

# COMMUNITY-BASED ADAPTATION TO FLOOD: A SYSTEMATIC LITERATURE REVIEW

**Musa Mustapha Danraka\*<sup>1,4</sup>, Sapura Mohamad<sup>2</sup>,  
& Siti Nur Hannah Ismail<sup>3</sup>**  
**\*Corresponding Author**

<sup>1,2,3</sup>*Department of Landscape Architecture, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, 81310, Johor Bahru. Malaysia*

<sup>4</sup>*Department of Architectural Technology, School of Environmental Studies, Nuhu Bamalli Polytechnic, Zaria. Kaduna State. Nigeria*

\*danraka@graduate.utm.my

b-sapura@utm.my

sitnurhannah.i@utm.my

Received: 29 December 2023

Accepted: 30 January 2024

Published: 31 March 2024

## ABSTRACT

*Communities have developed established knowledge and techniques to foresee, diminish the impacts of, react to, and restore from floods and comparable risks due to their intimate connections to their ecological environment. These are generally recognized as Community-based Adaptation (CBA) responses collectively. The motivation behind embarking on this systematic review stems from the fact that scholars and policymakers come across conflicting information in this field, making it challenging to handle. This review aims to comprehend the present state of knowledge on CBA to flood. The practices encompassing community-based approaches to flood management, the historical examination of these practices, and the current understanding of their alignment with flood adaptation have all been delineated via a comprehensive analysis of relevant scholarly works. This thorough investigation yielded a corpus of 25 articles written exclusively in the English language, which were subjected to both qualitative and quantitative scrutiny. The study discovered a wide range of community mobilisation strategies, with the majority of research on these focused on developed nations, ranging from early warning systems and hazard forecasts to livelihood-based adaptation. This systematic review assists in identifying new and significant study fields, the evolution of publications through time,*



Copyright© 2021 UiTM Press.  
This is an open access article  
under the CC BY-NC-ND license

*patterns of author collaboration, and future research directions. The study identified the author with the most publications and citations, the journal with the most publications, and the most common words from the content analysis. This study provides a general overview of the topic for academics interested in CBA solutions and paves the path for additional study in this area. Thus, government programmes for general recovery following a flood can be put into action more swiftly.*

**Keywords:** *Community-based, Adaptation, flood, CBA, Systematic Literature Review*

## INTRODUCTION

The term "flood" describes a situation when normally dry land is surrounded by water (Khan & Ahmad, 2017). When significant amounts of rain consistently fall upstream or in a specific area, a river will overflow its normal capacity and create a flood (Pande & Makalew, 2020). Flooding has the potential to give rise to a multitude of concerns and potential harm (Tun Jamil et al., 2018). Adversities resulting from flooding include death, injury, lack of resources, damage to vital infrastructure, disruption of the economy, and environmental degradation (Ahmad et al., 2020) and is one of the largest issues in the globe today (Obi et al., 2021). Furthermore, flooding has increased in frequency and severity throughout most of the world (Alizadeh et al., 2022). Thus, global warming, which results in climate change, has contributed to this rise in flood disasters (Kalfin et al., 2022).

The long-ignored contribution of indigenous knowledge to the development of successful flood catastrophe risk mitigation strategies is now receiving widespread acknowledgement (Obi et al., 2021). Moreover, community assessments of their capacity for adaptation, as demonstrated by self-competence and reaction competence, had an impact on how much they intended to adapt to the risks of floods (Tasantab et al., 2022). Nevertheless, indigenous knowledge has been successfully applied around the world to address difficulties with environmental degradation and improper resource management (Mairiga & Ibrahim, 2021). Thus, a multitude of new terms, such as "community-based," "participatory," and "people-centred," have emerged as a result of how scholars have defined using indigenous resources

(Hadlos et al., 2022).

This review's primary goal is to discuss the current state of knowledge about CBA to flood. With this information at hand, it is possible to identify the CBA strategies that offer good chances for additional research and development. Governments, researchers, and policymakers can derive substantial benefits from this thorough review in terms of organising the allocation of resources for pre- and post-disaster management, which includes the enhancement of infrastructure and the resuscitation of economic activity in areas affected by flooding (Daly et al., 2020).

## **MATERIALS AND METHODS**

The search strategy, selection criteria, inclusion and exclusion criteria, quality assessment and data extraction strategies are all covered in the ensuing subsections. This Systematic Literature Review (SLR) is conducted following PRISMA criteria.

### **Search Strategy**

This study devised a search strategy technique to find literature for this search and three databases were targeted: Scopus, Google Scholar, and Web of Science (Table 1). Additional search operators, such as Boolean ("OR," "AND," and wildcard ("\*")), were also used. "Community-based adaptation" OR "indigenous knowledge" OR "local knowledge" OR "traditional knowledge" AND "flood\*" were the search terms used. These suggest that any combination of "community-based adaptation", "indigenous knowledge", "local knowledge" or "traditional knowledge" and "flood\*" (including any other variations like "floods", "flooding," etc. as indicated by the asterisk) was employed as a scope of this SLR. The search was conducted on December 9, 2023, and the terms produced articles written in English only. Books, book chapters, conference papers and policy documents were excluded. The boolean search resulted in the inclusion of 76 documents across the databases.

