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CROWDFUNDING FOR POST-DISASTER RECONSTRUCTION PROJECTS: A CONCEPTUAL FRAMEWORK

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ABSTRACT

Post-Disaster Reconstruction (PDR) projects are essential for rebuilding communities affected by natural disasters and conflicts. Despite the increasing global demand, their success is often hindered by economic, social, and physical challenges. Among the economic constraints, insufficient funding is a critical barrier due to the substantial financial requirements involved. Therefore, this study aimed to review available financial mechanisms for PDR projects and to explore the feasibility of crowdfunding for PDR projects. Accordingly, a comprehensive literature review was conducted on existing studies related to financial mechanisms and the application of crowdfunding for PDR projects. The content analysis method was used to analyse the collected data. The findings identified challenges in existing financial mechanisms such as inadequate funding, high transactional costs, time delays, upfront payments and bureaucratic processes. Overcoming these challenges, the study identified crowdfunding as a viable and innovative solution to attract additional financial resources. Crowdfunding enables the collection of small funds from a broader community, providing an inclusive and accessible financing option. Hence, this study contributes to academic and practical knowledge by bridging the concepts of crowdfunding and post-disaster reconstruction. Beyond its theoretical value, the study offers significant social and economic contributions by promoting inclusive, community-driven financing approaches that enhance resilience and recovery. Furthermore, it supports the achievement of the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities), SDG 9 (Industry, Innovation and Infrastructure), and SDG 17 (Partnerships for the Goals), by fostering sustainable, innovative, and collaborative reconstruction efforts.

Keywords: *Crowdfunding; Financial Architecture; Financing Methods; Funding Mechanisms; Post Disaster Reconstruction (PDR)*

1. INTRODUCTION

PDR projects play a critical role in restoring affected infrastructure and livelihood (Pamidimukkalla et al., 2020). According to Ismail et al. (2014), PDR projects refer to

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the modification or complete replacement of a facility that has been completely or partially destroyed due to a catastrophic incident or disaster. Key components of PDR projects include damage assessment, reconstruction planning, community engagement, funding acquisition, construction management, and the implementation of more robust structural designs. In the Sri Lankan context, Siriwardhana and Kulatunga (2023) note that the country has placed considerable emphasis on PDR programs in response to the growing incidence of disasters.

PDR projects differ significantly from conventional construction projects due to their complexity, dynamism, and context-specific sociocultural and economic demands (Shafique & Warren, 2016). Despite support from governments, NGOs, and aid agencies, their success rate remains low due to implementation challenges (Ismail et al., 2014). Key issues include cost overruns from project delays and inefficient material use (Syaputra & Rarasati, 2023), as well as limited financial resources (Pamidimukkalla et al., 2020). Predominantly donor-driven, PDR projects rely on loans and aid, with limited private investment due to their non-profitable nature. In Sri Lanka, Nissanka (2008) identify Donor-Driven and Owner-Driven approaches in housing reconstruction, noting that many non-profits lack structured financial mechanisms for sustainable funding.

Due to limited access to conventional external financing, many entrepreneurs have increasingly turned to alternative funding sources, with crowdfunding emerging as a prominent and effective method (Hoque, 2024; Schwienbacher & Larralde, 2010; Mollick, 2014). Crowdfunding enables individuals to raise capital through small contributions from a large number of supporters via online platforms, bypassing traditional investment channels (Syaputra & Rarasati, 2023). Latorre (2016) highlights the growing application of crowdfunding in the construction industry, particularly in housing and real estate development. While several studies have explored its potential in construction financing, the use of crowdfunding specifically for PDR projects remains under-researched, and evidence of its successful implementation is limited.

