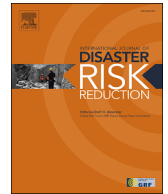


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Identifying major challenges in managing post-disaster reconstruction projects: A critical analysis

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ABSTRACT

This paper seeks to identify and categorise challenges encountered in managing post-disaster reconstruction projects. Literature relevant to the topic was identified using keywords from two databases—Scopus and Web of Science, and then filtered using title screening and abstract screening. Subsequently, an analysis of 66 relevant papers between 2000 and 2023 revealed a total of 223 challenges relating to post-disaster reconstruction. These were then categorised into nine groups—quality and workmanship; contractual, legislation and policy; management and collaboration; resources; community engagement and culture; financial; physical/territorial; natural causes; and other challenges. Among these nine categories, resource challenges; management and collaboration challenges; and contractual, legislation, and policy challenges emerged as notably prevalent issues. While acknowledging the unique contextual nuances of post-disaster scenarios, it is important to emphasise that the challenges identified here are general in nature, serving as a foundational resource for government and various implementing agencies to devise context-specific mitigation measures. Additionally, the research findings offer insights and directions for future research aimed at enhancing post-disaster reconstruction management, particularly in addressing gaps in reconstruction legislation, policies, and processes, as well as the lesser-explored domain of non-residential reconstruction projects. Given the increasing incidence of post-disaster projects failing to achieve their objectives, understanding and effectively addressing these possible challenges is paramount. Hence, this paper provides a comprehensive foundation for developing tailored mitigation strategies and refining management practices in post-disaster reconstruction endeavors.

1. Introduction

Construction is unique compared to other industries due to the delicate blend of technical complexity, high costs, and lengthy duration [1]. Even something as basic and straightforward as constructing a house requires collaboration between the owner and numerous other stakeholders, including contractors, specialist subcontractors, and construction professionals like architects, quantity surveyors, engineers, and trade contractors. What significantly differentiates construction from other industries is its high level of risk, primarily because of the active involvement of multiple stakeholders [2]. These risks in construction can materialise in many ways, not only in time and cost overruns but also in substantial financial losses, bankruptcy, environmental damages, and even loss of life [3].

As noted by Hughes et al. [1], sometimes the value of an individual construction project may even exceed the contractor's or client's annual turnover. This means if that one project fails, it could lead to stakeholders going into insolvency. Consequently, successful

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construction requires meticulous planning and precise execution while also providing appropriate contingencies for possible risks. However, managing risks in construction, like in any industry, is challenging. Nevertheless, due to high investment, involvement of numerous stakeholders, and many repercussions for failure, there is a pressing need to analyse and mitigate these risks thoroughly.

When analysing the issues within construction, those within sub-categories of construction must also be dealt with separately and carefully. In this paper, the construction industry is sub-categorised simply as “conventional construction” and “reconstruction.” While construction and reconstruction share some commonalities, certain inherent risks associated with reconstruction do not apply to conventional construction. As a result, reconstruction must be studied separately and given special attention in the literature.

After briefly discussing the current disaster statistics, this paper highlights key differences between conventional construction and post-disaster reconstruction, as well as specific challenges in managing reconstruction projects. This helps emphasise the importance of treating reconstruction separately and the necessity for more rigorous research.

1.1. Disasters and post-disaster reconstruction

In today's context, there is a growing belief that disaster occurrences and their associated damages are increasing [4,5]. Over the past 20 years, the United Nations Office for Disaster Risk Reduction [6] recorded 7348 disasters, claiming 1.23 million lives, affecting 4 billion people, and resulting in approximately \$2.97 trillion in economic losses. There is a stark contrast between this period and 1980 and 1999, where there were 4212 events, 1.19 million deaths, 3.25 billion people affected, and \$1.63 trillion in financial losses. Some researchers, like Alimonti and Mariani [7], argue that the increase in reported events may be the result of better recognition and documentation of disaster occurrences. While the increased numbers are alarming, it is crucial to consider these differing viewpoints and understand the factors influencing the perceived rise in number of disasters.

The United Nations Office for Disaster Risk Reduction, formerly the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR), defines disasters broadly. According to their definition, a disaster is: “A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources” [8]. This broad definition includes human-caused events such as wars. Reconstruction following these events have also been studied as post-disaster reconstruction in literature like Saleh et al. [9] and Enshassi et al. [10].

Most literature tend to classify disasters as either natural or non-natural. Various disaster record databases use these widely recognised terminologies [11]. However, the United Nations Office for Disaster Risk Reduction [6] report does not include statistics for non-natural or human-caused events. As a result, the overall impact of disasters is even more substantial than what is reported in this document.

It is alarming that the destructive effect of natural disasters is more pronounced in poorer or developing countries compared to more prosperous counterparts [12]. This assertion is supported by Toya and Skidmore [13], who, after examining 44 years of natural disaster data, concluded that countries with higher income, better education systems, and excellent financial systems tend to experience fewer adverse impacts during natural disasters compared to countries scoring lower on these metrics. According to Cheema [14], the International Monetary Fund classifies 152 countries globally as developing, and these countries are home to approximately 85 % of the world population (6.82 billion). The population in these developing nations is at a high risk of being impacted by natural disasters due to factors like poor economic conditions, old and aging physical infrastructures, and weak disaster management systems [15–17].

In the aftermath of natural disasters, economic disruptions occurring in these developing nations, place an additional burden on already financially strained governments during the post-disaster recovery phase [12]. Acharya et al. [18] also echo this concern, emphasising that post-disaster reconstruction poses particularly significant challenges in developing nations. It is important to prioritise post-disaster reconstruction studies because of the increasing frequency and severity of disasters, and their significant impact on the global population.

1.2. Post-disaster reconstruction success compared to conventional construction

Post-disaster reconstruction is riskier, more dynamic, and more complicated than conventional construction [19,20]. It not only involves the usual construction risks but is also influenced by social, political, and economic factors in the affected area [21,22,23]. Additionally, it faces obstacles like limited resources, inadequate communication and collaboration, and lack of legislation that differentiates it from conventional construction [24].

What is abnormal and more devastating during post-disaster scenarios is that one disaster can sometimes trigger multiple other disasters, like aftershocks following earthquakes, making massive variations in the project more likely. For instance, the Great East Japan earthquake also triggered a tsunami, resulting in more casualties than the earthquake itself [25]. Previous studies suggest that a disaster event can compress what would normally take 20 years to rebuild into only a few years of reconstruction when resources are severely disrupted—creating even greater challenges and risks [26,27]. Therefore, post-disaster reconstruction presents a decision-making environment that differs significantly from normal situations, making it even harder for the decision-makers [28]. It is critical to gain a good level of understanding of potential issues and seek efficient resolutions based on knowledge from past post-disaster experiences in order to make well-informed decisions and achieve project success.

Measuring the success of a project may be complex. Success measure varies by the project and has different meanings to different stakeholders due to their different interest in the project outcome [29]. A project considered successful by one party may not be accepted as successful by other parties involved. For example, Aliakbarlou et al. [30] note that clients in post-disaster reconstruction give lesser value to cost than in conventional construction. This shows that the concept of success can differ depending on the specific context of construction projects.

Traditionally, completing the project on time, within budget, and specified quality—the "iron triangle", sometimes referred to as the "golden triangle", has been a common and widely accepted measure of project success in the past [31,32]. However, other research challenges the idea that relying solely on the iron triangle factors is sufficient to gauge the success of large-scale projects, such as reconstruction. Toor and Ogunlana [29] and Walker et al. [33] argue that beyond the "iron triangle" considerations, other indicators, such as reduced disputes, enhanced satisfaction of stakeholders, and effective use of resources are also critical for large public sector development projects. These other measures are also relevant in large reconstruction projects involving multiple stakeholders—heightening the chances of dispute due to performance under resource constraints. This perspective is also supported by Charles et al. [34], who highlight the questionable applicability of "iron triangle" factors alone in reconstruction projects, emphasising that project outcomes are also contingent on how stakeholders' needs were considered throughout various stages of the project.

Successful reconstruction requires access to knowledge about the best practices and answers to questions like what is the best approach, how much to spend, what is the time frame, what is the need of the affected, what is to be given, and how to monitor the provided intervention [35]. Answers to these questions can come from the knowledge base from previous post-disaster experiences. However, since the available knowledge on reconstruction is fragmented, it is difficult to respond to these important questions [36]. Therefore, reconstruction projects still do not meet the objectives [37,38].

