Publisher: Scientific-Professional Society for Disaster Risk Management

International Journal of Disaster Risk Management

Article

Ensuring Disaster Management Practices in Academic Libraries of Ghana: The Issues at Hand

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Received: 1 February 2025; Revised: 9 March 2025; Accepted: 25 March 2025; Published: 30 June 2025.

ABSTRACT

The study focused on ensuring disaster management practices in academic libraries of Ghana, with a specific emphasis on a technical university library in Ghana. The convenience sampling method was used to select the study participants. The participants consisted of 455 respondents drawn from the university community. The study adopted a descriptive survey. The researchers used a Five-point Likert scale questionnaire to measure the various constructs. The researchers on the campus of a technical university in Ghana administered this. Out of 455 questionnaires distributed, 443 were valid for analysis. This represented 97.4% of the sample size and was valid for analysis. Using the Statistical Package for the Social Sciences (SPSS) version 25.0 computer software, the data obtained were analysed. The results showed that all the hypotheses tested indicated a positive relationship between the independent variables (Causes of Disaster, Technological Approaches, Challenges of Disaster Management, and Disaster Management Policy) and the dependent variable (Disaster Management Practices), except for the relationship between Challenges of Effective Management and the dependent variable. This suggests that the management of academic libraries in ensuring practical disaster management issues of the causes of disasters such as flooding, power fluctuations, power surges, fire outbreaks, roof leakages, earthquakes, mutilation, hacking of the library computers, plumbing defects as well as activities of pests (termites, cockroaches, rodents) among others should be given attention. The study recommends implementing technological approaches, such as fire detectors, fire extinguishers, smoke detectors, fire alarms, and CCT cameras, among others, to mitigate the occurrence of natural disasters. The study further recommends that academic libraries, in their pursuit of achieving effective disaster management, should develop a disaster recovery plan and policy to guide implementation. The policy should outline timelines for staff training, periodic inspections, security upgrades, repair of leakages and assembly points, and creation of awareness about disasters and emergency response lines, among others, as they form the core elements of ensuring disaster management practices in an emergency.

KEYWORDS

Causes of disaster; technological approaches; challenges of disaster management; disaster management policy; disaster management practices; disaster recovery plan.

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Edward, A., Dodzi, O. F., & Wilson, A. B. K. (2025). Ensuring Disaster Management Practices in Academic Libraries of Ghana: The Issues at Hand. *International Journal of Disaster Risk Management, 7*(1), 399–416.

1. Introduction

Disaster is an occurrence that causes damage and disruption to everyday activities. Libraries and Information Centres are vulnerable to a wide range of disasters, including natural events such as floods, earthquakes, and storms, as well as human-made threats like theft, criminal damage, fire, war, conflict, terrorism, inadequate security, and poorly maintained buildings, among others. There are also technical disasters, which include power outages, computer network breakdowns, gas leaks, communication failures, and issues with cooling, heating, and ventilation systems (Ottong & Ottong, 2013; Abdulsalami et al., 2022).

Disaster management encompasses all management issues necessary to deal with incidents that threaten library buildings, collections, services and human lives (Cvetkovic & Martinovic, 2020; Goyal, 2019; Mano & Rapaport, 2019). Since some public libraries of today are technology-driven, many nascent disasters are evolving. For example, changes in energy systems and lack of electricity supply endanger traditional library materials, just as digital materials are useless without energy supply. However, the unpredictability of their occurrences, including how they occur and which one occurs first, has been a great concern to individuals and organisations worldwide, including academic libraries in Ghana. The endemic damage caused by disasters in libraries, whenever one strikes, leaves the affected library in a deplorable condition (Abonyo, 2016; Ayoung et al., 2015).

Regardless of how the threats manifest or how they impact academic libraries, safeguarding and preserving their collections should be a top priority in their policies. It is very significant to note that the key to achieving this goal lies in effective preservation management, which enables long-term planning and informed decision-making. It will, therefore, be fair to assert that no public library is immune to these disasters, depicting that any of them could befall any academic library at any moment, as it is inescapable without appropriate control measures. The current study aims to advance disaster management practices in academic libraries of Ghana, using the Koforidua Technical University Library (KTUL) as the focal point of discussion. There have been recorded instances of disasters affecting libraries worldwide, including those in Africa and Ghana. These disasters have led to the elimination of entire collections of libraries.

The observation that disaster preparedness is not a significant concern in academic libraries is compounded by the fact that most disasters that occur in academic libraries are not adequately documented, and a significant number of cases go unreported (Abonyo, 2016; Ayoung et al., 2015). The effects of disasters range from financial implications to disruption of services, damage to library buildings, stacks, machines, staff, and physical communication channels such as roads, rails, and virtual channels like LAN, WAN, and the internet, among others. A visibility study conducted on the state of ensuring disaster management in KTUL reveals that there are no strategies in place to protect their holdings against disasters (Abonyo, 2016; Ayoung et al., 2015).

The preliminary investigations and observations indicate a state of disrepair, with leaking roofs, broken louvres, dead bulbs, dirty curtains, theft, mutilation, and exposed electrical wires, among others, in the library. Given the assertion above, this study aims to examine the process of ensuring disaster management practices at KTUL to protect their holdings against disasters through the phases of disaster management and planning, including prevention, preparedness, response, and recovery, if applicable. Though there have been some studies on disaster preparedness and management practices across the globe, for example, Abonyo (2016), IIo et al. (2020; 2018), Ismail et al. (2023), Ishola (2017), Taukur (2021), Rasaki (2021), Oyeniran (2023) Adeola et al., (2023) Simone and Carroll (2022) among others are some of the studies to mention. These studies typically concentrated on academic libraries in liberal universities without any connection to the technical university libraries in Ghana. The interesting scenario is that in Ghana, the researchers came across only a few studies, for example, Ayoung et al. (2015) and Frempong-Kore et al. (2022); this confirms that the issue of disaster preparedness and management is still not widely known and also a concern hence there is a gap that current study is to fill. The study aims to advance disaster management practices in academic libraries of Ghana, utilising the Koforidua Technical University Library (KTUL) as a case study.