Despite the potential for growth, social crowdfunding platforms have seen limited development, primarily due to investment constraints and concerns regarding transparency, reliability, and trustworthiness (Mollick, 2014). Developing a dedicated crowdfunding platform for PDR projects requires a comprehensive understanding of crowdfunding models and the determinants of campaign success. However, existing research lacks analysis of the critical success factors necessary to adapt crowdfunding as an alternative financing mechanism for PDR. Unlike real estate or housing projects, no dedicated crowdfunding models for PDR have been identified in the literature. Addressing this gap necessitates a thorough evaluation of traditional crowdfunding limitations and the development of a hybrid model tailored to the specific challenges of PDR fundraising. Furthermore, existing literature does not provide practical recommendations or structured guidelines for establishing customised crowdfunding mechanisms in this context. As objectives, the study reviews the types of financing mechanisms in PDR and reviews the crowdfunding concepts, types and processes.

This study comprises a detailed research methodology, followed by a comprehensive literature review that examines different financial mechanisms and then explores the applicability of crowdfunding as an alternative source of funds for PDR projects. Subsequently, the literature findings are discussed with the aid of a proposed conceptual

model for financing PDR projects. Finally, the key conclusions of the study and recommendations for further research directions and practical application are presented.

2. METHODOLOGY

A literature review explores the historical development of the subject matter and studies the key themes by broadening the significance of the study (Saunders et al., 2023). Further, Green et al. (2023) elaborate that a narrative literature review provides a discussion on theory and context, aiming to provoke thought and stimulate controversy. Thus, to achieve the research aim, a narrative literature review was undertaken to explore existing studies on the various financing mechanisms employed in post-disaster reconstruction (PDR) projects, with particular attention to the concepts, types, and processes of crowdfunding. Accordingly, a background study was conducted to understand funding challenges associated with PDR projects and to identify the potential in crowdfunding. Afterwards, a comprehensive literature review was conducted to investigate the types of financing mechanisms employed in PDR projects, examine challenges associated with existing financing mechanisms and explore the potential of crowdfunding to address these challenges.

The existing knowledge obtained through secondary sources such as journal articles, conference papers, books and reports were used for this study. To compile a comprehensive literature synthesis, various keywords were searched with the aid of search engines, including “Google Scholar”, “Emerald Insight”, “Scopus”, and “Science Direct”. In addition, reports and research papers published by professional bodies such as the Cambridge Centre for Alternative Finance (CCAF), European Crowdfunding Network (ECN), World Bank and Crowdfunding Professional Association (CfPA) were reviewed and incorporated into the literature analysis. The selection of keywords was primarily based on the themes associated with the study. Thus, keywords such as “post disaster reconstruction”, “PDR”, “financing method”, “funding methods”, “financial architecture”, “crowdfunding”, “crowdfunding models and topologies”, “investment models in crowdfunding” and “non-investment models in crowdfunding” were selected considering their significance and relevance for the study. However, articles specifically related to the targeted topic were identified after carefully reading the abstract to check for relevance.

The study employed a content-based analysis to analyse the collected literature. This method is commonly used in qualitative research for identifying themes and patterns methodically within textual data (Kongaracki et al., 2002). In this study,content-based analysis was helpful to identify types of financing mechanisms and to analyse the crowdfunding concepts and processes. Subsequently, the study presents a conceptual framework by analysing the operational procedure of the crowdfunding mechanism for PDR projects. A conceptual framework acts as an important research element to assist further investigations in the subject areas (Martín et al., 2019).

3. FINDINGS

3.1 FINANCING ARRANGEMENTS FOR POST-DISASTER RECONSTRUCTION

Suarez and Linnerooth-Bayer (2011) define reconstruction finance as the allocation of funds for the rebuilding and advancement of the constructed environment. According to Ryu and Kim (2018), potential sources may include loans, grants, donations, investments

from partner agencies, and programmatic below-market loans. Current discussions among policymakers and practitioners highlight the difficulty in precisely distinguishing between funding and financing sources, especially when determining whether infrastructure is funded or financed (Strickland, 2016). Hence, project financing serves as an umbrella term encompassing both funding and financing mechanisms in PDR projects. Accordingly, Feather (2021) uses the term 'Financial Architecture for Reconstruction' to describe the holistic mechanism for securing financial resources for PDR, integrating both financing and funding.

