018). Thus, while the university is able to keep afloat on current revenue streams, it is reliant on external funding for research, and without it, that research will suffer.

In order to address decreased funding from external donors, two departments of UDSM are pivoting their work from engineering and textiles toward personal protective equipment (PPE), sanitizer, and masks (Participant 17, 13 July 2020; Participant 19, 15 July 2020). This adaptive measure helps to bring in revenue, which shows innovation on the part of the university and an ability to pivot when necessary. Some projects are being restructured to do only essential work. This ability to adapt to extenuating circumstances bodes well for the university in that it demonstrates creativity in the face of external stressors and re-defining its priorities.

In responding to the crisis, one participant mentioned the “innovation” that has occured in terms of data collection, online meetings, and the placement of washing stations on campus (Participant 20, 20 July 2020). While much has returned to normal at the university, one participant remarked on how much more productive smaller meetings were in that everyone’s voice was heard. and each person had a chance to speak (Participant 20, 20 July 2020). This is a

morale boost for faculty members that were previously unheard, and helps the institution as it continues to act with cautious innovation. “We had to learn a different way of things. It may not be as efficient as the traditional ways, but they are innovative,” recounted one participant (Participant 20, 20 July 2020). This attitude is a positive step for transformative action for the university even while it welcomes its students back and holds classes. Yet, there is still stress and fear about the coronavirus, and “psychologically, some people are struggling with the impacts of COVID,” as one participant put it (Participant 14, 9 July 2020). However, as another interviewee said, “Whenever you have a crisis, you will find a solution to it” (Participant 20, 20 July 2020).

In its history, the University of Dar es Salaam had never been through a shock like the coronavirus (Participant 17, 13 July 2020; Participant 20, 20 July 2020). While there is “always some emergency plan”, this was an unexpected and unique situation, and thus there was “no preparedness” for the coronavirus (Participant 20, 20 July 2020). The school had faced student riots, which forced the university to close in the past, but that was a short-term impact (Participant 20, 20 July 2020). In this situation, if the university “had been prepared, then [they] would have had a way to teach online,” (Participant 17, 13 July 2020). Now there is discussion about how to offer courses online, so that the school can increase its resilience and adaptability to future shocks. For now, however, internet connectivity for many undergraduate and graduate students is poor, and classes have resumed as usual.

UDSM has absorbed the shock of coronavirus fairly well: there have been no mentions of layoffs, but some faculty took annual leave in order to stay safe at home (Participant 17, 13 July 2020). While meetings and continued education were difficult because of internet connectivity issues, lack of face-to-face interactions, and changes to research procedures, there is still an

overall attitude of acceptance (Participant 17, 13 July 2020; Participant 19, 15 July 2020). Ultimately, the university and Tanzania as a whole have "decided to live with coronavirus" (Participant 19, 15 July 2020). The school has adapted in ways to meet the needs of continued education, funding, and research, but because of its dependency on external aid for research funding, it is unclear how long this status quo will last. In addition, because the school has decided to continue as usual, it has made itself an island in the world of HEIs. It does not adhere to WHO guidelines on social distancing of students and other suggested measures, such as hybrid or online education. The capacity for the university to make such a shift is unclear, although because of poor internet connectivity in the country, it is unlikely to move entirely online. It is up to Tanzania's government and the community in Dar es Salaam to ensure that the university survives in the term.

Nelson Mandela African Institution of Science and Technology

Arusha, where NM-AIST is located, was the location of the first case of coronavirus in Tanzania. It has been a popular tourist destination in the country. The graduate school is a center of science and technology, and seeks to generate a generation of African scientists to further research on the continent.

NM-AIST and Climate Change Research

Research at NM-AIST was cancelled or postponed at the beginning of the pandemic, according to all participants interviewed. Most field work was postponed, and there was a plethora of new opportunities for coronavirus-related research (Participant 8, 1 July 2020). Climate change research all but "stopped and disappeared" because "grants have been diverted" to COVID-related research (Participant 8, 1 July 2020). Connecting climate change and

coronavirus is complicated, and so making climate-related research relevant to funders has become difficult (Participant 8, 1 July 2020).

The institution is reliant upon external funding for research, and so the topics of research are dependent on what funding is available. “African universities do not really fund researchers, unlike the U.S. and E.U.,” one participant noted (Participant 6, 30 June 2020). As a result, faculty members have shifted topics to win more funding for coronavirus research and combine it with research and expertise that already exists (Participant 8, 1 July 2020).

Positive attitudes around the continuation of climate research reigned, with 80% of participants confident that climate-related research would become a priority again, and fairly soon. Indeed, said one participant, “once we get used to coronavirus, the priority of climate will come back; it’s already re-entering the media,” (Participant 8, 1 July 2020).

