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IMPACT OF STRUTURAL GEOINFORMATION ON NATURAL DISASTER MANAGEMENT IN UNITED ARAB EMIRATES

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Abstract

In the United Arab Emirates (UAE), recent advancements have evolved toward the concept of disaster resilience. However, preparations for any coming disaster have been delayed, and disaster preparedness has only lately been placed on the national agenda, due to the country's recent legal creation as a nation. In light of the new nuclear power plant in the UAE's energy sector, it's critical to understand the sector's vulnerabilities as a means of preparing for potential natural or man-made disasters. Therefore, this research explores the impact that Geographical Information Systems (GIS) has on tacking natural disasters in UAE. A quantitative approach has been chosen as the approach of this study, with the use of a questionnaire survey using a 5-points Likert scale to gauge the respondents of this study regarding their perspective on exploring the impact that geoformation. A total of 251 responses were answered, accounting for 83.66 percent response rate. This study empirically focuses to explore and examine the relationships between disaster management and five GIS dimensions via the Structural Equation Modelling-Partial Least Square technique. The results have shown that the implementation of geoformation dimension produced a significant positive effect on disaster management performance. The study also proved that current practice of GIS for disaster management still significant while some element may not so critical.

Keywords: Disasters Management, Geographical Information Systems and SEM-PLS

Introduction

Crisis management is the applicability of strategies designed to help organizations respond to rapid and significant adverse events. Crisis management aims to minimize the damage caused by the crisis. However, this does not mean that crisis management and crisis confirmation are the same thing. Rather, crisis management is an integrated process that is put into practice before a crisis occurs. There are two types of crises: natural disasters and man-made crises. Crisis management involves the use of diplomatic and economic means to build a strong position to reduce tensions, reduce losses, and allow adversaries to compromise, while avoiding loss of control or escalation into war (Johnston, 2016)

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Even before the coronavirus pandemic, the Council ranked the digital/tech sector as the most important business first mover in 2020 — followed by acquiring the talent needed to enable technology transformation. But COVID19 has elevated digital initiatives to digital demands, immediately prompting HR managers to work with CEOs to rethink capability needs as business models rapidly shift. The pandemic proved what many people knew before. Traditional work techniques are outdated (Engler, 2020).

Globalization requires favourable conditions—a relatively free and non-discriminatory trade environment, low tariffs, efficient market processes, support institutions and a relatively stable operating environment, at least one characterized by manageable risks rather than disruptive uncertainties environment of. In addition, the recent wave of globalization requires efficient physical and digital infrastructure and sophisticated technologies to coordinate complex global supply chains and exploit opportunities for locational advantage. Any of these changes would alter the attractiveness of a global business strategy. The weakening of policy factors has become apparent in recent years. There are many conflicting arguments surrounding the root cause of these shifts—the U.S. focus on military primacy (Wertheim, 2020).

The truth is, COVID isn't telling us anything new about crisis management. Rather, it is a stark enlightener of known fission points in preparation and leadership. Successful crisis management is all about getting the right people into the right spaces so that the right decisions can be made to achieve unified strategic goals. This statement applies to organizations and countries and should be the ultimate goal of leaders facing a crisis. If we apply these lessons to our management techniques, we'll emerge stronger from this crisis—it doesn't matter what the next crisis brings. Crisis management research is conducted before, during, and after a crisis. (Morris, 2020).

Possible since the beginning of the COVID-19 crisis, such as evolving health or digital work solutions. Its start-ups have weathered the crisis better than any other economic leader. Many entrepreneurs use the Bricoleur persona as they try to drive change and create opportunity with the support available. Bricoleurs demonstrated that crises can foster the development of new modifications and alternative products and services (Brem, 2020).

The UAE economy is dominated by the energy industry, particularly in terms of demand and distribution, and it occupies a critical global role in the global economy. The UAE's prime concern ought to be the preservation of such infrastructure components, particularly in the energy industry, the shielding of oil and gas infrastructure from environmental and man-made risks (Copping et al., 2021). In the United Arab Emirates, recent advancements have evolved toward the paradigm of emergency preparedness. Nonetheless, preparedness for any coming disaster has indeed been delayed, and disaster preparedness has only lately been placed on the national conversation, owing to the state's recent legal creation as a sovereign. In anticipation of the recent nuclear power plant at Braga and other additions in the UAE's power sector, it's essential to comprehend the industry's vulnerability as a way of preparing for potential natural or man-made

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disasters (Alteneiji et al., 2020). As a result, the purpose of this study is to investigate the role of geoformation in dealing with natural disasters in the United Arab Emirates.

LITERATURE REVIEW

2.1 Disaster

Disasters are usually understood as interactions between humans and human systems and natural or man-made disasters. The United Nations International Disaster Reduction Strategy (Rosselló et al., 2020) defines disasters as:-Serious destruction of community or social meanings, including a vast ray of human, material, economic or environmental losses and impacts, beyond the scope of the affected communities or social use Respond with your resources.

Hazards are defined by (Smith, 2013) as “hazardous phenomenon, substances, human actions, or situations which may result in death, injuries, or other health impacts, infrastructure damage, economic difficulties and resources, economic and social degradation, or ecological harm”. Hazards might be natural or man-made, according to these classifications. The study of disasters and catastrophe management is becoming increasingly significant. As indicated in Figure 1, this is mostly attributable to a rise in the frequency of disasters. Please be advised of Figure 1, which depicts the ostensibly natural calamity. This refers to calamities brought on by weather or geological phenomena. The phrase "natural disaster" is a little deceptive, as we'll see subsequently. Several of the driving factors for the increase in disaster frequency can be attributed to, for instance, population growth and acceleration of climate change, as well as increased climate variability. In addition, it should be noted that disaster reporting has been improved (Thornton et al., 2014).

