International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 05 | May - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Construction After DisasterRebuilding After Human-Made Disasters: A Build Back Better Approach

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Abstract:

Historically, and even in recent events, when a community is struck by a disaster, a speedy return to the status quo is often hoped for. But one of the most significant lessons of the last few decades has been that simply rebuilding communities to pre-disaster standards will recreate the vulnerabilities that existed earlier and expose them to continuing devastation from future disasters. Over the years there has been an appreciation that reconstruction is an opportunity to build back better. Today recovery is defined as the restoration and improvement of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. This "build back better" approach first gained global attention during the reconstruction of Aceh, Indonesia, following the 2004 Indian Ocean earthquake and tsunami. While building back better has been defined in many ways, at its core, it advocates for the restoration of communities and assets in a manner that makes them less vulnerable to disasters and strengthens their resilience. The Hyogo Framework for Action (HFA) called for the 'incorporation of disaster risk reduction' measures into post-disaster recovery and rehabilitation processes and use opportunities during the recovery phase to develop capacities that reduce disaster risk in the long term'. The concept was further promoted through the International Recovery Platform, and the annual International Recovery Forum. The Global Platforms on Disaster Risk Reduction and the World Reconstruction Conferences 1 (in 2011) and 2 (in 2014) have consolidated the experiences given a higher profile to the concept of build back better. Resilient recovery and reconstruction are now recognized as imperative for sustainable development. To maintain a path toward sustainability, recovery and reconstruction programs require predictable technical and financial resource commitments for planning, implementation, and performance management. Additionally, at national levels, governments must have the capacity to develop policies and mechanisms that ensure integration of disaster risk reduction in recovery and reconstruction efforts. According to the 2007-2013 Hyogo Framework of Action Monitor, while many countries have successfully introduced policies to integrate disaster risk reduction in recovery planning, they often encounter difficulty during implementation. To be successful, recovery and reconstruction programs require high levels of political commitment and strong institutional frameworks, which provide greater opportunity for promoting risk reduction and building resilience, as well as a greater chance for recovery and reconstruction to be implemented in an efficient and effective manner that avoids negative consequences. Deliberations on a post-2015 framework for disaster risk reduction have highlighted "build back better" as a key priority. This brief presents a concept of resilient recovery: what it is; why it is important; and what measures communities, countries, and regions can adopt to ensure that efficient and effective recovery leads to sustainable development.

This paper seeks to identify and categorise challenges encountered in managing post-disaster reconstruction projects.

quality and workmanship; contractual, legislation and policy; management and collaboration; resources; community engagement and culture; financial; physical/territorial; natural causes; and other challenges.

Keywords:

1. Rebuilding opportunities
2. Sustainability And Energy Efficiency

3. Challenges
4. Reflection And Remembrance
5. Reconstruction
6. Successful project
7. Stakeholder Involvement
8. Community Ownership
9. Green Building Principles

Overview:

Construction is unique compared to other industries due to the delicate blend of technical complexity, high costs, and lengthy duration. 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 . 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

Rebuilding after a disaster is inherently risky, involving complex logistical, financial, and emotional challenges. The WTC site's rebuild faced unique hurdles, from managing stakeholder expectations to ensuring the safety and security of the new complex.

Despite these challenges, the WTC rebuild demonstrates the potential benefits of BBB. The rebuild transformed the site into a vibrant hub of activity, incorporating sustainable design, enhanced security measures, and meaningful memorialization. The project showcases the potential for rebuilding to revitalize communities, promote economic growth, and foster resilience.

This research paper will examine the WTC rebuild as a case study in BBB, highlighting the lessons learned and best practices that can inform future rebuilding efforts. By exploring the complexities and benefits of rebuilding, this study aims to contribute to the development of more effective and sustainable reconstruction practices.

Disaster

In today's context, there is a growing belief that disaster occurrences and their associated damages are increasing . Over the past 20 years, the United Nations Office for Disaster Risk Reduction 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 , 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" . 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. and Enshassi et al.

Most literature tend to classify disasters as either natural or non-natural. Various disaster record databases use these widely recognised terminologies . However, the United Nations Office for Disaster Risk Reduction 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 . This assertion is supported by Toya and Skidmore , 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 , 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 .

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. Acharya et al.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.

Disaster recovery can be complex involving communities, local authorities, business, national central governments and at times international organizations and partners. Yet as governments develop their capacity to conduct long-term disaster recovery planning and implementation, the most disaster-impacted regions of the world will experience significant and sustained benefits. Communities will face reduced exposure, and economic growth will experience greater resilience from the shocks of disruption due to disasters. Enhanced engagement with governments, bilateral and multilateral development organizations, disaster recovery experts, civil society, and the private sector will help make implementation a reality. Global studies at the regional, national, and local levels indicate that the capacity of governments to plan and perform recovery needs further strengthening. When disasters happen, governments need reliable access to a wide range of technical expertise. This may come from within their own ranks or from other sectors (private or nonprofit). All nations stand to benefit from an increase in capacities for recovery and pre-disaster recovery planning. The post-2015 framework for disaster risk reduction is expected to provide a broad template toward which governments may align their recovery planning and operational capacity development goals. Implementation necessitates a highly context-specific approach shaped by factors that are unique to each region, each country, and each community. Over the years the body of knowledge gained through global experience with major disasters offers a number of key guiding recommendations to support "build back better." The following measures should be considered when assessing a way forward for the post-2015 framework for disaster risk reduction: • Building greater financial resilience and predictability within government to manage and respond to disaster triggered by natural