NM-AIST and Coronavirus

Coronavirus disrupted many activities at NM-AIST, especially field research. The school has also implemented new safety measures, such as foot pedal-operated hand washing stations, and an edict to remain in individual offices instead of collaborating in groups with others. It was “good to see @NM-AIST [...] taking the #SARS-CoV-2 virus serious,” Tweeted a faculty member (Kreppel, 2020). There is still fear about the coronavirus, as it presents a “much more personal threat” than something like climate change (Participant 8, 1 July 2020). Lecturers were and still are teaching from home, as some have returned to their home countries and cannot re-enter Tanzania. However, the school has decided - upon government mandate - to reopen and “continue with caution” (Participant 15, 9 July 2020).

Interestingly, 60% of the participants interviewed from NM-AIST were not Tanzanian. These participants spoke more freely about the ramifications of political decisions on the

institution and on Tanzania in general. “If the government says corona doesn’t exist,” said one participant, “then we are supposed to act that way” (Participant 5, 29 June 2020). In fact, “it was not NM-AIST’s decision to send students home” because they were “waiting for the government to give directives” (Participant 15, 9 July 2020). The institution has been following what the government said about the disease. They have instituted preventative measures such as wash stations, a single entrance into the school, taking temperatures, and promoting air flow by opening windows instead of turning on the A/C (Participant 15, 9 July 2020). Like UDSM and in accordance with guidelines from the Tanzanian government, students have returned to NM-AIST with new protocols such as a one-meter distancing between students (africanews.com, 2020).

NM-AIST and Resilience

The reaction to the coronavirus at NM-AIST was immediate: the campus shut down except for administrators, students were sent home, and field work stopped. This is a similar reaction to the other three HEIs in this study. However, some students were unable to return home due to border closings, and so the institution housed these students or placed them in hostels where they continued their studies online (Participant 15, 9 July 2020). This quick shift in order to accommodate students in distress was an adaptive measure taken by NM-AIST that displays its flexibility in times of crisis.

Another way in which the institution was able to absorb this shock and adapt to it was through pivoting its research agendas to meet what funding was available. Adjusting to this reality was something the school did well, as it has linked much of its current research to coronavirus research.

Financially, the institution was impacted. Most of the institution’s funding was from several different projects. When field work stopped, so did the funding (Participant 15, 9 July

2020). However, there were no mentions of layoffs or furloughs evident in the interviews. Although many faculty left the country, they are still employed by the Tanzanian government. In addition, general external funding continues to be targeted to the Global North in places like Europe and the U.S. that focus on clinical and vaccine trials, mental health, and other aspects of COVID-19 management. Thus priority funding for NM-AIST and other institutions like it has been shifted elsewhere (Participant 8, 1 July 2020).

The institution has never been through a shock like COVID-19 before. Thus, they did not have an emergency plan in place to put in preventative measures (Participant 15, 9 July 2020). Many of their actions were implemented at the government's order. This places NM-AIST in a vulnerable position. If the institution is unable to choose their own reactions to a crisis like the coronavirus, they may not respond in the way that is most suitable for the institution. Many lecturers and students left the country, and therefore there is a necessity for online work. Yet, 40% of participants, when discussing online lectures mentioned a reduction in productivity. This is a stressor for both the lecturers and students. One participant even mentioned a general attitude of distaste for online learning in Tanzania (Participant 6, 30 June 2020). Thus, while it may be difficult, the university is adapting to a potential new normal, while continuing to follow government orders.

The country and the world are unsure of the number of coronavirus cases in Tanzania, as testing has stopped. Resumption of normal activities in Tanzania is unique in the region and even globally. However, as one participant put it, "It was taken as an important disease in the first month or two, but now it's like things have gone back to normal. Now it's regarded like any other infection" (Participant 13, 9 July 2020).

Comparisons across Institutions

When addressing climate change research, all four HEIs responded in a manner consistent with findings from other studies (Omary *et al*., 2020). These measures include continuation of research responsibilities in an adapted manner, a pivot to linked coronavirus research, limited lab usage and access, remote research, a balance between remote work and home life for faculty and staff members, and the continued submission of grants (Omary *et al*., 2020). There was a positive perception of continued research in 90% of interviews. A belief in the importance of research to inform public policy, education, and general knowledge was pervasive among the interviewees, and even those who were concerned their field may not be relevant as the world shifts its focus to COVID-19. While most participants believed their work would continue to be relevant, 45% of participants explicitly described adapting their research in order to be relevant to funders. The majority of these participants (66%) were from UVM. This willingness and ability to adapt research agendas from purely climate-focused to hybrid foci in order to be relevant is representative of a positive adaptive capacity and resilience for the institution.