1.1. Purpose and objectives

The purpose of this study was to examine the process of ensuring disaster management practices in academic libraries in Ghana, addressing the existing issues. The study seeks to address the specific objectives:

- To find out the causes of disaster in academic libraries in Ghana
- To find out the technological approaches to disaster management in academic libraries in Ghana
- To examine the challenges to effective management of disasters in academic libraries in Ghana
- To assess the emergency response plans of academic libraries in Ghana

1.2. Research questions

The study seeks to find answers to the following research questions: These are:

- ***RQ1*** – What are the causes of disaster in academic libraries in Ghana?
- ***RQ2*** – What are the technological approaches to disaster management in academic libraries in Ghana?
- ***RQ3*** – What are the challenges to effective management of disasters in academic libraries in Ghana?
- ***RQ4*** – Are there any emergency response plans for academic libraries in Ghana

1.3. Conceptual framework

In this study, the researchers incorporated aspects and concepts from theory, literature, contextual knowledge, and modelling to formulate a conceptual framework that guides the objectives and a literature review (see Figure 1). Ngulube (2020) contends that a conceptual framework can be formulated by incorporating aspects of theories, concepts from literature, or models. The construct causes of disasters, technological approaches to disaster management, challenges of effective disaster management, disaster management policies, and disaster management practices (Frempong-Kore et al., 2022; Abareh, 2014; Ayoung et al., 2015). As a result, the conceptual framework depicted in Figure 1 serves as the foundation for this study, informed by the literature and the identified models. Furthermore, these constructs influenced the study's objectives and literature review.

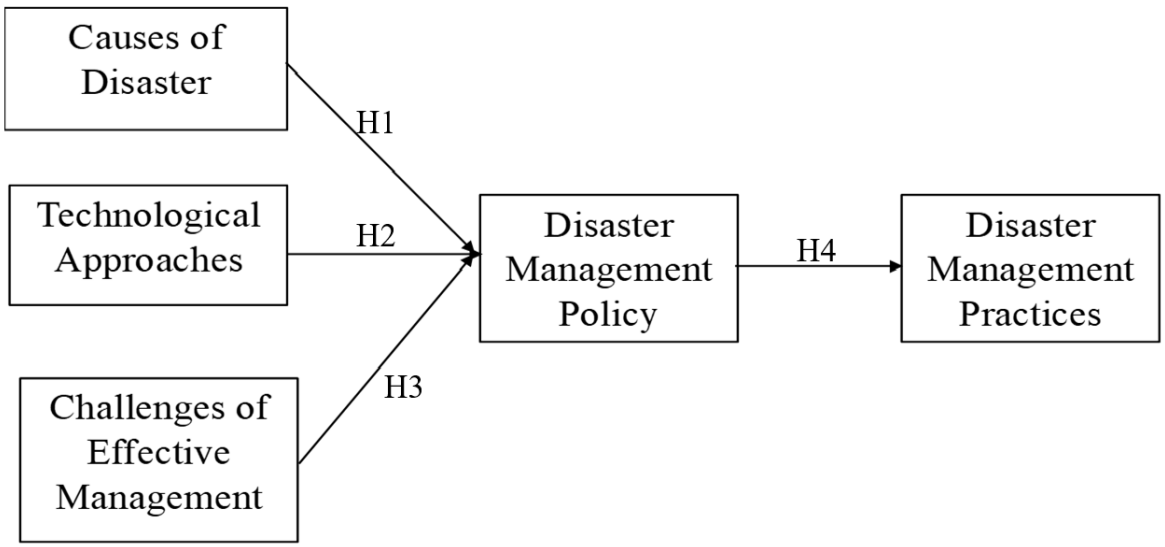

Figure 1: Research model.Source: Authors' Construct, 2024.

1.4. Literature review

Disaster perspective and causes in academic libraries

In the context of academic libraries, floods and fires are the most common disasters that destroy collections. According to Corrall and Brewerton (1999), the term encompasses both natural and man-made phenomena, such as storms, earthquakes, pests, blasts, asbestos, bombs, robberies, and civil disorder. Records show that Ghana has experienced a variety of disasters, including fires, earthquakes, floods, and arson cases (Adinku, 2005). The Aglonby Library in Accra, Ghana, was destroyed in the 1939 earthquake. The Agricultural Development Bank's headquarters caught fire in 1984, resulting in the destruction of valuable records. Akussah (1991) asserted that there were many attacks on Ghana's traditional libraries and archival materials; however, terrorist attacks were minimal. Any disaster is hazardous to humanity and properties, irrespective of the type and where it may occur. The devastating consequences of disasters are so severe that institutions like libraries need to prioritise disaster prevention measures over recovery measures (Frempong-Kore et al., 2022).

Another critical element that every library needs is the ability to formulate measures to recover quickly after a disaster; this will help the library achieve its institution's core objectives. In 1966, the Arno River in Florence "burst its banks and caused catastrophic flooding of the Bibliotheca Nazionale Centrale''. The flood destroyed one million volumes of documents (Fortson, 1992). In 1986, the Los Angeles Central Public Library's collections were also destroyed by arsonists. In 1988, a fire consumed 400,000 materials, including one-quarter of the newspapers at the USSR Academy of Sciences Library, due to defective wiring (Harvey, 1993). In 1997, the Morgan Library at Colorado State University was similarly damaged by a flood, which destroyed half of its collections (Alire, 2008).

