Building Urban Community Resilience against Hazards through Public-Private Partnerships: A Review of Critical Resilience Strategies

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Review

Building Urban Community Resilience against Hazards through Public-Private Partnerships: A Review of Critical Resilience Strategies

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Abstract: The need for governments and stakeholders to find urgent solutions to address the destructive effects of disasters in urban areas has led to the call for cross-sector collaborations such as public-private partnerships to assist with the development of urban community resilience in this modern era. This paper comprehensively reviews studies on the critical strategies in using public-private partnerships as a collaboration mechanism in building urban community resilience. Through a two-stage systematic literature review process, 83 publications related to PPPs and urban community resilience were retrieved for thorough content analysis. Based on an analysis of the literature, 35 critical resilience strategies for using PPPs in building urban community resilience were derived. These strategies were further categorized into nine major groupings. These groups include vulnerability and risks assessment, information gathering, database, legal, monitoring and evaluation, resilience capacity, communication and coordination, financial incentives, and business continuity. Furthermore, a theoretical framework was developed. These resilience strategies can be adopted by states and communities that intend to use the PPP concept to build the resilience of their urban communities. It also opens the international debate on the suitability of the PPP model for community resilience building.

Keywords: urban community; resilience; PPP; resilience strategies; systematic review

Citation: Osei-Kyei, R.; Ampratwum, G.; Tam, V.W.Y.; Komac, U.; Narbaev, T. Building Urban Community Resilience against Hazards through Public-Private Partnerships: A Review of Critical Resilience Strategies. *Buildings* **2024**, *14*, 1947. https://doi.org/10.3390/buildings14071947

Academic Editor: Jurgita Antucheviciene

Received: 1 June 2024
Revised: 17 June 2024
Accepted: 22 June 2024
Published: 27 June 2024

1. Introduction

The resilience of urban infrastructure is reflected in the continuity of key services and rapid recovery during disruptive events and unknown changes. Urban communities represent the synergistic blend between engineering, economic, and social structures [1]. Urban community resilience is the capacity of a community to adapt to change in ways that result in positive impacts on their wellbeing [2]. In recent years, cross-sector collaboration has advocated for including public-private partnerships (PPPs) in urban community resilience [1]. Chen et al. [3] also contends that PPPs are essential for preparing for, responding to, and recovering from large-scale natural disasters. In the United States, for instance, PPPs and resilience are closely linked to urban community resilience [4].

In this study, public-private partnership (PPP) is defined as a collaboration between the public and private sectors, working together to achieve a common goal while combining resources and sharing risks as well as benefits [5]. The PPP concept applied to resilience building and disaster management is slightly different from the usual PPP concept applied to infrastructure development and projects [6]. PPP for disaster management and resilience building focuses more on cross-collaboration on information, knowledge, and resources sharing [6]. In fact, PPP provides a positive strategic, operational. and tactical impact in

urban community resilience [4]. Reliance on PPP to build urban community resilience is due to the high proportion of privately owned critical infrastructure and the financial benefits that it generates [7]. Public- and private-sector institutions play critical roles in urban community resilience by enhancing community capacity and its critical infrastructure to adapt to disruptive events [8]. Essentially, a functioning partnership between the public and private sectors pools together diverse resources to enhance the preparation of urban communities and their infrastructure for their response and recovery from disasters [9,10]. Failing to utilize PPP mechanisms in developing urban community resilience could increase the post-disaster consequences because public sector institutions are largely incapable of handling and developing effective urban community resilience [1].

PPP has become critical in developing urban community resilience in the last few years. This is because, through collaborations between the public and private sectors, governments are able to better manage urban disruptions using technological innovations. Usually, the private sector possesses the technological skills required to respond quickly to urban disruptions and disasters, and this could be implemented through PPPs [11]. Importantly, with the increasing interest in PPPs in urban community resilience, many authors have attempted to explore some critical issues related to this field in the last decade. For example, Chi et al. [12] conducted research on partnerships for community resilience, garnering perspectives from the Los Angeles County community disaster resilience project. Hahn [13] also examined how public-private partnerships are useful for business continuity in urban communities. Marana et al. [14] developed a framework that defines and describes the successful characteristics of public-private-people partnerships (4P) in the city resilience-building process. They found 14 characteristics, including commitment, coordination, interdependence, trust, flexibility, user friendliness, etc. Cui and Li [15] measured community resilience using a social network analysis. Wang et al. [16] analyzed four exemplary cases of resilient urban communities while examining the resilient strategies of the urban communities. Onyeagoziri et al. [17] identified the mechanisms influencing the level of understanding of community resilience in a vulnerable community. Chen et al. [18] measured the comprehensive resilience level in different types of communities. Rapaport et al. [19] examined the extent of different forms of resilience among varying community types. Their study assessed five factors of perceived community resilience, including leadership, preparedness, collective efficacy, trust, and attachment to the place. Eadie and Su [20] explored the impact of disaster rehabilitation interventions on bonding social capital in a community in the Philippines. Nop and Thornton [21] explored the current climate-related hazards and their impacts on urban livelihoods in selected urban communities in Phnom Penh. The risks of climate-related hazards in Phnom Penh included heat waves, floods, storms, flooding, landslides, and vector-borne diseases. The impact of these hazards included health problems or disease, damage to infrastructure, damage to houses and other properties, loss of lives and jobs, and damage to crops and farms. Kammouh et al. [22] proposed an indicator-based method for measuring urban community resilience. In their study, the researchers developed a tool that can be used to quantify the resilience of urban communities using the PEOPLES framework structure. The tool was further tested using a case study. Mohamad et al. [23] used a qualitative approach to localize the resilience community indicators to measure the resilience level of the urban community. In their study, they developed resilience indicators based on three broad themes, namely social capital, environmental capital, and economic capital. These indicators were tested using a case study. Argyroudis and Mitoulis [24] investigated the vulnerability of urban critical infrastructure such as flood-critical bridges against unexpected hazards. The findings of the study provided reliable risk assessments of bridges against potential hazards. Similarly, adopting a case study (i.e., Californian highway bridges), Forcellini [25] also developed a model to assess the seismic resilience of bridges. Lastly, Osei-Kyei et al. [11] adopted a systematic literature review to explore the indicators of urban community resilience. However, the authors failed to investigate how PPP can be applied to urban community

resilience. More importantly, the findings do not provide any implications regarding the strategies to adopt when adopting PPPs for urban community resilience.