**Table 1. The Search String used for the Systematic Literature Review (09/12/2023)**

Database	Search string	Frequency of hits
Scopus	allintitle: AND "Community-based adaptation" OR "indigenous knowledge" OR "local knowledge" OR "traditional knowledge" "flood **"	44
Google Scholar	allintitle: AND "Community-based adaptation" OR "indigenous knowledge" OR "local knowledge" OR "traditional knowledge" "flood **"	2
Web of Science	"Community-based adaptation" OR "indigenous knowledge" OR "local knowledge" OR "traditional knowledge" (Title) AND "flood**" (Title)	30

Source: Authors, 2023

### **Selection Criteria**

The PRISMA 2020 Statement is designed to be used in SLR with synthesis (Page et al., 2021) and is the basis for the selection criteria. The main emphasis of the search was to map the literature that already exists in all the fields on CBA to flood. The databases' founding year and to date were the search window. The search encompassed all topics and nations. A total of 76 articles were retrieved from the databases as RIS file formats into the Zotero Reference Manager (ZRM) software.

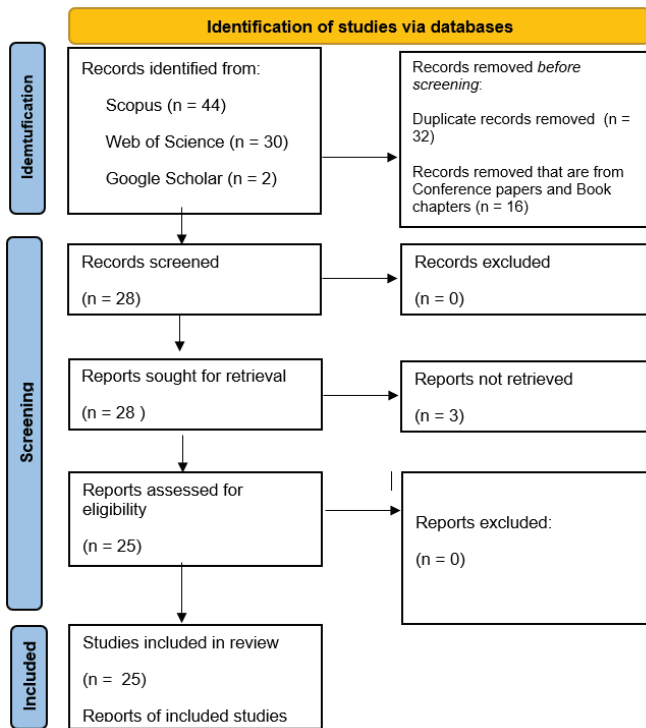
### **Quality Assessment**

This SLR employed solely English-language research articles. All duplications were carefully inspected with the use of the ZRM to maintain the review's high quality. A total of 32 duplicates are removed. To make sure that the academic literature included in the review process was of relevance, the abstracts of the papers were carefully examined for analysis and purification.

The articles were exported as RIS format files and imported into the Harzing Publish or Perish (POP) software. Following an evaluation of each item against the aforementioned inclusion and exclusion criteria, the researchers removed conference papers and book chapters to a total of 16 articles in the POP software. The remaining 28 articles were exported in CSV and RIS formats for further consideration. The inclusion and exclusion of literature at each stage are depicted in the PRISMA statement (Figure

1). The documents were filtered according to the following standards to be included in the subsequent evaluation (full-text review):

- "Community-based" or a synonymous term used in the boolean must have been used with a flood phenomenon, and already published in English.
- An article was by default maintained for full-text review if its abstract meets the speculated requirements. A total of 28 documents that satisfied the requirements were subjected to the full-text review.
- These articles are published before 2023 and from any country.



**Figure 1. Flowchart of the Search Strategy and Process**

Source: Adopted from PRISMA flow chart

## Data Extraction

Portable Document Formats (PDFs) were only available for 25 of the 28 articles that met the quality assessment criteria and were selected for the data extraction stage.

## Systematic Data Analysis

The study looked at an SLR approach. The retrieved articles were assessed, identified, and analysed following the research subject (i.e., CBA strategies to flood) in light of the findings drawn after reading each piece. In this study, article data were systematically analysed in the following stages:

- Citation metrics provide general details about the articles that are commonly cited, with their h and g-indexes using POP software (Harzing, 2007) and word and phrase frequency analysis using Wordstat 9.0 software.
- Visualizing all the studies included in the SLR and the most popular authors by citations and the connections of the authors. The most frequently used terms and the degree of attachment between terms were all visualised using the VOSviewer software (van Eck & Waltman, 2010).

## RESULTS

This section includes information on the 25 articles' data visualisation and the evolution of CBA to flood research. According to the databases used, 2.6% of scientific publications had a Google Scholar index, 57.9% had a Scopus index, and 39.5% had a Web of Science index. As a result, the index databases are where the majority of the scientific papers in this field are published.

### Citation Analysis

Table 2 presents the citation metrics for the documents that were retrieved. The metadata accessed from all the databases was analyzed using POP software. The metadata of the 25 articles was exported in RIS format from the ZRM and imported into POP software to determine the citation metrics. The concise description includes a compilation of citations along with the citation count for each paper, author, and year. The 25 articles received a total of 258 citations, resulting in an average of 18.43 citations per year. The average h-index and g-index for all publications were found to be 7 and 16 respectively, while each paper had an average of 10.32 citations.

**Table 2. Citation Metrics of 25 Articles**

Metric	Index
Publication years	2009-2023
Citation years	14 (2009-2023)
Papers	25
Citations	258
Cites/year	18.43
Cites/paper	10.32
Cites/author	68.80
Papers/author	9.33
Authors/paper	3.76
h-index	7
g-index	16
hl, norm	5
hl, annual	0.36
hA-index	5
Papers with ACC>1, 2, 5, 10, 20	11, 9, 6, 1, 0

Source: Harzing's Publish or Perish

## Word Frequency Analysis

Words and phrases present in the 25 articles, which were exported as CSV files from POP software, are identified through the utilization of word frequency analysis in WordStat 9.0 software by importing the articles. The text variable that is analyzed includes the year and source of the articles, as well as the authors, title, source title, abstract, and publisher and the desired number of topics is set at 5. This analysis identifies the terms that appear most frequently in the sources that have been imported into the software (Table 3). The word cloud, displayed in Figures 2 and 3, visually presents the most frequently occurring words and phrases across various categories.

