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The Critical Components of an Integrated Decision Making Framework for Enhancing Post Destruction Reconstruction

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ABSTRACT: Post destruction reconstruction of the built environment is a critical process that demands a balance between immediate recovery needs and long term sustainability. Although speed is frequently given priority over quality due to necessity of rebuilding, the lack of integrated decision making frameworks has led to disjointed efforts, insufficient resources and lesser ideal results. This systematical review investigates the critical components required to develop an integrated decision making framework targeted for post destruction reconstruction of the built environment. Pakistan faces frequent and swear natural disasters due to its geographic and climate conditions, including earthquakes, floods and droughts. Recent events such as the 2022 flood that affected over 33 million people, have exposed the vulnerabilities of the country's disaster management systems. Using a harsh methodology, this study examined peer-reviewed literature from 2010 to 2024, focusing on challenges, strategies and tools in reconstruction efforts. Key findings reveal the importance of three interconnected components that are stakeholder collaboration, technological integration and sustainability considerations. Stakeholder engagement fosters inclusivity and aligns priorities across governments, communities, and private organisations. Technological tools such as Geographic Information Systems (GIS), Building Information Modeling (BIM), and multi criteria decision analysis (MCDA) enhance planning and operational efficiency. Sustainability principles emphasize resilience through the use of energy efficient designs, environmentally friendly materials, and disaster resilient construction techniques. This review contributes in filling the gaps in the existing frameworks by synthesizing evidence and proposing actionable recommendations and also examines how an integrated decision making framework can enhance Pakistan's disaster response and reconstruction capabilities ensuring sustainability and Resilience. The insights aim to assist policy makers, urban planners, and reconstruction practitioners in improving recovery outcomes.

KEYWORDS: Post destruction reconstruction, decision making frameworks, built environment, stakeholder collaboration, technological integration, sustainability, resilience.

INTRODUCTION

Post destruction reconstruction of the built environment represents a critical challenge that affects millions of lives worldwide. Natural disasters, including earthquakes, hurricane, tsunamis, and floods, as well as man made crisis, often result in widespread destruction of physical infrastructure. The built environment, comprising residential housing, transportation systems, public facilities, utilities and commercial spaces, is vital for the social economic and environmental stability of affected regions (Ballash et al., 2020). If effective reconstruction efforts are not done in time, communities face prolonged descriptions to the livelihoods, and delayed recovery. However, despite it's significance, reconstruction efforts have often fallen short due to inadequate planning, fragmented decision making, and the absence of a comprehensive framework to guide the process (Guo et al., 2018).

Pakistan's susceptibility to natural disasters stems from its unique geographical position and extreme weather events due to climate change (World Bank, 2022). Events like the 2005 Kashmir earthquake and the 2010 Indus floods have caused extensive damage highlighting gaps in disaster preparedness and response. The 2022 floods alone resulted in losses exceeding $30 Billion, underscoring the need for a robust framework tailored to Pakistan 's context ("Pakistan Floods 2022: Post-Disaster Needs Assessment | UNDP Climate Promise," 2020). Effective decision making frameworks must consider the country's resource constraints, governance challenges and social economic differences.

Figure 1 Disaster management flowchart (Mungfali, 2018)

The built environment plays an essential role in disaster recovery by serving as the foundation for the resumption of economic activities, restoration of social services, and promotion of long term sustainability. Rebuilding the physical infrastructure after a disaster not only addresses immediate needs but also provides and opportunity to "Build Back Better" buy incorporating resilience, sustainability and innovation into reconstruction practices. Unfortunately, the urgency of post disaster recovery often leads to a prioritization of speed over quality, that results in the mismanagement of resources. There is no coordination, very poor management, and unsatisfactory outcomes. For instance, many reconstruction initiative fail to incorporate disaster resilient design principles, leaving the rebuilt infrastructure vulnerable to future disasters (Mavi et al., 2021)("International Journal of Disaster Risk Reduction | Vol 95, September 2023 | ScienceDirect.com by Elsevier," 2023). Similarly, a lack of integration among stakeholders, ranging from government and international organisations to local communities and private sectors, creates in efficiencies that hinder recovery efforts (Afkhamiaghda & Elwakil, 2022).

The complexity of post destruction reconstruction is compounded by the diverse and often conflicting priorities of stakeholders involved in the process. Governments typically emphasize public welfare while international organisations focus on funding distribution. Local community is as the primary beneficiaries, demand cultural appropriate and context sensitive solutions, where as private sector entities prioritize cost efficiency and profitability (Baroudi & R. Rapp, 2014) (Adaji, Mohamed, Ebenehi, Guma, & Onuvava, 2019). These competing interests under score the need for a decision making framework that can harmonized diverse objectives and faster collaboration among stakeholders. Effective stakeholder engagement is crucial for ensuring that reconstruction efforts are aligned with the needs of affected communities.

Technological advancements offer significant potential to improve the efficiency and effectiveness of post destruction reconstruction. Tools such as geographic information system (GIS), building information modelling (BIM), and multi criteria decision analysis (MCDA) have been increasingly adopted to enhance data driven decision making, and improve project management (Cao, Xu, Aziz, & Kamaruzzaman, 2023)(Jazmín & Guzmán, n.d.). GIS facilities special analysis and mapping of affected areas, providing critical insights into the extent of damage and resource needs.