Although the findings of previous studies are useful, they fail to holistically investigate how the PPP concept can be applied to building urban community resilience. More importantly, past studies have failed to review and develop a clear set of strategies or best practices, which are critical for the development of urban community resilience through PPP. In fact, such research is imminent, considering the rise in unexpected urban events and disruptions. A detailed set of critical strategies for PPPs in building urban community resilience will provide clear directions and information to both governments and private stakeholders on how urban communities can continue to function after serious unexpected events. Currently, no study has conducted a comprehensive review to unravel the salient strategies required to build urban community resilience through PPPs.

Against this background, this study aims to systematically review and develop critical resilience strategies for building urban community resilience through public-private partnerships.

The findings of this study will inform policymakers and stakeholders of the salient strategies to implement to build urban community resilience against unexpected events such as pandemics. Furthermore, the findings of this study provide a solid theoretical foundation for the formulation of relevant hypotheses for future empirical investigations in urban community resilience through PPP.

Following the introduction section is the research methodology. The third section is the Results and Discussion. The fourth section is the conceptual framework. The fifth section describes the knowledge gaps and future directions. The last section is the Conclusions and Implications section.

2. Research Methodology

This study adopted the systematic literature review methodology used by Osei-Kyei and Chan [26], Akomea-Frimpong et al. [27], and Tijani et al. [28]. The systematic review method is adopted because it is the most suitable methodological approach to gain in-depth insights into an emerging research domain such as PPP in urban community resilience [29]. More importantly, the systematic review method uses a research protocol that reduces the effects of probabilities and increases the validity and authority of the evidence identified in the review [30].

Following the research methodology protocol adopted by Osei-Kyei and Chan [26], a systematic literature review was conducted to analyze the literature to assemble the critical resilience strategies that are useful for using PPPs to build urban community resilience. The Scopus online database was used to search for relevant literature because it covers a wide range of academic journals from different disciplines [31]. Notwithstanding, Scopus is by far the most used database for systematic literature reviews in construction management and PPP research ([26,27]). Therefore, it is considered suitable and appropriate to use this database in this research. Figure 1 shows the systematic review process adopted for this study. The figure shows two stages of the review process, i.e., Stage 1—literature selection and stage 2—analysis of the targeted papers. The details of the stages are explained below.

2.1. Stage 1—Literature Selection

The search for the literature was conducted in three phases in order to not miss any relevant publications. The first literature search employed keywords on urban community resilience and PPP. The second literature search employed keywords on urban resilience and resilience. The third literature search employed only keywords regarding PPP and critical success factors. The combinations of keywords for each literature search at each stage were used to identify any publications whose research contents could help in achieving the aim of this study. It should be mentioned that the key differences between the three literature search phases were the different keywords used for the search.

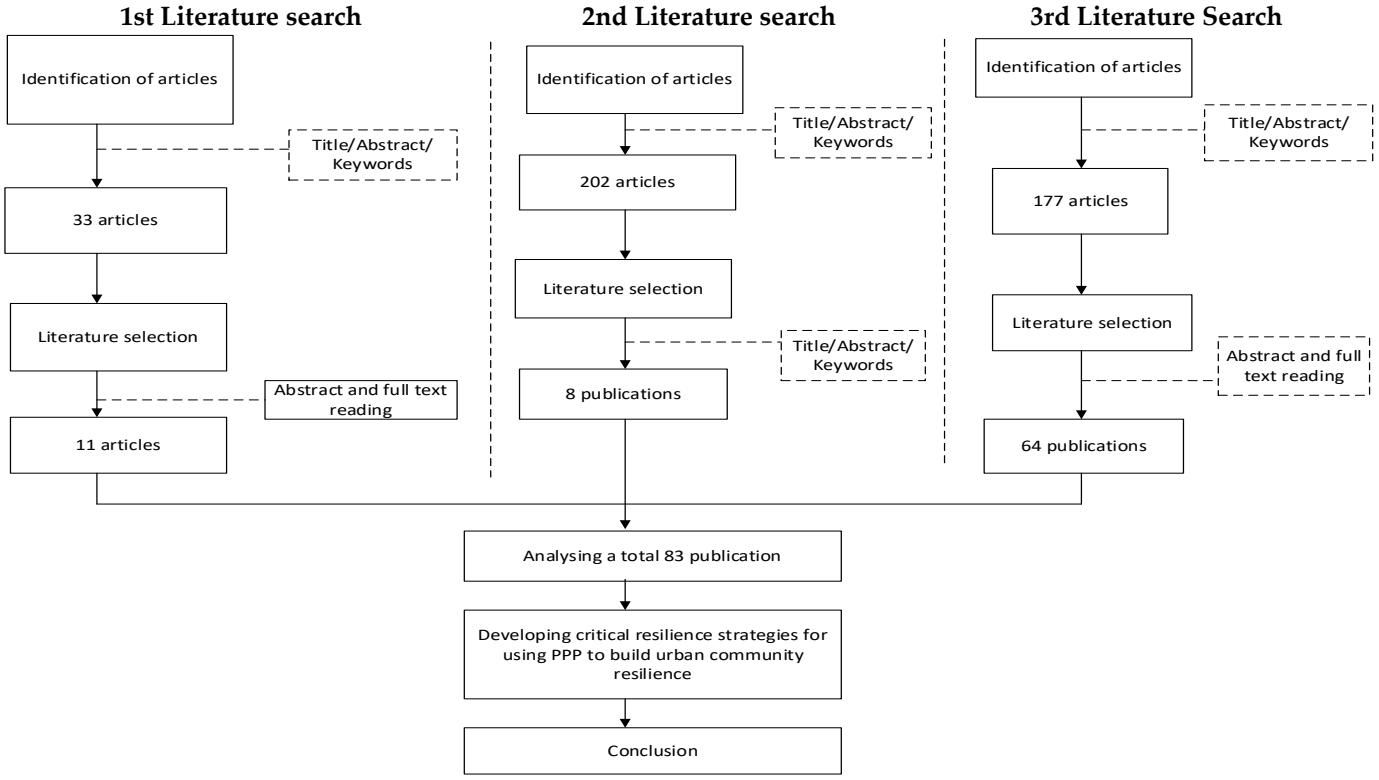

Figure 1. Research Process.