**Table 3. Word Count Frequency in WordStat 9.0 of the 25 Articles**

	Frequency	% Shown	% Processed	% Total	No. Cases	% Cases	Tf • IDF
Knowledge	95	9.46%	2.65%	1.52%	23	92.00%	3.4
Flood	89	8.86%	2.48%	1.42%	20	80.00%	8.6
Local	75	7.47%	2.09%	1.20%	20	80.00%	7.3
Risk	42	4.18%	1.17%	0.67%	13	52.00%	11.9

Floods	36	3.59%	1.00%	0.58%	13	52.00%	10.2
--------	----	-------	-------	-------	----	--------	------



**Figure 2. Word Cloud of the Most Frequently Used Words**

Source: Author's analysis in WordStat 9.0

These 10 most often-used words and phrases are displayed in several subject groups in the word cloud (Tables 3 and 4). Dominant words in terms of appearances include “Knowledge” (95), “Flood” (89), “Risk” (42), “Floods” (36), “Community” (31) and “Flooding” (26). With 35 instances of the term “Local Knowledge”, “Indigenous Knowledge” (29), “Flood Risk” and 9 instances of the phrase "Climate Change". The focus on CBA to tackle floods from a “Flood Forecasting” (9) perspective stands out among the studies' content analysis approaches.

**Table 4. Phrases Count Frequency in WordStat 9.0 of the 25 Articles**

	Frequency	No. Cases	% Cases	Length	TF • IDF
Local Knowledge	35	15	60.00%	2	7.8
Indigenous Knowledge	29	8	32.00%	2	14.4
Flood Risk	18	8	32.00%	2	8.9
Flood Vulnerability	14	2	8.00%	2	15.4
Climate Change	9	8	32.00%	2	4.5

Source: Author's analysis in WordStat 9.0



**Figure 3. Word Cloud of the Most Frequently Used Phrases**

Source: Author's analysis in WordStat 9.0



## Data Visualization for all Articles Included in the Review

The VOSviewer software was used to visualise the 25 articles' metadata in RIS format that was gathered from the ZRM and it was done to identify the connections between the data in the articles under consideration. As the results are from a reference manager and of different databases, there is a restriction to the number of analyses to be done with the bibliographic data in VOSviewer software. The study explores the options of creating a map based on bibliographic data using co-authorship using the author as the unit of analysis and creating a map based on text data.

### Co-authorship using the Author as the Unit of Analysis

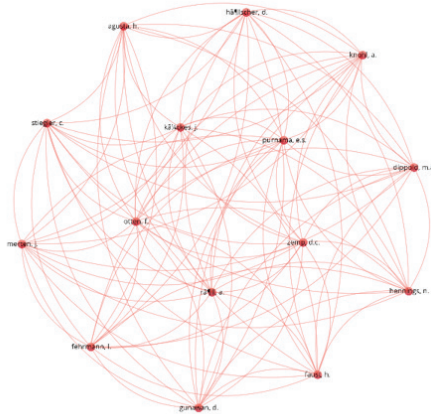
Analysis of Co-authorship using authors as the unit of analysis in VOSviewer (Table 5) reveals a connection between 15 distinct authors in a cluster, a document each and 14 total link strengths each. The visualisation shows the interconnectivity of the 15 authors. In the analysis, a total of 97 authors were considered, each having at least one occurrence of a document. Among them, Membele, G.M and Naidu, M. contributed two documents each, while the remaining 95 authors contributed one document each.

**Table 5. Co-authorship with the Author in VOSviewer of the top First 15 Authors**

id	Author	documents	total link strength
3	agusta, h.	1	14
14	dippold, m.a.	1	14
19	faust, h.	1	14
20	fehrmann, l.	1	14
25	gunawan, d.	1	14
26	hennings, n.	1	14
32	häßlicher, d.	1	14
47	knohl, a.	1	14
48	käzckes, j.	1	14
59	merten, j.	1	14
71	otten, f.	1	14
74	purnama, e.s.	1	14
76	räßll, a.	1	14
85	stiegler, c.	1	14

96	zemp, d.c.	1	14
----	------------	---	----

Source: Author's analysis VOSviewer, 2023



**Figure 4. Co-authorship with the Author in VOSviewer**

Source: Author's analysis in VOSviewer in 2023

### Term Co-occurrence Map Based on All Text Data

The metadata of the 25 articles' terms was determined based on the cluster's size in the visualization. This visualisation was generated by applying a full counting method in the VOSviewer software to the title and abstract fields. As a result, five clusters were formed, each containing 25 items. The presence of a term was discovered in the majority of articles within the databases if the cluster in the visualization is statistically significant in occurrences and vice versa (Table 6). Moreover, the distance between two clusters indicates the force of the connection between them (Figure 5). The degree of interaction between the two clusters is also revealed by the distance separating them.