According to Hlabaangani and Mnjama (2008), the old Immigration Department building in Gaborone, Botswana, caught fire in the 1990s, resulting in the destruction of a significant number of records. Numerous resources, including library materials, were destroyed in the attack on U.S. government offices in Kenya and Tanzania (McMichael, 2007). Oluwatola et al. (2015) posited that fire attacked the President Kennedy Library of Ahmadu Bello College, Zaria, where some library materials were consumed. In Ida, North Central Nigeria, students' protectors set fire to the Federal Polytechnic. Disasters can be caused by nature. These include floods, earthquakes, and tornadoes. Man can cause disasters. These include civil unrest, arson, and vandalism. Generally, the assumption is that disasters are large-scale events; however, most disasters are more minor in scope and less newsworthy, such as roof leakages and termite activities, yet just as destructive (Abareh, 2014).

Diamond (2006) further highlighted that natural disasters are those that occur as the result of any natural occurrence that causes significant damage and loss of life or the emergency that is the consequence of such an event or forces occurring in nature. He further added that artificial disasters are caused by human action, negligence, error, or the failure of a system. Man-made disasters are, in turn, categorised as either technological or sociological. In terms of technological disasters, failures can occur due to engineering failures, transportation accidents, or environmental disasters. On the other hand, sociological disasters often have a strong human motive, such as criminal acts, stampedes, riots, and war, among others (Abareh, 2014; Ayoung et al., 2015; Frempong-Kore et al., 2022).

Technological approaches to disaster management in academic libraries

The existing literature (Superio et al., 2024; Fatade et al., 2023; Frempong-Kore et al., 2022; Iroeze, 2021) on disaster management in academic libraries in Ghana and the wider West African region highlights several key concerns. Frempong-Kore et al. (2022) examine the state of disaster preparedness in selected university libraries in Ghana, revealing a concerning lack of preparedness. The study found that while all the surveyed library staff were aware of the potential for disasters, there was a significant shortage of disaster-resistant equipment, such as smoke detectors and fire extinguishers, beyond basic fire extinguishers. Additionally, the study highlighted the absence of disaster management committees and inadequate staff training in disaster preparedness. Building on these findings, the study further underscored the critical need for Ghanaian academic libraries to develop comprehensive disaster management policies and plans. The finding also emphasises the importance of disaster preparedness in academic libraries, as they are particularly vulnerable to a range

of natural and human-induced disasters, including fire, floods, theft, and vandalism. The literature also sheds light on the challenges associated with disaster management in digital libraries, which are becoming increasingly prevalent in academic institutions (Frempong-Kore et al., 2022). In their work, Cvetković and Šišović (2024) noted that education is one of the most important measures for reducing non-structural risk from the increasingly severe and frequent consequences of disasters.

Kehnemuyi (2021) and Ghorbanzadeh et al. (2020), for example, outline the potential threats to digital libraries, such as hardware failures, software malfunctions, and cyber-attacks, and the need for robust disaster management strategies to ensure the preservation of valuable digital collections. A study by Anyaoku et al. (2019) highlights the significance of digital information resources in disaster management. It emphasises the crucial role of information and communication technologies in developing effective disaster management plans for libraries and information centres.

Technological factors encompass aspects related to or involving the application of scientific advances, including any tool, technique, product, process, or method that benefits disaster management. Shuvasish and Sibsankar (2015) stated that technological advancements, especially in the information and communication sector, have provided a real yardstick for warning, preparing, sharing, and responding quickly to disasters, thereby minimising their impact. In some cases, it is even possible to avoid the damage caused by a natural disaster. Shuvasish and Sibsankar (2015) further listed technologies which can be helpful in the reduction of damage by a disaster:

Challenges to effective management of disasters in academic libraries

With the increasing shift towards digital collections, Biswas and Chaudhuri (2012) outline the potential threats to digital libraries, including hardware failures, software malfunctions, and cyberattacks, and emphasise the need for robust disaster management strategies to ensure the preservation of valuable digital collections. Brown (2021) highlights the evolving challenges in disaster management for libraries in the digital age. Additionally, the study by Kaur and Mahajan (2021) emphasised the significance of digital information resources in disaster management. It highlighted the critical role of information and communication technologies in developing effective disaster management plans for libraries and information centres. Disaster management in digital libraries presents unique challenges, as digital resources are more vulnerable to a distinct set of threats compared to physical collections. Hardware failures, software malfunctions, and cyber-attacks can lead to the loss of irreplaceable digital materials (Orenia & Cabonero, 2023). Furthermore, the reliance on complex information and communication technologies in digital libraries requires specialised expertise and robust backup and recovery procedures (Kaur & Mahajan, 2021).

Yamson and Cobblah (2016) recommended the use of Closed-Circuit Television (CCTV), electronic sensors, and electronic surveillance systems, as well as the need to employ well-trained security personnel in the library. Ilo, Ngwuchukwu, Michael-Onuoha, and Segun-Adeniran (2019) found that inadequate disaster facilities and equipment, as well as poor funding, were the most significant challenges confronting disaster mitigation in federal and state universities in Nigeria. Robert (2018) listed weak organisational policies regarding disaster management, a weak emergency plan, a poor attitude toward disaster management among staff members, general poverty within the institutions, and overpopulation as some of the factors that limit organisations from effectively managing disasters and security. Iroeze and Iroeze (2021) investigated the current status of preparedness in disaster management among academic libraries in the Southeast geopolitical zone of Nigeria. A base level of knowledge on disaster preparedness and current practices was assessed through a questionnaire distributed to 380 librarians at five academic libraries. Three hundred fifty-six responses were received, and after sorting, 337 were analysed. Frequency and percentage tables were used to analyse the collected data. Flood and fire were identified as significant threats to disaster in most academic libraries in the Southeast. Most of the academic libraries do not have a written disaster preparedness plan. Disaster preparedness measures and staff involvement in disaster preparedness by these libraries were found to be generally inadequate.