Overall, there was a perception that the four institutions would make it through the COVID-19 crisis. The only school that even addressed the option of closure was VLS. In the VLS case, the institution's leaders created a phase-out plan based on collaboration with other small schools in the state that have had to close. Being adequately prepared for multiple scenarios is an excellent tool for increasing institutional resilience.

Financially, these institutions were concerned for their future existence. At NM-AIST, external funding dictates how research is conducted, and government mandates dictate how the university is run. Student fees and consultancy fees supply research funding, but not as

predominantly as external funding. At UDSM, funding for research was split with some funding derived from external sources, some from the government, and some from consultancies and student fees. The concern about decreased funding was not as strong as at NM-AIST. At UVM there was concern about funding and the large number of layoffs, furloughs, and budget cuts. Dependency on undergraduate tuition has this institution focused on bringing back students in order to continue to function. At VLS, finances were of concern, as the school is also tuition-dependent, but it put in place plans in case of bankruptcy.

The ability to transform and overcome shocks and crises in order to build resilience is partially reliant on morale, a sense of community, and positivity within HEIs (Canney, 2012). Community was explicitly discussed in interviews at Vermont's institutions, but not at universities in Tanzania. The idea of community has been a theme in Vermont for decades, and especially during this crisis it has taken on a stronger meaning. While community may not be explicitly discussed in the same way at universities in Tanzania, that does not mean that community is not of importance at UDSM and NM-AIST. As one participant put it, "We all depend on each other" (Participant 15, 9 July 2020).

When asked about resilience, 70% of Vermont interviewees expressed positive perceptions of community and collaboration. Yet, 30% of the respondents in Vermont HEIs - all from UVM - had negative perceptions of the hierarchies at the school. "System inflexibility", "rigid systems", "extreme inequalities", and "inadaptability on an individual level [in] leadership" indicated that there was discord among employees of the university; these employees were concerned that the school may not be able to adapt to the exogenous shock of COVID-19 (Participant 2, 25 June 2020; Participant 10, 2 July 2020). According to interviewees, strong centralized decision-making at UVM could be a detriment to the university's ability to creatively

adapt to new circumstances. For large institutions, the debate around whether centralized or decentralized leadership is more resilient continues to be debated (Somers, 2009). Overall, and even among interviewees who had negative perceptions of institutional communities, there was still a belief in mutual support and collaboration within the HEIs in Vermont. It is these attitudes that help the institution to adapt and transform.

"Responding to change in a positive way is essential [for] resilience," says Canney (2012, p. 78) in her dissertation on resilience in HEIs. Of all the institutions during this project, VLS seems to have had the most positive response, with an enormous emphasis on community, collaboration, and support for staff and students. Recognizing the realities of coronavirus and the uncertainty it brings, the institution has shifted and adapted in order to maintain morale and continue teaching its students safely. These decisions were not taken lightly and were made collaboratively.

While UDSM and NM-AIST continued with their teaching, the decision was made externally by the national government. Both institutions were directed by the government, so they do not have autonomy to decide what might be best for the institution. True to the literature available on reactions to coronavirus, this project showed that "people can change behavior quickly when presented with institutional mandates to do so" (Manderson & Levine, 2020, p. 368). Perhaps because they are government employees, the faculty and staff members of the two Tanzanian HEIs did not discuss the schools as small, independent communities, but rather as followers of government mandates. This raises concern about the institutional resilience of HEIs in Tanzania, as "highly bureaucratic, command-and-control style structures impede creativity and adaptive behavior" (Somers, 2009, p. 13). While these two institutions followed regulations, 50% of respondents discussed their feelings of fear surrounding coronavirus. However, due to

the need for compliance to government regulations, there was a degree of accepted resignation. Acceptance of the coronavirus disease as the same as "any other infection" could be helpful for the country to continue doing necessary work (Participant 13, 9 July 2020). However, this is not the sentiment globally, so it may hurt Tanzania and its desire for normalcy in the long-term. Further study of the effectiveness of institutional versus national responses to increase resilience are needed as the coronavirus impacts continue.

Perceptions of continuation were pervasive across all institutions, but the actions of the institutions dictated what that continued services would look like. While UDSM and NM-AIST continued with in-person classes with new coronavirus-dictated guidelines, as well as some online courses and research specifically at NM-AIST, the two universities in Vermont have acted differently. University of Vermont, a large institution, seeks to continue in a hybrid fashion, allowing some students to return with strict social distancing and coronavirus guidelines in order to secure the bulk of its revenue from undergraduate tuition. Vermont Law School has pivoted to be entirely online. Thus, all four universities continue to deliver education, but the adjustments they have enacted differ.