In the first literature search, the two research domains, i.e., PPP and urban community resilience, were put together to retrieve relevant publications for analysis. The title, abstract, and keywords (TAK) bar in the Scopus database was used for the literature search using relevant keywords. There were no year limitations. The full search code used was as follows: (TITLE-ABS-KEY ("public private partnership" OR "PPP") AND TITLE-ABS-KEY ("city resilience" OR "urban resilience" OR "community resilience") AND TITLE-ABS-KEY ("resilience" OR "resilience strategies" OR "resilience improvement measures" OR "policies")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "p"))

This search code generated 34 documents. After reading the abstracts, introductions, and conclusions of the 34 papers, only 11 journal articles had their contents aligned to PPPs in urban community resilience.

In the second phase of the literature search, keywords grounded in only the urban community resilience research domain were used. The essence of this literature search was to identify any literature on urban community resilience that may have provided implications or recommendations relating to the use of PPPs as a mechanism to build urban community resilience. Also, this stage was critical to ensure that all relevant papers were included in this review study. The full search code used in the second stage of the literature search was as follows: (TITLE-ABS-KEY ("urban community") AND TITLE-ABS-KEY ("resilience" OR "resilience strategies" OR "resilience improvement measures" OR "resilience policies")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "p"))

The search code generated 202 documents. Similar to the first literature search, after thoroughly reading the abstracts, introductions, and conclusions of the 202 publications, only 8 journal articles were relevant, as they provided some practical measures or recommendations for using PPPs to build urban community resilience. It should be emphasized that at this phase, many of the publications from the first search appeared in the second

literature search. Therefore, all the duplicated papers were removed to derive the final 8 journal articles.

A third literature search was conducted in which only PPP-related keywords were used. The keywords were restricted to "critical success factors". The understanding of critical resilience strategies in this study originates from the concept of critical success factors in PPP, where critical success factors are dependent factors that influence the likelihood of using the PPP mechanism in urban community resilience. The third search was conducted to identify any relevant papers that have discussed or investigated the critical success factors or strategies for PPPs. The search code used for the third stage of the literature search was as follows: (TITLE-ABS-KEY ("critical success factors") AND TITLE-ABS-KEY ("PPP" OR "public-private partnership" OR "public private partnership")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j") OR LIMIT-TO (SRCTYPE, "p"))

This search code generated 177 documents. Only 64 publications had research contents that were relevant to critical success factors for PPP.

It should be emphasized that the final papers selected in each of the three stages were based on a thorough review of the abstracts and conclusions in relation to the keywords used. Although a thorough search was conducted to retrieve relevant papers, it should be mentioned that not all publications may have been included in this study. This limitation has been highlighted in past papers that adopted systematic review methods; for example, see [26,28,32]. Notwithstanding, the large number of publications retrieved were enough to achieve the objectives of this study.

2.2. Stage 2—Analyzing Target Papers

Combining all the search results from Stage 1, a total of 83 publications were selected and subjected to thorough content analysis through full text reading to glean critical resilience strategies for using PPPs to build urban community resilience [32]. The target articles were selected based on their inherent features and characteristics to PPPs in urban community resilience. For instance, critical success factors in PPPs from the 3rd literature search that aligned with urban community resilience were retrieved. The list of 83 publications is detailed in Appendix A.

It should be mentioned that despite the wide coverage of the literature search in three different phases, some papers that may have mentioned PPPs in urban community resilience would have been missed. Therefore, the findings of this review paper should be interpreted within the context of the selected papers. Notwithstanding, this paper did not seek to review the entire population of papers on PPP in urban community resilience but rather to explore the salient strategies that are required for developing urban community resilience through PPP. Thus, the number of selected papers is considered adequate to draw meaningful conclusions for future reference.

3. Results and Discussion

3.1. Critical Resilience Strategies for Using PPPs as a Mechanism to Build Urban Community Resilience

Building community resilience is a complex and important task that requires effective partnerships [33]. Following a thorough content analysis of the 83 publications, a set of strategies that are relevant for building urban community resilience through PPP was developed. The strategies were developed based on the conclusions and findings of the selected 83 publications. First, relevant words and statements were retrieved based on the examination of the papers. Subsequently, the extracted items were coded, and similar coding patterns were grouped into relevant themes [27,32]. Table 1 shows the major groupings of the critical resilience strategies and their sub-factors from literature. The list of critical resilience strategies is directly applicable and has significant implications for urban community resilience. The developed critical resilience strategies for urban communities in Table 1 should guide stakeholders in ensuring that communities withstand and recover

from disruptive events. Subsequent sections discuss the major groupings for the list of critical resilience strategies.

Table 1. List of critical resilience strategies for PPPs in urban community resilience.

S/N	Category	Critical Resilience Strategies	Publications in Appendix A List
1	Vulnerability and risks assessment	Conduct community needs assessment	1
		Practice preparedness actions	4
		Vulnerability assessment	82
2	Information gathering	Provide homes in risk-prone areas with seals of approval or risk scores based on their susceptibility to different hazards	10
		Develop community maps delineating current and future risk	10
		Information accessibility	2, 6, 7
		knowledge co-production	8, 12
		Efforts to locally contextualize disaster management information, including greater understanding of local vulnerability and resilience	17, 81
		Develop community risk awareness program	9, 10
3	Database	Development of resource database	3, 4, 11
		Documentation and formalization of community-level disaster management planning, processes, and coordination within existing disaster management arrangements	9
		Enablement of community feedback and contribution to the development of a disaster management database	9,83
4	Legal	Reasonable legal framework	19–21, 23–31, 33–36, 39–50, 52–55, 59–63, 71–74, 77–79
		Stable political system	19, 21–23, 25, 26, 28, 29, 34, 38–40, 44–47, 49, 53–55, 58–63, 65, 67, 72, 75–77
		Credibility of government policies	18
		Governance and institutional capacity	15, 24, 28
		Well-structured legal dispute resolution mechanism	30, 32, 36
		Government support	24, 26, 33, 39, 72, 80
		Policy/strategy formulation	5
		Defined roles and responsibilities	7
		Well-structured PPP urban community resilience policy	38
		Clarity of roles and responsibilities among parties	23, 40
5	Monitoring and evaluation	Consistent urban community resilience performance monitoring	38, 39, 41, 46, 77, 57
		PPP agencies for monitoring and controlling	43
6	Resilience capacity	Qualified and skilled expertise are employed in the project service delivery	30
		Employment of highly skilled and competent workmanship in service operations	37, 38