**Table 6. Term Co-occurrence on All text Data on a Full Count**

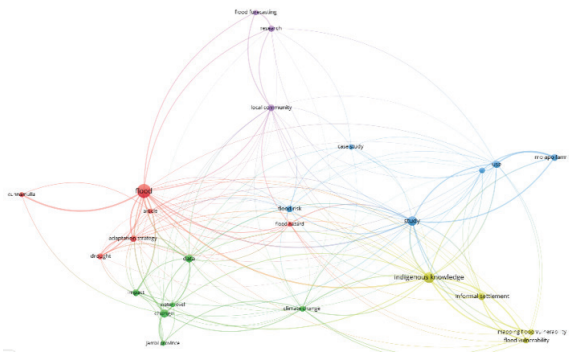
id	term	occurrences	relevance score
9	flood	39	0.6269
15	indigenous knowledge	24	0.336
23	study	19	0.2808
4	change	13	1.1238

7	data	12	0.5202
---	------	----	--------

Source: Author's analysis in VOSviewer.2023

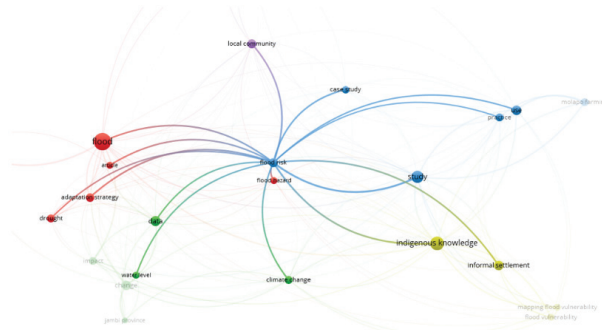
In comparison to the other clusters, the one connected with the quotation "Flood" in red colour is the greatest with 39 occurrences and a relevance score of 0.6269 from cluster one with six items. This shows that "Flood" and "Climate change" in green colour with seven occurrences and a relevance score of 0.3182 from cluster two with six items are the terms that have been discussed the most in these articles.

To gain further comprehension of the connections between clusters, the researchers proceed to analyze a specific term quote (by selecting a term) to demonstrate the relationships it has with other quote terms. The study exemplifies this by investigating the associations that arise from the term "flood risk" with various other terms (Figure 6). The figure permits the observation of the associations between this cluster and others, including "flood hazard", "indigenous knowledge", "local community", "flood" and "informal settlement".



**Figure 5. Visualisation of Term Co-occurrence Map Based on All Text Data**

Source: Author's analysis in VOSviewer in 2023



**Figure 6. Visualisation of Term Co-occurrence Map based on All Text**  
Source: Author's analysis in VOSviewer in 2023

### CBA to Flood-related Research

Communities and governments have responded favourably to CBA initiatives as evidenced by the demand for first response to flood from both the community and governments. Researchers have been quite interested in studies on CBA responses to flood risks. All the databases used have numerous research publications on this topic. Between 2010 and 2023, there was an overall tendency for a rise in the amount of published research in this field.

With up to five (5) scholarly articles published, 2022 had the highest number of publications in the field of CBA to flood. With only one paper each year, 2009, 2010, 2011 and 2013 saw the lowest amount of publications (Table 7). Before 2022, research in the area of CBA to flood risks has grown dramatically. This has been impacted by the destruction of homes and lives, as well as the rising frequency of floods.

The number of citations a piece of writing receives reveals how compelling the content is, such that it can be cited in other research publications. Concerning the search results on all databases, the highest cites per year value is 10.1, the highest cites per author value is 25, and the most cited document is 101. The article's publication time has no bearing on the number of citations. For instance, when comparing the number of citations in Table 7, an article from 2013 was cited the most, whereas an item from 2023 was cited the least. The article written by “Mavhura et al. (2013)” in the top spot received a total of 101 citations across all sources that

were considered. The study provides a detailed explanation of the articles according to their citations, and knowing these articles can be used to assess how communities have responded to CBA to flood-related studies in the past, present, and future.

**Table 7. The 25 Articles Arranged According to Number of Citations**

S/N	Authors and Year	Main concern	Phrase used	Method	F findings	Publisher	Cites	Cites/ Year	Cites/ Author
1	(Mavhura et al., 2013)	This study examines the indigenous methods employed by individuals to ensure survival and the divergent capacities of individuals to adapt to flooding in two flood-prone villages located in Muzarabani district, Zimbabwe.	Indigenous knowledge	Qualitative	The results indicate that the utilization of indigenous knowledge systems significantly contributed to mitigating the consequences of flooding.	Elsevier	101	10.1	25
2	(Islam et al., 2018)	The research delves into the significance of indigenous knowledge in managing and adjusting to inundation in Bangladesh.	local knowledge	Qualitative	The key discoveries indicate that there are benefits to considering tactics designed to address a particular occurrence of flooding.	Elsevier	40	8	10
3	(Trogrić et al., 2019)	The article deliberates on the significance of recognizing, recording, and evaluating the innovative tactics that individuals employ following their local knowledge to govern areas susceptible to flooding.	local knowledge	Qualitative		MDPI	35	8.75	5

4	(Khalafzai et al., 2019)	The article emphasises the effects of flooding and how traditional knowledge may be applied to lower the risk of disaster.	traditional knowledge	Qualitative	The study emphasises how participatory methods, such as flood mapping, can be used to integrate traditional knowledge into flood risk reduction.	Elsevier	21	5.25	7
5	(Merten et al., 2020)	The study emphasises how the Tembesti watershed has seen increases in flood frequency and intensity as a result of forest conversion.	local knowledge	Mixed	The study confirms the significance of combining traditional wisdom with a scientific investigation to effectively address environmental issues.	Research and society	18	6	2
6	(O'Gorman, 2012)	This article examines state responses to floods that had consolidated over the previous 20 years, with a focus on the 1990 Cunnamulla flood.	local knowledge	Qualitative	The Warrego River's flood history indicates that state government responses to floods should take a pragmatic management.	Oxford University Press	10	0.91	10
7	(Membele, Naidu, & Mutang, 2022)	The study argues that mapping flood vulnerability should investigate the integration of local and indigenous knowledge as an additional strategy, particularly in informal settlements.	local and indigenous knowledge	Mixed	This study illustrates how, in the context of informal settlements, local and indigenous knowledge was used to select indicators for mapping people's vulnerability to flood hazards.	Elsevier	8	8	3