Sustainable disaster emergency response plans in academic libraries

Numerous studies (Frempong-Kore et al., 2022; Abdullahi et al., 2022; Ilo et al., 2018; Asamoah et al., 2018) on disaster management in academic libraries in Ghana and the wider West African region highlight several key concerns. These studies examine the state of disaster preparedness in selected university libraries in Ghana, revealing a concerning lack of preparedness. The study further underscored the critical need for Ghanaian academic libraries to develop comprehensive disaster management policies and plans. The literature also sheds light on the challenges associated with disasters in complex information and communication technologies in digital libraries. Libraries, as repositories of knowledge and cultural heritage, face a constant threat from various disasters, both natural and human-made (Abdulsalami et al., 2022). These disasters can cause significant damage to collections, infrastructure, and equipment, disrupting services and leading to the potential loss of invaluable resources. The importance of disaster preparedness and management in libraries is well-documented in the literature (Ismail et al., 2023; Orenia & Cabonero, 2023; Iroeze, 2021; Aburuki, 2016; Velasquez et al., 2016). There is no one-size-fits-all model for developing emergency response plans (ERPs) for all libraries. Factors such as the funding authority's financial strength for emergency preparedness undertakings, staff strength of the organisations out of which members are drawn and designated as an emergency response team, availability of emergency equipment for prevention, preparedness and response drills, leadership philosophy of the emergency response team leader and others are essential determinants (IIo et al., 2020; 2018),

In addition, each library should examine its unique characteristics in terms of emergency antecedents, vulnerabilities, facilities, structure, resources, and user community, among others, to develop an ERP that is responsive to identified hazards. Furthermore, the integration of relevant stakeholders' insights, especially in the case of an academic library, is essential for the formulation process of the plan (Miles et al., 2018). To this end, numerous emergency management frameworks have been proposed to guide libraries in developing institution-specific ERPs (IIo et al., 2020; 2018). Kostagiolas et al. (2011), about the disaster management plan of the National Library of Australia, mentioned the need for libraries to accommodate two broad phases of the emergency management cycle – pre-disaster activities (emergency preparedness plans, mitigation, and prevention) and post-disaster activities (giving detailed analyses of response and recovery processes). According to the "Anatomy of a Disaster Plan" by the American Alliance of Museums (2012), the following are vital areas for consideration in the preparation of an emergency preparedness and control plan: introduction, emergency preparedness and prevention, response procedures, emergency clean-up and salvage procedures, and institution-specific information. Cvetković et al. (2021) found that the most important predictor of local self-government preparedness for disasters is the assessment of the relevant legislation.

The proposal by Halsted et al. (2005) appears more comprehensive, outlining 11 steps for developing a meaningful emergency management framework for libraries.

Having identified the peculiar items necessary for formulating an institution-specific plan, the decision becomes necessary as to whether the guidelines (the plan's contents) should be documented (written down) for everyone to follow in the event of an emergency. Some of the libraries that have ERPs have them in two formats – written and unwritten. The WERP does not eliminate hazards/emergencies or ensure everything is salvaged during and after an emergency response. However, suppose the guidelines are consciously written and religiously followed during an emergency response. In that case, they have the potential to help minimise the extent of damage and the cost of recovery (Hamilton, 2016), as response efforts will be well coordinated through the plan. The UERP, on the other hand, only exists in the minds of stakeholders. In the event of an emergency, response efforts will be discretionary, and as a result, the process will lack proper coordination. As noted earlier, whether written or unwritten, if relevant items are not captured in the plan, it may still not serve its purpose. However, it may still not be responsive if it is not regularly being evaluated and updated to accommodate emerging threats. It had earlier been reported that some librarians believe that disasters rarely occur in libraries (Zaveri, 2015; Abareh, 2014). Additionally, it was found that librarians do not differ in their views on the role of emergency preparedness, preservation, and conservation as safety measures for information resources in federal and state university libraries (Ilo et

al., 2020). Whether or not this perception applies to ERPs concerning emergency preparedness and control in university libraries is uncertain.

2. Methods

An explanatory research approach was employed to identify and establish the fundamental relationships and linkages between various constructs, providing further insight and a broader perspective on the determinants of disaster management practices in the academic library environment, with KTUL in focus.

Population

All permanent staff and registered students at the Koforidua Technical University (KTU) were considered as the target population for this study. The rationale was to ensure that each participant had an equal opportunity to contribute to the subject, thereby gathering a substantial number of responses for the study. The participants were selected from five faculties: the Faculty of Applied Science and Technology, the Faculty of Engineering, the Faculty of Built and Natural Environment, the Faculty of Business and Management Studies, and the Faculty of Health and Allied Sciences. The total population for the study was 8040 (in Table 1). The researchers obtained the information from the Registrar's office.

Sampling Technique

Convenience sampling was adopted for the study. The rationale for using this technique was its practical approach to gathering data quickly and efficiently. Again, the entire target population was difficult to reach. However, this cannot justify the absence of limitations in terms of generalisation and potential bias. The inherent limitation was that the data collected could not be generalised to other universities in Ghana.