Table 1. *Cont.*

S/N	Category	Critical Resilience Strategies	Publications in Appendix A List
7	Communication and coordination	Strengthening partnerships with non-governmental organizations	1, 6
		Shared responsibility	4
		Efficient communication and coordination	9, 11, 17
		Building information sharing platform	68
		Establish mechanisms for community input	1
		Publishing/disseminating the objectives, benefits, and implications of resilience strategies to all urban communities	22
8	Financial incentives	Financial support	4
		Insurance	10
9	Functional performance	Business continuity	3, 9

3.1.1. Vulnerability and Risks Assessment

Risk assessments involve identifying and understanding the vulnerabilities that urban communities are subjected to and identifying the proper measures to implement resilience strategies [34]. The critical resilience strategies in this category include conducting needs assessments; vulnerability assessments; practicing preparedness actions; and processing and coordinating within existing disaster management arrangements. In addressing the risks to urban communities, there is the need to identify the vulnerability of the urban communities before implementing the necessary adaptive capacity strategies [35]. For instance, a partnership between New Orleans, Veolia, and Swiss Re was formed to implement a urban resilience strategy [36]. The unique feature of the partnership between Veolia and Swiss Re in New Orleans was the assessment of critical infrastructure for vulnerabilities. A strategic roadmap with detailed action plan was subsequently developed to reduce the vulnerabilities and their impact in New Orleans [36]. A team of experts were commissioned to identify and quantify each site's vulnerabilities in terms of flood threat. Understanding the impacts of the cascading effects of disruptive events on urban communities is critical for planning urban community resilience [37]. A vulnerability assessment is a needs assessment that relates to the identification of long-term disruptive events and the implementation of risk-reduction strategies [38]. Proactive assessment of urban community susceptibility to disruptive events leads to the identification of the post-disaster actions that are important for recovery [39]. In the process of a needs assessment, different disruptive scenarios can be simulated to identify resilience gaps in urban communities [40]. Advanced simulation techniques for the scenario analysis add valuable insights about what could happen during the occurrence of disruptive events [34]. In addition, effort must be made to locally contextualize disaster management information and ensure the understanding of local vulnerability and resilience of the urban community. Modelling and simulation analyses provide the tools for the quantification of urban community resilience and allow for the evaluation and comparison of the effectiveness of different resilience strategies that are proposed to avoid and reduce the adverse consequences of disruptive events [34].

3.1.2. Information Gathering

The critical resilience strategies for this category include providing homes in risk-prone areas with seals of approval or risk scores based on their susceptibility to different hazards; knowledge co-production; developing community maps that delineate current and future risks of urban communities; information accessibility; efforts to locally con-

textualize disaster management information, including a greater understanding of local vulnerability and resilience; developing risk-awareness programs. Resilience capacity enhancement strategies must be identified and disseminated to the urban communities both the infrastructure operators and residential inhabitants [40]. Knowledge gained regarding risk hazards must include multi-hazard risk information identification to enhance interactions between scientists, municipal staff, and community members [37]. Multi-hazard risk mapping serves as a co-production activity and a medium for cross collaboration to occur between disciplinary boundaries and the boundaries of science and practice. The capacity of residents to respond to and recover from disaster requires that they have access to timely information about the threat and appropriate response mechanisms [41]. Information on vulnerable communities needs to be disseminated among the inhabitants [41]. Information gathering must be a continual effort to locally contextualize disaster management, including a greater understanding of local vulnerability and resilience [33]. Information sharing refers to the extent to which information is communicated to other partners, allowing task to be completed more effectively [14]. Public-private partnerships are a collective response to resilience-related issues in urban communities to help build the resilience of the urban community [42]. Clear communication protocols and timely notification of new or updated information among the public and private institutions and to the urban communities are valuable assets to urban community resilience [43]. This makes it possible to identify needs and resources that the urban communities require for timely intervention to reduce the impacts caused by any disruptive events [44].

3.1.3. Database

The critical resilience strategies for this category include the development of a resource database; the documentation and formalization of community-level disaster management planning, processes and coordination within existing disaster management arrangements; and the enablement of community feedback and contribution to the development of disaster management initiatives. A database may be developed to gather information on the urban community to identify the vulnerable group in the area [15]. The information gathered must be locally interpreted and disseminated [33]. Developing community maps that depict the current hazard hotspots in the community will inform stakeholders of the urban community on which resilience strategy will be appropriate [45]. Promoting risk understanding and acceptance of technical risk information is essential and must be undertaken by both the private and public sectors [45]. Historical event data collection in urban communities can support ex ante and ex post mitigations and decisions [46]. A catalogue of hazards and predicted hazards will require the public and private sectors to pool their resources together to develop it.

3.1.4. Legal

The critical resilience strategies within this category are a reasonable legal framework, a stable political system, the credibility of government policies, governance and institutional capacities, a well-structured legal dispute resolution mechanism, government support, policy/strategy formulation, a well-structured PPP urban community resilience policy, defined roles and responsibilities, and the clarity of the roles and responsibilities. Clear regulatory guidance defines the general regulations for the operational work of public and private sectors in urban community resilience [47]. Resilience policies need strong legal backing and political support to ensure their sustainability during a change in government [48]. In fact, the concept of PPPs in urban community resilience can only be successful if all stakeholders understand the positive impact of having legal regulation and are ready to invest resources into its development [49]. Also, defined roles and responsibilities for the public and private institutions in a partnership will help ensure decisive and timely responses to disruptive events [50]. In general, it should be emphasized that well-defined and updated legislation results in infrastructure that is safer and better prepared to prevent a crisis [51]. Furthermore, the public sector plays a significant role

in urban community resilience because it has the authority and capacity to increase the awareness of and commitment to resilience-building processes [51].