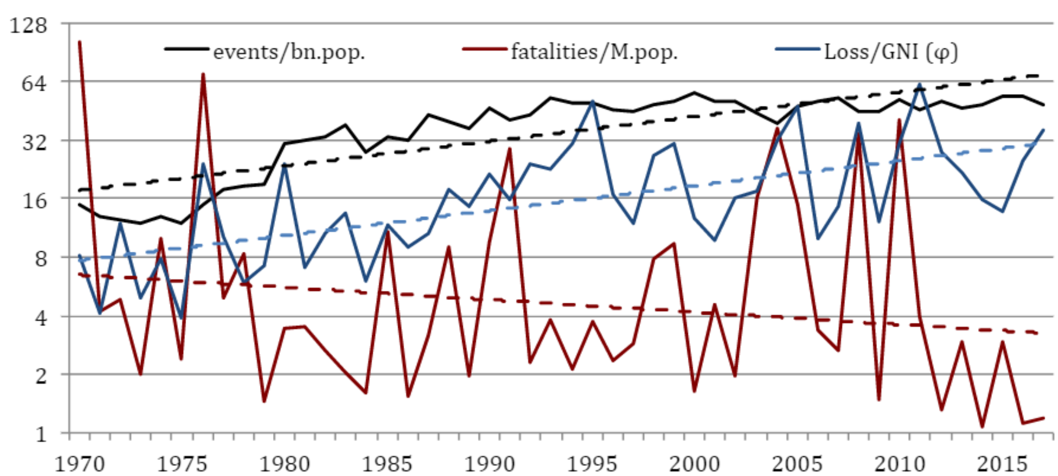

Figure 1: Natural Disasters Trends

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Disaster costs have also increased, for instance, hazardous occurrences affecting cities and urban regions are causing intense damages to property and infrastructure (Cui et al., 2019). This has led to increasing interest among individuals and institutions to find ways to lessen the effect of disasters. Although the frequency of disasters has increased, although the number of people affected has increased, the mortality rate has not increased correspondingly (Ma et al., 2020). There are a series of organizations that actively participate in reducing impacts internationally. For instance, the United Nations International Disaster Risk Strategy (UNISDR) goes to the national and sub-national level, and several nations have developed org to handle disasters.

Disaster is usually implicit as an occurrence that exceeds the ability to respond to and respond to the event. (Maves et al., 2020) pointed out: - "When the action demand exceeds the response capacity, a disaster will occur. Crisis." From this, it might be imagined that even a relatively small event will have little or no response capacity. It can also be overwhelming. It should be noted, however, that the type of organization proposed for the definition may lead to different views on what constitutes a disaster. For instance, the International Federation of Red Cross and Red Crescent Societies defines a disaster as: -A disaster is a sudden and catastrophic occurrence that severely disturbs the operation of a community or society, and causes more than the community or society to use itself. Ability to cope with resources. Although it is usually caused by nature, disasters can also be caused by man. The word "disaster" has been defined by disaster management experts. A disaster, for illustration, is defined by (Morganstein & Ursano, 2020) as "a single incident that results in substantial damages to individuals, infrastructures, or the ecosystem." Disasters, like risks, come from a variety of places (natural systems, societal systems, and technological failings). The Centre for Research on the Epidemiology of Disasters (CRED) classifies emergency and calamities according to a set of standards, including:

- Ten (10) or more people reported killed
- Hundred (100) or more people reported affected
- Declaration of a state of emergency
- Call for international assistance

As a result, the connotation of catastrophes may differ from one location to the next, as well as from one entity to the next, because CRED uses above that the standards to record such incidents into the databases. It is clear from these descriptions of catastrophe that any incident that involves humans and their support systems can culminate in a disaster. Hazards are divided into two categories by (Sutton et al., 2020): those with immediate repercussions, like earthquakes and lightning storms, and those with a longer beginning, including degradation or soil degradation. Technological risks can be categorized in the same way; for illustration, an airplane crash is a fast onset catastrophe, whereas urban air pollution is a long onset catastrophe in terms of morbidity and mortality.

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2.2 Disaster Management

Disaster management is the process of formulating strategies for preventing dangers as well as coping with the aftermath of a disaster. Disaster management (also known as disaster risk management) aims to reduce or lessen the negative consequences of disasters through a range of approaches, technology, and actions. Geographical Information Systems (GIS) to detect dangerous locations and Early Warning Systems (EWS) to advise people to seek shelter or evacuate the area are two examples of technologies that can be used (Perera et al., 2020). "The structured approach of leveraging administration guidelines, organizations, and operational key competencies to execute plans, strategies, and increased adaptive abilities in terms of reducing the damaging consequences of hazards and disasters (Shah et al., 2018).

They also served as advisors on matters that were hazardous, ambiguous, or challenging (Oswald et al., 2019). This was remarkable at the time since the Asipu did not promise to be able to predict the future and instead addressed the creation of advice thru a predictable, constant purpose of selecting significant aspects of the issue, examining possibilities, and gathering data. This is analogous to the risk analysis method, which helps the competent committees to assess the economic materials before making a risky choice. Societies have always worked to decrease the danger of disasters, therefore disaster management has a longstanding experience (Rehman et al., 2019). The chance of injury can be regarded as a risk in generality. Risk in the context of disasters can be defined as the likelihood of damage from several catastrophic events which might result in negative environmental effects, injury, mortality, economic recession, and the devastation of livelihood. Risk is defined by (Fan et al., 2020) as "the intersection of an event's likelihood and its negative repercussions.

Risk, according to (Guillard-Gonçalves & Zêzere, 2018), is the function of the combination of hazard and vulnerability. The Pressure and Release PAR Model (Figure 2) was created by the investigators. This design will be used to research the United Arab Emirates. The elements that affect risk will be revealed as the reasons of susceptibility and hazardous as a result of this. (Torkamani et al., 2018), for example, link the likelihood of danger to the likelihood of susceptibility, which contributes to unanticipated expense. Disaster risk, according to(Ahmadalipour et al., 2019), is a measure of both risk occurrence, and this connection is depicted in Figure 2, as follows: - (H) Hazard X (V) Vulnerability = (R) Risk

Whenever an incident happens, the larger the hazard and the larger the susceptibility, the higher the chance of negative effects. As noted previously, disaster management's purpose is to decrease or minimize negative outcomes. It is evident from the calculation that lowering vulnerability lowers risk. This isn't the first time vulnerabilities have been mentioned with disasters. The development of disaster management and how vulnerabilities became an intrinsic aspect of disaster management would be discussed in the subsequent.

