

Public-Private Partnerships in Disaster Management: A Systematic Review of Incentives and Challenges

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Abstract

In times of crisis, the seamless functioning of supply chains, the preservation of business operations, and the provision of essential goods to the population are shared concerns for both public and private entities. However, the primary responsibility for ensuring an adequate supply to the population rests with the government and its authorities. In a complex and unpredictable environment marked by scarce resources and limited data availability, fulfilling this responsibility alone becomes a nearly unsolvable challenge. Consequently, active participation from private actors, such as logistics service providers, becomes essential since their expertise and resources play a pivotal role in collectively ensuring operational continuity. Hence, there is a growing trend towards establishing Public-Private Partnerships to enhance the resilience of supply chains and critical infrastructure. Despite their potential, the implementation remains limited due to existing barriers and conflicting perspectives, which hinder effective crisis response in these collaborative efforts. Consequently, we present a comprehensive framework to tackle these challenges, offering enablers and incentives to facilitate and enhance long-term partnerships.

Keywordse: Collaboration; Resilience; Decision-support; Preparedness; Risk management

1 Introduction

Effective disaster management is crucial amid infrastructure damage, economic setbacks, health issues, and social vulnerabilities caused by natural disasters and humanitarian crises. The urgency stems from the interconnectedness within global supply chains, emphasizing the need for comprehensive disaster preparedness and response efforts. Public-Private Partnerships (PPPs) offer a promising approach, combining expertise and resources to enhance preparedness, response, and recovery efforts.

Despite the growing recognition of PPPs in disaster management, a significant gap exists in understanding the complex dynamics of these collaborations, especially in an uncertain

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environment. Time constraints, possible infrastructure damage, varying demand, numerous stakeholders, and limited resources make organizing an efficient ad-hoc response challenging [1]. Moreover, the existing literature often lacks a systematic and descriptive analysis of these issues, making it difficult for policymakers, researchers, and practitioners to derive practical insights and recommendations.

Therefore, this study explores the enablers, incentives, challenges, and decision-making mechanisms inherent in PPPs in a systematic review using the following research question to grasp the details of these collaborations and maximize their effectiveness:

RQ: What are the key enablers, challenges, and incentives for public and private sector stakeholders in establishing and sustaining effective disaster management PPPs?

We contribute a practical framework derived from our research findings, which captures insights from the reviewed papers. This structured foundation aims to shape future resilience strategies in disaster management. Drawing from past PPP initiatives, the framework serves as a practical guide, addressing challenges, identifying enablers, and highlighting incentives to enhance preparedness for upcoming disasters. Consequently, the outcomes of our study facilitate informed decision-making and enhance the overall effectiveness of disaster management efforts, particularly amid uncertainties.

The remainder of this work is structured as follows. Section 2 covers the role of uncertainty in disaster management and the theoretical concepts of PPPs. Section 3 presents the methodology of the applied systematic literature review. Subsequently, Sections 4 and 5 present and discuss the obtained results.

2 Theoretical Background

2.1 Uncertainty and challenges in disaster management

The environment of humanitarian disasters is highly dynamic and uncertain. The characteristics of humanitarian logistics also indicate the challenges relief supply chains face, including uncertainty about the occurrence of disaster [2], irregularity in demand [3], poor logistics infrastructures [4], slow coordination and response [5], and a lack of adequate resources [6].

Although each disaster is unique, most exhibit similarities in the logistical response and specific challenges or critical success factors that should receive constant and careful attention [7]. Based on the research of [5], [8], [9], and [7], those critical success factors comprise efficient network design, information management and technology, coordination and collaboration, and strategic transport decisions and last mile operations.

In particular, a lack of coordination and collaboration is often cited as one of the most significant challenges in relief operations (e.g., [10, 11, 12]). Hence, fostering public-private collaboration is crucial for effectively addressing the barriers and challenges arising from the uncertainty and complexity of disaster environments.

2.2 Collaboration and Public-Private Partnerships

Relief logistics requires fast and efficient actions from multiple participants in the humanitarian supply chain, including procurement, transportation, and warehousing [13]. Collaboration can occur between different actors intending to develop solid and beneficial relationships. These actors have different interests, capacities, and logistics expertise [12]. Consequently, PPPs are crucial for leveraging synergies between the private and public sectors to advance and improve disaster relief and logistics [13].