3.1.5. Monitoring and Evaluation

The critical resilience strategies for this category are consistent urban community resilience performance monitoring and instituting PPP agencies for monitoring and controlling. Setting up the sensors needed to gather information related to resilience in urban community is the main activity that should be carried out in monitoring any threats against the urban community [51]. Data acquisition and monitoring systems should be implemented throughout the infrastructure to gather information about the state of the infrastructure and to be able to anticipate an incident [51]. Strong monitoring and evaluation of urban infrastructure and systems will certainly ensure the timely prediction of any unexpected events. Furthermore, both the public and private sector can easily share information and knowledge on urban systems [52].

3.1.6. Resilience Capacity

Designing and constructing resilient infrastructure require the capacity of both the government and private sector in ensuring its success [52]. Trained personnel are a requisite in making critical infrastructure both resilient and adaptive to disruptive events [53]. Critical infrastructure operators in the urban community need to be trained to react to and control a disruption to maintain the continuity of essential services needed for the community [40]. Skilled personnel have the operational capacity to institute practices in urban communities that makes them ready to withstand or recover from disruptive events [38]. The coordinated efforts between public and private institutions may help to facilitate the immediate, medium-term, and long-term recovery of urban communities following a disaster [54]. The availability of skilled personnel will help urban communities return to pre-disaster levels of performance in a timely manner [55]. Community competence is the ability of urban communities to recognize, evaluate, and address emerging issues during disruptive events [10]. Community competence, coupled with the efforts of public and private institutions, can build the resilience of urban communities.

3.1.7. Communication and Coordination

The critical resilience strategies under this category include strengthening partnership with non-governmental organizations; efficient communication and coordination; shared responsibility; establishing mechanisms for community input; and publishing and disseminating the objectives, benefits, and implications of resilience strategies to an urban and building information sharing platform. Effective communication and coordination before any disruptive event can reduce the impact of disruptions on the urban community [40]. Engagement through public meetings and forums and daily contact with the community is a medium in which resilience strategies can be communicated. Greater integration of communities with public and private institutions can build trust and increase their participation in emergency preparedness activities [9]. Community collaboration, fostered with public-private collaboration, provides relevant social capital for communities to cope with disasters [15]. An integrated community emergency response command system will also yield positive benefits for the urban community. The responsibility of building the resilience of urban communities can be shared amongst public and private institutions within the community by coordinating roles among the community leaders. Kwok et al. [38] affirms the value of engaging local communities in understanding the broader scope of disaster risks and resilience. The urban communities must be included in critical decision makings about urban resilience [1]. Resilience gaps will not be addressed without cross-sector collaboration between public and private sectors [56]. The responsibility falls on government agencies to ensure an efficient coordination of the all stakeholders [57].

3.1.8. Financial Incentives

The efforts in building the resilience of urban communities must be supplemented with financial efforts [41]. Monetary resources are needed for urban resilience. In this regard, PPP offers the opportunity for public and private sectors to combine monetary resources for urban resilience [51]. In the context of this study, monetary resources are the necessary long-term funds or assets required to build urban community resilience through PPPs. These monetary resources should be available for long-term usage to ensure the effective adoption of PPPs in urban community resilience. In fact, without the necessary monetary resources and government policies such as financial incentives packages from the government, it will be difficult for the adoption of PPPs in urban community resilience to materialize. Generally, financing urban resilience is the responsibility of the government; however, public finances may be insufficient [36]. The availability of private-sector resources should be matched to relevant government financial resources to build enough systems to support urban disruptions and unexpected events [1]. Private developers must be financially incentivized to adopt resilience-based design standards. The relevant authorities should require resilience-based design standards and measurement systems to help in tracking the levels of resilience [56]. Misaligned incentives for risk reduction in urban communities may reduce the mitigation investments by business owners and inhabitants of urban communities [45]. Insurance can play an important role in communicating risks if property owners in urban communities are given information regarding their risk-based premiums [45]. Property owners in urban communities may be reluctant to invest in risk-reduction measures if the upfront costs may cause financial strain to the owners [45]. While requiring the public and private sectors to absorb some of the risk-reduction measures, property owners must be required to absorb some of the costs of risk reduction measures for disruption events.

3.1.9. Functional Performance

Business continuity plans must be developed for critical infrastructure within urban communities [58] to ensure continual service delivery for the urban community. Business continuity enables the stakeholders involved in the functional performance of critical infrastructure to be more confident when disruptive events occur and help identify where the plans are inadequate and could be improved. It also ensures the continual functioning of the communities, even amid disruptive events. The business continuity plans must be mandatory, which features the prevention and preparedness measures that infrastructure operators can rely on during disruptive events to ensure the infrastructure maintains functional performance during disruptive events and after disasters [59]. Public-private partnerships offer the ability to operationalize disaster management plans and business continuity for urban communities [1].

4. Theoretical Framework for Critical Resilience Strategies for Building Urban Community Resilience through PPPs

The diffusion of innovation involves communicating new ideas through certain channels [60]. The Rogers framework is an implementation framework that guides policy makers on how to implement the identified critical resilience strategies should they decide to use PPP to build urban community resilience. There are studies that have used Rogers' diffusion of innovation attributes to examine the implementation of technology, policies, etc. Gledson and Greenwood [61] used Rogers' innovation theory to investigate the adoption of 4D BIM in the UK construction industry. Ampratwum et al. [62] also used Rogers' innovation diffusion concept to develop a framework for the implementation of green certification of buildings in Ghana. Shibeika and Harty [63] drew upon the concept of Rogers' diffusion innovation theory in examining the diffusion of digital innovation in construction in the U.K. This section develops a theoretical framework using Rogers' [60] Diffusion of Innovation Theory and the critical resilience strategies developed in the literature. The list of developed critical resilience strategies is considered under the concept

of PPPs. This means the community must first accept PPPs as a medium to build urban resilience. There are studies that have acknowledged the importance of collaboration between public and private institutions to build urban community resilience. But how can this collaboration among stakeholders to build urban community resilience happen? By using Rogers' diffusion of innovation attributes, these identified critical resilience strategies in PPPs in building urban community resilience can be used to demonstrate their viability. In this theory, the factors influencing PPP adoption for urban community resilience are explored and infiltrated into the conceptual framework presented in Figure 2. These influencing factors include relative advantage, compatibility, complexity, trialability, and observability. As mentioned previously, the five factors are borrowed from Rogers' [60] Diffusion of Innovation Theory, and they are considered to be the perceived characteristics of an innovation that affects its adoption. Even though public-private partnerships are not a new concept, their usage in building urban community resilience may be described as a new concept.