Population sample

According to Cooper and Schindler (2014), a smaller set of the larger population is referred to as a sample size. The study employed Yamane's (1973) statistical formula to determine an appropriate sample size from a finite population. This formula was used to determine the representative sample size from each of the faculties as follows:

$$n = N / (1 + Ne^2)$$

Where n = required sample size

N = size of the population

e = alpha level, that is, allowable error e = 0.1 at 95% confidence interval

Equation 1:

$n = N / (1 + Ne^2)$

2766/ (1+2766(0.1)2 =99

Equation 2:

1398/ (1+1398(0.1)2 =93

Equation 3:

587/ (1+587(0.1)2= 84

Equation 4:

2755/1+2755(0.1)2=95

Equation 5:

534/ (1+534(0.1)2=84

Hence, the sample size for the study consisted of 455 participants.

Table 1: Population and Sampling.

Faculty	Population	The sample size for each faculty
Faculty of Applied Science and Technology	2766	99
Faculty of Engineering	1398	93
Faculty of Built and Natural Environment	587	84
Faculty of Business and Management Studies	2755	95
Faculty of Health and Allied Sciences	534	84
Total	**8,040**	**455**

Source: Registry of Koforidua Technical University, 2024.

Operational Definitions

Operational Definitions (OP) describe the procedures, methods, and instruments used to quantify or qualify a particular phenomenon, making it possible to observe, record, and analyse data. OP ensure that abstract concepts are clearly understood and consistently applied. By standardising measurement procedures, operational definitions promote reliability and reproducibility. Table 2 illustrates the OP adopted for the study. The various constructs that inform the study include causes of disasters, technological approaches, challenges to effective management, disaster management policy frameworks, and disaster management practices, along with their respective sources, which indicate the hypothesised relationship.

Table 2: Operational definitions of constructs.

Constructs	Operational definitions	Sources	hypothesised relationship
Causes of disasters	Natural or artificial factors leading to a danger	Abonyo (2016), IIo et al. (2020; 2018), Ismail et al. (2023), Ishola (2017)	CD- TA
Technological approaches	The specific scientific measure of mitigating dangers	Rasaki (2021), Oyeniran (2023)	TA- CEM
Challenges of effective management	Systematic control of a dangerous situation	Simone and Carroll (2022)	CEM- DMPc
Disaster Management Policy Framework	Guidelines for managing disasters	Rasaki (2021), Oyeniran (2023)	DMPc- DMP
Disaster management practices	Benchmarking or standard practices in terms of dangers	IIo et al. (2020; 2018), Ismail et al. (2023), Ishola (2017)	DMPc- CD

Source: Adopted from existing Literature, 2024

Measurement development

In this study, the development of the survey instruments was guided by Churchill's 1979 proposal for designing a survey instrument (Bhattacharjee, 2012). The questionnaire was developed based on a literature review and the adaptation of previous items that have demonstrated rigorous and significant validity in the field of library and information science, particularly in the context of waste management practices in academic libraries (Tijani et al., 2022). The variables measured included the causes of disasters, technological approaches to disaster management, challenges to effective disaster management, and sustainable disaster management policies. The questionnaire consists of two parts. Section A of the questionnaire pertains to the demographic characteristics of the respondents, including their gender, age, educational qualifications, and academic level. Section B relates to the research model's endogenous and exogenous variables questions, which were powered on a five-point Likert Scale ranging from 1= 'strongly disagree' to 5= 'strongly agree'

Data collection

The questionnaire was hand-delivered to a sample of 455 participants. The participants included users from various categories, such as library staff, faculty staff, administrative staff, and students. The participants were given the questionnaire as and when they visited the library. This procedure was chosen because it allows for a better response rate, especially in situations where participants do not complete questionnaires appropriately unless the researcher is present. However, bearing in mind that minimum contact was made during the questionnaire-filling process to reduce researcher bias. After one month of administering the questionnaire, a total of 453 questionnaires were retrieved, out of which 10 were identified as unfit for further analysis because they were incomplete. Hence, 443 questionnaires were correctly filled, representing a highly acceptable response rate of 97.4%.

Data analysis

In testing the research model, the partial least squares structural equation modelling (PLS-SEM) technique, a second-generation multivariate analytic technique capable of processing latent constructs and simultaneously assessing the measurement and structural models, was used. In other words, PLS-SEM simultaneously models structural paths, that is the theoretical relationships between latent constructs and measurement paths between latent constructs and their indicators. PLS-SEM software, SmartPLS3, was used to analyse the data.

The reasoning behind the use of PLS-SEM is that it enables researchers to simultaneously examine a series of interrelated dependent relationships between a set of constructs, represented by several variables or constructs while accounting for measurement error.

Thus, Structural Equation Modelling's (SEM) ability to simultaneously test relationships incorporated into an integrated model has contributed to its widespread application. Presently, there are two conventional approaches for SEM; the Covariance-Based (CB-SEM) approach used in LISREL (Linear Structural Relations), AMOS (Analysis of Moment Structures), and EQS (Anderson & Gerbing, 1988; Bentler, 1995; Bollen, 1989), and the Variance-Based (PLS-SEM) approach used in PLS-PC, PLS-Graph, Smart-PLS and XLSTATPLS (Chin, 1995 1998; Esposito et al.,, 2010; Fornell & Cha, 1994; Hansmann & Ringle, 2004; Wold, 1985). These two approaches belong to the family of techniques that Fornell (1987) and Lohmoller (1989) referred to as the second generation of multivariate data analysis techniques.

Partial Least Squares (PLS-SEM), a relatively new, powerful multivariate analysis technique with roots in path analysis (Wold, 1985), is ideal for testing structural models involving multiple constructs with multiple latent variables (Fornell, 1987; Lohmoller, 1989; Wold, 1989). According to Tenenhaus et al. (2005), unlike CB-SEM, a PLS-SEM analysis does not require any distributional assumptions to be fulfilled (Wold, 1975). It can provide robust and accurate fits for relatively small sample sizes (Tenenhaus et al., 2005).