8	(Kasei et al., 2019)	This article evaluates indigenous knowledge's contribution to flood risk early warning in informal urban settlements.	indigenous knowledge	Qualitative	The findings show that, in contrast to conventional forecasts, local indicators offer a timely and spatial fit.	The British Academy	7	1.75	2
9	(Kamarulzaman et al., 2016)	This investigation sought to ascertain the level of understanding among local communities regarding their preparedness for flooding.	local knowledge	Qualitative	The consequences of the significant inundation exhibited that all means of conveyance experienced an impact on lives, agricultural territories, and assets were forfeited.	Jurnal Teknologi	6	0.86	2
10	(Bucherie et al., 2022)	The application of social scientific approaches to delineate the local understanding of sudden and intense flooding among susceptible populations residing on the level shoreline of Lake Malawi.	local knowledge	Mixed	The integration of both local and scientific knowledge enhances comprehension of flash flood phenomena within the specific local setting.	Copernicus Publication	3	3	1
11	(Vargas-Lopez et al., 2020)	The impact of water quality and the level of connectivity in rivers on fisheries remains unclear in the context of harvesting wild crayfish.	local knowledge	Mixed	The findings offer valuable perspectives into the cognitive mechanisms employed by harvesters to inform their decision-making processes.	Wiley	3	1	1

12	(Jafar et al., 2022)	This article examines how the indigenous population residing in the Beaufort region of Sabah manages the recurring issue of floods, as well as the strategies it employs to minimize the risks associated with such inundations.	local knowledge	Quantitative	The findings revealed that the outcomes of the mapping analysis diverged from those obtained through the questionnaire due to the lack of consideration given to the elements associated with community coping capacity.	Common Ground	2	2	0
13	(Membele, Naidu, & Mutanga, 2022)	This study is to provide a thorough analysis of previous research studies and academic publications concerning the integration of Indigenous Knowledge and Geographic Information Systems (GIS) in the process of identifying regions in South Africa that are vulnerable to flooding.	indigenous knowledge	Review	The results show that flood vulnerability is primarily taken into account from an integrated perspective in South Africa. Inadequate community involvement.	Routledge	2	2	1
14	(Carnelli et al., 2020)	The study demonstrates how local knowledge plays a crucial role in the implementation of nature-based flood risk mitigation strategies.	local knowledge	Qualitative	This case study demonstrated how taking local knowledge into account when framing and managing flood risk can allude to the various purposes of nature-based solutions.	University of Gloucestershire	1	0.33	0



15	(Hirunsalee & Kanegae, 2010)	The goal of this study is to evaluate the extent to which local knowledge can help communities build self-defence mechanisms and manage flood disasters.	local knowledge	Quantitative	The findings disproved the notion that the strongest social network—family or kinship—is always the best source of local knowledge transfer.	World Academy of Science, Engineering and Technology	1	0.08	1
16	(Fox et al., 2023)	This article investigates how Cape Town's multiscalar governance may strengthen or weaken CBA's ability to respond to flooding in informal settlements.	community-based adaptation	Quantitative	The research revealed disparate perspectives influencing the stakeholders engaged in flood risk mitigation, specifically concerning the duration of informal settlements.	Routledge	0	0	0
17	(Nguimalet, 2018)	This study examines the strategies employed to accommodate floods and droughts in minor watersheds within Kenya.	community-based adaptation	Quantitative	The investigation revealed that the primary approach employed in the study area to cope with floods was temporary relocation, whereas the main approach utilized for dealing with droughts was the modification of livelihood activities.	Routledge	0	0	0
18	(Hooli, 2016)	This article investigates potential connections between social resilience and ecological resilience as well as whether resilience is a useful trait for characterising the social and economic circumstances of social groups.	indigenous knowledge	Quantitative	The article provides an exhaustive examination of the notion of social resilience, its markers, and its correlation with ecological resilience.	Sage	0	0	0

19	(Motsumi et al., 2012)	The primary objective of this research was to determine whether indigenous knowledge continues to play a significant role in flood-recession farming.	indigenous knowledge	Qualitative	The research discovered that the shift from community-based resource governance to a centralized approach spearheaded by the government has imposed constraints on the integration of Indigenous Knowledge into land management determinations.	Elsevier	0	0	0
20	(Sohail & Chen, 2022)	This study to identify potential causes of floods, assess future flood-related risks in the study area, and evaluate how farmers' knowledge of floods affects their ability to minimise the effects of floods on their daily lives and food security livelihood assets.	indigenous knowledge	Quantitative	The most important indicators, according to the results, are farmers' knowledge of adaptation techniques, food security, risk assessment, and livelihood assets,	Frontiers	0	0	0
21	(Rio et al., 2018)	An eco-type map of Zambia's Barotse Floodplain was made with the help of remote sensing and local knowledge.	local knowledge	Qualitative	The study helps direct agricultural research and development initiatives and integrates field data, remote sensing, and local knowledge for the classification of ecotypes.	Elsevier	0	0	0