Li [39] also pointed out that lack of experience in managing disasters and a lack of appropriate knowledge of countermeasures significantly increase the risk of cost overruns in post-disaster reconstruction. Therefore, there's a pressing need to conduct rigorous studies on best practices for managing post-disaster reconstruction projects.

1.3. Management of post-disaster reconstruction

Researchers believe that the post-disaster reconstruction body of knowledge is still in its infancy, with many gaps that need filling before a united body of frameworks can be made available for researchers and practitioners [40]. This belief is supported by Ingirige et al. [36], who point out that despite experiencing significant disasters of varying scales, the current body of knowledge on post-disaster reconstruction lacks cohesion and effective integration.

As a result, disaster situations are still commonly handled by modifying regular construction processes without any specific post-disaster reconstruction guidelines [41]. Brandon [42] emphasises the necessity for different management approaches for post-disaster scenarios due to the extreme conditions under which the management intervention takes place. Since disasters mainly impact low-income nations, swift recovery and reconstruction in these countries is crucial from a socio-economic standpoint as well [43]. There is a pressing need for further research in managing reconstruction projects to address the gaps in existing knowledge. Such research will enable decision-makers to make more informed decisions, ultimately increasing the success rate of post-disaster reconstruction projects.

1.3.1. Research gap and questions

Previous studies have consistently shown that post-disaster reconstruction projects often fail to achieve their intended goals [20,37,44]. This is of serious concern because reconstruction projects involve substantial funding and have a direct impact on a large population. Failing to meet these goals can have severe consequences, such as prolonging the time for individuals and countries to return to their pre-disaster condition due to delayed project completion. Additionally, post-disaster reconstruction may face other issues, including poor quality and a lack of accountability, which can lead to dissatisfaction among the stakeholders, which increases the chances of disputes [45].

One key challenge that exists today is that the majority of construction management literature focuses mainly on conventional construction rather than reconstruction [46]. Reconstruction, in general, receives less attention although it poses more significant problems. The failure of reconstruction projects can be attributed, in part, to a lack of research on the management of post-disaster reconstruction projects, with the primary focus only coming from the built environment discipline [47,48]. This perspective is supported by Liu and Liu [49] and Bilau and Witt [37], who emphasise that ineffective management processes are a critical factor in the failure of housing reconstruction projects.

While some earlier researchers have identified success factors and challenges, their studies focus mainly on single disaster experiences and provide limited intervention suggestions for specific projects or countries. Walker et al. [33] point out the lack of studies on the critical success factors in the management system that lead to project success. Denolf et al. [50] argue that these critical success factors are abstract and impractical, making available knowledge on success factors questionable for real-world use. Therefore, the primary focus of a post-disaster reconstruction study should be to identify implementation challenges and develop suitable intervention measures. Hidayat and Egbu [32] also support this notion, noting that identifying challenges can help develop intervention strategies for future reconstruction. The advantages of looking back at the challenges faced in previous reconstruction experiences cannot be neglected.

To bridge the gap in understanding these challenges, this paper aims to identify and categorise a comprehensive list of fundamental challenges faced in managing post-disaster reconstruction projects using a critical literature review and content analysis. The insights gained from this paper can then be used to formulate appropriate intervention strategies for addressing these challenges.

Thus, the main aim of this paper is to explore what challenges are typically encountered in managing post-disaster reconstruction projects following a disaster.

2. Research methodology and methods

A macro approach, similar to methods employed by Farni et al. [51] and Bilau et al. [52], was adopted for the study to gather relevant information from existing literature. As illustrated in Fig. 1, a structured method was followed to conduct a critical literature review of relevant articles.

To maintain high standards of quality, the selection process focused exclusively on peer-reviewed academic journal articles and academic peer-reviewed conferences due to their rigorous review processes. The search for relevant articles was conducted in two primary databases - Scopus and Web of Science.

Initially, the search results in English for literature during the period 2000–2023 in English yielded 154 articles in Scopus and 41 articles in Web of Science. Within these results, 17 duplicates were identified in both databases and were removed.

Following this, a two-step screening process was used, starting with a review of article titles followed by an assessment of abstracts. This allowed for eliminating articles that did not align with the objectives of this paper, which is looking at challenges encountered in managing the physical reconstruction of the built environment following a disaster. Ultimately, 66 papers that met the study's criteria were identified and included.

3. Study findings

This section covers the disasters studied for the paper and summarises the categorisation of the identified management issues.

In order to provide a comprehensive analysis, a range of disasters from both natural and human-caused events was examined. This inclusive approach is important because the physical reconstruction efforts following both natural disasters and human-caused events, such as post-conflict situations, are essential in restoring a country or region to its pre-disaster state and for enhancing resilience [53]. There are many parallels in objectives, processes, and challenges encountered in both scenarios. Post-conflict situations, like post-natural disaster situations, require substantial reconstruction of public infrastructure. However, financial and governance challenges in post-conflict situations create performance barriers. This makes reconstruction projects susceptible to construction and contractual malpractices that directly impact their outcomes [54]. These challenges are also present in post-natural disaster situations. Ullal [54] further highlights additional issues, such as policy-related concerns, low productivity, material shortages, the loss of skilled resources, and corruption in post-conflict situations, which are similarly prevalent in post-natural disaster scenarios. Including reconstruction studies following both post-conflict and post-natural disasters provides a holistic view of common challenges encountered in all reconstruction projects.

Only a limited number of studies on post-conflict reconstruction were included in the study following the screening stage. However, those included prove invaluable in highlighting prevalent common challenges within post-conflict reconstruction projects in this meta-study.

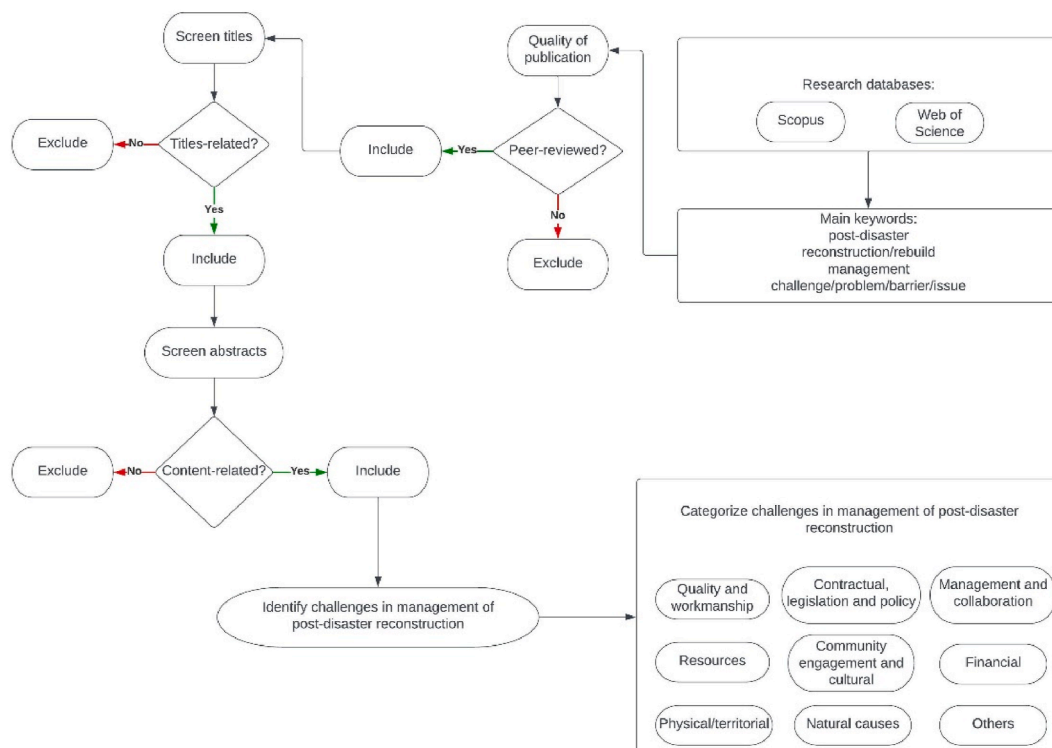


Fig. 1. Research framework and literature review process (adapted and modified from Safapour et al. [4]).

The issues from all identified studies were categorised into nine main areas discussed below.

3.1. Specific disaster studies

During the literature review, several studies consisting of case studies were identified, highlighting actual experiences from post-disaster reconstruction efforts in different countries worldwide.

Table 1 below tabulates some of the disasters with details such as country, year of occurrence, and associated references.