Additionally, the PLS-SEM method has been designed as a prediction-oriented approach to SEM that relaxes the demands on data and the specification of relationships set by CB-SEM (Jöreskog & Wold, 1982). For example, PLS-SEM can reliably estimate very complex models using only a few observations without imposing distributional assumptions on the data. Consequently, the two-step approach analytical procedures proposed were applied to the measurement and structural models. Besides, the bootstrapping method (5,000 resamples) was employed to test the significance level of path coefficients and loadings (Anderson & Gerbing, 1988; Ashill, 2011).

In a nutshell, the statistical properties of PLS-SEM particularly make it worthwhile for exploratory research settings that are ''simultaneously data-rich and theory-primitive'' (Wold, 1985, p. 589). Besides, its capabilities also support its use for theory testing; hence, it qualifies as a suitable approach to meeting the challenges faced by disaster management researchers, including the authors of this study, who are confronted with the increasing complexity of theories and cause-effect models (Hair, Ringle, & Sarstedt, 2011).

The use of PLS-SEM is gaining momentum and interest in various disciplines, including information systems (Chin & Gopal, 1995; Compeau & Higgins, 1995), marketing (Ashill & Jobber, 2009; Hulland, 1995), and organisational behaviour (Howell & Higgins, 1990).

3. Results and discussion

Evaluation of the measurement model

To achieve valid results, reliability, convergent, and discriminant validity, as well as the hypothesis of the measurement model were assessed. Convergent validity is the degree to which indicators of a latent construct converge or share high proportions of variance in common. Convergent validity is established when all indicators (observed) load highly on their assigned factors, for instance, with a loading of 0.5 or higher. Thus, it measures the extent to which items are free from random error and, as such, is capable of providing consistent results (Hair et al., 2010). As demonstrated in Table 4, all factor loadings are higher than the value of 0.6. Alternatively, Average Variance Extracted (AVE), which measures the variation explained by the latent variable about the random measurement error, is a commonly used criterion for assessing convergent validity. Fornell and Larcker (1981), as shown in Table 4, recommend that an AVE value of at least 0.5 indicates that the latent construct is able to explain, on average, 50 per cent of the variance of its indicators, thereby demonstrating adequate convergent validity. This requirement is fulfilled in this research, as it is demonstrated that AVE values for all the constructs shown in Table 4 are above the recommended threshold of 0.5. Finally, about composite reliability, all the scores are well above the cutoff value of 0.7 (Hair et al. (2010). Discriminant validity assesses the degree to which the measures of different constructs differ from one another.

The establishment of discriminant validity can be done in two ways, as indicated in Tables 4 and 5. The first method involves examining cross-loadings, which are obtained by correlating the values of each latent variable component with those of all other items. The second method involves comparing the square root of the average variance extracted (AVE) for each construct with the correlations among constructs. Suppose the square root of each AVE is much larger than any correlation among any pair of latent variables, and it should be higher than .50. In that case, the validity of the measurement model is established. In this study, as shown in Table 3, the correlation values are less than the square root of the AVE values, indicating acceptable discriminant validity (Chin, 1998; Fornell & Larcker, 1981).

Table 3: Demographic information of respondents.

Gender	Frequency	Percentage (%)
Male	243	54.8
Female	200	45.2
Total	443	100
Age groups	Frequency	Percentage
20-25	187	42.2
26-30	108	24.4
31-35	109	24.6
36-40 & above	39	8.8
Total	443	100
Faculty	Frequency	Percentage
Faculty of Applied Science and Technology	102	23.0
Faculty of Engineering	85	19.0
Faculty of Built and Natural Environment	63	14.2
Faculty of Business and Management Studies	115	26.8
Faculty of Health and Allied Science	78	17.0
Total	443	100

Source: field data, 2024

Table 3 shows that the majority, 243 (58.8%) of the respondents, were male, while females constituted 200 (45.2%) of the respondents. This indicates that more males answered the questionnaire compared to their female counterparts. Additionally, the results in Table 3 show that most of the

respondents were between the ages of 20-25 (42.2%), while 108 fell between the ages of 26-30 (24.4%), followed by 31- 35 (24.6%), and 39 (8.8%) of the respondents were in the age bracket 36-40 and above. Table 2 confirms that the majority, 115 (26.8%), of respondents who completed the questionnaire were students from the Faculty of Business and Management Studies. This was followed by students from the Faculty of Applied Science and Technology (109, 23.0%), students from the Faculty of Engineering (85, 19.0%), and so on.

Table 4. Structural model results of Loadings – Cross loadings and reliability statistics.

Items	CD	DMPc	CEM	TA	DMP	CA	CR	AVE
CD 1	0.865	0.326	0.316	0.395	0.423	0.867	0.911	0.785
CD 2	0.853	0.320	0.311	0.338	0.384			
CD 3	0.875	0.270	0.301	0.311	0.269			
CD 4	0.859	0.242	0.286	0.180	0.211			
DMPc 1	0.898	0.371	0.242	0.242	0.242	0.886	0.985	0.858
DMPc 2	0.917	0.372	0.370	0.270	0.270			
DMPc 3	0.915	0.356	0.326	0.326	0.326			
DMPc 1	0.769	0.301	0.320	0.320	0.320	0.871	0.864	0.649
CEM 2	0.860	0.316	0.371	0.371	0.371			
CEM 3	0.865	0.311	0.371	0.372	0.372			
CEM 4	0.797	0.286	0.372	0.356	0.356			
TA 1	0.854	0.395	0.356	0.301	0.301	0.829	0.863	0.677
TA 2	0.849	0.338	0.395	0.316	0.316			
TA 3	0.867	0.311	0.338	0.311	0.311			
TA 4	0.589	0.180	0.311	0.286	0.286			
DMP1	0.889	0.423	0.423	0.423	0.395	0.746	0.852	0.585
DMP 2	0.627	0.211	0.211	0.211	0.338			
DMP 3	0.784	0.384	0.384	0.384	0.311			
DMP 4	0.709	0.269	0.269	0.269	0.180			

Source: Field Data, 2024

Notes: Causes of Disaster (CD), Disaster Management Practice (DMPc), Disaster Management Policy (DMP), Technological Approaches (TA), Challenges of Effective Management (CEM), Cronbach's alpha (CA), Composite reliability (CR), Average variance extracted (AVE).