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THE PROGRESSION OF VULNERABILITY

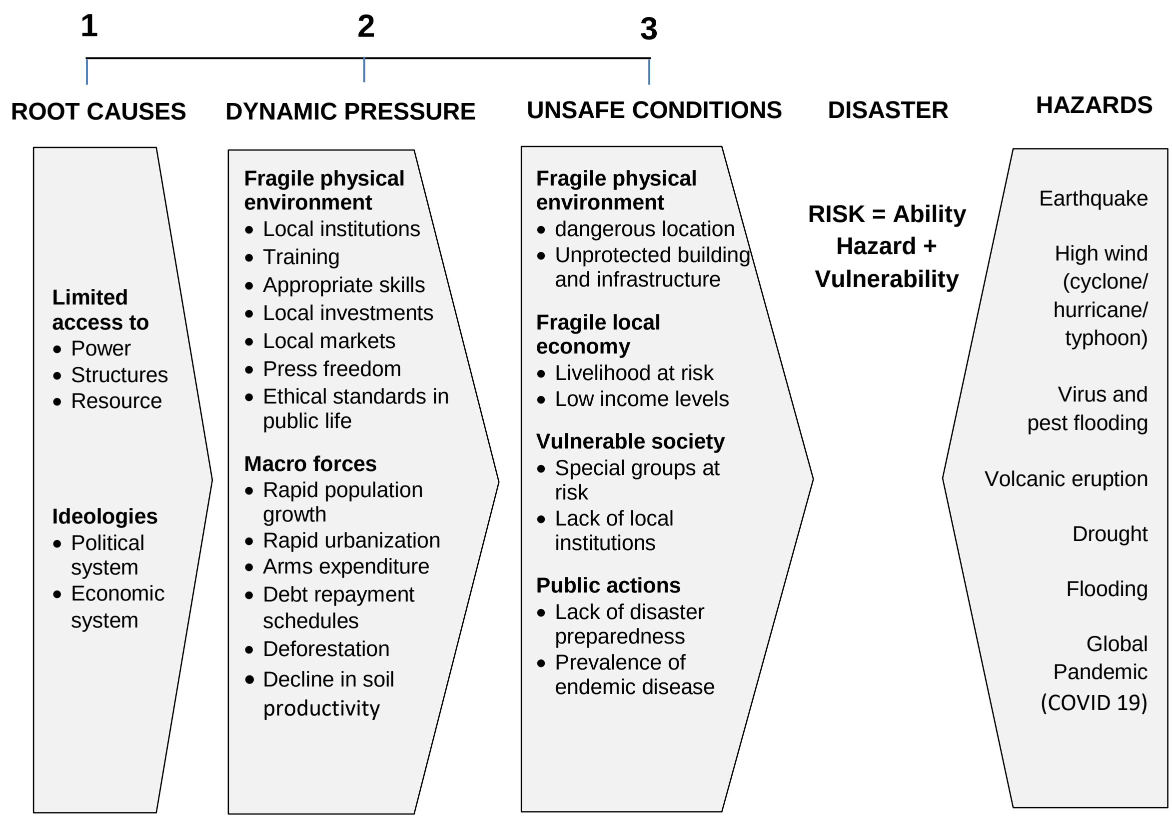

Figure 2: Pressure and Release Model

According to Cuthbertson et al., (2019), scholars are increasingly considering disaster management as a process rather than a reaction to a singular incident. The writers are referring to the processes that lead to distaste. They suggest that reasoning in this approach may improve with vulnerabilities. They go on to say, nevertheless, that exposure minimization isn't often factored into growth plans. Delavar & Sadrykia, (2020) agree with the pragmatic technique and pointed out that culture has an impact on vulnerability assessment and catastrophe management. A portion of the study will focus on Islam's influence in these regions.

As a result, identifying hazards is critical to determine their core reasons and the influence they have had on vulnerabilities. As a result, it's critical to comprehend hazard features, especially some that happen regularly (Smith & Merritt, 2020). Flash floods, for instance, are common in the UAE's urban regions, making them extremely exposed (Abdouli et al., 2019). In addition, stress the necessity of preventing and managing the core conditions that contribute, like social, political, environmental, and economic factors.

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2.3 Global Pandemic (COVID-19)

In December 2019, a novel coronavirus (SARS-CoV-2) that produces the COVID-19 virus was transferred from bats to humans in Wuhan, China. It quickly spread globally (Chen, 2020). COVID-19 is a disease caused by a novel coronavirus. "CO" stands for coronavirus, "VI" for virus, and "D" for disease. Previously, the disease was called "2019 Novel Coronavirus" or "2019-nCoV". The COVID-19 virus is a new virus in the same family as severe acute respiratory syndrome (SARS) and some types of common cold viruses. The virus is spread through direct contact with respiratory droplets (produced by coughing and sneezing) from an infected person. Individuals can also become infected by touching surfaces contaminated with the virus. Because this is a new virus, there is currently no vaccine for COVID-19. The outbreak of coronavirus disease (COVID-19) has been declared a Public Health Emergency of International Concern (PHEIC) and the virus has now spread to many countries and territories (Bender, 2020)

The former Supreme Comptroller agreed that asking about public health needs was a priority, but said there could be a significant economic downturn. The government should be modified to spend a lot of money to protect businesses and households. Most countries have been broadly impacted by the COVID-19 pandemic, but some are managing better than others, and some emerging countries are recovering. However, companies do not always recognize the actual threat posed by a potential crisis event. There have been several pandemic outbreaks in the past, but the main impact of the outbreak has been business and economic disruption. (Möller, 2017).

Managing a global crisis is a complex matter. It requires individual, organizational and institutional responses and large-scale coordination involving interdisciplinary and multidisciplinary approaches. There are two directions, the first is enterprise crisis management, which involves how the enterprise responds to the crisis. The second category suggests which policies can foster the company's survival during a crisis. Therefore, what barriers exist in the second stream can help policymakers develop appropriate interventions (Kuckertz, 2020).