3.2. Classification of challenges

In this study, the categories defined by Safapour et al. [4] were adopted and modified to classify the identified management challenges from the literature. These challenges were grouped into nine categories: quality and workmanship; contractual, legislation and policy; management and collaboration; resources; community engagement and culture; financial; physical/territorial; natural causes; and other challenges. Detailed description of each category is provided in sub-sections below.

The number of challenges identified in each category is summarised in Table 2 below.

3.2.1. Quality and workmanship challenges

Quality and workmanship were the most reported challenges in the literature. These challenges are critical as they directly influence the project's functionality, durability, safety, aesthetics, and market value.

Table 3 presents 41 challenges relating to quality and workmanship as reported in the literature. There were seven citations relating to the "Lack of quality inspection and supervision during construction leading to defects and failure." It was the most re-

Table 1
Disaster studies identified.

Item	Disaster	Country	Year	References
1	Prolonged war in Afghanistan	Afghanistan	From 1978	Sadiqi et al. [55]; Sadiqi et al. [56]
2	Gujarat Earthquake	India	2001	Powell [22]; Tafti and Tomlinson [35]
3	Bam Earthquake	Iran	2003	Omidvar et al. [57]; Tafti and Tomlinson [35]; Fayazi et al. [26]; Fayazi and Lizarralde [58]
4	Iraq War	Iraq	2003	Waheeb and Andersen [59]
5	Aceh Tsunami	Indonesia	2004	Ophiyandri et al. [45]; Chang et al. [19]; Daly and Brassard [60]; Chang et al. [24]; Malahayati et al. [61]
6	Wenchuan Earthquake	China	2008	Ge et al. [62]; Li [39]; Chang et al. [63]; Wang et al. [64]; Lu and Xu [65]; Li et al. [66]
7	Western Sumatra Earthquake	Indonesia	2009	Farni et al. [51]
8	Morakot Typhoon	Taiwan	2009	Lin [67]; Lin and Lin [68]
9	Maule Earthquake	Chile	2010	Platt and So [21]
10	Canterbury Earthquake	New Zealand	2010/11	Walker et al. [33]; Chang-Richards et al. [69]; Tagliacozzo [70]; Sun et al. [71]
11	Great East Japan Earthquake	Japan	2011	Cho [25]; Platt and So [21]
12	Van Earthquake	Turkey	2011	Platt and So [21]
13	Emilia-Romagna Earthquake	Italy	2012	Tagliacozzo and Magni [72]; Tagliacozzo and Magni [73]
14	Lushan Earthquake	China	2013	Xu et al. [74]
15	Gorkha Earthquake	Nepal	2015	Rawal et al. [75]; Crawford and Morrison [76]; Uddin et al. [77]; Uddin et al. [78]; Acharya et al. [18]
16	Kaikoura Earthquake	New Zealand	2016	Sun et al. [71]
17	Wildfire in Portugal	Portugal	2017	Freitas and Mendes [79]
18	Tropical Cyclone Harold	Vanuatu	2020	Ahmed and McDonnell [80]

Table 2
Sum of challenges categorised.

Item	Description of category	The sum of challenges identified under each category in the literature	Total number of citations
1	Quality and workmanship challenges	41	63
2	Contractual, legislation, and policy challenges	36	66
3	Management and collaboration challenges	36	83
4	Resource challenges	31	86
5	Community engagement and cultural challenges	23	50
6	Financial challenges	20	47
7	Physical/territorial challenges	7	27
8	Challenges from natural causes (succeeding disasters, weather, and climate)	3	4
9	Other challenges	26	48
	Total	223	474

Table 3
Quality and workmanship challenges.

Item	Description of challenge	Source	Number of citations
1	Lack of quality inspection and supervision during construction leading to defects and failure	Sospeter et al. [81]; Ahmed and McDonnell [80]; Powell [22]; Chang et al. [19]; Ophiyandri et al. [45]; Saleh et al. [9]; Farni et al. [51]	7
2	Use of sub-standard and hazardous materials (for example, Asbestos recommended in Indian Standard 2002)	A. A. Bilau et al. [82]; Daly and Brassard [60]; Powell [22]; Hidayat and Egbu [83]; Chang et al. [84]; Saleh et al. [5]	6
3	Local contractors lacking experience and capacity	Enshassi et al. [10]; Chang et al. [24]; Chang et al. [19]; Ophiyandri et al. [45]; Farni et al. [51]	5
4	Inappropriate designs	Daly and Brassard [60]; Ophiyandri et al. [45]; Farni et al. [51]	3
5	Lack of knowledge on disaster resilient design and construction	Acharya et al. [18]; Ahmed and McDonnell [80]	2
6	Lack of competency in implementing organisations and staff resulting in poor supervision	A. A. Bilau et al. [82]; Hidayat and Egbu [83]	2
7	Non-adherence to quality guidelines	A. A. Bilau et al. [82]; Farni et al. [51]	2
8	Use of inappropriate technology and slow adoption of new technology	A. A. Bilau et al. [82]; Chang et al. [84]	2
9	Lack of materials testing or delayed testing - inspection process neglected.	Powell [22]; Waheeb and Andersen [59]	2
10	No detailed understanding of the causes of damages	Kim and Choi [38]	1
11	Lack of technical capacity and expertise of local engineering firms	Kim and Choi [38]	1
12	Lack of technical support from technical consultants	Kim and Choi [38]	1
13	Poor quality and qualification of consultants	Waheeb and Andersen [59]	1
14	Unqualified people in monitoring leading to poor quality	Saleh et al. [5]	1
15	Lack of competency of project managers	Saleh et al. [9]	1
16	Overload of engineers in local small engineering firms compromising the quality of design	Kim and Choi [38]	1
17	Engineers are biased towards modern industrial materials and modern construction systems due to limited knowledge and lack of confidence in traditional materials and design	Rawal et al. [75]	1
18	Poor design due to pressure to rebuild quickly	Saleh et al. [9]	1
19	The one-size-fits-all design is not satisfactory to beneficiaries	Saleh et al. [5]	1
20	Breaches to standard earthquake construction procedure due to the use of an owner-driven approach	Acharya et al. [18]	1
21	Lack of skill of local construction workers in rural areas to use new construction materials	Acharya et al. [18]	1
22	Overload of project officers	Kim and Choi [38]	1
23	Limited availability of engineering services resulting in either unauthorised construction or a significant expense of hiring private consultants	Rawal et al. [75]	1
24	Lack of information and advice during construction leading to rejection after completion of buildings	Rawal et al. [75]	1
25	No follow-up inspections from local institutions after issuing building permits	Ahmed and McDonnell [80]	1
26	Very few university-trained engineers and architects and an even lesser number active in a technical capacity	Ahmed and McDonnell [80]	1
27	Lack of ability to understand design	Ahmed and McDonnell [80]	1
28	Lack of skilled labour and inadequate training and certification to up-skill local artisans and develop local skills lead to poor workmanship	A. A. Bilau et al. [82]	1
29	Use of imported labour affecting local architecture	A. A. Bilau et al. [82]	1
30	Poor selection of materials and construction techniques	Fayazi et al. [26]	1
31	Non-alignment of local industry to building codes and health and safety expectations creating delays	A. A. Bilau et al. [82]	1
32	Lack of enforcement of PPEs	A. A. Bilau et al. [82]	1
33	Contractors lacking technical, administrative and financial efficiency	Waheeb and Andersen [59]	1
34	Contractors not following safe construction practices despite receiving a considerable degree of information	Fayazi et al. [26]	1
35	Poor performance by contractors leading to time and cost overrun	Rad et al. [85]	1
36	Quality and safety lost priority due to economic hardships of households after the discontinuation of supervision	Tafti and Tomlinson [35]	1
37	Management costs increased due to building complexity and the need for more specialist	Brandon [42]	1
38	Poor construction practices, including covering poor construction before the inspection	Powell [22]	1
39	Inadequate workers' skills leading to poor quality	Hidayat and Egbu [83]	1
40	Involvement of workers without experience in construction leading to poor quality and cost overruns.	Ophiyandri et al. [45]	1
41	Beneficiary dissatisfaction due to delay and low-quality construction	Farni et al. [51]	1

ported challenge in the literature. Item 2, "Use of sub-standard and hazardous materials (for example, Asbestos recommended in Indian Standard 2002)," was cited six times. Item 3, "Local contractors lacking experience and capacity," was cited five times, and Item 4, "Inappropriate designs" was cited three times. Five challenges (items 5–9) were cited twice, completing the top five most cited challenges.