BIM supports integrated project design and management, enabling stakeholders to visualize reconstruction plans and evaluate their feasibility. MCDA provides a structured approach for evaluating trade-offs among multiple objectives, helping decision makers prayer toys actions based on social, economic and environmental criteria (Guo et al., 2018). Despite their potential these technology is often underutilise due to a lack of technical expertise, financial constraints and limited coordination among stakeholders.

In addition to technological integration, sustainability is a fundamental consideration in post destruction reconstruction. Sustainable reconstruction practices emphasize the use of environmental friendly materials and disaster region construction techniques to create infrastructure that can with stand future shocks while minimising environmental impacts (Sertyesilisik, 2017)(Rose, 2011). The concept of sustainability extends beyond environmental dimensions to include social and

economic aspects. For Example, re-building efforts in culturally sensitive areas should respect to rational architectural styles and community preferences while incorporating modern safety standards. However, achieving sustainability in reconstruction requires a balance between immediate recovery needs and long term development goals which is often difficult to achieve without a clear and integrated framework (Ballash et al., 2020).

Even while the value of integrity is seen making frameworks is becoming more widely acknowledged, current methods are still inadequately adopted to the challenges of post destruction restoration. The application of many frameworks to a variety of scenarios is limited because they are created for particular disaster kinds or geographical areas. Furthermore, that dynamic nature of rebuilding requires constant adaptation to changing circumstances and stake order objectives which is something most frameworks for short of addressing (Rose, 2011)(Ismail, Halog, & Smith, 2017). These gaps highlight the need for a systematic review to identify the critical components of an effective decision making framework and proposed strategies for its development and implementation.

This study seeks to address these caps by answering the central research question: what are the critical components of an integrated the CN making framework for enhancing post structure reconstruction of the built environment? Through a systematic review of the literature, this study aims to identify key challenges, strategies and tools that can inform the development of robust frameworks. The review focuses on three interconnected components: stakeholder collaboration, technological integration, and sustainability considerations. Stakeholder collaboration emphasizes the important of inclusivity, transparency and alignment of priorities. Technological integration highlights the potential of advanced tools and methodology to improve decision making, resource management and project outcomes. Sustainability considerations highlights the need to balance immediate recovery needs with long term resilience.

By synthesizing evidence from existing studies, this review AIIMS to bridge the gap between the theoretical frameworks and practical applications, offering insights for policy makers, and reconstruction practitioners. This review also identifies opportunities for future research to define and expand existing frameworks, ensuring their applicability to diverse regional and cultural contexts

To provide a systematic and coherent analysis, this review is organised into several sections. The methodology section describes the systematic approach used to identify and analyse relevant literature. The literature review examines the challenges, strategies, and tools associated with post destruction reconstruction. The results section summarisation key findings related to the critical components of effective decision making frameworks. The discussion section interprets these findings, proposes are conceptual framework, and addresses limitations. Finally, the review concludes by highlighting key takeaways and offering recommendations for future research and practical implementation. This study seeks to advance the field of post destruction reconstruction and support efforts to build resilient and sustainable build environments.

METHODOLOGY

Research Design

This study adopts a systematic review methodology to investigate the critical components of an integrated decision making framework foreign enhancing post destruction reconstruction of the built environment. Systematic reviews are widely recognised as a rigorous and transparent method for synthesizing existing research to answer complex research questions (Petticrew & Roberts, 2006). This approach is particularly suited to the present study as it enable the identification, evaluation and synthesis of diverse evidence from various disciplines such as disaster management and sustainability studies. The systematic review design ensures a comprehensive and unbiased assessment of the existing literature and providing foundation for developing recommendations and frameworks.

The selection of a systematic review design aligns with the study's objective to provide an evidence based understanding of decision making frameworks in post destruction reconstruction. Unlike narrative reviews, which often lack methodological preciseness and our susceptible to bias, systematic reviews follow a structured and replicable process to identify relevant studies (Moher, Liberati, Tetzlaff, & Altman, 2009). This ensures that the findings are comprehensive, reliable, and applicable to both theoretical and practical contexts. Furthermore, the systematic review approach facilitate the integration of multi disciplinary perspectives, which is essential for addressing the complex and multi faced nature of post disaster reconstruction.