International business policy is part of that. Past experience has shown that governments turn to protectionism during economic downturns, and this time was no exception. When the epidemic first hit, some countries responded to the global shortage of personal protective equipment and testing kits by banning or restricting the export of medical equipment and medicines (Evenett, 2020). Global business clearly emerged in the aftermath of the global financial crisis. Although trade has grown slightly, trade as a percentage of gross domestic product (GDP) has not declined since 2008, a period sometimes referred to as "globalization." Natural disasters create difficult situations, and as such, they also create the possibility of creating value for people, where change can begin to promote healing and repair. Business people are willing to use their awareness of opportunity-driven systems with huge growth potential (Irving, 2020)

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2.4 Geographical Information Systems (GIS)

Since the data is related to a universal configuration, GIS can serve as an avenue of conceiving around and responding to underlying problems. It is simple to be using the same data in numerous applications and to also associate dissimilar large datasets previously unattainable for study by researchers. Topology allows for new concerns to be raised and supports a unique design of investigation which is, in several situations, essentially superior to previous methods. The foregoing are some of the advantages of GIS:

Better decision-making: This usually refers to making important choices regarding where to go. Property investment placement, route/corridor classification, regulation, management, conserving, environmental assets, and other instances are prevalent. People are starting to realize that choosing the right location is critical to a business's future.

Improved communication: GIS-based mapping and visualizations are extremely helpful in comprehending events and expressing stories. They are a new language that helps individuals, divisions, specialties, specialized domains, companies, and the general public communicate more effectively.

Better geographic information recordkeeping: Many organizations are charged with the core purpose of keeping accurate records of the current and evolution of geographies (geographic accounting). Zoning, demographic censuses, landholding, and land tenure are all instances of cultural anthropology. Forest assessments, ecological stockpiles, protection of the environment, river runs, and a variety of other geographical accountings are types of physical geographies. Having comprehensively involved with having analytics facilities, GIS provides a robust structure for administering these kinds of programs.

Managing geographically: GIS has become increasingly important in governmental and several huge organizations to know what is happening. GIS information solutions are used by senior management and professionals at the highest ranks to collaborate. Such items include a visual foundation for understanding about, comprehending, and prescription behavior. Sessions on diverse spatial patterns and linkages, such as lands usage, criminality, the ecosystem, and defensive line concerns, are illustrations.

3. Components of Geographic Information System

A GIS is a computer system that combines equipment, programming, and data to capture, manage, analyze, and exhibit all types of geographically linked data. GIS allows users to see, comprehend, query, analyze, and visualize data in a variety of methods, including maps, globes, reports, and charts, to highlight correlations, patterns, and tendencies. By examining data in a manner that is clearly understood and disseminated, a GIS can assist users in answering questions and providing information (Hoskins, 2020).

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A geographic information system (GIS) is a system that combines hardware, programming, geospatial data, and people to acquire, store, upgrade, alter, analyze, and portray all types of spatially linked data. GIS technology combines standard database functions like queries and scientific techniques with the distinctive display and geospatial analytical capabilities of mapping.

The data or information (parameter info) is linked to geographical analysis (feature layers). Schools are an illustration of this. The spatial analysis represents the real locations of the institutions. The descriptive analysis also included information like the institute of education, school ID, and school type. The combination of these two data kinds is what makes GIS a really powerful problem-solving technology. The GIS makes it possible to perform "why" and "what if" simulations by connecting to the database linked with the strata and creating a consequent map presenting a visual examination. These five important elements comprise a functioning GIS: technology, software, data, people, and techniques (Wilson et al., 2021).

3.1 Hardware

A GIS's hardware is the machine on which it runs. GIS is now available on a variety of hardware platforms, ranging from centralized data centers to independent or interconnected personal computers (Drennan, 2020). GIS software consists of a variety of hardware types, ranging from centralized computer servers to personal PCs, and in freestanding or networked configurations. End-user equipment like graphical gadgets, subversives, and scanning is referred to as hardware. A variety of processors are used for data representation and management. Web servers are now an integral feature of many systems' architectures as a result of the rise of the Internet and Web-based applications; as a result, most GIS's use a 3-tier structure. It is made up of the computer network that will execute the GIS software. The hardware systems available ranged from 300MHz desktop computers to TeraFLOPS Super Computers. The computers are the heart of the GIS hardware, receiving data from scanning or digitizing board. A scanner translates a physical image into a digital image that can be processed further. The scanner's outputs can be saved in a variety of formats, including TIFF, BMP, and JPG. A digitizing board is a flat board that are used to vectorize a set of mapping components. The most typical output signals for a GIS hardware configuration are printers and conspirators.

3.2 Software

GIS application supports the capabilities and equipment needed for storing, analyzing, and displaying geographic data (Ashkezari et al., 2018). The following are important software packages:

- A database management system (DBMS)
- Tools for the input and manipulation of geographic information
- Tools that support geographic query, analysis, and visualization
- A graphical user interface (GUI) for easy access to tools

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Software is also a very dynamic component of the system. There are now many GIS software suites available. These technologies are available from a variety of embedded systems and have a variety of useful possibilities. GIS software includes features and functions for storing, analyzing, and displaying geographic data. ArcGIS, MapInfo, Global Mapper, AutoCAD Map, and other GIS tools are used. The software on offer is categorized as application-specific. Mapinfo is the best choice for low-cost GIS work on desktop Global mapping. It's simple to use and has a lot of GIS features. ArcGIS is the ideal solution if the user intends to conduct intensive GIS analysis, comprising simulation and report preparation. AutoCAD Map is a wonderful alternative for AutoCAD users who want to branch out into GIS.

3.3 People

Even without a manager managing the system by making methods for deploying it to real-world situations, GIS technology is of insufficient use. Users of GIS range from technical experts who create and manage the platform to all of those who utilize it to assist them in their daily tasks. Users are the outcome essential for a genuine GIS. Any individuals who would use GIS to promote initiative or intended outcomes, or an organization at large that would use GIS in service of its mission statement, is referred to as a "user." The individuals who utilize a GIS are the ones who give it its true power. Computers have grown considerably easier and somewhat more economical for businesses, institutions, and organizations during the last years. People in a variety of fields are now using GIS as skills to assist them to execute their work more efficiently. GIS is used by authorities to fight crime, and by emergency, 911 managers to dispatch emergency crews to a potential victim. GIS is used by biologists to safeguard plant and animal species, and instructors use it to educate geographies, literature, and technological subjects. The range of GIS users in the twenty-first millennium is endless. The client is essential to a good GIS, regardless of the program. GIS programmers are frequently portrayed as persons who work with computers daily. Although this is partially true, a broader range of GIS users is frequently selected.