3.2.2. Contract, legislation, and policy challenges

Contract, legislation, and policy are essential in reconstruction as they provide a framework of how the finances, resources, and accountability are apportioned to help in swift decision-making and efficient reconstruction.

Table 4 presents 36 challenges relating to contract, legislation, and policy as reported in the literature. Item 1 was cited ten times and was the most reported challenge in the literature. It relates to "Inadequate or lack of government legislation and policies in disaster management." Item 2, "Lack of proper planning and government preparedness" was cited nine times, and Item 3, "Lack of effective implementation plans, compliance system and procedures", was cited four times. Three challenges (items 4–6) were cited three times, and five challenges (items 7–11) were cited twice, completing the top five most cited challenges.

3.2.3. Management and collaboration challenges

Management and collaboration are critical in reconstruction as they help implement the project systematically and in a timely manner with the help of collaboration among diverse stakeholders.

Table 5 presents 36 challenges relating to management and collaboration as reported in the literature. There were 15 citations relating to "Failure to coordinate and integrate the work of various stakeholders and implementing partners who have their own goals and expectations can result in work duplication, resource wastage and incomplete implementation." It was the most reported challenge in the literature. Item 2, "Lack of technical and managerial capacity of local institutions and aid organisations to manage reconstruction", and Item 3, "Competition among aid agencies and NGOs for limited resources", were cited six times. Item 4, "Lack of expertise, competency and adequate capacity of NGOs and INGOs", was cited five times. Four challenges (items 5–8) were cited four times, and two challenges (items 9–10) were cited thrice, completing the top five most cited challenges.

3.2.4. Resource challenges

Reconstruction relies heavily on vital resources such as materials, equipment, labour, and other essential items. If these resources are lacking, the reconstruction process may be delayed, and the quality of work may suffer as a result.

Table 6 presents 31 challenges relating to resources as reported in the literature. There were 17 citations relating to "Resource shortages and challenges in securing adequate resources (manpower and materials)." It was the most reported challenge in the literature. Item 2, "Cost escalation of resources", and Item 3, "Disruption of supply chain and logistical and distribution challenge", were cited eight times and seven times, respectively. Item 4, "High transportation costs and poor infrastructure for dispersal and delivery", was cited six times. Two challenges (items 5–6) were cited five times, completing the top five most cited challenges.

3.2.5. Community engagement and cultural challenges

Community engagement and local culture preservation are essential in reconstruction as they help the community have a sense of ownership in reconstruction and help protect local identity and history.

Table 7 presents 23 challenges relating to community engagement and culture as reported in the literature. There were nine citations relating to "Inadequate opportunities for community participation." It was the most reported challenge in the literature. Item 2, "Community needs are not articulated, and community diversity is not taken into consideration", and Item 3, "Inefficient and ill-organised communication and engagement of beneficiaries resulted in compromised social cohesion and poor housing products", were cited seven times and five times, respectively. Item 4, "Project culture and model not fitting to the needs of the community", was cited four times. Two challenges (items 5–6) were cited three times, completing the top five most cited challenges.

3.2.6. Financial challenges

Finance in reconstruction comes from various sources like government funds, international and national aid, private sector investment and other contributions. Suppose there is a lack of financial resources; in that case, the efforts to reconstruct may face limitations or delays, ultimately leading to prolonged suffering for those impacted and hindering their ability to recover and move forward. Furthermore, the mobilisation of resources is also directly dependent on available finance. Therefore, looking at financial challenges is essential in reconstruction.

Table 8 presents 20 challenges relating to reconstruction finance as reported in the literature. There were 13 citations relating to "Shortage of funds for reconstruction causing additional financial burdens." It was the most reported challenge in the literature. Item 2, "Corruption of reconstruction budget by management and contractors", and Item 3, "Inadequate financial management", were cited eight times and four times, respectively. Item 4, "Fraudulent use and waste of funds", was cited thrice. Three challenges (items 5–7) were cited twice, completing the top five most cited challenges.

3.2.7. Physical/territorial challenges

The reconstruction process is obstructed by physical and territorial challenges, which create a situation where affected regions become isolated, and the local population is forced to relocate, making it difficult for authorities to govern and for the affected individuals to resettle in a new area.

Table 9 presents seven challenges relating to physical location and territory as reported in the literature. There were nine citations relating to "Complex property rights issues (unclear land ownership, boundaries and access)." It was the most reported chal-

Table 4
Contract, legislation, and policy challenges.

Item	Description of challenge	Source	Number of citations
1	Inadequate or lack of government legislation and policies in disaster management	Tagliacozzo [70]; Tagliacozzo and Magni [73]; Bilau and Witt [37]; Wang et al. [64]; Chang et al. [24]; Powell [22]; Chang et al. [19]; Hidayat and Egbu [83]; Le Masurier et al. [86]; Saleh et al. [9]	10
2	Lack of proper planning and government preparedness	Acharya et al. [18]; Platt and So [21]; Wang et al. [64]; Chang et al. [24]; Hidayat and Egbu [32]; Li [39]; Chang et al. [63]; Kim and Choi [38]; Saleh et al. [9]	9
3	Lack of effective implementation plans, compliance systems and procedures	Ahmed and McDonnell [80]; A. A. Bilau et al. [82]; Wu et al. [87]; Wang et al. [64]	4
4	Existing mechanisms not fitting to disasters causing frustrations during implementation	Ahmed and McDonnell [80]; Rotimi and Wilkinson [41]; Le Masurier et al. [86]	3
5	Lack of clarity and transparent process and informal and incremental construction mechanisms	Acharya et al. [18]; Sospeter et al. [81]; Rawal et al. [75]	3
6	Overreliance on donors and their processes, which are sometimes disconnected from local capacities	Sewordor et al. [88]; Fayazi et al. [26]; Daly and Brassard [60]	3
7	Lack of consistency of government mandates and change of priorities	Platt and So [21]; Chang et al. [84]	2
8	Regulatory change (building code and land-use planning) may require skill that was not available locally	Sun et al. [71]; Fayazi and Lizarralde [58]	2
9	No specific government organisations working in disaster response before the disaster	Acharya et al. [18]; Ahmed and McDonnell [80]	2
10	Imposing arbitrary codes and standards adapted from other countries which do not match the local context	Ahmed and McDonnell [80]; Daly and Brassard [60]	2
11	Lack of proper contractor selection system (including prequalification)	Kim and Choi [38]; Saleh et al. [9]	2
12	Policies excluding people without land rights and not addressing multiple-ownership households	Tafti and Tomlinson [35]	1
13	Extended time is taken to establish a disaster response organisation due to political instability	Acharya et al. [18]	1
14	Government frequently changing the structure of disaster response organisation	Manandhar et al. [89]	1
15	Government directly managing disaster finances and resources, and having a say in staffing of disaster response organisation	Manandhar et al. [89]	1
16	Strict bureaucratic rules and practices that limit the flexibility of disaster response organisation	Manandhar et al. [89]	1
17	Insufficient regulatory mechanism to make sure building codes, construction guidelines, and quality management procedures are followed and enforced properly	Saleh et al. [9]	1
18	Lack of consistent standards among implementing agencies	Saleh et al. [9]	1
19	Difficulty in getting permits	Saleh et al. [9]	1
20	Lack of legislation and supervision from the government regarding safety	Uddin et al. [78]	1
21	Strict technical requirements for modern buildings displaced traditional architecture	Fayazi et al. [26]	1
22	No accrediting body of engineering and construction professionals	Ahmed and McDonnell [80]	1
23	Government not meeting the level of support required by new legislation	Edgington [40]	1
24	Other priorities of the government	Tagliacozzo [70]	1
25	Conflicting donor objectives	Enshassi et al. [10]	1
26	A shift of donor priorities	Enshassi et al. [10]	1
27	Lack of focus on infrastructure	Chang et al. [24]	1
28	Lack of prioritisation of contract work and no definitive criteria for dividing and awarding contracts	Kim and Choi [38]	1
29	Late design, late issuance of project tenders and delayed construction start	Kim and Choi [38]	1
30	Poor quality of bidding document	Li [39]	1
31	Inconsistencies in tender vs contract due to tight preparation schedule and special clauses not detailed enough	Li [39]	1
32	Selection of low-price-bid	Waheeb and Andersen [59]	1
33	Extensive chain of sub-contractors	Daly and Brassard [60]	1
34	Change of scope of contracts	Kim and Choi [38]	1
35	Government not standardising the construction market in disaster areas (rising number of construction enterprises, improper resource management)	Li [39]	1

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Table 4 (continued)

Item	Description of challenge	Source	Number of citations
36	Suspension and termination of contracts from the political situation	Saleh et al. [9]	1

lenge in the literature. Item 2, "Relocation causing extra costs and change to indigenous lifestyles", and Item 3, "Lack of access, poor access, or no alternate access to sites compromising resource delivery", were cited eight times and five times, respectively. Item 4, "A challenge from difficult terrain and some areas inaccessible due to weather", was cited two times. Three challenges (items 5–7) were cited once, completing the top five most cited challenges.