This research is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a widely accepted standard for conducting and reporting systematic reviews (Page et al., 2021). The PRISMA framework was chosen 4 it's emphasis on transparency, reproducibility and methodological preciseness. It's structured approach includes 4 key stages: eligibility, identification, screening and inclusion. Each stage is documented to ensure clarity and consistency to enable future researchers to replicate the study if needed

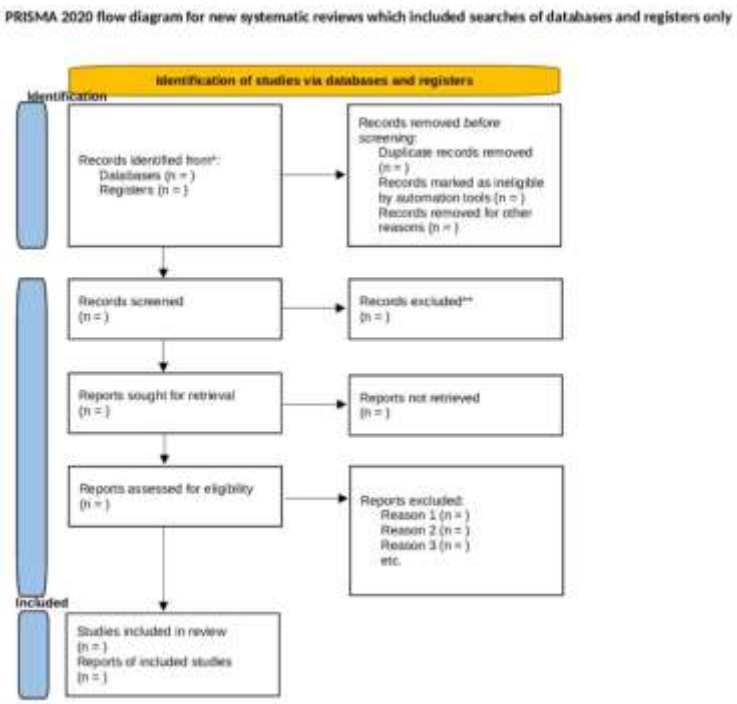

Figure 2 PRISMA 2020 flow diagram for new systematic reviews

The systematic review design also reflects the study's commitment to addressing gaps in the existing literature. Relevant studies revealed a lack of comprehensive frameworks that integrates stay order collaboration, technological advancements and sustainability principles in post destruction reconstruction. Bye synthesizing evidence from diverse sources, this review aims in filling these gaps and offer insights for researchers.

Given the interdisciplinary nature of the research topic, they study incorporates evidence from various domains including disaster risk reduction and sustainable development. The systematic review design helps create these diverse perspectives, highlighting differences in approaches to post destruction reconstruction. It is crucial for identifying the best method, challenges and opportunities that can aid in the development of effective decision making frameworks.

The research design also emphasizes inclusivity hand transparency in the development of results. Efforts were made to minimise bias by clearly defining inclusion and exclusion criteria using multiple databases and utilizing standardised data extraction and analysis procedures. Additionally, this study recognises the importance of factors such as geographic location, cultural considerations and social economic conditions. They have any effect on the applicability of decision making frameworks. By explaining these factors, this systematic review aims to provide insights that are both generalized and context sensitive.

RESEARCH STRATEGY

The search strategy for this systematic review was designed to identify, select an evaluate the most relevant literature addressing decision making frameworks for post destruction reconstruction. To guarantee the accuracy and reproducibility of the results, authoro methodology was used that included several databases, previously determinant search phrases, and widget inclusion and exclusion criteria. This systematic and transparent search process alliance with the PRISMA framework and strengthens the credibility of this review (Moher, Liberati, Tetzlaff, & Altman, 2009).

The study relies on a systematic review of Pakistan specific disaster management literature, including reports from the national disaster management authority NDMA, and international organisations. Case studies from the 2005 earthquake in 2010 floods are analysed to understand the effectiveness of existing frameworks. For instance, the NDMA's strategies are evaluated for their impact on community resilience and resource allocation. Secondary data is drawn from peer-reviewed journals, government reports and international aid evaluations.

The literature search was conducted across multiple electronic databases including Scopus, Web of Science, PubMed, and Google Scholar. These databases were selected based on their extensive coverage of peer reviewed journals and relevance to the research topic. Additionally, specific sources such as International Journal of Disaster Risk Reduction and The Journal of Urban Resilience were reviewed to capture specific studies. To ensure inclusivity,

policy documents and reports from organisation such as United Nations Office for Disaster Risk Reduction (UNDRR) and the World Bank, were also considered.

The search process begin with the development of a set of keywords and phrases based on the research question and objectives. These terms was selected to reflect the key components of the study including "post destruction reconstruction, decision making frameworks, built environment, stakeholder collaboration, technological integration, sustainability, and resilience". Operators such as AND, OR and NOT why used to refine search queries and capture relevant studies. Wild card symbols why also utilized four variations in terminology such as "reconstruction" and "rebuilding".

The search was limited to articles published in English between 2010 and 2024 to obtain perspectives on post destruction reconstruction while excluding outdated or irrelevant studies. This time frame was selected to reflect the increasing global emphasis on resilience, sustainability and technologic innovation in disaster recovery over the past two decades. Inclusion and exclusion criteria while predefined to ensure the relevance and quality of the selected studies.

Studies were included which:

- Address this year making frameworks or models relevant to post destruction reconstruction
- Focused on stakeholder collaboration, technology or sustainability in reconstruction efforts.
- Presented empirical and theoretical evidence, applicable to disaster recovery contexts.

Studies were excluded which:

- Focused solely on non disaster related reconstruction.
- Published in languages other than English
- Lacked sufficient methodological detail or relevance to the research question

Duplicate studies were identified and removed, ensuring that only unique articles for included in the final data set. By employing a structured search strategy, this review aims to provide a comprehensive synthesis of existing knowledge on integrated decision making frameworks for post destruction reconstruction. The documentation of search processes and criteria ensures transparency and reliability.