Apart from VLS, which entirely transformed the way it engaged with its research and education by embracing a new online format, the other institutions involved tended towards a desire to "move on with life as usual, regardless of risk" (Manderson & Levine, 2020, p. 369). UVM aimed for a hybrid schooling method and UDSM and NM-AIST held in -person classes. A return to normalcy is a goal that was raised in 70% of the interviews in Tanzania, but only 10% of the Vermont interviews. This suggests that the institutions in Vermont will not return to the pre-coronavirus status quo for the foreseeable future, and thus in the short-term will have to adjust practices and expectations.

CONCLUSION

A fundamental part of what makes an institution resilient to exogenous shocks the people, including leaders, who make up the institution. Community, cohesiveness, and collaboration are common themes in resilience literature. The interviews conducted for this project also recovered evidence of these themes. Positivity and communication are important factors to prevent burn-out and stress among faculty and staff members. Collaboration also ensures the burden of increased work does not fall on only a few individuals in times of crises. While priorities are often difficult to establish during a crisis, it is collaboration that helps steer an institution toward resilience.

In Vermont, the coronavirus crisis has been handled with precaution, which allowed the economy to slowly reopen while taking steps to ensure safety. Testing is free and open and the movement of the disease dictates policy in the state. While the rest of the U.S. has fluctuated in its policies and the corresponding cases of illness, Vermont has been measured in its approach and has attempted to flatten the curve of cases, which as of July 2020 it has achieved. Higher education in the state is fairly independent of state funds, and thus the schools are left to their own devices when planning for reactionary measures to the coronavirus. While the requested funding from the state to keep them afloat, the two HEIs in this study made their own decisions on how to move forward, neither having been through a crisis like coronavirus. Continued monitoring of these two universities and how they fare in the coming months and years is necessary to firmly understand the success of their resilience strategies..

While declared nonexistent in Tanzania, the coronavirus is still rampant around the world. Thus, Tanzania is much like an island that continues to suffer from lost revenue from

international tourism on which it depends. It could be argued that the country is resilient, as it is acting as one large community and following the directives of its leaders. However, because the rest of the world is not responding the same way, the long-term ramifications of these actions are unknown. All parts of Tanzanian society may be impacted, including HEIs, which are already feeling the effects of reduced external funding. Follow-up studies to understand how these two HEIs in Tanzania fare over the long-term will determine the impacts of present-day decisions on climate research and institutional resilience.

This project assessed the impacts of coronavirus on institutional resilience at HEIs. By understanding the resilience of HEIs during the exogenous shock of coronavirus, it is possible to bolster resilience in the future when these institutions are confronted with other external shocks. The results show that in order to build resilience, communal decisions about the future of HEIs should be made by HEIs in order to cater to their specific needs. Flexibility in research agendas and a willingness to change the way the institution delivers education are important adaptation strategies that will aid the persistence of HEIs in the future when confronting other shocks like climate change.

It is important to recognize that the coronavirus pandemic will likely persist. Recognizing this fact and taking the appropriate steps to respond are important parts of building institutional resilience. While the economic situation in Tanzania (a "developing country") differs greatly from the U.S. (a "developed country"), a top-down political strategy that does not report the number of coronavirus infections forces a normalcy that may ultimately harm the country. Denial of this crisis can create confusion and fear. The theme of continued fear despite a continuation life as normal is detrimental to the country's resilience. Faculty and staff members expressed concern over funding for their research, and, with donor countries turning inward to prioritize

their own national priorities, this concern appears to be a legitimate threat to research. In order to build resilience to COVID-19 and to impending shocks that will arise from climate change, the HEIs in Tanzania - and the policies that govern their actions - must allow for flexibility in teaching strategies and mechanisms and the types of primary funding sources. Remaining steadfast in the face of an unknown may work in the short-term, but in the long-term the country and its HEIs must be allowed more creativity and license to act in a way that enables agency and flexibility. Based on the evidence and outcomes of this project, resilience is about communities acting creatively together: communities at HEIs must be allowed to do what they see fit for their institutions. The schools, along with the economy, have been forced to re-open and resume activities, which could make them more vulnerable to spreading coronavirus. In addition, the lack of flexibility in online learning puts the Tanzanian HEIs at a disadvantage when trying to compete on a global scale.

In Vermont, the state legislature dictates general guidelines for adaptations to the coronavirus, but the HEIs are able to make their own decisions to adapt in an appropriate way. The University of Vermont, a large research institution, made decisions such as lay-offs of staff, and cuts to programs, often without sufficient warning to the community or general consensus. These steps ultimately will weaken the institution's resilience fragmenting its community. Smaller sub-communities within the institution are more flexible, for example the Gund Institute These sub-communities made decisions and altered research agendas to fit available funding that has helped it adapt to changed circumstances. Vermont Law School has also done this. VLS is able to be nimble in its course delivery and in applications for funding. Within bounds, it has supported its staff and students, and made management plans for multiple future scenarios, even if those scenarios involve the institution's eventual obsolescence. Their community is strong, and

its research will continue, because the school has bent to allow for continued education in a safe learning environment.