hazards, and formalized strategic and resource commitments toward recovery planning, implementation and performance management; • Promoting the institutionalization of post disaster assessments and national recovery frameworks to enhance risk governance, ensure recovery readiness; strengthen coordination of governments, civil society, multi-laterals and other, and; increase efficient and effective recovery and reconstruction operations; • Strengthening capacity for recovery planning and monitoring at the national, local, and community level, and establishing clear roles and responsibilities for all actors in a recovery setting, including national and local governments, private sector, academia, and civil society organizations; • Strengthening mechanisms for cooperation with services in areas of recovery and reconstruction that include sharing rosters of experts, capacity building, tools, bi-lateral support between countries, progress monitoring; and standardized approaches for post-disaster assessments and recovery planning frameworks; • Development of national and international policy standards for informing and guiding disaster recovery strategies; • Maintaining an institutional continuum between preparedness, response, recovery, mitigation and sustainable development measures.

Disasters are both natural and human made – a battery of floods, droughts, cyclones, land slides, earthquakes, communal riots, armed conflicts, fires, volcanic eruptions and epidemics and industrial disasters (Bhopal Gas Tragedy).

The magnitude of disasters is documented by reference to the degree of vulnerability of the affected population.

Disaster Management should not be seen in isolation but various phases of management in addressing this particular issue i.e. in the form of preparedness, relief, rehabilitation mitigation and reconstruction. Many organizations are involved in relief and rehabilitation. Most often the focus on preparedness, mitigation and reconstruction remain neglected. It is necessary for organizations, which are concerned about disaster to address various stages of disaster management.

Disaster mitigation

Tools and methodologies:

1. Education of the public regarding the government relief available, through pamphlets giving information regarding the various relief measures announced by the government.
2. Document complaints for presentation to the authorities. A volunteer team to register complaints that are represented in person, through post or by phone and follow it up.
3. Organize volunteers' task force in important government offices like the RDO office, MRO office, Panchayat office, Government hospital, where people come with complaints and help them with guidance, assistance and organize protests to achieve results.
4. Run a mobile cell, which visits the villages to enquire if people are getting the relief, medical care, basic needs etc.
5. Motivate NGOs with information, material and expertise to be efficient and effective in their interventions.
6. Ensure proper enumeration of families, who need relief and rehabilitation.
7. Organize public hearings for addressing issues of that need public attention, support and solidarity actions.
8. Organize and coordinate the relief operations.
9. Prevent out break of epidemics etc.

Literature review/case studies

The Construction Institute's Committee on Social and Environmental Concerns in Construction has examined 24 items of social and environmental concerns in construction that will have to be considered by those who are going to be involved in the reconstruction of the World Trade Center. These topics include the economic aspects of the reconstruction, the planning and design, the environmental issues, the transportation challenges, the contractual problems, the memorial, and the security

requirements. During the drafting of this report, the Committee received assistance and guidance from the engineering staff of the Port Authority of New York and New Jersey. Some Committee members visited the World Trade Center site at Ground Zero during the preparation of the report. Also consulted by the Committee were some well-known, highly qualified engineers on various aspects of the report. These contributions from nonmembers of the Committee made the report richer. It is the intent of this report to serve as a starting point for planning and redevelopment.

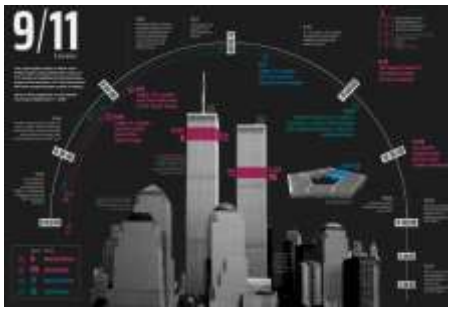
The assault and subsequent collapse of the World Trade Center towers in New York City on September 11, 2001 (9/11), released more than a million tons of debris and dust into the surrounding area, engulfing rescue workers as they rushed to aid those who worked in the towers, and the thousands of nearby civilians and children who were forced to flee. In December 2015, almost 15 years after the attack, and 5 years after first enactment, Congress reauthorized the James Zadroga 9/11 Health and Compensation Act, a law designed to respond to the adverse health effects of the disaster. This reauthorization affords an opportunity to review human inhalation exposure science in relation to the World Trade Center collapse. In this Special Article, we compile observations regarding the collective medical response to the environmental health disaster with a focus on efforts to address the adverse health effects experienced by nearby community members including local residents and workers. We also analyze approaches to understanding the potential for health risk, characterization of hazardous materials, identification of populations at risk, and shortfalls in the medical response on behalf of the local community. Our overarching goal is to communicate lessons learned from the World Trade Center experience that may be applicable to communities affected by future environmental health disasters. The World Trade Center story demonstrates that communities lacking advocacy and preexisting health infrastructures are uniquely vulnerable to health disasters. Medical and public health personnel need to compensate for these vulnerabilities to mitigate long-term illness and suffering.