Table 1 Summary of studies reviewed

AUTHOR(S)	TITLE	KEY FINDINGS
Ahmad et al. (2021)	Leverage in technology in disaster management	Discussed the role of advanced technology such as drones and IoT, any proving disaster assessments and reconstruction efficiency.
Petticrew & Roberts (2006)	Systematic reviews in the Social science. A practical guide.	Provided a methodological foundation for conducting systematic reviews to synthesize evidence effectively.
UNDP (2022)	Pakistan floods 2022: damage, loss and needs assessment	Analysed tha socio economic and environmental impacts of the 2022 floods in Pakistan, emphasizing the need of sustainable recovery
Adaji et al. (2019)	Stakeholders in Post Disaster Housing Reconstruction (PDHR): Meaning, Classification, and Benefits	Identified key stakeholder rolls in housing reconstruction post disaster, emphasizing their classification and benefits to recovery.
Afkhamiaghda & Elwakil (2022)	Challenges Review of Decision Making in Post-Disaster Construction	Highlighted the CN making challenges in post disaster construction including resource constraints and stakeholder misalignment

Bakic & Ajdukovic (2021)	Resilience After Natural Disasters: Harnessing Resources in Flood-Exposed	Community is discussed community based resource mobilization and resilience building post flood.
Baroudi & Rapp (2014)	Stakeholder Management in Disaster Restoration Projects	Emphasized the importance of effective state holder management to streamline disaster Restoration projects.
Cao et al. (2023)	BIM–GIS Integrated Utilization in Urban Disaster Management: Contributions, Challenges, and Future Directions	Analysed the integration of BIM and GIS for disaster management, addressing contributions, challenges and future opportunities.
Khan & Jan (2014)	Community-Based Disaster Risk Management in Pakistan	Provided inside into community drive and disaster risk management strategies tailors for Pakistan unique social economic contexts.
Shah et al. (2022)	Inter-Agency Collaboration and Disaster Management: A Case Study of the 2005 Earthquake Disaster in Pakistan	Highlighted the importance of intelligence collaboration during the 2005 earthquake recovery efforts in Pakistan.
Shi et al. (2021)	A conceptual Framework Integrating "Building Back Better" and Post-Earthquake Needs	Proposed a framework combining the building back better concept with disaster recovery needs to enhance reconstruction outcomes.
Ahmed & Mustafa (2020)	Disaster risk reduction in Pakistan	Discussed systemic issues and challenges in Pakistan's disaster risk reduction efforts and proposed community inclusive solutions.
UNDRR (2020)	Sendai Framework for Disaster Risk Reduction 2015-2030	Established global guidelines for disaster risk reduction focusing bone resilience and sustainability
World Bank (2022)	Building resilient infrastructure for the future	Address the role of resiliant infrastructure introducing disaster vulnerability and fostering long term recovery
Qureshi (2020)	Disaster management in Pakistan: A case study of 2005 earthquake	Examined challenges in disaster management during the 2005 earthquake and recommended improvements in coordination
Jones & Silva (2019)	Sustainable design principles in reconstruction: a systematic review.	Highlighted sustainable practices for reconstruction including eco friendly materials and renewable energy integration.

Higgings & Green (2011)	Cochrane handbook for systematic reviews of interventions.	Provided methodological gardens for systematic reviews to ensure rigor and reliability in evidence synthesis
Kitchenham & Charters (2007)	Guidelines for performing systematic literature reviews in software engineering	Detailed systematic review methodologies that can be adopted to various domains, including disaster management
Khan et al. (2015)	Community based disaster risk reduction in Pakistan: lessons from the 2010 floods.	Identified effective community based disaster risk reduction strategies implemented during Pakistan's 2010 floods.
Chmutina et al. (2018)	Sustainability in post disaster recovery	Explode the importance of sustainability in reconstruction efforts focusing on environmental and social dimensions.
Page et al. (2021)	PRISMA 2020 Statement: updated guidelines for reporting systematic reviews	Updated the PRISMA framework to in short transparency and reproducibility in systematic review reporting.
Brauner et al. (2016)	Utilising GIS in urban disaster management	Demonstrated the effectiveness of GIS in mapping and assessing disaster affected urban areas for reconstruction.
NDMA (2020)	Pakistan disaster risk management framework	Outlined institutional strategies and gaps in disaster risk management specific to Pakistan.
Brereton et al. (2007)	Lessons from applying the systematic literature review process	Shared practical insights into conducting systematic reviews including common challenges and solutions
Zuo et al. (2022)	The hybrid model in post disaster reconstruction	Proposed a hybrid decision making model that balances centralised planning with localised execution to enhance reconstruction outcomes.
Higgins et al. (2011)	Cochrane handbook for systematic reviews of interventions	Provided detailed methodologies for quality assessment and bias mitigation in systematic reviews
Jordan et al. (2019)	Multi stakeholder approaches in disaster recovery	Emphasized Danish SST of stakeholder coordination to streamlined disaster recovery efforts.