3.4 Methods

An effective GIS follows a well vision and strategic principles, which are the patterns and operational processes that are specific to each company. Geographic Information System (GIS)- A system that allows users to share information in a structured way (Ashkezari et al., 2018).

Where these individuals operate. GIS stands for Geographic Information System, and it is a computer software program for organizing data with a spatial component. Its ability to incorporate principles and techniques from a wide variety of topics, including mapping, geographies, mapping, analytics, operational methodological approaches, and computation arithmetic, makes it a powerful platform for working with spatial datasets. This provides a unified evaluation by establishing a one-to-one relationship among

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geographic and non-spatial elements. The photogrammetry might be in the form of diagrams, aerial photographs, satellite pictures, planes table inspected graphs, and GPS-generated observations, all of which are effectively mapping databases. The non-spatial or characteristic statistics might be in the combination of language, figures, and symbols gathered from authorities such as censuses, supplementary investigations, and other resources.

A good GIS follows a well-designed roadmap along with business logic, which are the principles and operational processes that are specific to each corporation. For the construction of maps and their subsequent use in any enterprise, a variety of strategies are employed. The maps could be created to use an automatic pixel to the graphic converter or individually vectorized utilizing imported pictures. These computerized maps were created using either surveyed company maps or satellite images.

3.5 Data

The information is maybe the most significant aspect of a GIS. Geospatial data works together to achieve information that can be analyzed in-house or bought from an infomercial network operator. A GIS will incorporate geographic information with some other information systems and could even manage geographic information using a database management system (DBMS), and is used by most organizations to integrate and coordinate their information. Vector and raster datasets are the two primary types of geospatial data (Bereta et al., 2018)

In GIS, vector data/layers are distinctive structures described by endpoints, arrows, and polygon. Lines are created by joining two or more points together, and polygonal is a private area of Lines. Geometries with a shared set of properties are represented as layers. The topological of entities inside a stratum is bilateral. Digitalized maps, attributes collected from picture inspections, and several other vector resources can be found.

Raster data is a two-dimensional continual matrix of pixels or the three-dimensional counterpart of hexagonal cell lines. Continuous and categorical raster data are theoretically separated. Every cell value in a categorized raster is associated with a classification in a different table. Instances Types of soil and vegetation Land appropriateness, for example. Continuous raster pictures, like the Digital Elevation Model, are used to depict continual occurrences in place, with each pixel representing an elevations measurement.

A GIS's data is among the most significant, and quite often very costly, aspects. In a GIS, all data is either geographic data or analytical. The location of anything is determined by geographical analysis. Attribute data describes what happens; it describes the nature or qualities of geographic data. A process known as digitizing is used to enter geospatial information that is made up of geographical data and their associated attribute values, into a GIS. This procedure entails electronically capturing topographical elements like structures, highways, and district lines. Tracing the position, direction, or border of geospatial data on a computer monitor with scanning maps in the backdrop, or on a

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detailed map coupled to digitizing tablets, is the process of digitizing. Whether digitizing massive data like soil basins, torrents, or topography contouring, the procedure can be arduous and time-consuming.

Mr. Ershad Ali | Ananda Chandra College, Jalpaiguri-735101, India | Department of Geography | 9 Interestingly, most of the information GIS users require was developed by government and other private businesses and is free of charge or for payment through the data supplier or a geographic information repository. To organize and maintain attribute values, GIS relies on Relational Databases. A GIS may connect spatial information with the other different databases and sometimes even administer spatial information using a database management system (DBMS), which is used by many organizations to keep track of their information.

Any data with a definite link to space, comprising information regarding objects and people which exist in nature, is the material that a GIS works with. Hard-copy data, such as classic topographical maps, contractor records, demographic data, topographical assessments, and fieldwork summaries, were once part of this. With advancements in geographical data gathering, segmentation, and precision, a growing number of service digital processing at various scales are now obtainable (Barrile et al., 2019)

4. Research Methodology

This research purely quantitative method the questionnaire survey to the impact of geoformation on natural disaster management in UAE. A total of 290 were self-administrative distributed to the staff of National Emergency Crisis and Disasters Management Authority. Only 251 responses were received back with 83.66 percent. 26 surveys were either partially completed or rejected because of incorrect completion. Therefore, there were a total of 225 valid surveys were employed in the analyses. The analysis of data using appropriate statistical techniques statistical package for social sciences (SPSS) and structural equation modelling smart PLS as the research is quantitative.

The model developed for this study was generated through theories and literature review, introducing variables and elements that have not been used (see APPENDIX for details). The preceding literature review helped in the development of the conceptual framework of this research work and the hypothesis:

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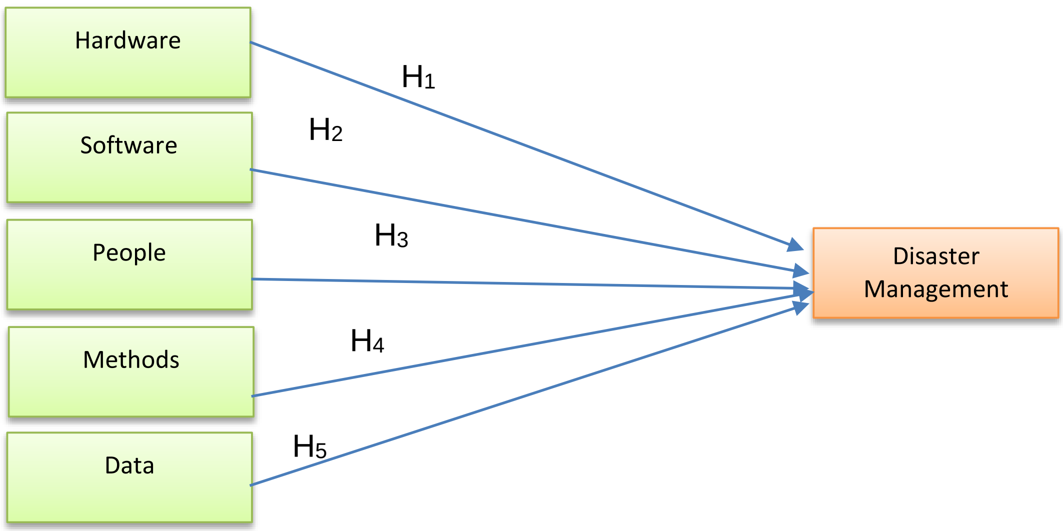