Despite its importance, disaster management research lacks a structured understanding of reconstruction finance. Most academic studies emphasise governmental subsidies and risk transfer tools, while practitioner reports often focus on fund disbursement rather than acquisition, overlooking the high costs of rebuilding (Usta et al., 2019). This has resulted in limited insight into how PDR is financed. Although various case studies have attempted to classify financial approaches in different countries, there remains a need for a comprehensive framework in this field (Feather, 2021).

Researchers have developed several classifications to understand the financing architecture for Post-Disaster Reconstruction (PDR). Accordingly, Feather (2021) identifies two main categories: "Ex Ante" and "Ex Post," where the former refers to financial mechanisms established before a disaster occurs, while the latter involves mobilising resources after a disaster through channels like donor aid, government relief, and emergency loans. Accordingly, Table 1 illustrates the different financial mechanisms used to manage risk at different phases of PDR projects.

Table 1: Financing mechanisms for risk management of post-disaster reconstructions
Adapted from: (Feather, 2019; Hammett & Mixter, 2017)

Risk	Ex Ante	Ex Post
Risk Transfer	**Capital Market Instruments**	**Credit**
	Indemnity Insurance	Government Bank Loans
	Parametric insurance	Bank and Non-Bank Lending
	Reinsurance	**Co-Finance**
	Catastrophic bonds	Intergovernmental transfers
	Derivatives	Public-private partnerships
Risk-Retention	**Public finance for disaster budget**	**Government Recovery Program**
	Taxation revenues	Discretionary Aid
	Non-taxation proceeds	**Organisational Resources**
	Lines of contingent capital (Credit)	Household assets, including savings and remittances
		Business revenue
		Civil society grants
		In-kind contributions

Different financing mechanisms are used to manage risk in the form of transfer and retention across various phases of PDR projects. In the ex-ante phase, risk is transferred through capital market instruments, while public funds and contingent credit lines are allocated for risk retention. In the ex-post phase, risk transfer is facilitated through credit

and co-financing mechanisms, whereas government recovery programs and organisational or community resources are used to retain risk.

3.2 SOURCES OF TYPICAL FINANCIAL ARCHITECTURE FOR PDR PROJECTS

3.2.1 Major Capital Providers and Sources of Reconstruction Finance

The various types of financial architecture for reconstruction are built on key funding sources that form the foundation for post-disaster financing. Feather (2021) identifies four primary mechanisms commonly used by property owners: insurance, grants, loans, and capital assets. Insurance functions as a risk transfer tool, offering compensation for property damage and including instruments like government subsidies and catastrophe bonds as proactive financial strategies (Feather, 2019). Grants, provided by governmental and non-governmental organisations, play a key role in funding infrastructure repairs and housing reconstruction (Daly et al., 2020). Loans issued by state bodies or financial institutions are often used to finance rebuilding efforts. Lastly, capital assets and personal or organisational financial resources can also be mobilised by property owners to fund reconstruction. Collectively, these mechanisms form the foundation of post-disaster recovery and are often used in combination to address diverse reconstruction needs.

3.2.2 Challenges with the Capital Providers and Sources

The drawbacks associated with traditional sources of funding for PDR projects are extensively discussed in academic literature. Overall, many authors, including Feather (2021), Ptashchenko and Chechelashvili (2018), discuss the difficulties in achieving funding sources through typical methods for projects with the motive of social well-being. The major reason here is the reluctance of stakeholders to invest in non-profitable social facilities. Furthermore, the governments may also not prioritise the financing of social projects, leading to a gap in funding for the construction.