Owen & Dávila (2020)	Building back Better: community participation in post disaster reconstruction	Demonstrated the effectiveness of involving communities in recovery planning.
Khan & Mustafa (2015)	Disaster preparedness in Pakistan: lessons from the 2010 floods	Highlighted community level preparedness strategies that mitigated losses during the 2010 floods in Pakistan
World Bank (2016)	Building resiliant cities	Provided a framework for urban resilience IND disaster prone areas emphasizing planning and technology integration.
Grant & Booth (2009)	A Typology of reviews: an analysis of 14 review types and associated methodologies.	Categorised various review types and their methodologies. Provided insights into systematic review best practices.

DATA COLLECTION

That data extraction process was designed to collect and organise relevant information from selected studies. The step is crucial for synthesizing evidence to answer the research question effectively and develop an integrated the same making framework for post destruction reconstruction. To speed up the extraction process and reduce errors, a systematic method was used that was driving by standard formats and software tools.

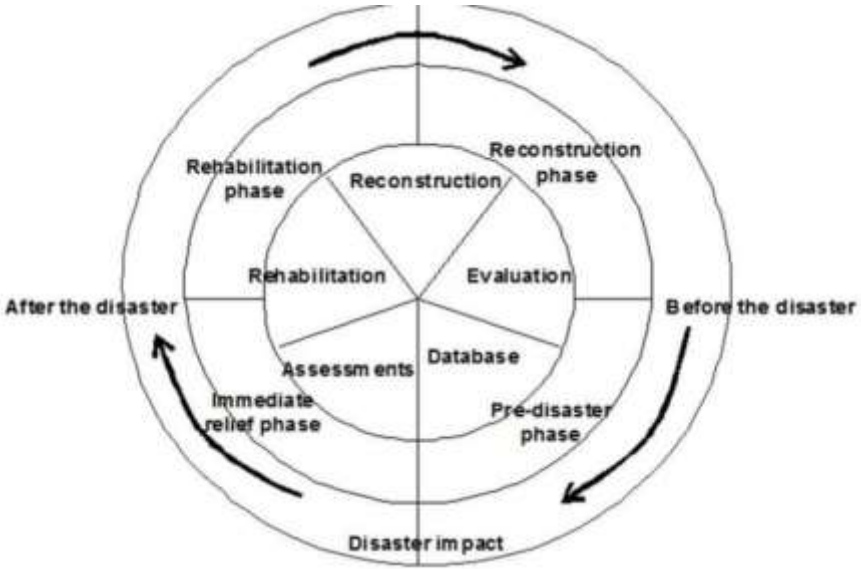

Figure 3 Post disaster reconstrution cycle (Adamy, Bakar, & Razak , 2019)

To gather important information from each study, such as bibliographic information, key findings, research objectives, methodologies and relevance to the study objectives, a data extraction form was created. To make sure that it was comprehensive and clear, this form was tested on a number of articles. The form's usefulness for gathering a variety of evidence types, such as quantitative data, qualitative results and theoretical ideas was in short via adjustments based on feedback from this trial phase (Kitchenham & Charters, 2007).

The key variables collected from the extracted data and analysis of the study include:

Study characteristics: Author, year of publication, title and source

Research context: geographic location, disaster type, and reconstruction phase addressed

Methodology: research design, data collection methods and analytical approaches

Framework element: stakeholder involvement, technology integration and sustainability principles

Findings and implications: Key outcomes, recommendations and relevance to the decision making framework

For studies involving quantitative data, additional details such as statistical techniques and results were recorded. The standardised form made sure that all relevant aspects of each study world systematically extracted aiding in the comprehensive analysis. The extracted data was regularly refined or whenever needed.

To summarize, The attacks action process was carefully designed to ensure systematic and precise collection of information from the selected studies. The use of standardised form and software tools in has the reliability of the process that made sure a proper synthesis and analysis of the findings.

Data Synthesis and Analysis

In this systematic review, the synthesis and analysis of collected data are crucial processes that help convert unstructured data into insightful knowledge that addresses the study topic. A mixed methods approach was used to integrate qualitative and quantitative findings because the topic is diverse. It ensures and in-depth understanding of post destruction reconstruction decision making frameworks.

Filtering the data of obtained according to the central concept areas relevant to the study goals was the first stage of the data synthesis process. Stakeholder corporation, technology integration, sustainability concepts, and decision making procedures were among the major themes. These themes were created naturally from emerging patterns found during data extraction as well as deductively from the study question and inclusion criteria. The categorization of each study to one or more categories allowed for a thorough comparison of results from various sources (Braun & Clarke, 2006).

Based on the synthesized findings, an integrated framework for decision making in post destruction reconstruction was generated. This framework draws best practices and evidence from the literature, incorporating the elements of stakeholder collaboration, technological innovation and sustainability principles. The framework is designed to be adaptable to diverse contexts, acknowledging the variability in cultural factors, social economic factors and geographic that affect the reconstruction processes.