All four institutions addressed can bolster their resilience. One recommendation is to diversify their funding sources and adapt their research agendas to better match existing funding. Another recommendation for increased resilience is staff and faculty members should be assured a voice in the institution's actions: an important factor to maintain community resilience within the institutions over the short- and long-term. The question of resilience or emergency plans that can be altered as institutions learn more from their actions is an essential step to secure resilience in the face of crisis. Such plans should be disseminated to all community members for cohesiveness.

The four institutions of higher learning studied in this project are deeply impacted by the COVID-19 pandemic. The institutions have absorbed the shock and adapted to unique circumstances to varying degrees. In its own way, each university was resilient. The lessons of COVID-19 will inform institutional resilience to future shocks, including on-going climate change.

REFERENCES

All Tanzanian schools reopen amid strict virus protocols. (1 June 2020). *Africanews*. <https://www.africanews.com/2020/07/01/all-tanzania-schools-reopen-amid-strict-virus-protocols//>.

Ashour, H. M., Elkhatib, W. F., Rahman, M., & Elshabrawy, H. A. (2020). Insights into the recent 2019 novel Coronavirus (SARS-CoV-2) in light of past human coronavirus outbreaks. *Pathogens*, *9*(3), 186.

Associated Press. (12 May 2020). UVM president says big changes from virus looming. *Burlington Free Press*. <https://www.burlingtonfreepress.com/story/news/2020/05/12/uvm-president-says-big-changes-virus-looming-layoffs-salary-union/3114945001/>.

Béné, C., Godfrey-Wood, R., Newsham, A. & Davies, M. (2012). Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. *IDS Working Papers*, *2012*(405), 1-61.

Board, R. (17 July 2020). Vermont becomes the only state in the nation without a death from COVID-19 in 30 days. *Burlington Free Press.* <https://www.burlingtonfreepress.com/story/news/2020/07/17/vermont-goes-30-days-no-covid-19-deaths/5432416002/>.

Canney, J. W. (2012). What makes a higher education institution resilient?: An interpretive case study. *Education Doctoral Dissertations in Organization Development* 15.

Chiteji, F. M., Ingham, K., Mascarenhas, A. C., Bryceson, D. F. (17 March 2020). Tanzania Economy. *Encyclopaedia Britannica.* <https://www.britannica.com/place/Tanzania/Economy>.

Choi, I., & Loftus, S. (2020). UVM asks state for millions in relief due to COVID-19 stresses.

VT Digger. <https://vtdigger.org/2020/04/17/ uvm-asks-state-for-millions-in-relief- due-to-covid-19-stresses/>.

Clarke, G. (8 April 2020).COVID-19: impact could cause equivalent of 195 million job losses, says ILO chief. *UN News*. <https://news.un.org/en/story/2020/04/1061322>.

Climate Action Network Tanzania (CAN TZ) hosts the International CAN Annual Strategy Meeting in Arusha. (2020). *Climate Action Network Tanzania*. <http://cantz.or.tz/2020/02/18/press-release-annual-strategy-meeting-arusha/>.

Climate and Health. (2020). *Vermont Department of Health*. <https://www.healthvermont.gov/environment/climate>.

Climate Change: How Do We Know? (2020). *NASA*. <https://climate.nasa.gov/evidence/>.

Climate Change Information Platform. (2020). *GCCA Tanzania Programme*. <http://climate change.ceba.co.tz/>.

Coronavirus: John Magufuli declares Tanzania free of COVID-19. (8 June 2020). *BBC*. <https://www.bbc.com/news/world-africa-52966016>.

Coronavirus Live Updates: C.D.C. says cases could be 2 to 13 times higher than reported in parts of the U.S. (21 July 2020). *New York Times*. <https://www.nytimes.com/2020/07/21/world/coronavirus-covid-19.html>.

Coronavirus Resource Center. (2020). *Johns Hopkins University*. <https://coronavirus.jhu.edu/>.

COVID-19 (Coronavirus) Information and Updates. (2020). *UVM Office of Emergency Management.* <https://www.uvm.edu/emergency/covid-19-coronavirus-information- and-updates>.

Dalziell, E., and McManus, S. (2004). Resilience, vulnerability and adaptive capacity:

Implications for system performance. *International Forum for Engineering Decision Making*, Stoos, Switzerland.

Duffort, L. (5 June 2020). UVM cuts salaries for non-unionized staff and faculty, hints at furloughs. *VTDigger*. <https://vtdigger.org/2020/06/05/uvm-cuts-salaries-for-non-unionized-staff-and-faculty-hints-at-furloughs/>.