Table 2: Challenges associated with capital-providing sources

Capital providers and sources	Challenges	References
Insurance	Inadequate coverage, delayed payouts, and complex damage assessments.	(Cummins & Weiss, 2009),
	Government subsidies and catastrophe bonds may lack scalability and effectiveness in large-scale disaster contexts.	(Cebotari & Youssef, 2020)
Grants	The amount of grants is often insufficient for comprehensive reconstruction.	(Banomyong, 2001),
	Grants are affected by bureaucratic processes, uncertain availability and potential misallocation.	(Daly et al., 2020)
	Overreliance on grants may hinder timely and efficient reconstruction efforts.	
Loans	Loans pose challenges such as high interest rates, repayment burdens, and eligibility constraints, limiting access for some property owners.	(Sharma et al., 2018).
	Inadequate loan funding remains a barrier to reconstruction	

Capital providers and sources	Challenges	References
	Slow and bureaucratic application processes can delay fund disbursement, increase costs, and affect project timelines.	
Capital assets	Not readily available or sufficient for all property owners. Upfront fees in traditional financing models.	(Awodele et al., 2022).

In summary, the drawbacks associated with the major sources underscore the importance of considering an alternative effective mechanism. The involvement of multiple sources can be addressed as a problem since financial arrangements for reconstruction can be complex with multiple funding sources, all with their accounting requirements and allocation timeframes (McCawley, 2008).

3.3 CROWDFUNDING AS AN ALTERNATIVE SOURCE OF FUNDS FOR PDR PROJECTS

Crowdfunding can be considered a multifaceted solution for PDR financing, which provides not only financial support but also fosters community engagement. Crowdfunding is a way to collect money from a large group of people, where each person gives a small amount. Instead of getting big amounts from a small group of investors (Belleflamme et al., 2014). Usually, crowdfunding gathers contributions from many backers through the Internet (Short et al. 2017), often without traditional financial intermediaries (Mollick, 2014). This concept originates from applying crowdsourcing principles to fundraising, creating new channels for community-backed financing in various project areas such as business, culture, humanitarian efforts, social causes, politics, environment, and technology (Schwienbacher & Larralde, 2012). Initially, consisting of sporadic independent efforts, crowdfunding has evolved into numerous dedicated platforms that mediate between fundraisers and contributors within a trusted framework. According to data from various platforms, global alternative finance volumes, covering all crowdfunding types, reached USD 371 billion in 2017, growing by 42% from 2016 (Ziegler et al. 2019).

3.3.1 Crowdfunding as a Capital Source for Construction Projects

Crowdfunding is increasingly recognised as an effective financing tool across various industries, including construction (Hoque, 2024). In the real estate sector, crowdfunding helps bridge the funding gap left by traditional banks, as illustrated by Slesarev (2022), who explored how Finnish real estate developers leverage crowdfunding to finance development projects. Similarly, in Nigeria, crowdfunding offers solutions to the limitations of traditional financing, such as restricted fund access, lengthy processes, and high upfront fees, by enabling more inclusive and efficient funding (Awodele et al., 2022). Their research outlines a model where project developers launch campaigns to attract small equity or rewards-based investment and use the funds for construction, particularly beneficial for smaller projects. However, the model carries inherent risks, such as potential fraud and limited investor protection.

3.3.2 Current Status of Crowdfunding in PDR

Crowdfunding has demonstrated effectiveness in supporting immediate relief efforts (Behl and Dutta, 2019). However, research on its application in PDR projects remains limited, with less emphasis placed on long-term reconstruction activities. Ptashchenko and Chechelashvili (2018) advocate for the utilisation of crowdfunding as a means to finance social infrastructure, proposing that crowdfunding platforms can attract investment from socially engaged individuals. They argue that crowdfunding offers a viable solution to bridge financing gaps in the development of innovative ideas and social projects. Within this context, PDR projects can be viewed as a form of social empowerment, providing a meaningful opportunity to explore the potential of crowdfunding in supporting sustainable recovery and reconstruction efforts.

A key consideration in crowdfunding is selecting the most suitable model to achieve specific objectives, as success largely depends on the mechanism employed. Therefore, it is crucial to conceptualise the prominent models currently employed to construct an effective and specific mechanism for funding PDR projects through crowdfunding. Accordingly, reviewing the components and typologies of existing crowdfunding models is crucial.