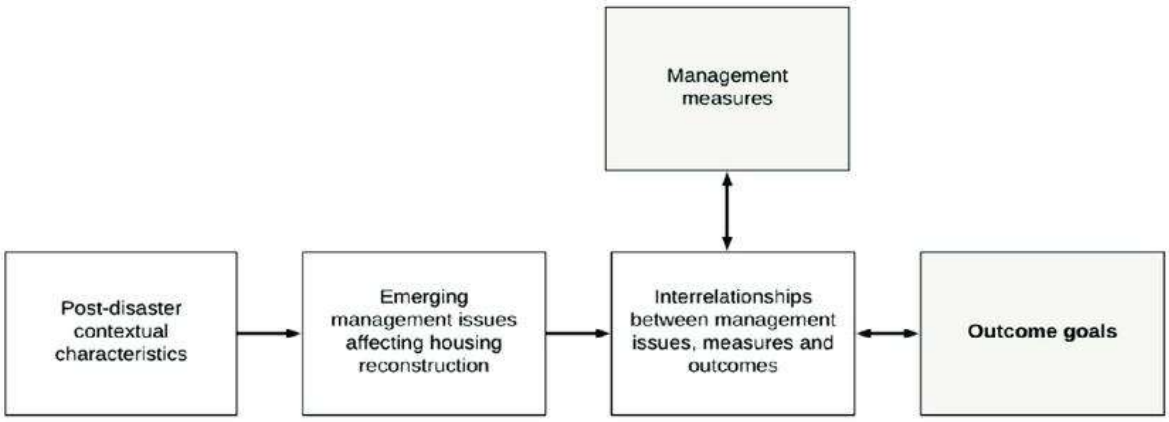

Figure 4 Conceptual framework for the management of post disaster housing reconstruction (Rashmi Sanchaniya, Nithya Somrajan, & Ineta Geipele, 2023)

To make sure the reliability and validity of the findings, a critical appraisal of included studies was conducted. Those with significant methodological limitations were weighted less heavily in the synthesis, to make sure that conclusions were primarily based on high quality evidence.

Bias in data was addressed through several strategies such as: Transparency: detailed documentation of the synthesis process allowing for reproducibility AND Triangulation: cross referencing findings from multiple studies to verify their consistency

The synthesized data was interpreted in the light of study objectives and existing practical frameworks such as disaster risk reduction and urban resilience theories. This interpretive process highlighted the practical implications of the findings of recommendations for policy makers, researchers and practitioners. For instance, integration of GIS and Bam was identified as a key source of efficient and sustainable reconstruction.

In conclusion, the data synthesis and analysis process provided a comprehensive understanding of the second making frameworks for post destruction reconstruction by combining qualitative insights with quantitative evidence. This review is the best foundation for developing and integrated framework that addresses the complexity of disaster recovery.

Ethical Considerations

Ethical considerations were integral to the planning and execution of this systematic review. Ethical considerations were challenged by the need to access subscription based articles which limited the inclusion of

some potentially relevant studies. Open access resources were priorities were possible to ensure inclusivity and accessibility of evidence.

Key ethical principles observations include:

Transparency and reproducibility: the review process was designed to be transparent and reproducible. Detailed documentation of search strategies, inclusion and exclusion criteria, and data extraction procedures were maintained. This approach in shows that other is searchers can replicate the study or built upon its findings enhancing the credibility and impact of the review (Moher, Liberati, Tetzlaff, & Altman, 2009). Copyrighted materials and published articles were accessed via legitimate means, including institutional subscriptions and open access repositories.

Avoidance of plagiarism: all of the written content is original and tools such as turnitin was employed to ensure that the review adhere to high standards of academic integrity.

Fair representation of evidence: bias in the selection and interpretation of studies was minimized by sticking to the predefined criteria and involving multiple reviewers in key stages of the review process. This ensures that the review provides a balanced representation of the evidence by avoiding selective reporting or over emphasis on specific findings.

Ethical use of technology: software tools used for data extraction were licenced.

RESULTS

The results of this systematic review provide an in-depth understanding of the components and dynamics involved in developing and integrated decision making framework for a better built environment in post destruction reconstruction. The findings are organised into thematic areas that align with the study's objectives and offer valuable insights into existed practices, challenges and future directions.

A total of 34 studies met inclusion criteria and were analysed in this review. The included studies had various disciplines including disaster management, environmental engineering and Social sciences. Geographically, the studies were distributed across multiple regions with the significant focus on disaster prone areas such as Southeast Asia South America and parts of Africa.

The publication dates of the studies range from 2010 to 2024, that reflects a growing interest in the subject in recent years. It particularly follows the major global disasters such as the 2004 Indian ocean tsunami, the 2010 Haiti earthquake, and the 2011 East Japan earthquake. The methodology is employed in the studies varied including qualitative case studies, quantitative surveys and mixed methods research.

The results reveal that while Pakistan has made significant progress in disaster management through the establishment of the NDMA and provincial disaster authorities, critical gaps still remain. For instance, during the 2022 floods, work coordination among agencies delayed aid distribution, which prolonged the crisis ("Pakistan Floods 2022: Post-Disaster Needs Assessment | UNDP Climate Promise," 2020b). The review identifies that incorporating technology like GIS and BIM can streamline disaster assessments and reconstruction planning. Additionally, community engagement in the rural areas has proven effective in fostering resilience, as evidenced in the 2010 floods (Khan & Jan, 2014).