Table 5: Test of Discriminant Validity (Fornell–Larcker criterion)

	Causes of Disaster	Disaster Management Practices	Disaster Management Practice	Technological Approaches	Challenges of Effective Management
Causes of Disaster	0.863				
Disaster Management Practices	0.683	*0.810*			
Disaster Management Practice	0.670	0.697	*0.814*		
Technological Approaches	0.812	0.635	0.624	0.889	
Challenges of Effective Management	0.656	0.695	0.611	0.662	*0.758*

Source: Field Data, 2024

Structural model and hypothesis testing

After the construct measures had been proven to be reliable and valid, the next stage was to assess the structural model results, displayed in Table 6. Before assessing the structural model, the researchers conducted a test for multicollinearity on all variables. The assessment of the variance inflation factor (VIF) demonstrated the non-existence of multicollinearity, and all variance inflation factors obtained were lower than 1.234, which is far less than the conservative threshold of 5.0, as recommended by Rogerson (2001).

Table 6: Hypothesis testing of paths

Hypothesis	Path		Path Coefficient	T-Statistics	P-Values	Result
H1	CD	DMPc	0.428	4.258	0.024	Supported
H2	TA	DMPc	0.697	23.559	0.000	Supported
H3	CEM	DMPc	0.111	0.075	0.941	Not Supported
H4	DMPc	DMP	0.555	6.711	0.000	Supported
Total Indirect Effect						
	CD	DMP	0.361	4.260	0.024	Supported
	TA	DMP	0.109	0.064	0.941	Not Supported
	CEM	DMP	0.462	4.718	0.000	Supported

Source: Field Data, 2024

The model explained 0.687% of the variation in Disaster Management Policy and 0.768 % variance in Disaster Management Practices. Out of the four hypothesised relationships stated in this study, three are supported. As assumed in H_1, Causes of Disaster have an association with Disaster Management Practices with a path coefficient of ($\beta = 0.428^{***}$). This implies it supports H_1. This revelation confirms the previous research outcomes of authors such as Tijani et al. (2022) and Frempong-Kore et al. (2022), as well as IIO et al. (2018), who share a common idea that disaster management practices are associated with the causes of disasters. Also, H_2 states that Technological Approaches influence Disaster Management Practices. This is confirmed by the path coefficient ($\beta = 0.697^{***}$). The outcome corroborates the conclusions of authors such as Ismail et al. (2023), Frempong-Kore et al. (2022), and Oyeniran (2023) that the adoption of technological approaches in mitigating disasters affects the disaster management practices in place.

Similarly, the Challenges of Effective Management influence Disaster Management Practices, with a path coefficient ($\beta = 0.111$ ***); although positive, this does not support H_3. This finding is not significantly different from that of Oluwole (2019) and Kolawole et al. (2015), as well as Adeola et al. (2023), who claimed that disaster management practices adopted cannot be without challenges in ensuring a disaster-free environment.

Similarly, H_4 demonstrated a positive effect of Disaster Management Practices on Disaster Management Policy. This was significant, with a path coefficient ($\beta = 0.797^{***}$). This result is not far from the position of authors such as Abonyo (2016), Tijani et al. (2022), and Kalawole et al. (2015), who argue that disaster management practices should be aligned with a suitable disaster management policy. Overall, the implication is that in the process of ensuring disaster management practices in academic libraries, critical success factors such as the causes of disasters and effective disaster management practices are key. Technological approaches, as well as disaster management policies, should be taken into consideration.