3.3.3 Main Stakeholders and the Typical Process of Crowdfunding

The essence of crowdfunding revolves around a mutually beneficial dynamic involving three primary stakeholders: the fundraiser, the backer, and the platform. The fundraiser initiates funding campaigns, gaining not only capital but also market exposure, customer engagement, and product feedback (Ryu & Kim, 2018). As another major stakeholder, backers support projects financially and benefit from influencing innovations, improving personal consumption opportunities, and fostering community ties (Shneor & Munim, 2019). Platforms act as intermediaries, connecting fundraisers and backers through online systems, and generate income through success fees and service charges (Belleflamme et al., 2015). Each successful campaign boosts the reputation of the platform and expands its user base (Thies et al., 2018).

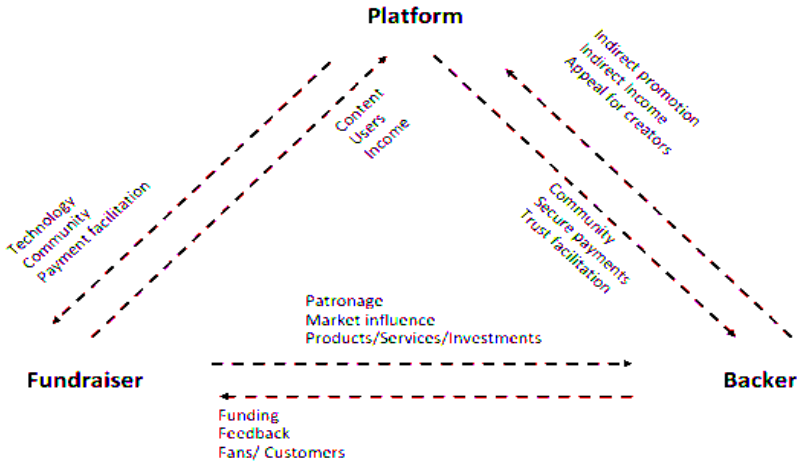

Figure 1: The win-win dynamics of crowdfunding
Source: (Shneor et al., 2020)

At the core of crowdfunding practice lies an expectation for a "win-win" game, where all parties enjoy various benefits from their involvement in the process, as highlighted in

Figure 1 (Shneor et al., 2020). In addition to the main stakeholders, public authorities play a significant role in influencing the crowdfunding industry's development and the interactions between its participants. Regulations, primarily focused on consumer and investor protection, establish the framework for different crowdfunding models. Furthermore, authorities aim to facilitate greater public contributions to civic, cultural, educational, and environmental initiatives, aligning with government policies.

3.3.4 Common Crowdfunding Models and Typologies

The literature categorises crowdfunding models and types according to varying value propositions, practice patterns, funder motivations, associated risks, and regulatory requirements of crowdfunding platforms (Shneor et al., 2020). Belleflamme et al. (2015) propose a basic distinction between 'investment models' and 'non-investment models,' focusing on the nature of compensation promised to funders. Non-investment models involve reward and donation crowdfunding, while investment models encompass lending and equity models, including royalty variations like profit or income sharing.

The CCAF provides a comprehensive categorisation of crowdfunding models in its annual industry reports (Ziegler et al., 2018; Zhang et al., 2018), clearly illustrating the relationships among various crowdfunding types. A simplified version of this categorisation is presented in Figure 02.

Investment based Models

Investment-based crowdfunding models include debt-based, equity-based, and emerging models like invoice trading. Debt-based models, such as peer-to-peer (P2P) and balance sheet lending, connect borrowers with investors or provide loans directly from the platform’s funds. A distinct form, pro-social lending, incorporates social impact goals, with microfinance focusing on small loans to the poor (Short et al., 2017). Equity-based models, including equity crowdfunding, enable investments in unlisted shares of SMEs, expanding into areas like real estate crowdfunding and community shares, where social return often outweighs financial gain (Zhang et al. 2017). Invoice trading allows SMEs to sell invoices at a discount for quick liquidity, aiding short-term cash flow (Dorfleitner et al., 2017).