3.2.8. Challenges from natural causes (succeeding disasters, weather, and climate)

Succeeding disasters may lead to a need for significant funding and bring out new challenges in logistics, planning, and environmental considerations. Additionally, weather and climate affect may also slow down reconstruction. Therefore, these natural factors must all be considered for effective and sustainable long-term reconstruction.

Table 10 presents three challenges from natural causes as reported in the literature. There were two citations relating to "Reduced productivity due to high temperature in summer and rainfall in winter and spring." It was the most reported challenge in the literature. Item 2, relating to "Secondary damage from succeeding disaster/aftershocks", and Item 3, relating to "Long non-working periods due to climate and weather (extreme hot or cold)", were cited once.

3.2.9. Other challenges

Apart from the eight categories discussed in the sections above, there are other challenges that impact the reconstruction process. These are mainly related to the complexity of reconstruction, safety and environmental concerns, psychological issues, etc., after the impact of disasters.

Table 11 presents 26 other challenges as reported in the literature. There were seven citations relating to "Inflexible short deadlines due to pressure from donors, government and other stakeholders to produce tangible outcomes quickly." It was the most reported challenge in the literature. Item 2, "Slow or delayed reconstruction", was cited five times. Four challenges (items 3–6) were cited thrice, and four challenges (items 7–10) were cited twice. All remaining challenges (items 11–26) were cited once, completing the top five most cited challenges.

3.2.10. Cross-category comparison

This section compares and ranks the main categories of challenges based on the number of challenges identified and the total number of citations for each category.

The top five categories based on the number of challenges reported in the literature are quality and workmanship challenges (with 41 challenges identified); contractual, legislation, and policy challenges (with 36 challenges identified); management and collaboration challenges (also with 36 challenges identified); resource challenges (with 31 challenges identified); community engagement and cultural challenges (with 23 challenges identified); and financial challenges (with 20 challenges identified). These findings suggest that post-disaster reconstruction projects are highly likely to encounter various types of quality and workmanship; contractual, legislation, and policy; management and collaboration; resource; and community engagement and cultural challenges.

When considering the number of citations, resource issues (with 86 citations) were the most frequently reported category of issues, followed by management and collaboration (with 83 citations), and contractual, legislation, and policy challenges (with 66 citations). Quality and workmanship challenges (with 63 citations) were a close fourth, and community engagement and cultural challenges (with 50 citations) ranked fifth. This ranking indicates that resource issues, and management and collaboration challenges are more persistent in post-disaster situations globally and are frequently discussed in numerous studies. Other persistent issues are contract, legislation, and policy challenges; quality and workmanship challenges; and community engagement and cultural challenges.

Fig. 2 displays the top five challenges that are most frequently cited within the top five categories. It is important to prioritise addressing these persistent challenges in post-disaster reconstruction since they consistently reappear in various projects, according to the literature.

4. Discussion and conclusion

This study uses critical literature review and content analysis to identify and categorise challenges encountered in managing post-disaster reconstruction projects. This was done by analysing 66 papers, published between 2000 and 2023 that met the selection criteria discussed in Section 2. The findings of this paper provide a broad review of challenges in managing post-disaster reconstruction projects and allows individuals and organisations working in post-disaster reconstruction projects to develop context-specific mitigation measures to address these challenges. The findings of the paper are discussed below.

First, the study identified 223 challenges in management of post-disaster reconstruction projects and categorised them into nine categories in Tables 3–11. The categories used to classify the challenges are quality and workmanship challenges; contractual, legislation and policy challenges; resources challenges; community engagement and cultural challenges; financial challenges; physical/territorial challenges; challenges from natural causes; and other challenges.

Table 5
Management and collaboration challenges.

Item	Description of challenge	Source	Number of citations
1	Failure to coordinate and integrate the work of various stakeholders and implementing partners who have their own goals and expectations can result in work duplication, resource wastage and incomplete implementation	Acharya et al. [18]; Sospeter et al. [81]; Freitas and Mendes [79]; A. A. Bilau et al. [82]; Xu et al. [90]; Fayazi and Lizarralde [58]; Enshassi et al. [10]; Walker et al. [33]; Fayazi et al. [26]; Bilau and Witt [37]; Hidayat and Egbu [83]; Ophiyandri et al. [45]; Kim and Choi [38]; MacAskill and Guthrie [28]; Saleh et al. [9]	15
2	Lack of technical and managerial capacity of local institutions and aid organisations to manage reconstruction	Sospeter et al. [81]; A. A. Bilau et al. [82]; Fayazi et al. [26]; Hidayat and Egbu [32]; Osland [91]; Saleh et al. [9]	6
3	Competition among aid agencies and NGOs for limited resources	Sewardor et al. [88]; Lu and Xu [65]; Chang et al. [24]; Chang et al. [19]; Hidayat and Egbu [83]; Ge et al. [62]	6
4	Lack of expertise, competency and adequate capacity of NGOs and INGOs	Sadiqi et al. [55]; Chang et al. [24]; Chang et al. [84]; Chang et al. [19]; Von Meding et al. [92]	5
5	Reconstruction was not a priority of the government, and bureaucracy slowed the reconstruction processes	Acharya et al. [18]; Freitas and Mendes [79]; Ophiyandri et al. [45]; Bilau and Witt [37]	4
6	Lack of clear accountability and transparency	Sospeter et al. [81]; A. A. Bilau et al. [82]; Hidayat and Egbu [32]; Daly and Brassard [60]	4
7	A large number of stakeholders and organisations involved making collaboration complex	Daly and Brassard [60]; Li [39]; MacAskill and Guthrie [93]; Xu et al. [74]	4
8	Scant sharing of knowledge among participants	Fayazi and Lizarralde [58]; Walker et al. [33]; Fayazi et al. [26]; Ophiyandri et al. [45]	4
9	No previous experience and lack of capacity of government on large-scale reconstruction	Sadiqi et al. [55]; Chang et al. [84]; Saleh et al. [9]	3
10	Rigid top-down approach for management and government making centralised decisions	Sadiqi et al. [56]; Cho [25]; Daly and Brassard [60]	3
11	Lack of support and coordination between central state authorities and local government	Freitas and Mendes [79]; Chang et al. [19]	2
12	The gap between donors and affected communities	Sadiqi et al. [56]; Ophiyandri et al. [45]	2
13	Local-level units could not oversee large areas of varying topographical and climatic conditions leading to poor knowledge dissemination and control	Acharya et al. [18]	1
14	Data gathering in a centralised paper-based form in a bureaucratic manner leading to manipulation	Shuvo et al. [94]	1
15	Hard to find out who is eligible for assistance	Lin and Lin [68]	1
16	Local political affiliations resulting in lack of accountability and effectiveness of aid efforts	Daly and Brassard [60]	1
17	Inadequate institutional and organisational arrangements for management and implementation	Sospeter et al. [81]; A. A. Bilau et al. [82]	1
18	Lack of agencies in post-disaster	Daly and Brassard [60]	1
19	No strategic framework for coordination and collaboration among agencies	Hidayat and Egbu [32]	1
20	Lack of mutual understanding of priorities (collaboration) between organisations	Fayazi et al. [26]	1
21	Necessary information is not easy to obtain, and if obtained not on time	Sun et al. [71]	1
22	Uniform allocation of workloads to project officers	Kim and Choi [38]	1
23	Lack of communication between the designer, resident engineers, and project officers	Kim and Choi [38]	1
24	Implementation of building code challenging in dispersed islands	Ahmed and McDonnell [80]	1
25	Attitude to prioritise short term reconstruction over long-term development	Ahmed and McDonnell [80]	1
26	Recovery agencies not working well together and not communicating effectively with local authorities	Chang et al. [24]	1
27	The inconsistent flow of information released by recovery agencies	Chang-Richards et al. [69]	1
28	Reconstruction stages overlapped due to new aftershocks	Tagliacozzo [70]	1
29	Lack of coordination of organisations with local government affecting the distribution of grants	Saleh et al. [9]	1
30	People who experienced the most severe damage had to wait to get support due to poor management	Tagliacozzo [70]	1
31	Change of reconstruction communication during response and recovery, and later reconstruction	Tagliacozzo [70]	1
32	Temporary characteristics of participation of humanitarian organisations	Fayazi et al. [26]	1
33	Lack of trust of the community towards authorities	Tagliacozzo and Magni [72]	1