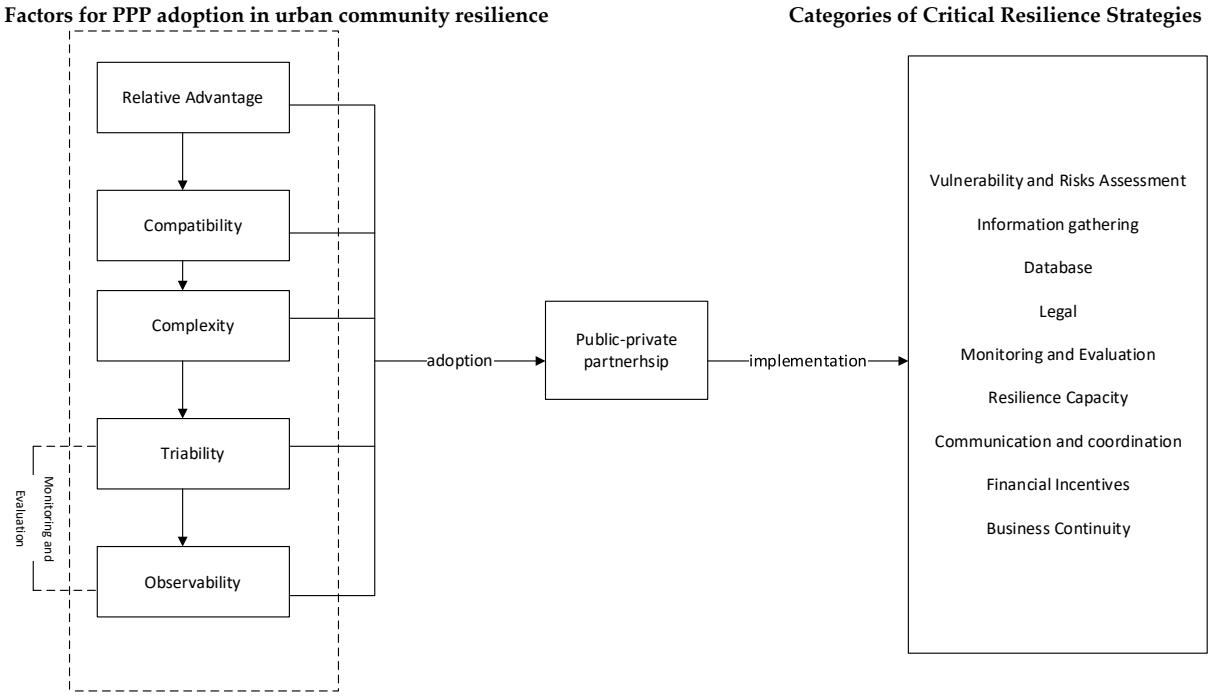

Figure 2. Conceptual framework for using PPPs in building urban community resilience.

The conceptualization of Rogers' [60] characteristics of innovation adoption for adopting PPPs to build urban community resilience has been discussed, as described below.

1. Relative advantage: The use of PPPs to build the resilience of urban communities must provide the potential of public and private institutions or agencies in partnership with the understanding that PPPs will yield fruitful results in urban community resilience rather than siloed efforts.
2. Compatibility: The use of PPPs in urban community resilience must be demonstrated to potential public and private institutions or agencies, showing that adopting the PPP strategy will yield the desired outcomes. It must be demonstrated to them how collaborating with each other will be consistent with the resilience gaps in their urban communities.
3. Complexity: The collaboration between the public and private institutions or agencies must not be complex. To increase the likelihood of collaboration between more public institutions and private agencies, the rules or responsibilities of each party need to be easily understood. In addition, the critical resilience strategies needed for using PPPs to build urban community resilience must be understood and easily implemented.

4. Trialability: Companies are more likely to invest in strategies that have been tested on a trial basis. An urban community can be selected for collaboration between public and private institutions or agencies on a trial basis. Under this collaborative PPP, the identified critical resilience strategies in this study can be replicated with constant monitoring and evaluation of the results. Positive outcome may increase the likelihood of other urban communities adopting PPPs to build the resilience of their urban communities.
5. Observability: Using PPPs as a medium to build urban community resilience needs to be presented in a way that the results will be recognizable to stakeholders. This implies that the public and other external stakeholders should be able to understand the benefits and relative advantages of adopting PPPs in building urban community resilience. Certainly, if the general community and external stakeholders can realize the benefits of PPPs in building urban community resilience, they will be willing to contribute and support the adoption of the PPP concept in building resilience.

5. Implications for Practice and Research

Practically, the outcomes of this study, particularly its strategies, will serve as a management decision guide for key decision makers and stakeholders with the responsibility of building urban community resilience.

First, it is recommended that both the public and private parties conduct a thorough risk assessment prior to the use of PPPs in urban community resilience. This is very important, because it will enable both parties to explore any potential setbacks affecting the partnership.

Second, governments should provide financial support in the form of tax rebates and incentives to the private sector for the building of community resilience in urban areas.

Lastly, information sharing and communication among parties are very critical to the effective adoption of PPPs in building urban community resilience. Essentially, the rapid sharing of information will lead to timely and quick responses to situations within urban communities.

For future research, the outcomes add to the urban community resilience literature by expanding discussions on the application of new partnerships and collaboration models or concepts such as PPPs in building disaster management and community resilience.

In addition, the findings provide a solid knowledge base for the formulation of hypotheses for future empirical research.

6. Conclusions

This study sought to explore the critical resilience strategies adopted when using PPPs as a medium to build urban community resilience. This study presented a systematic review of 83 articles to identify relevant strategies that align with critical resilience strategies in using PPPs to build urban community resilience. The aim of this study was to analyze the literature to assemble the critical resilience strategies useful in using PPPs to build urban community resilience. This study generated 35 critical resilience strategies, which were grouped into 9 categories. The categories included are vulnerability and risk assessments, information gathering, databases, legal, monitoring and evaluation, resilience capacity, communication and coordination, financial incentives, and business continuity. Using Rogers' theory of diffusion and its strategies, a conceptual model for adopting PPPs in urban community resilience was developed.