Non-investment-based Models

Finally, the reward and donation crowdfunding models are arguably the models most commonly recognised by the public. These models typically involve individuals or businesses providing funding to projects without expecting monetary returns. In reward models, funders often receive pre-sales of products or services within a specified timeframe. In donation models, there are no tangible rewards, and funders derive satisfaction from contributing to something they deem important. An interesting variant is patronage, featuring subscription-like payments (rather than a one-time donation) to support ongoing occupations or careers, particularly relevant for artists (Swords, 2017), despite being relatively marginal in the overall crowdfunding sphere so far.

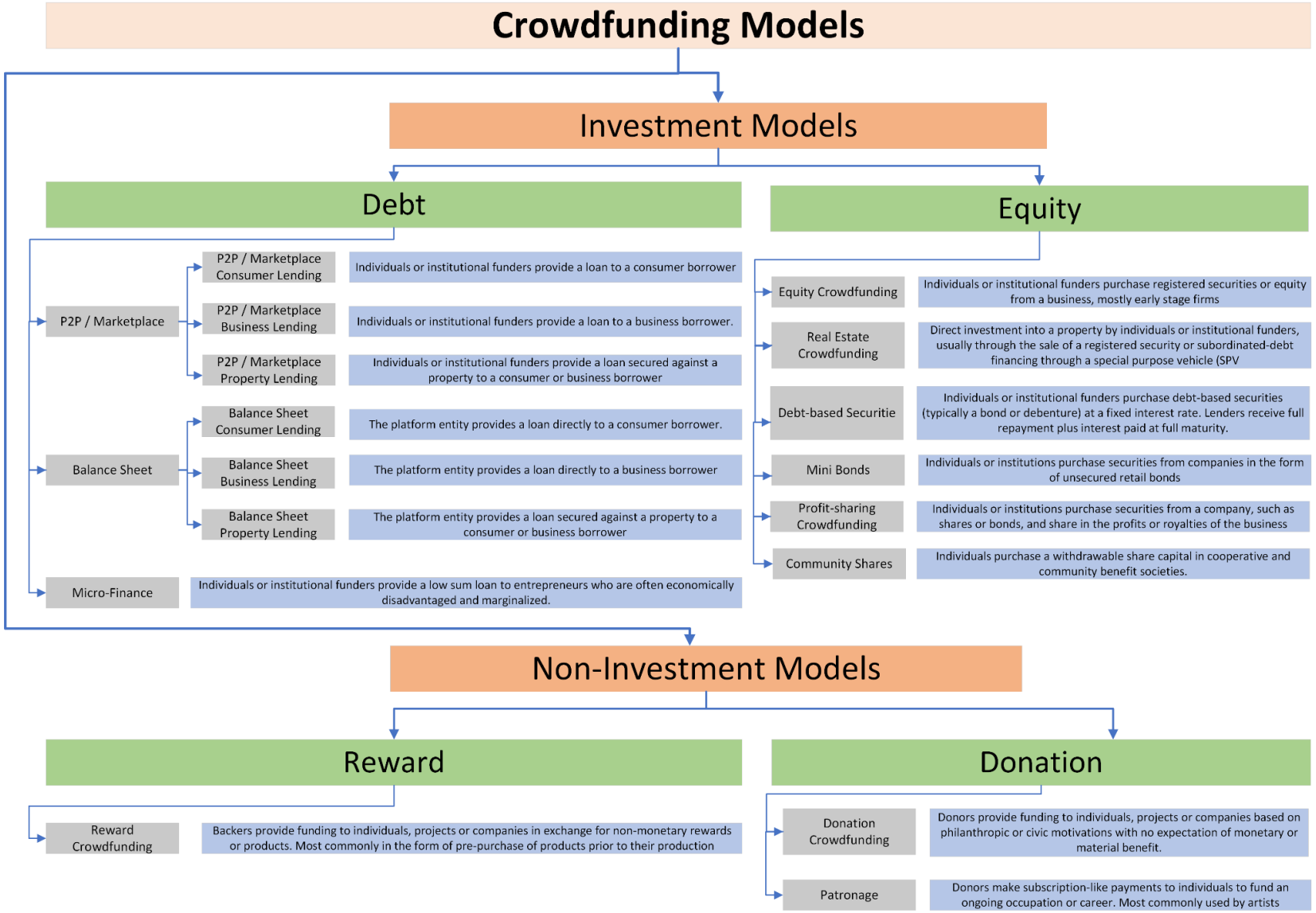

Figure 2: Summary of crowdfunding types/models
Adapted from: (Ziegler et al., 2018; Zhang et al., 2018)

4. DISCUSSION

The growing frequency of natural disasters and conflicts has significantly increased the demand for PRD, essential for restoring normalcy for affected populations. However, a key challenge in implementing these projects lies in securing adequate financing, as PDR projects often lack a standardised financing structure (Feather, 2021). Instead, various financing architectures are employed depending on the context, comparable to architectural designs where similar components are arranged differently. These architectures are built from core revenue streams such as insurance, grants, loans, and capital assets (Feather, 2021). Each of these sources has limitations, affecting the efficiency and success of PDR efforts. As a result, crowdfunding is emerging as a promising alternative, particularly suited for philanthropic causes like disaster recovery. While four primary crowdfunding models exist, the CCAF highlights the potential of developing hybrid models tailored to specific funding needs.