Collaborative efforts between governments, non governmental organisations, private sectors and affected communities were found to enhance the efficiency of the reconstruction efforts. Governments were identified as the primary coordinators of reconstruction initiatives. They were responsible for policy development and resource allocation. Community participation was emphasized as critical for ensuring that the reconstruction aligns with local needs and cultural values. The role of private sectors in providing financial aid and technology expertise was highlighted in several studies. These findings also revealed challenges such as conflicts of interest among stakeholders, and lack of communication that can hinder collaborative decision making.

The incorporation of modern technology became an important element. Tools like geographic information system GIS, building information modelling BIM, and drones played Victor role in post disaster reconstruction. GIS was extensively used for mapping disaster effected areas assessing the damage and planning reconstruction (Cao, Xu, Aziz, & Kamaruzzaman, 2023). BIM facilitated the design and simulation of resilient infrastructure allowing stakeholders to evaluate various reconstruction scenarios. Drones and IoT devices were utilised for real time data collection and monitoring of reconstruction activities.

Strategies such as using eco friendly materials, restoring natural habitats and incorporating renewable energy sources were frequently discussed (United Nations, 2015). Cost effective reconstruction methods and long term economics planning for local communities were emphasized. Ensuring quality and community resilience was identified as critical components of sustainable reconstruction. The review identified various decision making models employed in post destruction reconstruction including centralized, decentralized, and hybrid approaches

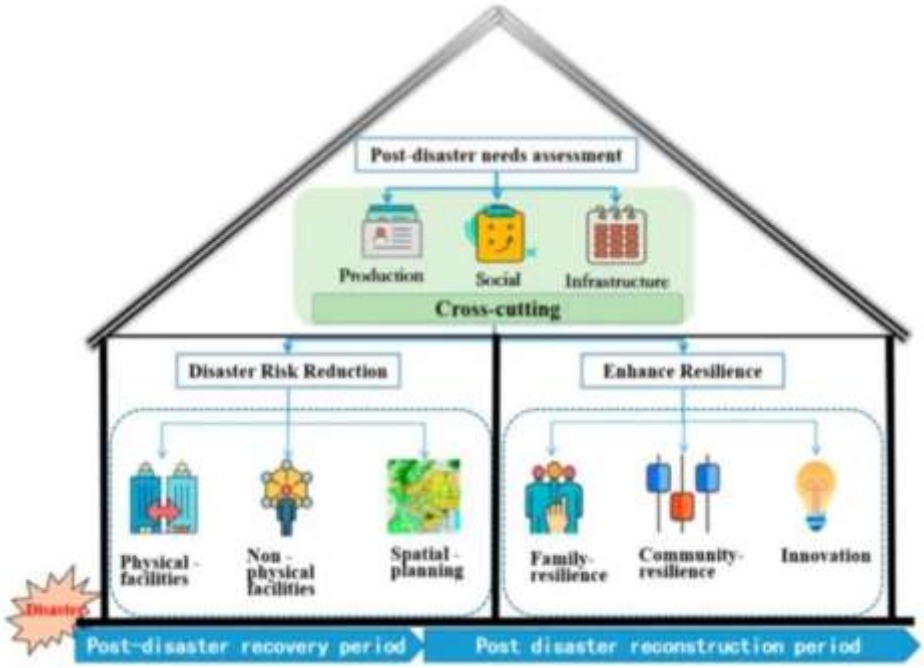

Figure 5 The theoretical N-BBB framework (Shi, Cao, Ran ,& Wei, 2021)

Several gaps and challenges were faced as well. Many frameworks failed to incorporate the voices of marginalised groups such as women children and minorities. There was seen limited use of technology in low income regions. There was inadequate focus on long term sustainability. Lack of coordination among stakeholders lead to fragmented and inefficient reconstruction efforts.

Despite the challenges, this review highlighted several best practices that can inform the development of an integrated decision making framework. Engaging communities from the planning to implementation ensures that reconstruction aligns with local priorities. Leveraging technology such as the use of GIS, BIM and digital tools enhanced the efficiency and transparency of reconstruction efforts. Incorporating sustainability principles and multi stakeholder collaboration into decision making processes leads to more equitable and resilient outcomes. Strong institutional frameworks and supportive policies are essential for coordinating reconstruction activities.

The results of this systematic review provide a comprehensive understanding of the factors influencing decision making in post destruction reconstruction. By synthesizing evidence from diverse contexts, this review identifies key challenges, opportunities and best practices that can guide the development of an integrated framework. The findings underscore the importance of stakeholder collaboration, sustainability and technological in achieving a better built environment after disasters.

DISCUSSION

That development of an integrated decision making framework for post destruction reconstruction presents a multi disciplinary challenge, intersecting domains of disaster management, urban planning, sustainability and technology. This sectionals into the critical insights, implications and challenges identified in the systematic review. It focuses on the framework's components, effectiveness and applicability.