After a thorough analysis of the literature on PPPs in urban community resilience, the following are the limitations of this study and the proposed future research.

First, the critical resilience strategies identified in this study are yet to be empirically tested. Therefore, it is suggested that a mixed methodology using semi-structured interviews and questionnaire surveys should be adopted to explore the criticality of the nominated strategies. Furthermore, analytical techniques such as the fuzzy synthetic evaluation technique and structural equation modeling should be used for data analysis to

understand the relationship between the PPP adoption factors and the strategies. Also, the relationships among the strategies should also be examined.

Second, other critical issues such as risks allocation and performance assessment of PPPs for urban community resilience have been unexplored. These two critical concepts are essential in ensuring the successful implementation of PPPs in urban community resilience. Considering this, future research studies should explore the relationship between the critical strategies identified in this study and performance indicators of PPPs in urban community resilience.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. List of Selected Publications

S/N	Authors	Title	Year	Source Title
1	Chi G.C., Williams M., Chandra A., Plough A., Eisenman D.	Partnerships for community resilience: Perspectives from the Los Angeles County Community Disaster Resilience project	2015	Public Health
2	Maraña P., Labaka L., Sarriegi J.M.	We need them all: development of a public private people partnership to support a city resilience building process	2020	Technological Forecasting and Social Change
3	Daniel Hahn	How to create a public-private partnership: A replicable project associated with business continuity	2010	
4	Scott J., Coleman M.	Reaching the unreached: Building resilience through engagement with diverse communities	2016	Journal of business continuity & emergency planning
5	Budiati L.	Local leadership model towards a resilient city in Semarang municipality	2017	Planning Malaysia
6	Chandra A., Williams M., Plough A., Stayton A., Wells K.B., Horta M., Tang J.	Getting actionable about community resilience: The Los Angeles county community disaster resilience project	2013	American Journal of Public Health
7	Marana P., Labaka L., Sarrieg J.M.	A framework for public-private-people partnerships in the city resilience-building process	2018	Safety Science
8	Aguilar-Barajas I., Sisto N.P., Ramirez A.I., Magaña-Rueda V.	Building urban resilience and knowledge co-production in the face of weather hazards: flash floods in the Monterrey Metropolitan Area (Mexico)	2019	Environmental Science and Policy
9	Bajracharya B., Hastings P., Childs I., McNamee P.	Public-private partnership in disaster management: A case study of the Gold Coast	2012	Australian Journal of Emergency Management
10	Kousky C., Kunreuther H.	Risk Management Roles of the Public and Private Sector	2018	Risk Management and Insurance Review
11	Cui P., Li D.	A SNA-based methodology for measuring the community resilience from the perspective of social capitals: Take Nanjing, China as an example	2020	Sustainable Cities and Society
12	Bixler R.P., Yang E., Richter S.M., Coudert M.	Boundary crossing for urban community resilience: A social vulnerability and multi-hazard approach in Austin, TX, USA	2021	International Journal of Disaster Risk Reduction

S/N	Authors	Title	Year	Source Title
13	Wang Y.-C., Shen J.-K., Xiang W.-N., Wang J.-Q.	Identifying characteristics of resilient urban communities through a case study method	2018	Journal of Urban Management
14	Williams D.S., Máñez Costa M., Sutherland C., Celliers L., Scheffran J.	Vulnerability of informal settlements in the context of rapid urbanization and climate change	2019	Environment and Urbanization
15	Rodriquez C., Monteiro R., Ceresa P.	Assessing Seismic Social Vulnerability in Urban Centers—the Case-Study of Nablus, Palestine	2018	International Journal of Architectural Heritage
16	Onyeagoziri O.J., Shaw C., Ryan T.	A System Dynamics Approach for Understanding Community Resilience to Disaster Risk	2021	Jamba: Journal of Disaster Risk Studies
17	Chen Y., Liu T., Chen R., Zhao M.	Influence of the built environment on community flood resilience: Evidence from Nanjing City, China	2020	Sustainability (Switzerland)
18	Ullah F., Thaheem M.J., Sepasgozar S.M.E., Forcada N.	System Dynamics Model to Determine Concession Period of PPP Infrastructure Projects: Overarching Effects of Critical Success Factors	2018	Journal of Legal Affairs and Dispute Resolution in Engineering and Construction
19	Ahmadabadi A.A., Heravi G.	The effect of critical success factors on project success in Public-Private Partnership projects: A case study of highway projects in Iran	2019	Transport Policy
20	Wang Y.	Evolution of public-private partnership models in American toll road development: Learning based on public institutions' risk management	2015	International Journal of Project Management
21	Ng S.T., Wong Y.M.W., Wong J.M.W.	Factors influencing the success of PPP at feasibility stage -A tripartite comparison study in Hong Kong	2012	Habitat International
22	Zou W., Kumaraswamy M., Chung J., Wong J.	Identifying the critical success factors for relationship management in PPP projects	2014	International Journal of Project Management
23	Osei-Kyei R., Chan A.P.C.	Review of studies on the critical success factors for public-private partnership (PPP) projects from 1990 to 2013	2015	International Journal of Project Management
24	Mota J., Moreira A.C.	The importance of non-financial determinants on public-private partnerships in Europe	2015	International Journal of Project Management
25	Ngullie N., Maturi K.C., Kalamdhad A.S., Laishram B.	Critical success factors for PPP MSW projects — perception of different stakeholder groups in India	2021	Environmental Challenges
26	Zhang X.	Critical success factors for public-private partnerships in infrastructure development	2005	Journal of Construction Engineering and Management
27	Kwofie T.E., Afram S., Botchway E.	A critical success model for PPP public housing delivery in Ghana	2016	Built Environment Project and Asset Management
28	Almarri K., Boussabaine H.	Interdependency of the critical success factors and ex-post performance indicators of PPP projects	2017	Built Environment Project and Asset Management