In contrast to traditional capital sources such as insurance, government subsidies, grants, loans, and capital assets, which often suffer from limitations such as inadequate coverage, bureaucratic delays, high interest rates, and limited accessibility (Cummins & Weiss, 2009; Banomyong, 2001; Awodele et al., 2022), crowdfunding offers a more flexible and inclusive financing alternative. Investment-based models, including debt and equity crowdfunding, enable direct engagement between funders and recipients, often with quicker disbursement and broader eligibility (Short et al., 2017). Non-investment-based models, such as donation and reward crowdfunding, foster community-driven support without repayment burdens, providing accessible funding especially in socially motivated contexts (Swords, 2017). Furthermore, crowdfunding platforms can rapidly mobilise dispersed capital, making them particularly suitable for post-disaster recovery or niche funding needs where traditional mechanisms fall short (Ziegler et al., 2018; Zhang et al., 2018).

This paper contributes to the field of PDR by reviewing alternative fundraising mechanisms and identifying the challenges associated with traditional sources such as insurance, grants, loans, and capital assets. It identified crowdfunding as an effective alternative to address persistent financing gaps in PDR projects, particularly due to its potential to mobilise resources efficiently, inclusively, and in support of philanthropic or community-driven initiatives. The study further explores the applicability of various crowdfunding models and the roles of key stakeholders in enhancing funding strategies for PDR. For future advancement, research should focus on empirically validating the proposed model, identifying critical success factors for its practical implementation, and addressing relevant regulatory considerations.