22	(Bermatchez et al., 2011)	Mapping the levels reached by flooding during the storm has been made possible by an integrated approach that combines local knowledge with LIDAR surveys and a DGPS system.	local knowledge	Quantitative	The findings show that these levels exhibit significant spatial variability, with anthropogenic perturbations accounting for up to a 2-meter discrepancy between actual levels reached and tide gauge readings.	Elsevier	0	0	0
23	(Tran et al., 2009)	The application of Geographic Information Systems (GIS) at the local level and the necessity of incorporating both contemporary technology and traditional knowledge into disaster management.	local knowledge	Qualitative	Local communities actively participated in risk reduction and decision-making after local knowledge was effectively incorporated into flood risk maps.	Wiley	0	0	0
24	(Acharya & Prakash, 2019)	This study aims to document the diverse range of advanced techniques utilised by indigenous populations residing in the transboundary Gandak to predict floods and intense precipitation.	local knowledge	Qualitative	The ability to forecast floods locally relies on the triangulation of multiple indicators and information sources. These computations are used to make flood preparations.	Elsevier	0	0	0
25	(Lai et al., 2023)	Participatory GIS (PGIS) is utilised in this study to quantify the costs and benefits of adaptation measures and to explore local knowledge in a community in Zhejiang that is prone to flooding.	local knowledge	Quantitative	The results show that the residents of the flood-prone community have gradually adopted flood adaptation strategies through a series of flood events and educational initiatives.	Elsevier	0	0	0

## **DISCUSSION**

The number of CBA responses to flood-related research significantly increased since 2010. This kind of research will assist future planners as well as individuals, communities, governments, and non-governmental organisations in reducing the loss of property and life. The researchers learnt some fascinating information about CBA responses to floods from the study. Our review shows that the qualitative method is predominantly used. The journal with the highest number of publications for this kind of research is Elsevier. Top-cited publications are also introduced in this study. The study also identifies the top authors using co-authorship analysis.

Through a comprehensive analysis of the databases, it was determined that there exists a substantial number of scholarly papers that delved into the topic of flooding. By utilizing local and indigenous knowledge to select indicators for mapping flood vulnerability, a more comprehensive understanding of flood vulnerability in informal settlements can be achieved. This approach also offers decision-makers and other stakeholders a glimpse into adaptable measures that can be implemented to enhance the resilience of the affected population (Membele, Naidu, & Mutang, 2022).

The study emphasizes the importance of amalgamating scientific research with traditional knowledge to effectively address environmental issues and provides insightful information about the challenges faced in achieving sustainable development in the area (Merten et al., 2020). The study revealed the impacts of climate change on flooding, as well as the significance of recording and preserving traditional knowledge for future generations (Khalafzai et al., 2019). For early warning and adaptation strategies to be effective, it is imperative to consider the validation and integration of relevant indigenous knowledge into early warning scientific systems (Kasei et al., 2019). Insufficient community involvement, a lack of sensitivity analysis and map validation, and a limited application of indigenous knowledge all contribute to the mapping of flood vulnerability in most informal settlements.

The selected keywords for the review reveal a scarcity of research on the utilization of CBA in flood risk management. This scarcity further emphasizes the potential benefits of employing CBA approaches to evaluate flood vulnerability. Researchers from various parts of the world are diligently studying the repercussions of flooding on human civilization. Local knowledge is characterized by its multifaceted and dynamic nature, and it plays a crucial role in community resilience. It offers diverse strategies for flood risk management, but its practicality and accessibility are influenced by social, political, and environmental factors (Trogrlić et al., 2019).

The susceptibility to flooding is closely linked to resistance and coping capacity. It is crucial to distinguish between short-term coping strategies and long-term adaptation strategies, underscoring the reliance on local knowledge in the absence of well-structured adaptation programs (Islam et al., 2018). However, the incorporation of CBA in flood assessment has significantly enhanced the importance of flood risk management.

To assess flooding and vulnerability in the affected areas, it is essential to employ statistical methods and geographic tools in conjunction with local knowledge (Membele, Naidu, & Mutanga, 2022). The coordination of these approaches can facilitate the prompt identification of vulnerable areas and enable effective visualization of flood events. As other studies have indicated, urban flooding is becoming increasingly prevalent due to the ongoing process of urbanization. The impact of indigenous knowledge systems in mitigating the effects of floods and the variations in coping abilities based on geographical location, exposure to flooding, and socio-economic factors are also explored (Mavhura et al., 2013). The study emphasizes the capacity to connect extensive global datasets with local knowledge to enhance the practicality of flash flood alerts (Bucherie et al., 2022).

## **CONCLUSION**

The research studies on CBA responses to flood-related crises have already been done extremely well in developed nations, but developing nations are trailing behind. The academic literature on flooding was found to be intricate and multidimensional. Every nation that struggles with flood hazards needs

to concentrate on research if it wants to advance progressively. This study was designed with a boolean search to give an overview of the articles' trends through the year 2023 and to identify the topics in CBA responses to flood-related research.

Key findings obtained from the analysis of some articles encompass the utilization of CBA strategies to cope with flooding incidents has proven to be efficacious in enhancing community resilience and diminishing the associated flood hazards. The establishment of effective channels of communication and collaboration amongst community members, local governing bodies, and other relevant stakeholders holds paramount significance for the successful implementation of CBA initiatives for flood risks. Further exploration into the prolonged efficacy of CBA approaches, as well as the exploration of effective methods to inclusively engage marginalized communities in the adaptation process, is urgently required.

In general, the systematic literature review concerning CBA measures to combat flood occurrences strives to furnish an all-encompassing depiction of the present state of knowledge on this subject matter and identify areas necessitating further investigation. Future studies may focus on a particular approach or type by combining fewer keywords and more databases.

## **ACKNOWLEDGEMENT**

The esteemed research databases of Universiti Teknologi Malaysia, Johor Bahru, Malaysia, were graciously made accessible, and a highly conducive learning environment was provided. The researchers extend our acknowledgement and gratitude to them. Furthermore, the researchers express sincere appreciation for the invaluable study leave granted by Nuhu Bamalli Polytechnic, Zaria, Kaduna State, Nigeria, to pursue a doctoral program and to Hauwa Abubakar Buhari of English Department, School of Liberal Studies, Nuhu Bamalli Polytechnic Zaria for proofreading the manuscript.