As per the definition provided by the German Federal Ministry for Economic Cooperation and Development, PPPs are defined as collaborations between the public sector and private businesses in the design, planning, construction, financing, management, operation, and exploitation of public services previously provided solely by the state [14]. There are multiple ways in which collaboration or PPPs can take place depending on the level of engagement, phase of the disaster relief operation, financial agreement, or logistics activities [15].

For instance, some companies such as Walmart Inc., Home Depot Inc., Lowe's Companies Inc., the Coca-Cola Company, Chick-fil-A Inc., or British Airways engage routinely in collaborations to make resources and services available to public actors [12, 16, 17]. Even though there are many different types and concepts of collaboration or partnerships, [18] highlight long-term partnerships as an opportunity for increased knowledge transfer and better strategic collaboration.

Although the idea of PPPs is intensively discussed, a significant gap exists in understanding how these collaborations can effectively benefit all stakeholders and what essential factors are required for integrating them seamlessly into complex networks. Therefore, we outline the theoretical potential and practical mechanisms necessary to adopt PPPs across diverse supply chain environments successfully.

3 Methodology

The study employs a systematic review of scientific literature to answer the underlying research question. The systematic method ensures a thorough exploration of the current knowledge. It identifies potential areas for future research, enabling detailed analysis and providing valuable insights into PPPs. The systematic review methodology was implemented based on [19, 20] to guarantee future reproducibility and comparability. The applied process is illustrated in Figure 1.

In the initial phase of the study, we carefully considered establishing precise search parameters and selecting an appropriate database and keywords central to the study. We chose Scopus, a reputable and widely used scientific database, to ensure the inclusion of all relevant literature.

Subsequently, an iterative process was employed to formulate an effective search string, aligning with the central research question and the field of study. Relevant keywords were identified and tested in various combinations using Boolean operators, enabling the analysis of corresponding results. This iterative process provided valuable insights into search patterns and associated keywords, resulting in the selection of the following search string to query the aforementioned scientific database:

TITLE-ABS-KEY(("public-private" OR "cross-sector" OR "partnership") AND "disaster" AND ("incentive" OR "challenge" OR "decision"))

The search took place on October 13, 2023, yielding 506 articles. We screened these publications based on specific inclusion and exclusion criteria to extract relevant articles and maintain the reliability of the systematic process. The review includes studies directly relevant to PPPs and the determined research question encompassing peer-reviewed journal articles published in English. Our review excludes studies that do not primarily focus on PPPs or fail to provide substantial information on the underlying research aim. Non-academic sources, such as news articles, opinion papers, and blog posts, are not included due to their informal nature.