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Table 5 (continued)

Item	Description of challenge	Source	Number of citations
34	Lack of adequate knowledge of the local context of INGOs	Sadiqi et al. [55]	1
35	Non-participatory approach to rebuilding by local and overseas private contractors	Sadiqi et al. [55]	1
36	Poor coordination and communication between contractors and beneficiaries	Farni et al. [51]	1

The results of the study also reflected that some categories of challenges receive more focus than others in the literature. In terms of number of citations, resource challenges were the most reported, followed by management and collaboration challenges, and contractual, legislation and policy challenges. This suggests that resource challenges; management and collaboration challenges; and contractual, legislation, and policy challenges are more prevalent and persistent in post-disaster situations globally and have been the subject of numerous studies. The most prevalent challenges in each of these categories are:

- Resource challenges
 - o Resource shortages and challenges in securing adequate resources (manpower and materials).
 - o Cost escalation of resources.
- Management and collaboration challenges
 - o Failure to coordinate and integrate the work of various stakeholders and implementing partners who have their own goals and expectations can result in work duplication, resource wastage and incomplete implementation.
 - o Lack of technical and managerial capacity of local institutions and aid organisations to manage reconstruction.
- Contractual, legislation and policy challenges
 - o Inadequate or lack of government legislation and policies in disaster management.
 - o Lack of proper planning and government preparedness.

Second, the analysis of the findings has brought to light a prevalent challenge in reconstruction projects. The reliance on conventional legislation, policies, statutory processes, including standard construction contracts has led to numerous complications throughout the reconstruction process. Compounding this issue, governments often attempt to address these challenges by introducing new legislation without considering implementation requirements, consequently causing more project delays.

On the one hand, the use of standard legal frameworks in reconstruction raises concerns as they were not specifically designed to address disaster situations, and therefore directly impact the efficiency and effectiveness of reconstruction projects. For example, the implementation of standard council processes in New Zealand after the 2004 Manawatu Flood and 2005 Matata debris flow led to significant delays in reconstruction projects, attributed to a substantial backlog in building and resource consents [86].

On the other hand, when new legislation and regulatory requirements are introduced without thorough understanding of the implementation requirements, they may necessitate additional resources or skills not available locally, which impede the progress of reconstruction projects [71]. A good example of this issue is the Japanese government's enactment of new legislation for the reconstruction of the Sanriku region following the 2011 earthquake [40]. Insufficient support provided for implementing these new processes resulted in a slower reconstruction pace compared to the response to the Kobe earthquake of 1995.

There is a critical need for studies that explore legislation, policies, processes, procurements, and contracts specifically tailored for reconstruction following disasters. These studies should not merely highlight the need for different legislation, policies, and processes but should rigorously evaluate the implementation requirements. The findings of such studies will prove beneficial for governments and other stakeholders involved in the implementation phase in their endeavor to facilitate effective and timely reconstruction operations.

Third, the literature review also shows the majority of studies in the area of reconstruction concentrates mainly on housing reconstruction projects. Very few investigate non-residential projects. The research findings reveal a considerable portion of the studies chosen for this meta-analysis following the screening process were focused on the reconstruction of residential projects. This emphasis on housing reconstruction studies aligns with the observations made by Tafti and Tomlinson [35] and Daly and Brassard [60], indicating that the concentration on housing studies corresponds to the prevalent reality where a substantial portion of reconstruction funds from both governments and donors consistently prioritises residential reconstruction. Nevertheless, the importance of non-residential projects cannot be ignored, as the success of recovery efforts following a disaster relies on the timely reconstruction of critical infrastructures such as transportation [99].

A notable gap in the literature on reconstruction of non-housing projects was also highlighted by Hidayat and Egbu [83], who pointed out that there was then limited research on infrastructure reconstruction. While a few studies on infrastructure reconstruction have taken place since 2010, these studies are primarily focused on the reconstruction of road infrastructures only [99,100–104]. These existing studies in non-residential reconstruction fail to delve into challenges resulting from lack of necessary knowledge for procurement and contracting of large-scale non-residential reconstruction projects.

This gap presents a major limitation in this field. The absence of essential knowledge leads to the procurement of large-scale non-residential reconstruction projects through conventional methods, employing inadequately modified construction contracts ill-suited for post-disaster reconstruction needs. Li [39] highlights that the use of poorly drafted construction contracts results in challenges during the implementation phase of the reconstruction projects, particularly in cost control. Additionally, it was observed that recon-

Table 6
Resource challenges.

Item	Description of challenge	Source	Number of citations
1	Resource shortages and challenges in securing adequate resources (manpower and materials)	Acharya et al. [18]; Sospeter et al. [81]; Sun et al. [71]; Ahmed and McDonnell [80]; Freitas and Mendes [79]; Sewordor et al. [88]; Tagliacozzo [70]; A. A. Bilau et al. [82]; Fayazi and Lizarralde [58]; Enshassi et al. [10]; Bilau and Witt [37]; Hidayat and Egbu [83]; Ophiyandri et al. [45]; Chang et al. [84]; Chang et al. [63]; Omidvar et al. [57]; Farni et al. [51]	17
2	Cost escalation of resources	Acharya et al. [18]; Enshassi et al. [10]; Hidayat and Egbu [32]; Hidayat and Egbu [83]; Chang et al. [84]; Chang et al. [63]; Saleh et al. [9]; Farni et al. [51]	8
3	Disruption of supply chain and logistical and distribution challenges	Drolet et al. [95]; A. A. Bilau et al. [82]; Enshassi et al. [10]; Chang et al. [24]; Hidayat and Egbu [32]; Ophiyandri et al. [45]; Chang et al. [84]	7
4	High transportation costs and poor infrastructure for dispersal and delivery	A. A. Bilau et al. [82]; Enshassi et al. [10]; Chang et al. [24]; Chang et al. [19]; Saleh et al. [9]; Farni et al. [51]	6
5	Price fluctuations, volatility, and inflation due to excessive demand	Bilau and Witt [37]; Chang et al. [24]; Brandon [42]; Chang et al. [84]; Saleh et al. [5]	5
6	Long-lead time in acquiring resources (including importation)	A. A. Bilau et al. [82]; Chang et al. [19]; Chang et al. [84]; Ophiyandri et al. [45]; Chang et al. [63]	5
7	Lack of technical staff and trained personnel for monitoring	Sospeter et al. [81]; Ahmed and McDonnell [80]; Sun et al. [71]; Saleh et al. [9]	4
8	Lack of adequate skills for reconstruction	Ahmed and McDonnell [80]; Hidayat and Egbu [32]; Chang-Richards et al. [69]	3
9	Competition for limited resources	Fayazi and Lizarralde [58]; Chang et al. [24]; Chang et al. [84]	3
10	Inadequate manpower and materials in the local market	A. A. Bilau et al. [82]; Chang et al. [24]	2
11	Lack of transport alternatives	Chang et al. [24]; Saleh et al. [9]	2
12	Manpower shortage due to the introduction of modern building techniques and lack of timely training	Acharya et al. [18]; Saleh et al. [5]	2
13	Linguistic, cultural and visa challenges for migrant workers	Drolet et al. [95]; A. A. Bilau et al. [82]	2
14	The local industry could not produce materials like cement, steel, and concrete to meet large-scale reconstruction	Chang et al. [24]; Saleh et al. [9]	2
15	Poor resource management	Chang et al. [84]; Chang et al. [63]	2
16	The political situation leading to the departure of qualified labours	Saleh et al. [9]	1
17	Shortage of construction contractors	Wang et al. [96]	1
18	Lack of PPEs and safety materials at the site	Uddin et al. [78]	1
19	Shortage of experts and deployable skilled labour due to high demand	Ahmed and McDonnell [80]	1
20	A temporary supply of talent pool does not build long-term disaster resilience	Chang-Richards et al. [69]	1
21	The problem of providing temporary housing for contractors who come from outside of the town	Wang et al. [96]	1
22	Roles and responsibility sharing due to inadequate resources	A. A. Bilau et al. [82]	1
23	Delinquent delivery of materials	A. A. Bilau et al. [82]	1
24	Short-term expatriate contracts have detrimental effects in long-run	Opdyke et al. [97]	1
25	Recurring staff transitioning leads to new staff unknown about past operations and informal ties with the community	Opdyke et al. [97]	1
26	A large supply of low-cost imported labour	Daly and Brassard [60]	1
27	Factories impacted by disasters, resource constraints and transportation challenges	Li [39]	1
28	Use of inferior resources due to resource shortages	Chang et al. [19]	1
29	Low local transportation and supply capacity	Chang et al. [19]	1
30	Lack of suitable alternative resources	Chang et al. [84]	1
31	Difficulty in getting reconstruction materials to sensitive areas	Saleh et al. [9]	1

Table 7
Community engagement and cultural challenges.