Duffort, L. (14 July 2020). UVM will divest its endowment from fossil fuels. *VTDigger*. Retrieved from <https://vtdigger.org/2020/07/14/uvm-will-divest-its-endowment-from-fossil-fuels/>.

Duffort, L. (14 May 2020). UVM faculty, students hold car protest to push back on cuts. *VTDigger*. <https://vtdigger.org/2020/05/14/uvm-faculty-students-hold-car-protest -to-push-back-on-cuts/>.

Duffort, L. (29 June 2020). Vermont Law School will be online in fall; Dartmouth will stagger students. *VTDigger*. <https://vtdigger.org/2020/06/29/vermont-law-school-will- be-online-in-the-fall-dartmouth-will-stagger-students/>.

Dyers, G. & Andrews, J. (2011). Higher education's role in adapting to a changing climate. American College & University Presidents' Climate Commitment. <https://secondnature. org/wp-content/uploads/Higher_Education_Role_Adapting_ Changing_Climate.pdf>.

Fincham J. E. (2008). Response rates and responsiveness for surveys, standards, and the journal. *American journal of pharmaceutical education, 72*(2), 43.

Fisher, P. B. (2017). Resilience thinking in higher education: Institutional resilience as a sustainability goal. In *Handbook of Theory and Practice of Sustainable Development in Higher Education*. Pp. 209-222. Springer.

Forbes. (2019). *Best States for Business 2019: Vermont*. <https://www.forbes.com/places/vt/#17

eb8ddd68cb>.

Glaser, B. G., Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. United Kingdom: Aldine.

Goodman, J., (1 July 2020). UVM faculty files unfair labour complaint. *VTDigger.* <https://vtdigger.org/2020/07/01/uvm-faculty-union-files-unfair-labor-complaint-%EF%BB%BF/>.

Hongoltz-Hetling, M. (30 May 2018). Vermont Law School Plans Faculty Cuts. *Valley News*. <https://www.vnews.com/Vermont-Law-School-restructuring-faculty-positions-17851217>.

IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.

Jeans, H., Castillo, G., & Thomas, S. (2016). The future is a choice: The Oxfam framework and guidance for resilient development. Oxford: Oxfam.

Katella, K. (2020). Our New COVID-19 Vocabulary - What does it all mean? *Yale Medicine.* Retrieved 2 July 2020 from <https://www.yalemedicine.org/stories/covid-19-glossary/>.

Keim, M. E. (2008). Building human resilience: The role of public health preparedness and response as an adaptation to climate change. *American Journal of Preventive Medicine*, *35*(5), 508-516.

Kreppel, K. [@kkreppel]. (2020). Good to see that @NM_AIST is taking #SARS_COV_2 serious. <https://twitter.com/kkreppel>.

Lee, A. V., Vargo, J., & Seville, E. (2013). Developing a tool to measure and compare organizations' resilience. *Natural hazards review*, *14*(1), 29-41.

Lugongo, B. (1 June, 2020). All set for studies resumption. *Daily News*. <https://dailynews.co.tz/news/2020-06-015ed41f774eef5.aspx>

Luhunga, P. M., Kijazi, A. L., Chang'a, L., Kondowe, A., Ng'ongolo, H., & Mtongori, H. (2018). Climate Change Projections for Tanzania Based on High-Resolution Regional Climate Models from the Coordinated Regional Climate Downscaling Experiment (CORDEX)-Africa. *Frontiers in Environmental Science*, *6*, 122.

Makame, M. O. (2013). *Vulnerability and adaptation of Zanzibar east coast communities to climate variability and change and other interacting stressors* (Doctoral dissertation, Rhodes University).

Manderson, L., & Levine, S. (2020). COVID-19, Risk, Fear, and Fall-out. *Medical Anthropology*, 1-4.

Morrissey, C. T., & Sanford, D. G. (9 April 2020). Vermont Economy. *Encyclopaedia*

Britannica. <https://www.britannica.com/place/Vermont/Economy>.

McCubbin, L. (2001). Challenges to the Definition of Resilience. *Annual Meeting of the American Psychological Association, 24 August 2001*. San Francisco, California: Educational Resources Information Center.

National Research Council (NRC). (2006). Surface Temperature Reconstructions For the Last 2,000 Years. National Academy Press, Washington, D.C.

O'Connell, D., Walker, B., Abel, N., & Grigg, N. (2015). The resilience, adaptation and transformation assessment framework: From theory to application. Canberra: CSIRO.

Omary, M. B., Eswaraka, J. R., Kimball, S. D., Moghe, P. V., Panettieri Jr, R. A., & Scotto, K. W. (2020). The COVID-19 pandemic and research shutdown: Staying safe and productive. *The Journal of Clinical Investigation*.