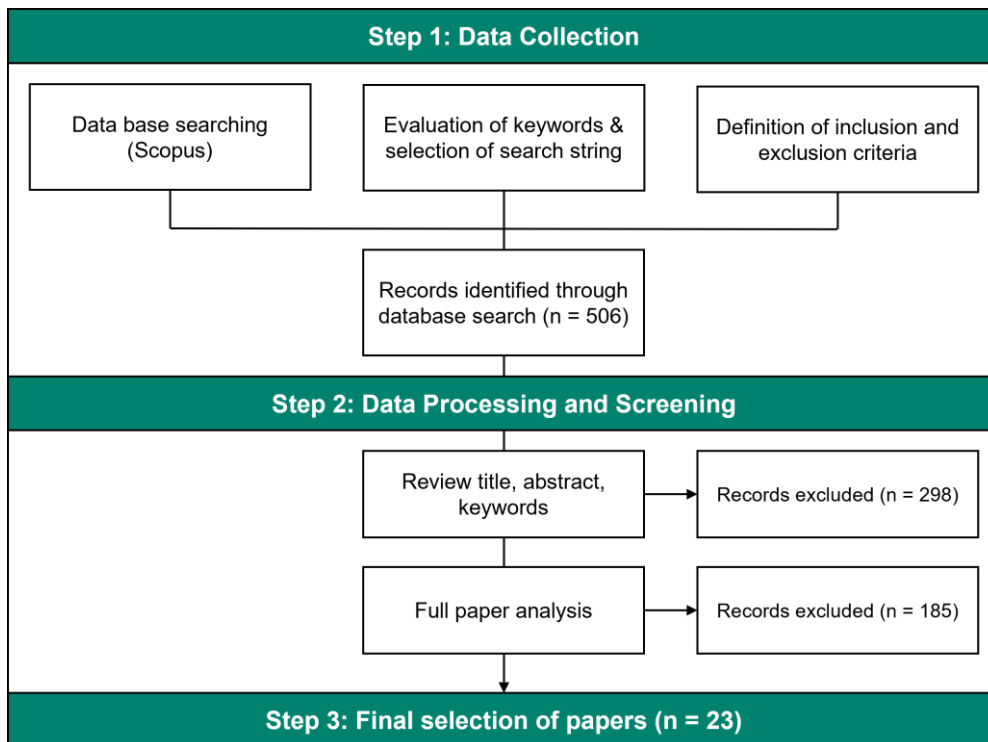


Figure 1: Schema of literature review

In the next step, articles were initially screened based on their titles and abstracts following the established criteria. To manage the volume of papers, topics regarding insurance, sustainability, construction, and specific case studies were excluded. We closely examined each article, extracting relevant information to address the research question. Furthermore, we coded specific sections in the papers using a classification scheme to develop the framework. Subsequently, these coded sections were assigned to their respective categories in alignment with the established framework. The following sections offer detailed insights into the descriptive and thematic findings from the remaining 23 articles.

4 Results

4.1 Descriptive analysis of the reviewed articles

In the last decade, as illustrated in Figure 2, there has been a notable rise in papers focusing on collaborations between public and private actors. Furthermore, the three-year moving average indicates a consistent upward trend, highlighting a growing interest in this field. Table 1 outlines the methodologies of the chosen articles from the systematic review and specifies the journals to which they are affiliated. The five journals with the highest number of contributions (count in parentheses) are: International Journal of Disaster Risk Reduction (5), Journal of Humanitarian Logistics and Supply Chain Management (3), Journal of Disaster Research (2), International Journal of Production Economics (2), and International Journal of Environmental Research and Public Health (2). Moreover, the widespread distribution of individual articles across diverse journals underscores the broad significance of collaborations in various domains and sectors.