Item	Description of challenge	Source	Number of citations
1	Inadequate opportunities for community participation	A. A. Bilau et al. [82]; Sadiqi et al. [56]; Bilau and Witt [37]; Lin [67]; Chang et al. [24]; Hidayat and Egbu [32]; Chang et al. [19]; Ge et al. [62]; Saleh et al. [9]	9
2	Community needs are not articulated, and community diversity is not taken into consideration	Acharya et al. [18]; Fayazi and Lizarralde [58]; Edgington [40]; Sadiqi et al. [56]; Sadiqi et al. [55]; Von Meding et al. [92]; Saleh et al. [5]	7
3	Inefficient and ill-organised communication and engagement of beneficiaries resulted in compromised social cohesion and poor housing products	Shuvo et al. [94]; A. A. Bilau et al. [82]; Sadiqi et al. [55]; Chang et al. [84]; Xu et al. [74]	5
4	Project culture and model not fitting to the needs of the community	Sospeter et al. [81]; Tran [98]; Lin and Lin [68]; Bilau and Witt [37]	4
5	Voices of marginalised (poor, disabled and isolated) and grass-root people not listened	Crawford and Morrison [76]; Cho [25]; Ge et al. [62]	3
6	Community lacking the capacity and skill to participate	Sadiqi et al. [56]; Tran [98]; Saleh et al. [5]	3
7	Resources from NGOs and public donations are not well distributed due to sociocultural differences	Lin and Lin [68]; Hidayat and Egbu [32]	2
8	Community withdrawing from housing process to focus on generating income	Tafti and Tomlinson [35]; Saleh et al. [5]	2
9	Not considering the eligibility of project participants	Kim and Choi [38]	1
10	Challenges in the selection of project beneficiaries	Hidayat and Egbu [32]	1
11	Long-time was taken to form a community organisation	Saleh et al. [5]	1
12	Non-transparent recruitment process leading to dissatisfaction from the community	Malahayati et al. [61]	1
13	Leaders of community organisations are chosen without expertise and skills in housing construction	Malahayati et al. [61]	1
14	Land-less people are discriminated in getting housing grants	Crawford and Morrison [76]	1
15	Type design compromising the local traditional architecture	Acharya et al. [18]	1
16	Many valuable heritage were unnecessarily demolished instead of being retrofitted because there was a lack of understanding of heritage reconstruction procedures	Acharya et al. [18]	1
17	Reduction of community engagement and bi-directional communication by the predominant use of social media	Tagliacozzo and Magni [73]	1
18	The belief in the safety of modern buildings and the idea of progressing communities caused a shift away from preserving the original architectural styles	Rawal et al. [75]	1
19	A challenge to distinguish the native community from opportunistic immigrants	Fayazi et al. [26]	1
20	Low-income people using up the support money	Tafti and Tomlinson [35]	1
21	Community-saving up reconstruction grant for alternative use	Osland [91]	1
22	Community unwilling to manage the reconstruction of their homes	Saleh et al. [5]	1
23	Late change and redesign from the community	Waheeb and Andersen [59]	1

struction projects often employ complex standard construction contracts recommended by donors, necessitating a high-level of administration. Due to the inherent complexity of reconstruction projects, the administrative demands of these contracts often surpass the capacity and capability of the implementers [60]. Consequently, the resulting administrative challenges directly impact efficiency, lead to disputes, and ultimately result in delays in the reconstruction process. There is a compelling need for further research on post-disaster reconstruction of non-residential projects to enhance knowledge and establish best practices for effective procurement and implementation.

Although this paper does not address every highlighted gap in the literature, it equips the readers with a comprehensive understanding of the types of challenges encountered in post-disaster reconstruction projects. This knowledge not only helps in risk mitigation in reconstruction projects but also empowers the decision-makers to make better-informed decisions. Lastly, the identified gaps offer potential avenues for future research, particularly in areas that have received limited attention in the reconstruction literature.

Limitations

The paper's resources were mainly collected from academic databases and only included peer-reviewed journal and conference papers. Very little information from other relevant sources, like theses at post-graduate levels, books, and reports, was considered. Furthermore, papers and journals using languages besides English were also scoped out from the study. More comprehensive research could be done by including resources in the future.

Table 8
Financial challenges.

Item	Description of challenge	Source	Number of citations
1	Shortage of funds for reconstruction causing additional financial burdens	Sospeter et al. [81]; Rawal et al. [75]; Ahmed and McDonnell [80]; Enshassi et al. [10]; Sadiqi et al. [56]; Powell [22]; Hidayat and Egbu [83]; Osland [91]; Chang et al. [63]; MacAskill and Guthrie [28]; Waheeb and Andersen [59]; Saleh et al. [5]; Saleh et al. [9]	13
2	Corruption of the reconstruction budget by management and contractors	Shuvo et al. [94]; Sospeter et al. [81]; Freitas and Mendes [79]; Sadiqi et al. [56]; Hidayat and Egbu [32]; Brandon [42]; Von Meding et al. [92]; Saleh et al. [5]	8
3	Inadequate financial management	A. A. Bilau et al. [82]; Enshassi et al. [10]; Sadiqi et al. [56]; Von Meding et al. [92]	4
4	Fraudulent use and waste of funds	Sadiqi et al. [56]; Sadiqi et al. [55]; Saleh et al. [5]	3
5	Difficult to secure support for less-known areas due to inequitable funding practices	Sewordor et al. [88]; Edgington [40]	2
6	Cost overruns due to escalation of materials and labour costs	Sospeter et al. [81]; A. A. Bilau et al. [82]	2
7	Delayed remittance of donor pledges and non-flexible budgetary system causing a delay in the disbursement of funds	Uddin et al. [77]; A. A. Bilau et al. [82]	2
8	National income dependent on aid	Ahmed and McDonnell [80]	1
9	Excessive pressure leading to funds not being allocated in an optimum way	Wang et al. [64]	1
10	Implementation failure due to insufficient funding	Farni et al. [51]	1
11	Regular fund release modality implemented despite Reconstruction Act establishing separate reconstruction fund	Acharya et al. [18]	1
12	Unaffordable costs leading to the construction of small-sized homes that do not meet the needs of owners	Rawal et al. [75]	1
13	Insufficient funds for training community	Malahayati et al. [61]	1
14	Lack of safety due to the limited financial capacity	Tran [98]	1
15	High inflation slowing reconstruction	Tafti and Tomlinson [35]	1
16	Delays from local government with insufficient funds relying on the central government for funding	Le Masurier et al. [86]	1
17	High cost of repairs	MacAskill and Guthrie [28]	1
18	Owner trying to expand scope on a fixed budget	Waheeb and Andersen [59]	1
19	Donor influence in politics with conditional funding	Saleh et al. [9]	1
20	Political conflict from uneven distribution of aid money	Osland [91]	1

Table 9
Physical/territorial challenges.