The airborne assault and subsequent collapse of the World Trade Center (WTC) towers on September 11, 2001 (9/11) released more than a million tons of debris and dust into the surrounding area (1), engulfing rescue workers as they rushed to aid those in the towers and the thousands of civilians and children who were forced to flee the disaster impact area. Almost 15 years after the attack and 5 years after initial enactment, Congress reauthorized the James Zadroga 9/11 Health and Compensation Act (Zadroga Act), designed to respond to the health effects of the disaster. The reauthorization of the Zadroga Act affords us a timely opportunity to review our collective response to all populations affected by the environmental disaster of 9/11 to better understand how to reduce harm from future catastrophic environmental events. We review the history and reasons behind creation of the Zadroga Act in the context of concepts of human exposure science with a focus on the experience of the local community.

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 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.



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

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 . 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 . Therefore, post-disaster reconstruction presents a decision-making environment that differs significantly from normal situations, making it even harder for the decision-makers . 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 . A project considered successful by one party may not be accepted as successful by other parties involved. For example, Aliakbarlou et al. 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 . 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 and Walker et al. 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. 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 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] Therefore, reconstruction projects still do not meet the objectives

Li [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.

Tables and figures:

1946

In 1946, New York State Legislature created the World Trade Corporation to develop the proposed World Trade Center.

1948

The World Trade Corporation nominated one of the nation's premier architectural firms, Skidmore, Owings, and Merrill (SOM) to develop a plan for a "new Lower Manhattan" in 1958.

1962

September 20, 1962: The Port Authority chose the current site for the World Trade Center.

1970

December 23, 1970: the topping out ceremony of the North Tower.

1980s

Developed by Silverstein Properties, the 47-story Seven World Trade Center was completed.

1990s

A van loaded with 1,500 pounds of explosives was planted by a group of terrorists in an underground parking garage of the north tower.

2000

On July 24, Larry Silverstein holds the keys to the World Trade Center.

2002

Beyer Blinder Belle and Parsons Brinkerhoff selected to develop a master plan for the reconstruction and transportation planning.

July 2002

The 1st round of the design competition for the reconstruction of the World Trade Center.

Nov 2002

The plans for the first major rebuilding project were announced by Larry Silverstein for 7 World Trade Center, a 52-story steel and glass skyscraper.

Dec 2002

The 2nd round of competition for the design contest, known as the "Innovative Design Contest" included Daniel Libeskind's scheme as a submittal.

2003

Design by Daniel Libeskind of Berlin, Germany chosen to replace the 16-acre WTC site.

July 2003

Architect David Childs of Skidmore, Ownings & Merrill was selected to design 1 World Trade Center.

Dec 19 , 2003

1 WTC plans were unveiled to the public.

2004

Michael Arad and Peter Walker were selected as the designers of the Memorial 'Reflecting Absence'.

May 3, 2004

Richard Rogers and Fumihiko Maki chosen to design World Trade Center towers.

July 4, 2004

Honoring the "Enduring spirit of freedom", Mayor Bloomberg laid the cornerstone of the Freedom Tower.

Dec 2004

The final design of the WTC Memorial and museum was unveiled by Arad and Walker.

2005

On June 29th, the 1 World Trade Center was redesigned due to security concerns.

Dec 15 2005

Silverstein Properties announced Lord Norman Foster to design Tower 2 at the World Trade Center.

2006

In March, workers began to remove remaining debris and started surveying work at the World Trade Center. This marked the start of construction on the National September 11 Memorial & Museum.

Result 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 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.

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:

The WTC rebuild serves as a model for "Build Back Better," showcasing resilience, sustainability, and community focus. By integrating these principles, the project transformed a site of tragedy into a vibrant and meaningful space that honors the past while embracing the future.

References:

1. https://wtc.com/history-timeline/
2. https://pmc.ncbi.nlm.nih.gov/articles/PMC5018893/
3. Jayaraj Annie . Post disaster reconstruction experiences in andhra pradesh, in india . https://www.preventionweb.net/files/554_8040.pdf

4. Ministerial Roundtable . Reconstructing after disasters: Build back better . in Japan .
5. https://www.wcdrr.org/uploads/Reconstructing-after-disasters-Build-back-better.pdf

6. Puri Ayush . Elkharboutly Mohamed . Ali Ameer Naseem . 1 june 2024. _Identifying major challenges in managing post-disaster reconstruction projects: A critical analysis . International Journal of Disaster Risk Reduction . https://www.sciencedirect.com/science/article/pii/S221242092400253X