Figure 3: Research Conceptual Model

The hypotheses postulated are as follows:

H1: There is a relationship between Hardware and disaster management

H2: There is a relationship between Software and disaster management

H3: There is a relationship between People and disaster management

H4: There is a relationship between methods and disaster management

H5: There is a relationship between Data and disaster management

5. Structural Model Evaluation

Every one of the defined standards for measurement model validity was met in the past segment, completing the very first phase of the two-staged PLS-SEM assessment procedure. The next part of the equation is discussed in detail. Collinearity testing, significance testing of structural model relationships, assessment of the level of R2, assessment of effect size, and assessment of predictive relevance of the model are all part of the structural model review process (Hair et al., 2014). The structural model is shown in Figure 4, with the t-values and p-values of the respective path coefficients and factor loadings.

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Path Coefficient

Inside the structural model, these path coefficients are estimations of the hypothesised link among the endogenous latent variable (disaster management) and the extraneous latent variables (hardware, software, data, and method). The size and significance of the estimations reveal the causal relations. Significant positive entities are represented by path coefficients which are near to +1, whereas strong negative interactions are represented by path coefficients which are closer to -1. (Hair et al, 2014). The significance of the path estimations is assessed to use the Smart PLS-SEM software's bootstrapping process, which uses the crucial t-value for significance testing at a 5% significant level.

Table 1: Path Coefficient

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	***f2***	**R^2**
Data -> Disaster Management	0.515	0.083	6.197	0.000	0.391	**0.497**
Hardware -> Disaster Management	-0.082	0.105	0.785	0.433	0.011	
Method -> Disaster Management	0.058	0.113	0.513	0.608	0.005	
People -> Disaster Management	0.303	0.099	3.051	0.002	0.125	
Software -> Disaster Management	-0.057	0.102	0.558	0.577	0.006	

The path coefficients (β) are listed in Table 2, together with their t-values, p-values, and f2 values. Two paths show substantial positive relations, whereas three paths show significant negative relationships, as seen in the table. Data and catastrophe management had the strongest significantly positive path association (β=.515, t=6.197, p< .050) while the least positive significant path relationship was between people and disaster management (β=.3.03, t=3.051, p< .050), hypotheses H3 and H5 were supported. Besides that, the path relations among hardware and disaster management reveals a negative significantly path relations (β=-.082, t=0.785, p**>**.05), so hypothesis 1 was not supported. There is also negative relationship between Method and disaster management with path model (β=-.058, t=0.513, p**>**.05), hence, hypothesis 2 was rejected (not supported). However, when the considered from the questions on the questionnaire, it is clear that the respondents rated highly on the software scales that

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measured their perceived disaster management that shows that they considering themselves better up in terms of handling disaster.

Table 2: Heterotrait-Monotrait

	Data	Disaster Management	Hardware	Method	People	Software
Data						
Disaster Management	**0.510**					
Hardware	**0.428**	**0.185**				
Method	**0.515**	**0.262**	**0.261**			
People	**0.357**	**0.547**	**0.209**	**0.279**		
Software	**0.180**	**0.172**	**0.185**	**0.177**	**0.233**	

Coefficient of Determination (R^2)

The coefficient of determination (R-square) is a major indicator of the forecast accuracy of a structural equation model. It is the sum of all endogenous variable constructions' impacts on the endogenous model of the study. In the structural model, the R-square also demonstrates the number of variation in the endogenous latent variable accounted by all the exogenous latent variables (Hair, et al 2014). Table 2 shows that all five exogenous constructs in the structural model have a significant (large) influence on the endogenous latent variable (R2=.497). The overall impact of the external latent constructs explained around 49% of the variation in the endogenous latent variable, according to this. This suggests that hardware, software people, data and method collectively predict individual's intentions to effectively handle disaster management.

Effect size (*f* 2)

The contributions of various exogenous factors which constituted the framework could be examined subsequently using the R-square as a metric for gauging total predictive accuracy. The f 2 reflects the difference in R2 as a result of removing a certain exogenous construct from a model. It has been used to see how distinct external constructs affect the endogenous construct's R2 value (Hair, et al., 2014). Cohen's (1988) recommendations are used to determine the effect size, with f 2 scores of.02,.15, and.35 indicating small, medium, and large affects, correspondingly. The f2 scores of the relevant path relationships in the structural model are shown in Table 4.16. The findings reveal that data have large effect on effective disaster management with effect sizes of *f* 2=0.391. All other constructs have similarly large effects on the R-square. For hardware,

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software people, and method has shown effect, f^2 0.011, 0.005, 0.125 and 0.006 respectively shows values effects on the R-square value.