## FUNDING

The financial resources for the execution of this research endeavour were made available by the Tertiary Education Trust Fund (TETFUND) in Nigeria. State the information about the funding for this research.'

## AUTHOR CONTRIBUTIONS

The design and concept of the study, implementation of the search strategy, and composition of the manuscript were undertaken by the corresponding author. The first co-author was specifically responsible for data cleansing and providing recommendations for the tabulation procedures. The second co-author diligently examined and provided suggestions on the software employed in the final manuscript. The final manuscript has been diligently examined and authorized by all authors, signifying their mutual concurrence on its substance and discoveries.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## REFERENCES

- Acharya, A., & Prakash, A. (2019). When the river talks to its people: Local knowledge-based flood forecasting in Gandak River basin, India. *Environmental Development*, 31, 55–67.
- Ahmad, E. F., Mohd Zin, I. N., & Alauddin, K. (2020). Criteria of resilience infrastructure in flood-prone areas in Kelantan: A pilot study. *Malaysian Journal of Sustainable Environment*, 7(1), 171. <https://doi.org/10.24191/myse.v7i1.8917>.
- Alizadeh, B., Li, D., Hillin, J., Meyer, M. A., Thompson, C. M., Zhang, Z., & Behzadan, A. H. (2022). Human-centered flood mapping and intelligent routing through augmenting flood gauge data with crowdsourced street photos. *Advanced Engineering Informatics*, 54, 101730. <https://doi.org/>

<https://doi.org/10.1016/j.aei.2022.101730>.

Bernatchez, P., Fraser, C., Lefaivre, D., & Dugas, S. (2011). Integrating anthropogenic factors, geomorphological indicators and local knowledge in the analysis of coastal flooding and erosion hazards. *Ocean & Coastal Management*, 54(8), 621–632. <https://doi.org/10.1016/j.ocecoaman.2011.06.001>.

Bucherie, A., Werner, M., Homberg, M. Van Den, & Tembo, S. (2022). Flash flood warnings in context: Combining local knowledge and large-scale hydro-meteorological patterns. *Natural Hazards and Earth System Sciences*, 22(2), 461–480. <https://doi.org/10.5194/nhess-22-461-2022>.

Carnelli, F., Mugnano, S., & Short, C. (2020). Local knowledge as key factor for implementing nature-based solutions for flood risk mitigation. *Rassegna Italiana Di Sociologia*, 61(2), 381–406. <https://doi.org/10.1423/97838>.

Daly, P., Mahdi, S., McCaughey, J., Mundzir, I., Halim, A., & Srimulyani, E. (2020). Rethinking relief, reconstruction and development: Evaluating the effectiveness and sustainability of post-disaster livelihood aid. *International Journal of Disaster Risk Reduction*, 49, 101650.

Fox, A., Ziervogel, G., & Scheba, S. (2023). Strengthening community-based adaptation for urban transformation: managing flood risk in informal settlements in Cape Town. *Local Environment*, 28(7), 837–851.

Hirunsalee, S., & Kanegae, H. (2010). The use of local knowledge and its transfer for community self-protection development in flood prone residential area. *World Academy of Science, Engineering and Technology*, 64(Query date: 2023-12-08 22:43:33), 480–485.

Hooli, L. J. (2016). Resilience of the poorest: coping strategies and indigenous knowledge of living with the floods in Northern Namibia. *Regional Environmental Change*, 16(3), 695–707. <https://doi.org/10.1007/s10113-015-0782-5>.

Islam, M. R., Ingham, V., Hicks, J., & Kelly, E. (2018). From coping to adaptation: Flooding and the role of local knowledge in Bangladesh. *International Journal of Disaster Risk Reduction*, 28(Query date: 2023-



- 12-08 22:43:33), 531–538. <https://doi.org/10.1016/j.ijdr.2017.12.017>.
- Jafar, A., Sakke, N., Mapa, M. T., Dollah, R., & George, F. (2022). The Adaptive Capacity in Flood Hazards and Enhancement of Local Knowledge among Floodplain Community in Beaufort District, Sabah, Malaysia. *International Journal of Climate Change: Impacts and Responses*, 14(2), 35–47. <https://doi.org/10.18848/1835-7156/CGP/v14i02/35-47>.
- Kalfin, K., Sukono, S. S., & Mamat, M. (2022). Insurance as an Alternative for Sustainable Economic Recovery after Natural Disasters: A Systematic Literature Review. *Sustainability*, 14(7), 4349.
- Kamarulzaman, N. H., Vaiappuri, S. A. L. K. N., Ismail, N. A., & Mydin, M. A. O. (2016). Local knowledge of flood preparedness: Current phenomena to future action. *Jurnal Teknologi*, 78(5), 85–89. <https://doi.org/10.11113/jt.v78.8246>.
- Kasei, R. A., Kalanda-Joshua, M. D., & Benefor, D. T. (2019). Rapid urbanisation and implications for indigenous knowledge in early warning on flood risk in African cities. *Journal of the British Academy*, 7(Query date: 2023-12-08 22:43:33), 183–214. <https://doi.org/10.5871/jba/007s2.183>.
- Khalafzai, M.-A. K., McGee, T. K., & Parlee, B. (2019). Flooding in the James Bay region of Northern Ontario, Canada: Learning from traditional knowledge of Kashechewan First Nation. *International Journal of Disaster Risk Reduction*, 36(Query date: 2023-12-08 22:43:33). <https://doi.org/10.1016/j.ijdr.2019.101100>.
- Khan, M. K., & Ahmad, S. (2017). Flood resistant buildings: a requirement for sustainable development in flood prone areas. *International Journal of Emerging Technology*, 8, 114–116.
- Lai, X. X., Wen, J. H., Shan, X. M., Shen, L. C., Wan, C. C., Shao, L., Wu, Y. J., Chen, B., & Li, W. J. (2023). Cost-benefit analysis of local knowledge-based flood adaptation measures: A case study of Datian community in Zhejiang Province, China. *International Journal Of Disaster Risk Reduction*, 87(Query date: 2023-12-08 22:43:33). <https://doi.org/10.1016/j.ijdr.2023.103573>