Polizzi, C., Lynn, S. J., & Perry, A. (2020). Stress and coping in the time of COVID-19: Pathways to resilience and recovery. *Clinical Neuropsychiatry*, *17*(2), 59-62.

Resilient Organizations Ltd. (2020). *What is organizational resilience?* Resilient Organizations. <https://www.resorgs.org.nz/about-resorgs/what-is-organizational-resilience/>.

Ross, J. (3 April 2020). Universities form global network on climate change. <https://www.insidehighered.com/news/2020/04/03/universities-form-global-network-climate-change>.

Roy, R., Gain, A. K., Hurlbert, M. A., Samat, N., Tan, M. L., & Chan, N. W. (2020). Designing adaptation pathways for flood-affected households in Bangladesh. *Environment, Development and Sustainability.*

Somers, S. (2009). Measuring resilience potential: An adaptive strategy for organizational crisis planning. *Journal of Contingencies and Crisis Management, 17*(1), 12–23.

Storms, K., Simundza, D., Morgan, E., & Miller, S. (2019). Developing a resilience tool for

higher education institutions: A must-have in campus master planning. *Journal of Green Building, 14*(1), 187-198.

Strada Education Network. (2020). *Many Americans lack confidence in the career value of postsecondary education and their own ability to succeed as learners.* Strada Education Network. <https://www.stradaeducation.org/press-release/many-americans-lack-confidence-in-the-career-value-of-postsecondary-education-and-their-own-ability-to-succeed-as-learners/>.

Sturgess, P. (2016). Measuring resilience. *Evidence on Demand, UK.* <https://assets.publishing.service.gov.uk/media/57a08956e5274a27b200002f/EoD_Topic_Guide_Measuring_Resilience_May_2016.pdf>.

University of Dar es Salaam. (February 2018). *Annual Report 2016-2017*. <https://www.udsm.ac.tz/upload/20190126_031400_ANNUAL%20REPORT%202016-2017.pdf>.

University of Vermont. (2018). *Climate Action at UVM*. UVM Office of Sustainability. <https://www.uvm.edu/sustain/sustainability-uvm/climate-action-plan>.

University of Vermont (2020). *Fall 2020 Return to Campus*. <https://www.uvm.edu/returntocampus/our-phased-approach>.

University of Vermont (2020). *FY2020 Sourcebook.* <https://www.uvm.edu/sites/ default/files/UVM-Office-of-Institutional-Research/sourcebook/sb19.pdf>.

U.S. Embassy in Tanzania. (18 June 2020). Health Alert: U.S. Embassy Dar es Salaam. <https://tz.usembassy.gov/health-alert-u-s-embassy-dar-es-salaam-june-18-2020/>.

Vermont Department of Health. (16 July 2020). *Current activity in Vermont*. <https://www.healthvermont.gov/response/coronavirus-covid-19/current-activity-vermont#data summaries>.

Vermont Department of Health. (17 July 2020). *Weekly Summary of Vermont COVID-19 Data*. <https://www.healthvermont.gov/sites/default/files/documents/pdf/DataTeam_WeeklySummary_7.17.20.pdf>.

Vermont Law School. (2017). *Report on Giving*. <https://connect.vermontlaw.edu/file/VLS-FALL17- ROG-web.pdf>

Vermont Law School. (2020). *Coronavirus: Preparedness and Information*. <https://vermontlaw.edu/news-and-events/newsroom/press-release/coronavirus-preparedness-and-information>.

Vermont Law School. (29 June, 2020). *Vermont Law School announces virtual fall semester for 2020*. <https://www.vermontlaw.edu/news-and-events/newsroom/press-release/vermont-law-school-announces-virtual-fall-semester-2020>.

Woodward, C. (17 November 2016). America's First All-Renewable Energy City. *Politico*. <https://www.politico.com/magazine/story/2016/11/burlington-what-works-green-energy-214463>.

Wulff, K., Donato, D., & Lurie, N. (2015). What is health resilience and how can we build narratives about climate change help to motivate communal action against a common it? *Annual Review of Public Health*, *36*, 361-374.

APPENDIX

Interview Questions

To Administrators

1. What is your role at your institution? What does it entail?
2. Has your institution been through a shock like COVID-19 before (e.g. economic downturns, funding loss, low student enrolment etc.) that has heavily impacted the

university? If so, what was the shock, and how did the institution respond (i.e. administrative/faculty changes, spending cuts, temporary shut down, department cuts etc.)?