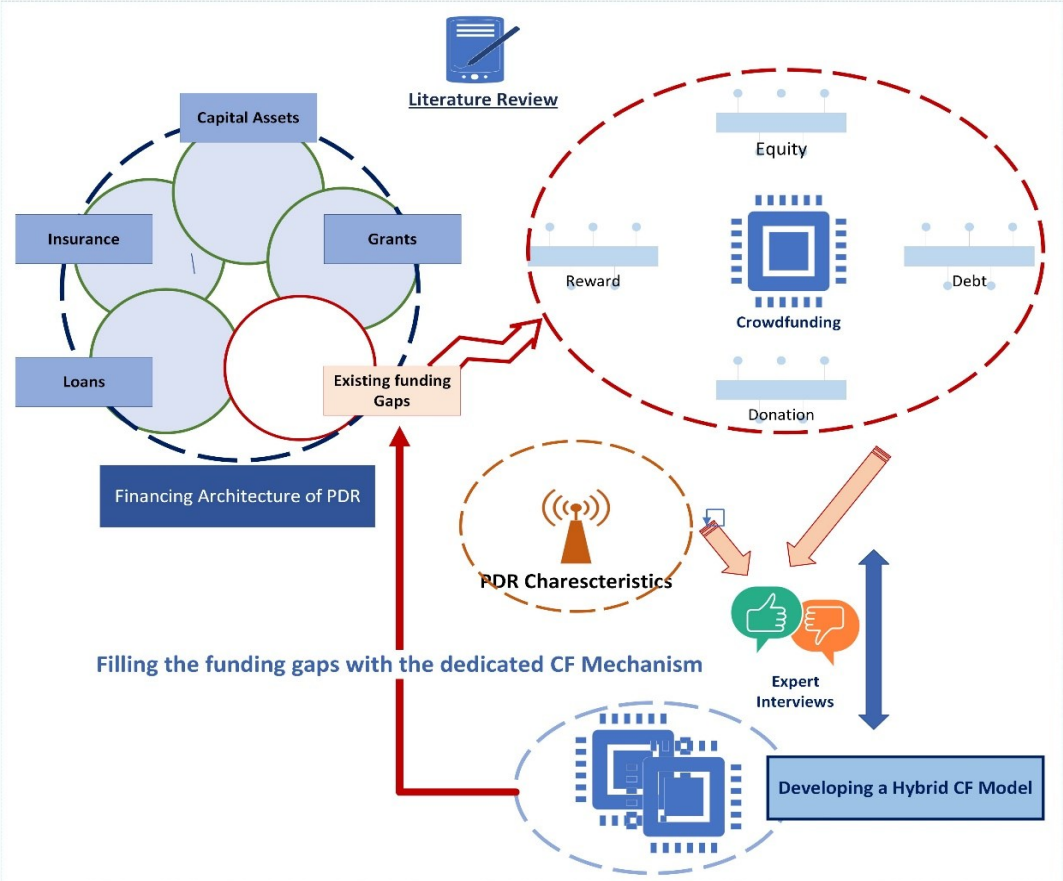

Figure 3: Conceptual framework

5. CONCLUSION AND RECOMMENDATIONS

In conclusion, the research focuses on the financial issues related to the PDR projects that significantly impact throughout the entire project lifecycle. Among the financial challenges, insufficient funding is a major issue due to huge funding requirements and limited funding availability because of the inherent nature of PDR projects. Therefore, the typical financing methods of PDR projects and the issues with sources of funds are analysed and evaluated through the literature findings. Crowdfunding, as an emerging funding tool, has proven to be a viable alternative source of capital for various types of projects, particularly in the construction sector, such as real estate and condominium developments. Its unique features, such as decentralised funding, community engagement, and flexibility, make it especially suitable for these project types. Similarly, PDR projects, which represent a distinct category of construction with urgent and socially driven objectives, can also benefit from the implementation of crowdfunding to attract necessary funds and bridge financing gaps often left by traditional mechanisms.

The study offers substantial contributions across multiple dimensions. Socially, it proposes an inclusive funding model that empowers affected communities and enhances participatory engagement. Economically, it introduces an alternative mechanism for the efficient mobilisation of capital for PDR projects. Academically, it addresses a notable gap in the literature by situating crowdfunding within the broader discourse of disaster recovery finance. Furthermore, research provides a conceptual guideline for industry practitioners to adopt crowdfunding as an alternative financing mechanism for attracting

funds. Moreover, the study aligns with and supports the advancement of several SDGs, specifically SDG 11 Sustainable Cities and Communities, SDG 9 Industry, Innovation and Infrastructure and SDG 17 Partnerships for the Goals.

Nonetheless, the research adopts a narrative literature review approach, which, while offering valuable thematic insights and conceptual clarity, inherently limits empirical generalizability. Therefore, future research should focus on evaluating the viability and effectiveness of the proposed crowdfunding framework for funding PDR projects. Moreover, as further research should explore the potential of integrating blockchain and Building Information Modelling (BIM) for developing crowdfunding platforms.

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