Item	Description of challenge	Source	Number of citations
1	Complex property rights issues (unclear land ownership, boundaries and access)	Sospeter et al. [81]; Li et al. [66]; Edgington [40]; Hidayat and Egbu [32]; Daly and Brassard [60]; Brandon [42]; Osland [91]; Waheeb and Andersen [59]; Saleh et al. [9]	9
2	Relocation causing extra costs and changes to indigenous lifestyles	Sospeter et al. [81]; Edgington [40]; Sadiqi et al. [56]; Lin and Lin [68]; Sadiqi et al. [55]; Hidayat and Egbu [83]; Waheeb and Andersen [59]; Xu et al. [74]	8
3	Lack of access, poor access, or no alternate access to sites compromising resource delivery	Sospeter et al. [81]; Enshassi et al. [10]; Bilau and Witt [37]; Ophiyandri et al. [45]; Farni et al. [51]	5
4	A challenge from difficult terrain and some areas inaccessible due to weather	Acharya et al. [18]; Edgington [40]	2
5	Lack of job opportunities in relocated areas	Lin and Lin [68]	1
6	Difficulties in land acquisition	Lin [67]	1
7	Geographically dispersed sites causing delays	A. A. Bilau et al. [82]	1

Declaration of use of generative AI

During the preparation of this work the author(s) used Grammarly and ChatGPT in order to simplify complex and hard-to-read sentences, aiming to make the overall writing clearer, more concise, and grammatically correct. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Table 10
Challenges from natural causes.

Item	Description of challenge	Source	Number of citations
1	Reduced productivity due to high temperatures in summer and rainfall in winter and spring	Chang et al. [63]; Waheeb and Andersen [59]	2
2	Secondary damage from succeeding disasters/aftershocks	Kim and Choi [38]	1
3	Long non-working periods due to climate and weather (extreme hot or cold)	Kim and Choi [38]	1

Table 11
Other challenges.

Item	Description of challenge	Source	Number of citations
1	Inflexible short deadlines due to pressure from donors, government and other stakeholders to produce tangible outcomes quickly	Sadiqi et al. [56]; Walker et al. [33]; Bilau and Witt [37]; Daly and Brassard [60]; Hidayat and Egbu [83]; Chang et al. [84]; Von Meding et al. [92]	7
2	Slow or delayed reconstruction	Freitas and Mendes [79]; Edgington [40]; Platt and So [21]; Hidayat and Egbu [32]; Osland [91]	5
3	Lack of site information and other data	Sun et al. [71]; Freitas and Mendes [79]; Hidayat and Egbu [32]	3
4	Challenges in the safe management of debris due to space constraints, unstable structures, location and aftershocks	Uddin et al. [77]; Bilau and Witt [37]; Hidayat and Egbu [32]	3
5	Workers' low morale, stress, fatigue, and mental health problems leading to lowered productivity after disasters	Uddin et al. [78]; Uddin et al. [77]; Tagliacozzo and Magni [73]	3
6	Security issues (including terrorism)	Tagliacozzo [70]; Sadiqi et al. [55]; Waheeb and Andersen [59]	3
7	Owners pressurising workers to do overtime and to work faster, compromising health and safety in an owner-driven reconstruction approach	Uddin et al. [78]; Uddin et al. [77]	2
8	Socio-psychological impact on owners slowing reconstruction - some do not want to participate in the reconstruction	Chang et al. [24]; Omidvar et al. [57]	2
9	Political uncertainty in the country	Sospeter et al. [81]; Hidayat and Egbu [83]	2
10	Chaotic and dynamic reconstruction environment	Bilau and Witt [37]; Rad et al. [85]	2
11	Extended demolition phase lasting years	Tagliacozzo [70]	1
12	Unknown and hidden damages	Kim and Choi [38]	1
13	A long gap between relief and reconstruction	Brandon [42]	1
14	Delay in the design phase causing frustration	Fayazi et al. [26]	1
15	Inaccurate damage data taking a long-time for validation, causing delays	Malahayati et al. [61]	1
16	Lack of safety training leading to workplace injury, illness and fatality	Uddin et al. [78]	1
17	Workers declining offers from lack of safety equipment due to safety risk perception	Uddin et al. [77]	1
18	Hazardous and contagious debris	Uddin et al. [78]	1
19	Not having training in disaster psychology or social interaction skills, and lacking the ability to cope with the challenges of disasters	Chang-Richards et al. [69]	1
20	New public holidays delaying reconstruction	Waheeb and Andersen [59]	1
21	Large housing demand in the short term	Li et al. [66]	1
22	Scale and complexity of reconstruction	Bilau and Witt [37]	1
23	Lack of industry engagement	Chang et al. [24]	1
24	Environmental concerns in the mining of materials after a disaster	Chang et al. [63]	1
25	Academic and professionals in disaster management few in number and also insufficient in the proficiency of skills and scope of research	Ge et al. [62]	1
26	External factors (national power shortage, water unavailability, sewerage problems, high groundwater, pest breakouts, etc.)	Waheeb and Andersen [59]	1

CRediT authorship contribution statement

Ayush Puri: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Mohamed Elkhariouty:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Naseem Ameer Ali:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

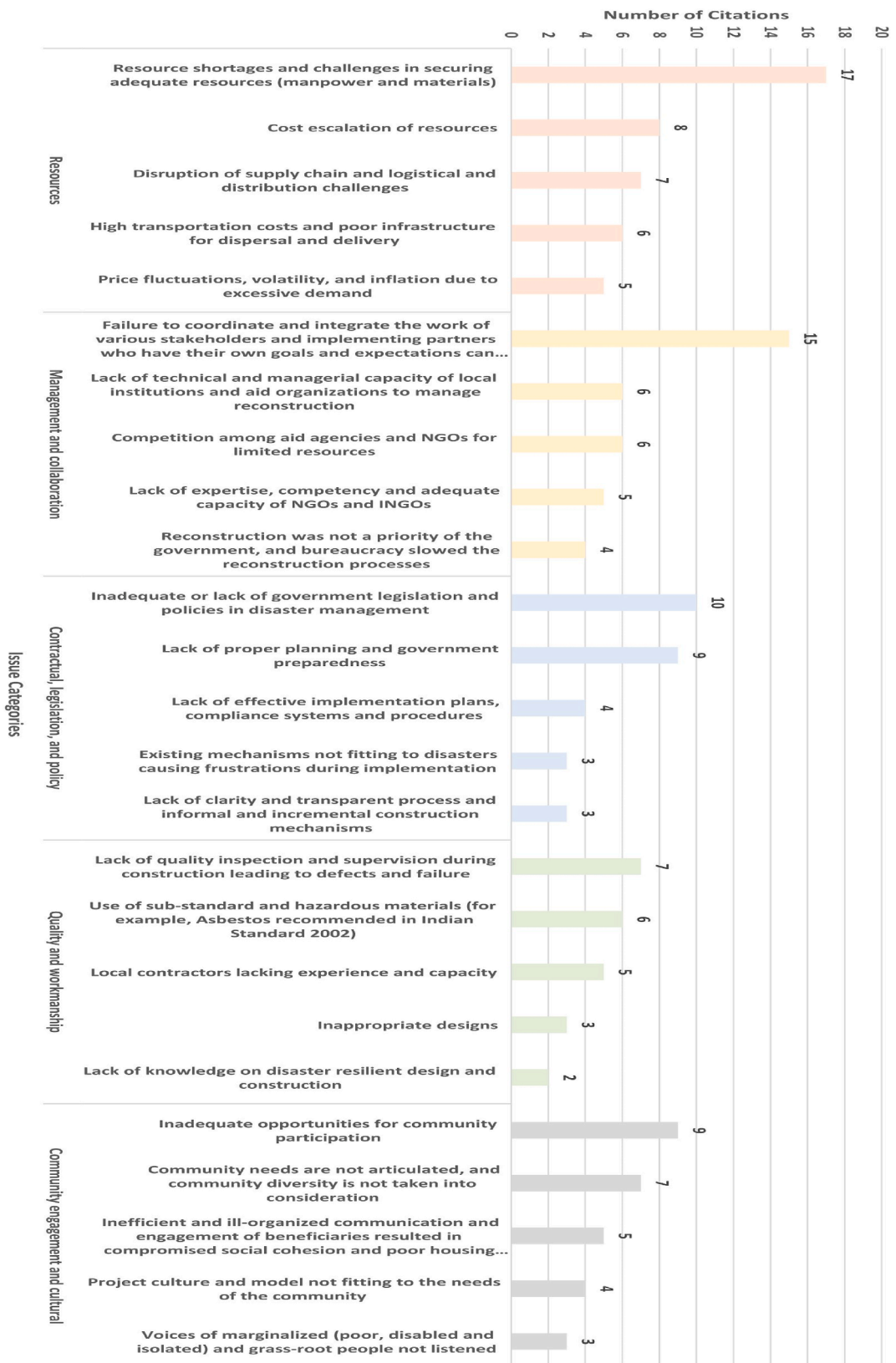


Fig. 2. Five most-cited challenges within top five most-cited categories.

Data availability

No data was used for the research described in the article.

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