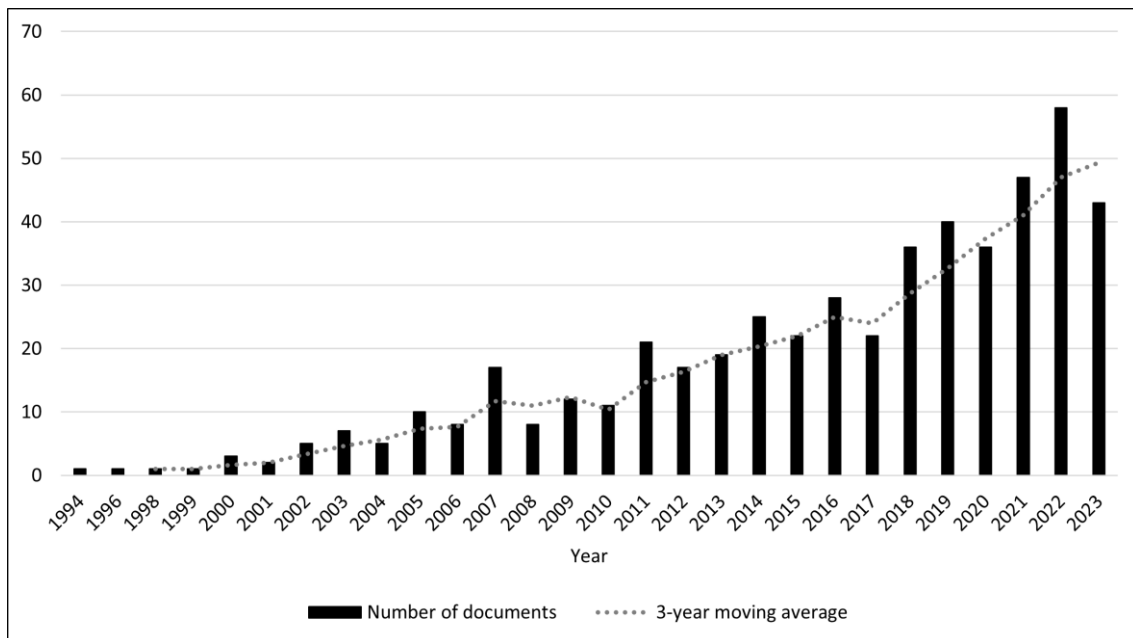


Figure 2: Number of documents by year

Examining the research methods employed in these journals, it is evident that qualitative empirical analysis is the primary approach. This methodical preference among disaster risk reduction and humanitarian logistics researchers might be the case since qualitative empirical approaches offer detailed insights and contextual knowledge. Quantitative methods also play an essential role, emphasizing statistical analysis and interpretation of numerical data. While researchers widely employ empirical methods, the limited use of mathematical and analytical models underscores the unique nature of the topic, emphasizing the significance of real-world observations and human-centered approaches.

Table 1: Number of documents by journal and methodology

Journal	Methodology	Articles
International Journal of Disaster Risk Reduction (n = 5)	Empirical Analysis (Qualitative)	2
	Empirical Analysis (Quantitative)	1
	Empirical Analysis (Qualitative & Quantitative)	1
	Analytical/ Mathematical	1
Journal of Humanitarian Logistics and Supply Chain Management (n=3)	Empirical Analysis (Qualitative)	1
	Empirical Analysis (Qualitative & Quantitative)	1
	Analytical/ Mathematical	1
Journal of Disaster Research (n = 2)	Empirical Analysis (Qualitative)	1
	Empirical Analysis (Qualitative & Quantitative)	1
International Journal of Production Economics (n = 2)	Empirical Analysis (Qualitative)	1
	Empirical Analysis (Qualitative & Quantitative)	1
International Journal of Environmental Research and Public Health (n=2)	Empirical Analysis (Qualitative)	2
Transportation Research Record (n =1)	Empirical Analysis (Qualitative)	1
Transportation Journal (n = 1)	Empirical Analysis (Qualitative)	1
SCM Journal of Homeland Security and Emergency Management (n=1)	Empirical Analysis (Qualitative)	1
International Journal of Production Research (n = 1)	Empirical Analysis (Qualitative)	1
International Journal of Emergency Management (n=1)	Analytical/ Mathematical	1
HSO Management, Leadership and Governance (n = 1)	Empirical Analysis (Qualitative)	1
Decision Analysis (n = 1)	Analytical/ Mathematical	1
American Review of Public Administration (n = 1)	Empirical Analysis (Qualitative)	1

4.2 A decision-support framework for public and private actors

We developed a robust decision-support framework based on the selected review papers to understand PPPs and manage the complexity of these relationships. The framework presented in Figure 3 identifies critical enablers, challenges, incentives, and practical examples that guide stakeholders toward successful collaboration. The following subsections elaborate on the primary categories of the framework.

4.2.1 Enablers

Identifying the factors that enable successful PPPs is crucial to implement them efficiently. According to the reviewed papers, these enablers encompass: Information & knowledge sharing [21, 22, 23, 24, 25, 26], collaboration & communication mechanism [27, 28, 21, 29, 30, 31, 22], framework agreements [32, 24, 23, 30, 21], alignment of interests [28, 22, 33], trust-building [28, 21, 30], infrastructure & technology [31, 26, 21, 24, 23, 22, 28], quality of services [27], training [21, 22, 31], and management commitment [22, 26].

In particular, sharing information & knowledge and collaboration & communication mechanisms were often cited as critical success factors in effective partnerships. According to [21], a clear legal basis, platforms for information sharing, mechanisms for acquiring and sharing critical resources, and regular communication mechanisms are essential. One possible solution is to

collaborate based on legal framework agreements (FAs) established before disasters or through intermediary agencies to support coordination [32, 30].