- Mavhura, E., Manyena, S. B., Collins, A. E., & Manatsa, D. (2013). Indigenous knowledge, coping strategies and resilience to floods in Muzarabani, Zimbabwe. *International Journal of Disaster Risk Reduction*, 5, 38–48.
- Membele, G. M., Naidu, M., & Mutang, O. (2022). Using local and indigenous knowledge in selecting indicators for mapping flood vulnerability in informal settlement contexts. *International Journal of Disaster Risk Reduction*, 71(Query date: 2023-12-08 22:43:33). <https://doi.org/10.1016/j.ijdrr.2022.102836>.
- Membele, G. M., Naidu, M., & Mutanga, O. (2022). Integrating Indigenous Knowledge and Geographical Information System in mapping flood vulnerability in informal settlements in a South African context: a critical review. *South African Geographical Journal*, 104(4), 446–466. <https://doi.org/10.1080/03736245.2021.1973907>.
- Merten, J., Stiegler, C., Hennings, N., Purnama, E. S., RÃ¶ll, A., Agusta, H., Dippold, M. A., Fehrmann, L., Gunawan, D., HÃ¶lscher, D., Knohl, A., KÃ¼ckes, J., Otten, F., Zemp, D. C., & Faust, H. (2020). Flooding and land use change in Jambi Province, Sumatra: Integrating local knowledge and scientific inquiry. *Ecology and Society*, 25(3), 1–29. <https://doi.org/10.5751/ES-11678-250314>.
- Motsumi, S., Magole, L., & Kgathi, D. (2012). Indigenous knowledge and land use policy: Implications for livelihoods of flood recession farming communities in the Okavango Delta, Botswana. *Physics And Chemistry Of The Earth*, 50(Query date: 2023-12-08 22:43:33), 185–195. <https://doi.org/10.1016/j.pce.2012.09.013>.
- Nguimalet, C. R. (2018). Comparison of community-based adaptation strategies for droughts and floods in Kenya and the Central African Republic. *Water International*, 43(2), 183–204. <https://doi.org/10.1080/002508060.2017.1393713>.
- Obi, R., Nwachukwu, M. U., Okeke, D. C., & Jiburum, U. (2021). Indigenous flood control and management knowledge and flood disaster risk reduction in Nigeria's coastal communities: an empirical analysis. *International Journal of Disaster Risk Reduction*, 55, 102079.

- O’Gorman, E. (2012). Local knowledge and the state: The 1990 floods in Cunnamulla, Queensland, Australia. *Environmental History*, 17(3), 512–546. <https://doi.org/10.1093/envhis/ems045>.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 89. <https://doi.org/10.1186/s13643-021-01626-4>.
- Pande, K. A. P., & Makalew, A. D. N. (2020). Settlement landscape planning based on flood mitigation in Pinang sub-district Tangerang city. *IOP Conference Series: Earth and Environmental Science*, 501(1), 012007.
- Rio, T. Del, Groot, J. C. J., DeClerck, F., & Estrada-Carmona, N. (2018). Integrating local knowledge and remote sensing for eco-type classification map in the Barotse Floodplain, Zambia. *DATA IN BRIEF*, 19(Query date: 2023-12-08 22:43:33), 2297–2304. <https://doi.org/10.1016/j.dib.2018.07.009>.
- Sohail, M. T., & Chen, S. M. (2022). A systematic PLS-SEM approach on assessment of indigenous knowledge in adapting to floods; A way forward to sustainable agriculture. *Frontiers In Plant Science*, 13(Query date: 2023-12-08 22:43:33). <https://doi.org/10.3389/fpls.2022.990785>.
- Tasantab, J. C., Gajendran, T., & Maund, K. (2022). Expanding protection motivation theory: The role of coping experience in flood risk adaptation intentions in informal settlements. *International Journal of Disaster Risk Reduction*, 76, 103020.
- Tran, P., Shaw, R., Chantry, G., & Norton, J. (2009). GIS and local knowledge in disaster management: a case study of flood risk mapping in Viet Nam. *Disasters*, 33(1), 152–169. <https://doi.org/10.1111/j.1467-7717.2008.01067.x>
- Trogrić, R. Å. ., Wright, G. B., Duncan, M. J., Homberg, M. J. C. van den, Adeloye, A. J., Mwale, F. D., & Mwafufulirwa, J. (2019). Characterising local knowledge across the flood risk management cycle: A case study

of Southern Malawi. *Sustainability (Switzerland)*, *11*(6). <https://doi.org/10.3390/su11061681>.

Tun Jamil, S. J., Ahmad, N. A., & Jasiman, J. J. (2018). Connecting Felda communities with solar electrification during flood disaster: The methodology. *Malaysian Journal of Sustainable Environment*, *4*(1), 57. <https://doi.org/10.24191/myse.v4i1.5607>.

van Eck, N., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538.

Vargas-Lopez, I. A., Kelso, W. E., Bonvillain, C. P., Keim, R. F., & Kaller, M. D. (2020). Influence of water quality, local knowledge and river–floodplain connectivity on commercial wild crayfish harvesting in the Atchafalaya River Basin. *Fisheries Management and Ecology*, *27*(4), 417–428. <https://doi.org/10.1111/fme.12422>