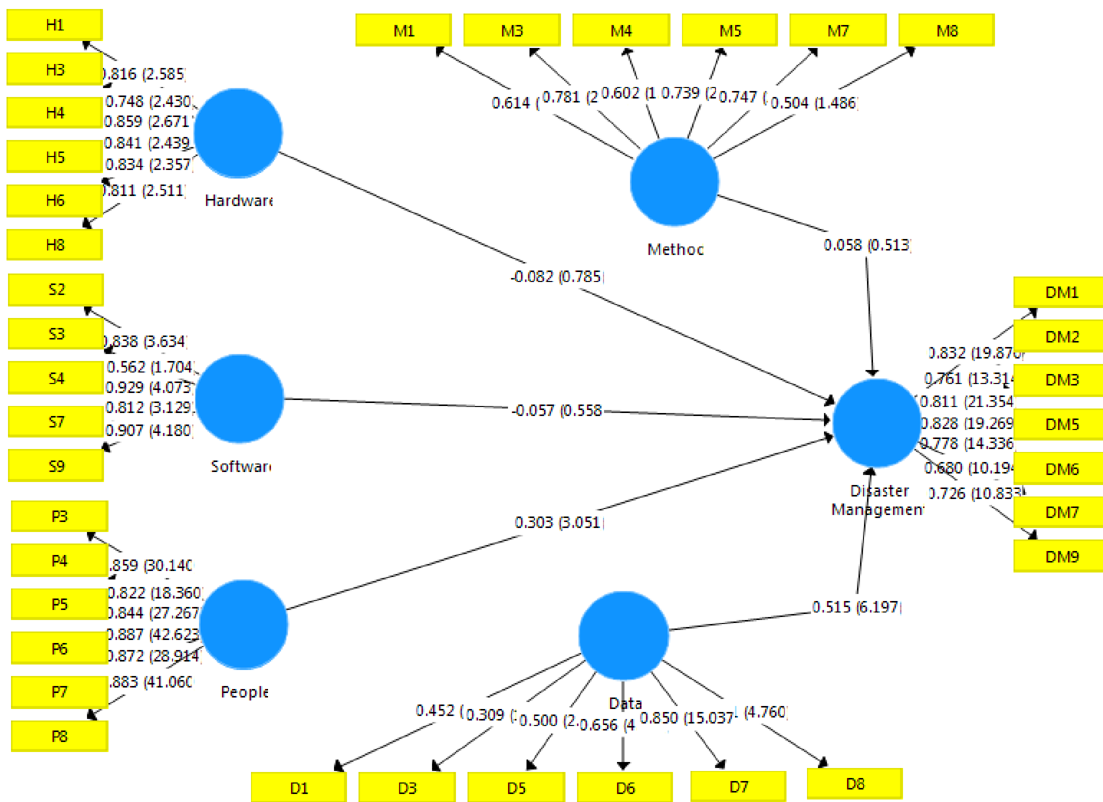

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Figure 4: Structural Model

As revealed by the result, geoformation dimension people positively significantly affect disaster management (β=.3.03, t=3.051, p< .050). These results are in line with the results from previous research conducted across the countries (Li et al., 2018). The positive effect of people dimension geoformation on disaster management seems to work across different countries as they are similar in both developing and developed countries. Consumers of GIS varies from technical experts who create and manage the technology to regular people who utilize it to benefit them with their daily tasks (Ali, 2020)

The results also revealed that data has a significantly positive impact on disaster management (β=.515, t=6.197, p< .050). These findings are consistent with other empirical findings that data can stimulate disaster management by pursuing new technologies in the markets (Gold Thorpe et al., 2018). In those studies, With advancements in geographical data gathering, segmentation, and precision, a growing

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number of standard digital processing at various scales are now obtainable (Jiang et al., 2018).

Geoformation hardware has been shown to have a negative significant effect on disaster management (β=-.082, t=0.785, p**>**.05). The finding of this study is not consistent with the prior studies in the geoformation and disaster management study (e.g. Bow lick et al., 2018). GIS is now available on a variety of hardware platforms, ranging from centralized computer systems to personal systems in independent or interconnected setups.

In respect of geoformation software, the result revealed that software has a significantly negative effect on disaster management (β=-.0.057, t=0.558, p>0.05). However, the finding of this study contradicts many studies conducted in developed countries (Jiang et al., 2018). The capabilities and equipment required to save, analyse, and present geographical data are provided by the software.

The result revealed that the method does not have a positive significant relationship with disaster management ((β=-.058, t=0.513, p**>**.05). The findings of the current research are in line with previous studies' findings (Chu et al., 2018). Similarly, As referenced as the technique of geoformation, GIS functions as per a well-designed strategy and business principles, which are the patterns and operational procedures specific to every enterprise.

6. Conclusion

The stipulations of the previous studies on the National Emergency Crisis and Disasters Management Authority form the theoretical underpinning of this investigation (NCEMA). The survey's significant benefit would be that it increased the usefulness of geo-information for UAE people. This has been accomplished by developing a theoretical model that incorporates the relationship between independent variables (people, hardware, software, data, and method) and disaster management. to aid in the construction of the research model and hypotheses The empirical relationships here between study constructs presented in the smart PLS have been shown in this investigation. It's worth noting that while geoinformation has been linked to disaster management and has become the topic of a lot of research, however little is documented about the impact of (people, hardware, software, data, and method) in the UAE. This study met that need by researching and developing a research theory that describes how and why various independent variables interact with the predictor variables. However, extending the present survey of geoinformation, the structural research model has bridged the gap in the literature on (people, hardware, software, data, and method) and disaster management.

Additionally, the application of PLS-SEM in this work allows for a thorough examination of the geoinformation model. This was accomplished by creating and analyzing the models, evaluating the impact of independent variables, and generating numerous fit indices from the structural model. This type of multivariate analysis allowed researchers to have a better grasp of the phenomenon. It also adds to our understanding of the interdependencies between the components.

This seems to be an important contribution. This is a significant departure from prior findings in the area of geoinformation that have been linked to catastrophe management. The research looked into both indirect effects on the relationship between the independent variables and the relationship between the factors. In this aspect, the formation of multifaceted correlations among the variables used in this study is a significant differentiation that has not been observed in earlier investigations. Furthermore, the research model established can be used as a screening tool for geoinformation and catastrophe management. The conclusions of this study have implications for both the governmental and private sectors in the UAE.

REFERENCES

1) Abdouli, K. A., Hussein, K., Ghebreyesus, D., & Sharif, H. O. (2019). Coastal runoff in the United Arab Emirates—The hazard and opportunity. *Sustainability*, *11*(19), 5406.

2) Ahmadalipour, A., Moradkhani, H., Castelletti, A., & Magliocca, N. (2019). Future drought risk in Africa: Integrating vulnerability, climate change, and population growth. *Science of The Total Environment*, *662*, 672-686.