3. Does the institution have an emergency plan for large exogenous shocks (i.e. those mentioned in previous question)? If so, how is it being enacted? If not, do you think one would be helpful in dealing with future shocks?
4. What have been the impacts of COVID-19 to funding (i.e. shrinking budget, looking for different sources, spending less on certain activities etc)? Leadership/community? (i.e. downstaffing, furloughing, etc) The university environment? (i.e. student body size, research, campus activities and clubs etc).
5. How does the institution prioritize its funding?
    a. If you know/if you can take a guess, how much funding is allocated to climate change research at the institution? Has this funding changed since the onset of COVID-19 (i.e. reallocation, cutting spending, finding different funding opportunities)?
6. In your opinion, how long is/are the change/s anticipated to continue? What are the repercussions of funding shifts? Are there any new plans, guidelines, or frameworks (i.e. resilience frameworks) being put in place? Any new collaborations or changes in networks that might occur?
7. Do you think climate change research will continue unchanged at the institution after this pandemic? Why or why not? If not, how do you think it will change?
8. How has the educational community (within the field of climate change) responded to this crisis?

9. What questions didn't I ask that you would like to answer?
10. Are there any other staff you might suggest who would be interested in participating in this study?

To Researchers of Climate Change

1. What is your role at your institution?
2. What is your research/work related to climate change?
3. How has your research been impacted by the COVID-19 crisis?
4. What will be the long-term impact of this crisis on your research?
5. Do you see your research to be a main research area/a spotlight in the future? Why/not? Will funders continue to recognise its relevance?
6. What are your concerns about the future of climate change research during and after COVID-19?
7. How does your institution prioritize its funding? Has its strategy shifted as a result of COVID-19?
8. Are you able to advocate at the institution for your continued research? How? (i.e. what arguments will you use?) Why do you think your research is particularly important in these times during and after the pandemic?
9. Do you think the political landscape in your country with regards to COVID-19 affects your future research?
10. What questions didn't I ask that you would like to answer?
11. Are there any other researchers you might suggest who would be interested in participating in this study?

Consent form

Dear Interviewee,

My name is Stephanie Clement. I am a Master's student at the SIT-Graduate Institute in Brattleboro, Vermont. This interview contributes to my Master's Capstone Project: The Global Pandemic's Impacts to Climate Change Research and Institutional Resilience in Higher Education in Vermont and Tanzania.

This interview is intended to collect data about your institution's resilience during the COVID-19 pandemic, and also any impacts of the pandemic to climate change research by you and your institution.

Your participation in this interview is completely voluntary. The interview will take up to one hour. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any question, you can skip a question or withdraw from the interview at any point.

If you prefer, your identity will be kept anonymous. All interview responses will be coded and kept on a password-protected personal computer in my possession at all times.

Thank you for your time and contributions to this project.

Stephanie Clement

Name: _____

Date: _____

Tables

Table 1: Gender breakdown by school

	Female	Male

University of Vermont	6	2
Vermont Law School	1	1
University of Dar es Salaam	2	3
Nelson Mandela African Institution of Science and Technology	4	1
TOTAL	13	7

Table 2: Number of faculty members and staff by gender

	Faculty Members	Staff
University of Vermont	3 (1 male, 2 female)	5 (1 male, 4 female)
Vermont Law School	1 (1 male)	1 (1 female)
University of Dar es Salaam	5* (3 male, 2 female)	2* (2 male)
Nelson Mandela African Institution of Science and Technology	4 (1 male, 3 female)	1 (1 female)
TOTAL	11	10

* Two male UDSM interviewee were both faculty and staff

Table 3: Participant Information

Participant	Date	Institution	Role	Gender	Method
1	23 June 2020	VLS	Faculty	M	Zoom
2	25 June 2020	UVM	Faculty	M	In-person
3	26 June 2020	UDSM	Faculty	F	Zoom

4	26 June 2020	UVM	Faculty	F	Zoom
5	29 June 2020	NM-AIST	Faculty	F	WhatsApp
6	30 June 2020	NM-AIST	Faculty	M	Zoom
7	30 June 2020	UVM	Administration	F	Zoom
8	1 July 2020	NM-AIST	Faculty	F	Skype
9	1 July 2020	UVM	Administration	F	Zoom
10	2 July 2020	UVM	Administration	F	Zoom
11	8 July 2020	VLS	Administration	F	Zoom
12	8 July 2020	UVM	Administration	M	Zoom
13	9 July 2020	NM-AIST	Faculty	F	WhatsApp
14	9 July 2020	UDSM	Faculty	F	WhatsApp
15	9 July 2020	NM-AIST	Administration	F	Skype
16	9 July 2020	UVM	Administration	F	Zoom
17	13 July 2020	UDSM	Faculty/Administration	M	Zoom
18	13 July 2020	UVM	Faculty	F	Zoom
19	15 July 2020	UDSM	Faculty	M	WhatsApp
20	20 July 2020	UDSM	Faculty/Administration	M	Zoom