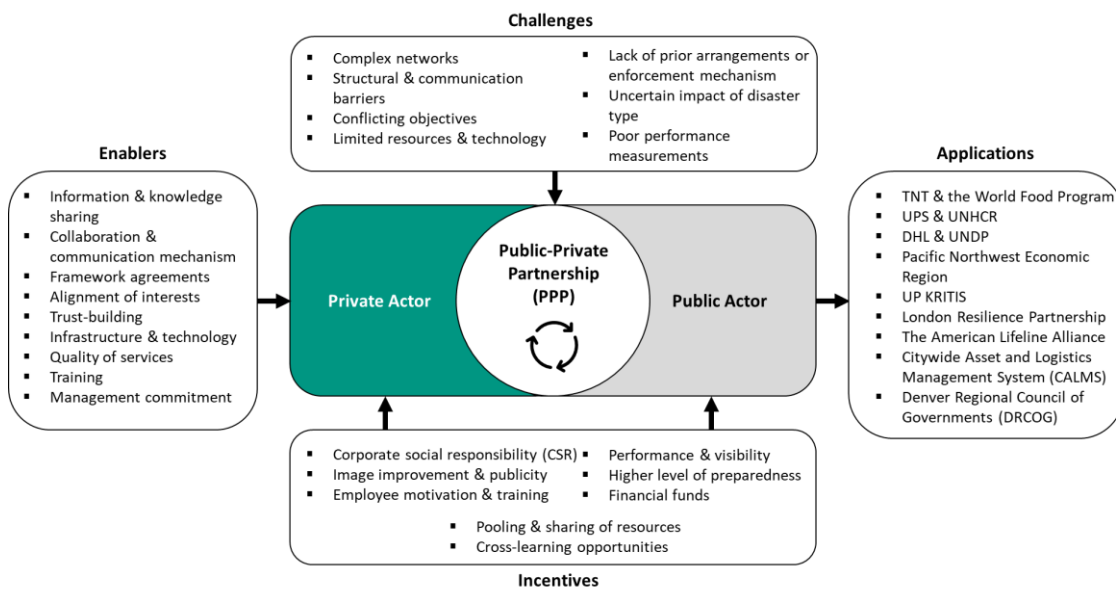


Figure 3: Framework for Public-Private Partnership

In addition, it is vital to define a common goal, align the interests of all stakeholders, build trust, create compatibility, and ensure the availability of critical infrastructure, technology, and resources to carry out the necessary actions. Both sides should specify the expected performance quality, which can be ensured, for example, through collaborative exercises and adequate commitment.

4.2.2 Challenges

While PPPs offer numerous benefits, they also come with significant challenges. Overcoming these challenges is crucial for long-term success and the smooth functioning of operations.

The main challenges highlighted in the examined articles can be summarized as follows: Complex networks [34, 35, 36], structural & communication barriers [27, 25, 30, 37], conflicting objectives [35, 31, 38], limited resources & technology [34, 32, 39, 24], lack of prior arrangements or enforcement mechanism [40, 36, 32], uncertain impact of disaster type [31, 35], and poor performance measurements [27, 36].

Humanitarian relief networks typically involve multiple stakeholders with diverse and conflicting objectives, protocols, perspectives, and a strong inclination towards asserting control and maintaining independence. This diversity often leads to duplicated efforts, unidirectional communication, ill-defined decision-making, and unknown accountability, making the relief process less effective and coordinated.

Furthermore, conducting humanitarian relief operations is complex due to constrained resources and a political atmosphere marked by urgency and unpredictability. Additionally, there are fluctuating needs and diverse impacts on the population and infrastructure. According to [40], prior arrangements with private service providers are essential to supply a critical response

component during an emergency. However, failure to honor the contractual agreement can have intense and widely dispersed impacts on human health and well-being, with little room for adequate contract enforcement.

Therefore, a long-term basis of building trust, elaborated measures to ensure performance even under exceptional circumstances, a constant exchange of critical information, and fostering close collaboration during non-crisis periods are essential prerequisites.