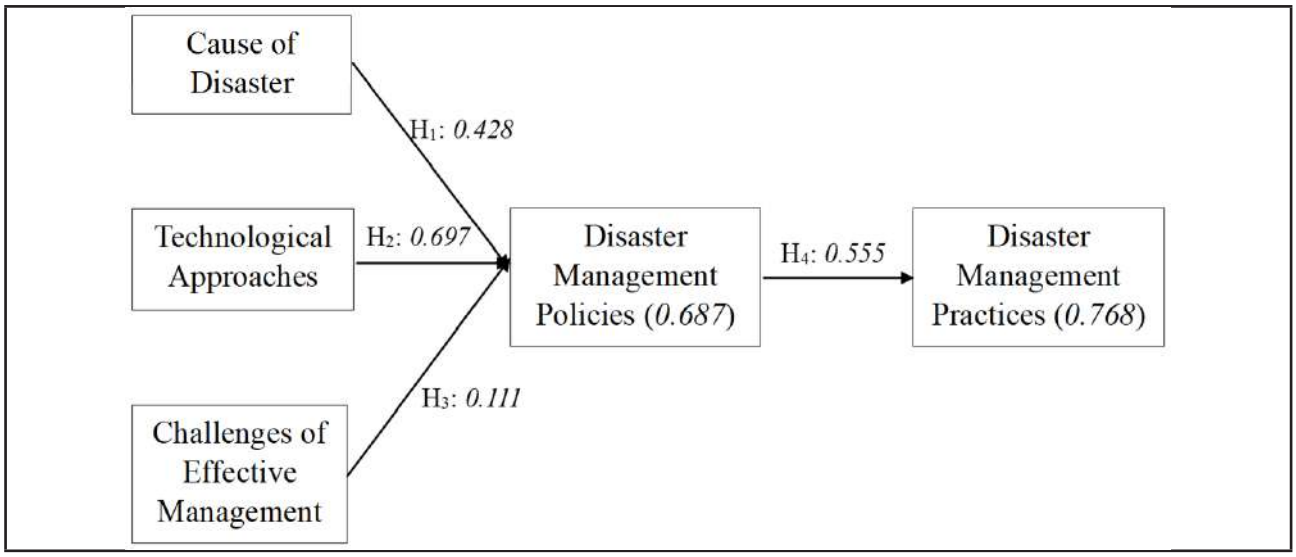

Figure 2: Structural model and path coefficient, 2024.
Source: Field data, 2024.

4. Recommendations

Based on the findings of this study, the researchers recommend possible solutions to ensure long-term measures for effective disaster management practices in academic libraries, especially those of technical universities. Therefore, the following measures were recommended:

The management of academic libraries should develop a comprehensive disaster management policy, as it forms the core of ensuring effective disaster management practices in an emergency.

The management of the academic libraries should organise regular training and drills on disaster management for all library staff.

The management of the academic libraries should install necessary disaster management systems such as fire detectors, fire extinguishers, smoke detectors, and fire alarms for earlier detection of a flood, power fluctuations, power surges, fire outbreaks, roof leakages, earthquakes, mutilation, hacking of the library computers, plumbing defects as well as activities of pests (termites, cockroaches, rodents) among others.

5. Conclusion

Based on the methods and results, the study concludes that the causes of disasters, technological advancements, and the presence of disaster management policies all have a substantial impact on disaster management practices at Ghana's Technical University Libraries (TULs). The linkages between these constructs and their effects on disaster readiness and response in the academic library setting were successfully identified through the explanatory research approach, which was combined with a descriptive survey design. Although the results may not apply to Traditional Universities, the researchers were able to obtain valuable insights from the university community by using convenience sampling with a sizable sample of 455 individuals, of which 443 responses were considered legitimate.

The findings highlight the importance of prioritising technical interventions and preventive measures, such as installing fire alarms, extinguishers, and surveillance systems, to mitigate the effects of disasters. The lack of a substantial correlation between the difficulties of effective management and catastrophe management procedures also highlights a potential area for further research and development. Notably, the report promotes the adoption of thorough catastrophe recovery procedures that involve public awareness campaigns, regular inspections, and employee training. Other TULs

seeking to enhance resilience and ensure continuity in academic library services during emergencies can utilise these findings as a starting point.

Disclosure statement: No potential conflict of interest was reported by the author(s)

APPENDIX 1

Questionnaire for Participants

Dear Respondents,

We kindly request that you spare us a few minutes of your time to answer this questionnaire. The purpose of this study is on the title **" Ensuring Disaster Management Practices in Academic Libraries of Ghana: The Issues at Hand."**

Please be assured that your responses to the questions will be kept confidential and used solely for this research. You have the option to discontinue your participation at any time you deem necessary.

Thank you. Yours sincerely,

Section A: Demographic information of respondents

Gender: i. Male [ ]; ii. Female [ ]

Age: i. 20-25 [ ]; ii. 26-30 [ ]; 31-35 [ ]; 36-40 [ ] 41-45 [ ]

Level: i. 100 [ ]; 200 [ ]; 300 [ ]; 400 [ ]

Department, faculty of respondents

i. Faculty of Applied Science and Technology [ ]

ii. Faculty of Engineering [ ]

iii. Faculty of Built and Natural Environment [ ]

iv. Faculty of Business and Management Studies [ ]

v. Faculty of Health and Allied Science [ ]

Kindly tick (⚜) on a scale of 1- 5, where 1= Very often; 2= Often; 3 = Sometimes; 4 = Rarely; 5= Never)

Section B: Causes of disaster in academic libraries

Causes	Very Often	**Often**	**Sometimes**	**Rarely**	**Never**
Flood					
Draught					
Earthquakes					
Neglect/inadequate maintenance					
Fire					
Theft					
Riots					
Roof leakage					
Plumbing defect					
Mutilation					
Insects					
Fungi					
Rodents					
Cockroaches					
Termites					

Kindly tick (✓) on a scale of 1- 5, where 1= Very common; 2= Common; 3 = Occasionally; 4 = Rare; 5= Never)

Section C: Technological approaches to disaster management in academic libraries

Causes	Very Common	Common	Occasionally	Rare	Never
Metal detectors					
Smoke detectors					
Fire alarms					
Fire extinguisher					
CCTV/surveillance cameras					

Kindly tick (✓) on a scale of 1- 5, where 1= Strongly agree; 2= Agree; 3 = Neutral; 4 = Disagree 5= Strongly disagree)

Section D: Challenges to effective management of disasters in academic libraries

Causes	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Inadequate/poor funding					
Lack of disaster control plan					
Improper use of technological equipment					
Inadequate training					
Inadequate staff					
Lack of awareness of what to do when disaster strikes					

Kindly tick (✓) on a scale of 1- 5, where 1= Very often; 2= Often; 3 = Sometimes; 4 = Rarely; 5= Never)

Section E: Emergency response plans of academic libraries

Causes	Very Often	Often	Sometimes	Rarely	Never
Flood Response Plan					
Drought Response Plan					
Earthquake Response Plan					
Maintenance and Repair Response Plan					
Fire Safety Response Plan					
Theft Prevention and Response Plan					
Emergency Evacuation Plan					
Pest Control and Management Plan					

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