The integration of an adaptable decision making framework in Pakistan required addressing unique challenges such as financial constraints, government fragmentation, and limited technological infrastructure. For example, during the 2005 earthquake international aid was effective due to centralised coordination but local participation was limited, reducing the long term recovery outcomes (Shah et al., 2022). To enhance resilience, Pakistan must laboratory emerging technologies like drones for damage assessment and blockchain for transparent fund distribution. Additionally sustainable practices such as flood resistant infrastructure eco friendly materials should be prioritised to reduce future vulnerabilities.

The review highlights the complexity of decision making in post destruction reconstruction. It in shows that broad policy objectives are met while addressing community's specific needs. Technology integration emerged for efficient decision making. Tools like geographic information system GIS, building information modelling BIM, drones and IoT devices monitor the processes (Cao, Xu, Aziz, & Kamaruzzaman, 2023). However there adoption is uneven. They are often constrained by financial barriers particularly in the low income regions.

Government plays a vital role in policy formulation, resource allocation and inter agency coordination (Adaji, Mohamed, Ebenehi, Guma, & Onuvava, 2019). Non-governmental organizations complement these efforts by bridging gaps in capacity and funding while private sector participation introduces innovation and investment.

Despite its theoretical robustness, implementing an integrated decision making framework faces significant hurdles. Financial constraints are among the most significant issues, specially in regions with limited disaster budgets. This review also highlights the importance of capacity building.

Sustainability is essential to post destruction reconstruction. The reviewed studies emphasize balancing environmental, social and economic dimensions to create long term resilience. Using environmental friendly materials and designs minimizes ecological impact while promoting economic recovery through job creation.

The rapid advancement of technology presents significant opportunities for enhancing decision making frameworks. Artificial intelligence AI and machine learning can predict disaster impacts and optimize resource allocation. The potential of these tools highlights they are need for further research as well.

Comparative analysis of existing decision making models reviews the advantage of an integrated framework. Unlike traditional models, the proposed framework fosters collaboration and adaptability. However, it also requires governance structures to manage the complexities of integration.

Policy makers must priorities the development of disaster management systems that are not only reactive but also proactive. This includes investing in early warning systems, and infrastructure resilience. Mean while practitioners should focus on building partnerships and technologies to enhance reconstruction efforts

While the review provides valuable insights, it is not without limitations. The reliability on secondary data may introduced biases. The generalizability of findings is constrained by the variability in disaster contexts. Further studies should consider longitudinal analysis and research to address these gaps.

CONCLUSION

The integration of decision making frameworks for post structural reconstruction has emerged as a crucial strategy to address the complexities of disaster recovery. This systematic review has explored the intricacies of combining various elements: stakeholder collaboration, technology advancements, sustainability principles and strategic governance. They were essential to develop an effective and adaptable framework. In doing so, it shed light on both the opportunities and challenges in this approach. It offers insights that are essential for policy makers, practitioners, and researchers.

A fundamental conclusion drawn from this review is the necessity of community centred approaches in the designing of decision making frameworks. Engaging local populations to fosters trust and ensures that reconstruction aligns with the needs and aspirations of those most impacted. Pakistan's frequent exposure to natural disasters, necessitates an integrated decision making framework that addresses the specific challenges. Buy combining community participation, technological integration and sustainable practices the country can build back better and reduce future vulnerabilities. The review under scores the importance of strengthening governance, investigating in early warning systems and fostering international collaboration. Lessons from past disasters, such as the 2005 earthquake and 2010 floods, provider road map for implementing effective strategies.

Technology place are transformative role in the development of integrated decision making frameworks. As highlighted in this review tools such as geographic information systems GIS, building information modelling BIM, drones and IoT have revolutionized data collection, assessment and monitoring in post disaster contexts. These technologies enable real time data collection and enhance the efficiency of reconstruction processes. However their adoption is uneven particularly in the low income regions where financial and technical constraints hinder access.

This review also highlights the importance of stakeholder collaboration in the success of integrated decision making frameworks. Governments as primary agents of disaster management are tasked with formulating policies, allocating resources and coordinating inter agency efforts. Non governmental organisations and international agencies complement these efforts by filling gaps in capacity and funding specially in resource constrained areas. Despite it's potential, the implementation of an integrated decision making framework faces significant challenges. Financial limitation remains and issue that also limits the scope and speed of reconstruction efforts specially in developing countries. The lack of trained personnel capable of employee advanced technology further adds to this problem.

Policy makers must prioritize that development of comprehensive disaster management systems that are both proactive and reactive. Investments in early warning systems, resilient infrastructure are essential to mitigate the impacts of future disasters. Additionally integrating sustainability principles into policy frameworks can ensure that reconstruction efforts contribute to long term resilience rather than merely addressing immediate needs. Meanwhile practitioners should focus on tailoring reconstruction strategies to unique context of affected communities.

In conclusion, that development of an integrated decision making framework for post destruction reconstruction is a critical step towards achieving sustainable and resilient framework. By synthesizing insights from various disciplines and addressing multiple challenges of reconstruction, Such frameworks can transform disaster management practices, making them more impactful and efficient. However realizing this vision requires efforts from all stakeholders, government agencies, NGO's , private sectors and communities. If they collaborate and commit to a

shared goal of building back better. The path forward is not without obstacles but with right strategies and resources the promise of a more sustainable and resilient built environment is well within reach.

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