3) Ali, E. (2020). Geographic Information System (GIS): Definition, Development, Applications & Components. *Department of Geography, Ananda Chandra College. India*.

4) Alteneiji, H. R., Ahmed, V., & Saboor, S. (2020). A qualitative approach to investigate emergency preparedness state for the built environment in the UAE. *Engineering, Construction and Architectural Management*.

5) Ashkezari, A. D., Hosseinzadeh, N., Chebli, A., & Albadi, M. (2018). Development of an enterprise Geographic Information System (GIS) integrated with smart grid. *Sustainable Energy, Grids and Networks*, *14*, 25-34.

6) Barrile, V., Candela, G., & Fotia, A. (2019). Point cloud segmentation using image processing techniques for structural analysis. *International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences*.

7) Bereta, K., Stamoulis, G., & Koubarakis, M. (2018). Ontology-based data access and visualization of big vector and raster data. IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium,

8) Copping, A. E., Hemery, L. G., Viehman, H., Seitz, A. C., Staines, G. J., & Hasselman, D. J. (2021). Are fish in danger? A review of environmental effects of marine renewable energy on fishes. *Biological Conservation*, *262*, 109297.

9) Cui, Y., Cheng, D., Choi, C. E., Jin, W., Lei, Y., & Kargel, J. S. (2019). The cost of rapid and haphazard urbanization: lessons learned from the Freetown landslide disaster. *Landslides*, *16*(6), 1167-1176.

10) Cuthbertson, J., Rodriguez-Llanes, J. M., Robertson, A., & Archer, F. (2019). Current and emerging disaster risks perceptions in Oceania: Key stakeholders recommendations for disaster management and resilience building. *International journal of environmental research and public health*, *16*(3), 460.

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DOI 10.17605/OSF.IO/UE42W

11) Delavar, M. R., & Sadrykia, M. (2020). Assessment of enhanced Dempster-Shafer theory for uncertainty modeling in a GIS-based seismic vulnerability assessment model, case study—Tabriz city. *ISPRS International Journal of Geo-Information*, *9*(4), 195.

12) Drennan, R. D. (2020). *Place-based decision making: the use of GIS by local governance groups to support salmon conservation and management on the West Coast of Vancouver Island*

13) Fan, B., Fan, W., & Smith, C. (2020). Adverse drug event detection and extraction from open data: A deep learning approach. *Information Processing & Management*, *57*(1), 102131.

14) Guillard-Gonçalves, C., & Zêzere, J. L. (2018). Combining social vulnerability and physical vulnerability to analyse landslide risk at the municipal scale. *Geosciences*, *8*(8), 294.

15) Hoskins, M. (2020). *Wake County Public Water Quality: A GIS-powered web application to aid residents of Wake County, NC in exploring local drinking water quality*.

16) Ma, H., Chiu, Y.-h., Tian, X., Zhang, J., & Guo, Q. (2020). Safety or travel: which is more important? The impact of disaster events on tourism. *Sustainability*, *12*(7), 3038.

17) Maves, R. C., Downar, J., Dichter, J. R., Hick, J. L., Devereaux, A., Geiling, J. A., Kissoon, N., Hupert, N., Niven, A. S., & King, M. A. (2020). Triage of scarce critical care resources in COVID-19 an implementation guide for regional allocation: an expert panel report of the task force for mass critical care and the American College of chest physicians. *Chest*, *158*(1), 212-225.

18) Morganstein, J. C., & Ursano, R. J. (2020). Ecological disasters and mental health: causes, consequences, and interventions. *Frontiers in psychiatry*, *11*, 1.

19) Oswald, D., Wade, F., Sherratt, F., & Smith, S. D. (2019). Communicating health and safety on a multinational construction project: Challenges and strategies. *Journal of Construction Engineering and Management*, *145*(4), 04019017.

20) Perera, C., Jayasooriya, D., Jayasiri, G., Randil, C., Bandara, C., Siriwardana, C., Dissanayake, R., Hippola, S., Sylva, K., & Kamalrathne, T. (2020). Evaluation of gaps in early warning mechanisms and evacuation procedures for coastal communities in Sri Lanka. *International journal of disaster resilience in the built environment*.

21) Rehman, J., Sohaib, O., Asif, M., & Pradhan, B. (2019). Applying systems thinking to flood disaster management for a sustainable development. *International journal of disaster risk reduction*, *36*, 101101.

22) Rosselló, J., Becken, S., & Santana-Gallego, M. (2020). The effects of natural disasters on international tourism: A global analysis. *Tourism management*, *79*, 104080.

23) Shah, A. A., Ye, J., Abid, M., Khan, J., & Amir, S. M. (2018). Flood hazards: household vulnerability and resilience in disaster-prone districts of Khyber Pakhtunkhwa province, Pakistan. *Natural hazards*, *93*(1), 147-165.

24) Smith, K. (2013). *Environmental hazards: assessing risk and reducing disaster*. Routledge.

25) Smith, P. G., & Merritt, G. M. (2020). *Proactive risk management: Controlling uncertainty in product development*. productivity press.

26) Sutton, R. T., Pincock, D., Baumgart, D. C., Sadowski, D. C., Fedorak, R. N., & Kroeker, K. I. (2020). An overview of clinical decision support systems: benefits, risks, and strategies for success. *NPJ digital medicine*, *3*(1), 1-10.

27) Thornton, P. K., Ericksen, P. J., Herrero, M., & Challinor, A. J. (2014). Climate variability and vulnerability to climate change: a review. *Global change biology*, *20*(11), 3313-3328.

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DOI 10.17605/OSF.IO/UE42W

28) Torkamani, A., Wineinger, N. E., & Topol, E. J. (2018). The personal and clinical utility of polygenic risk scores. *Nature Reviews Genetics*, *19*(9), 581-590.

29) Wilson, J. P., Butler, K., Gao, S., Hu, Y., Li, W., & Wright, D. J. (2021). A five-star guide for achieving replicability and reproducibility when working with GIS software and algorithms. *Annals of the American Association of Geographers*, *111*(5), 1311-1317.