4.2.3 Incentives

Building effective PPPs requires careful balancing of incentives for private and public actors to maintain long-lasting relationships. Private actors are generally motivated by their shareholders' interests and the importance of generating profit as a corporation [24].

However, Corporate Social Responsibility (CSR) [27, 31, 37, 41], image improvement & publicity [28, 36], as well as employee motivation & training [27, 36], play an essential role in attracting customers and staying competitive. Although there may not be a direct financial gain, social engagement can result in indirect economic advantages. Companies engaging in CSR initiatives and sharing core competencies and resources can enhance employee motivation and improve the company's image and visibility. Consequently, these efforts can attract a broader customer base and lead to an expansion of market share. In contrast, public entities prioritize the population's welfare and strive to maximize the level of service. Therefore, incentives primarily involve enhancing the performance of relief operations and increasing visibility among the population [38, 31], improving disaster preparedness [28, 29], and ensuring the availability of financial funds [36].

Both public and private organizations have valuable resources and knowledge to share during emergencies [27, 24, 23, 42, 34, 36]. For example, public entities can provide crisis expertise, special privileges, and permits, such as transit options for employees, and coordinate the distribution of goods to minimize the risk of stock-outs and maintain business continuity. Meanwhile, private organizations can provide technical and operational expertise, access to data, rapid response capabilities, and financial resources.

4.2.4 Application examples

PPPs have been widely and successfully utilized across various sectors and industries to cope with unforeseen events and leverage the strengths of both actors. In the reviewed articles, various application examples are provided, such as the logistics company TNT Express NV & the World Food Program [31], UPS Inc. & UNHCR [27], DHL Paket GmbH & UNDP [31], the Pacific Northwest Economic Region (PNWER) [30], the public-private cooperation UP KRITIS [35], the London Resilience Partnership (LRP) [25, 30], the American Lifeline Alliance (ALA) [30], the Citywide Asset and Logistics Management System (CALMS) [24], or the Denver Regional Council of Governments (DRCOG) [24].

For example, the ALA is a PPP project funded by the Federal Emergency Management Agency (FEMA). Its objective is to mitigate risks to essential services like transportation systems during hazardous events. The UP KRITIS working group in Germany represents a collaboration between critical infrastructure operators, their associations, and relevant government agencies [43]. The aim is to safeguard critical infrastructure through PPPs.

At the city level, the LRP, comprising more than 170 organizations, assigns distinct roles to each entity for emergency preparedness and response. Moreover, this partnership involves diverse organizations and communities, fostering a holistic approach to emergency management [44]. Likewise, the Logistics Management System CALMS comprises a database of private assets and resources provided by the New York City Office of Emergency Management (NYC OEM) to enable potential opportunities for sharing resources within the community during emergencies [45]. These examples demonstrate the versatility of PPPs, showcasing their ability to address various needs and promote resilience structures.

5 Conclusion

In conclusion, PPPs benefit significantly from the synergies of resources and knowledge by leveraging public and private assets and expertise. This synergy is particularly evident when private or public entities can deliver a service more efficiently than their counterparts, especially when resources are scarce and time is limited. Preparing for and responding to disaster situations is highly challenging due to the unpredictable nature of their extent.

While overcoming every barrier may be challenging, consistent communication and collaborative training are critical to building trust and effectively resolving differences. Consequently, it is essential to define common objectives during the preparation phase. This process involves creating awareness, emphasizing the importance to all stakeholders, anticipating limited resources, and establishing potential arrangements or communication platforms. Nevertheless, partnerships, especially long-term partnerships in disaster relief, are still rare, and the collaborative challenges faced by public and private actors represent some of the key reasons why companies may be hesitant to commit to such relationships [27].

Therefore, our comprehensive decision-support framework is valuable in managing the complexity and uncertainty of disaster management and collaborative partnerships. It helps address the underlying challenges and promotes long-term partnerships. A structured decision-making process can be developed by incorporating identified enablers, mitigating challenges, and reinforcing incentives. Moreover, insights gained from successful and challenging experiences in PPPs can influence the course of collaborative efforts. Integrating these lessons can pave the way for more resilient, responsive, and sustainable partnerships between public and private stakeholders.

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