S/N	Authors	Title	Year	Source Title
29	Babatunde S.O., Perera S., Zhou L., Udeaja C.	Stakeholder perceptions on critical success factors for public-private partnership projects in Nigeria	2016	Built Environment Project and Asset Management
30	Osei-Kyei R., Chan A.P.C., Ameyaw E.E.	A fuzzy synthetic evaluation analysis of operational management critical success factors for public-private partnership infrastructure projects	2017	Benchmarking
31	Babatunde S.O., Perera S., Zhou L.	Methodology for developing capability maturity levels for PPP stakeholder organisations using critical success factors	2016	Construction Innovation
32	Wang L., Zhang P., Zhang P., Li R., Zhang Y., Wu Y.	A systematic approach for public-private partnership projects CSFs evaluation	2018	Engineering, Construction and Architectural Management
33	Osei-Kyei R., Chan A.P.C.	Empirical comparison of critical success factors for public-private partnerships in developing and developed countries A case of Ghana and Hong Kong	2017	Engineering, Construction and Architectural Management
34	Babatunde S.O., Perera S.	Cross-sectional comparison of public-private partnerships in transport infrastructure development in Nigeria	2017	Engineering, Construction and Architectural Management
35	Ameyaw E.E., P.C. Chan A.	Critical success factors for public-private partnership in water supply projects	2016	Facilities
36	Osei-Kyei R., Chan A.P.C.	Perceptions of stakeholders on the critical success factors for operational management of public-private partnership projects	2017	Facilities
37	Alteneiji K., Alkass S., Abu Dabous S.	Critical success factors for public-private partnerships in affordable housing in the United Arab Emirates	2020	International Journal of Housing Markets and Analysis
38	Osei-Kyei R., Tam V., Ma M.	Effective strategies for developing retirement village public-private partnership	2021	International Journal of Housing Markets and Analysis
39	Ishawu M., Guangyu C., Adzimah E.D., Mohammed Aminu A.	Achieving value for money in waste management projects: determining the effectiveness of public-private partnership in Ghana	2020	International Journal of Managing Projects in Business
40	Dithebe K., Aigbavboa C.O., Thwala W.D.D., Hayhow S., Talebi S.	Stakeholder management in the alleviation of legal and regulatory disputes in public-private partnership projects in South Africa	2021	Journal of Engineering, Design and Technology
41	Kavishe N., Chileshe N.	Critical success factors in public-private partnerships (PPPs) on affordable housing schemes delivery in Tanzania: A qualitative study	2019	Journal of Facilities Management
42	Ameyaw E.E., Chan A.P.C., Owusu-Manu D.-G.	A survey of critical success factors for attracting private sector participation in water supply projects in developing countries	2017	Journal of Facilities Management
43	Dithebe K., Aigbavboa C.O., Thwala W.D., Oke A.E.	Factor analysis of critical success factors for water infrastructure projects delivered under public-private partnerships	2019	Journal of Financial Management of Property and Construction

S/N	Authors	Title	Year	Source Title
44	Węgrzyn J.	The perception of critical success factors for PPP projects in different stakeholder groups	2016	Entrepreneurial Business and Economics Review
45	Chan A.P.C., Lam P.T.I., Chan D.W.M., Cheung E., Ke Y.	Critical success factors for PPPs in infrastructure developments: Chinese perspective	2010	Journal of Construction Engineering and Management
46	Osei-Kyei R., Chan A.P.C.	Model for predicting the success of public-private partnership infrastructure projects in developing countries: a case of Ghana	2019	Architectural Engineering and Design Management
47	Kahwajian A., Baba S., Amudi O., Wanos M.	Identification of Critical Success Factors (CSFs) for Public Private Partnership (PPP) construction projects in Syria	2014	Jordan Journal of Civil Engineering
48	Almarri K., Boussabaine H.	The Influence of Critical Success Factors on Value for Money Viability Analysis in Public-private Partnership Projects	2017	Project Management Journal
49	Kuru K., Artan D.	A canvas model for risk assessment and performance estimation in public-private partnerships	2020	International Journal of Construction Management
50	Cheung E., Chan A.P.C., Lam P.T.I., Chan D.W.M., Ke Y.	A comparative study of critical success factors for public private partnerships (PPP) between Mainland China and the Hong Kong Special Administrative Region	2012	Facilities
51	Budayan C.	Analysis of critical success factors in public private partnership projects by triangulation method: Turkey perspective [Kamu özel sektör işbirliği ile yapılan projelerdeki kritik başarı faktörlerinin çeşitleme ile incelenmesi: Türkiye'deki inşaat sektörü perspektifi]	2018	Journal of the Faculty of Engineering and Architecture of Gazi University
52	Muhammad Z., Sik K.K., Johar F., Sabri S.	An overview of critical success factors of publicprivate partnership in the delivery of urban infrastructure and services	2016	Planning Malaysia
53	Debela G.Y.	Critical success factors (CSFs) of public-private partnership (PPP) road projects in Ethiopia	2019	International Journal of Construction Management
54	Hsueh C.-M., Chang L.-M.	Critical success factors for PPP infrastructure: perspective from Taiwan	2017	Journal of the Chinese Institute of Engineers, Transactions of the Chinese Institute of Engineers, Series A
55	Li B., Akintoye A., Edwards P.J., Hardcastle C.	Critical success factors for PPP/PFI projects in the UK construction industry	2005	Construction Management and Economics
56	Chileshe N., Njau C.W., Kibichii B.K., Macharia L.W., Kavishe N.	Critical success factors for Public-Private Partnership (PPP) infrastructure and housing projects in Kenya	2020	International Journal of Construction Management
57	Muhammad Z., Johar F.	Public-private partnership for housing construction projects a comparative analysis of the success factors between Malaysia and Nigeria	2019	IOP Conference Series: Materials Science and Engineering

S/N	Authors	Title	Year	Source Title
58	Chou J.-S., Ping Tserng H., Lin C., Yeh C.-P.	Critical factors and risk allocation for PPP policy: Comparison between HSR and general infrastructure projects	2012	Transport Policy
59	Niazi G.A., Painting N.	Critical success factors for public private partnership in the Afghanistan construction industry	2018	Lecture Notes in Mechanical Engineering
60	Olusola Babatunde S., Opawole A., Emmanuel Akinsiku O.	Critical success factors in public-private partnership (PPP) on infrastructure delivery in Nigeria	2012	Journal of Facilities Management
61	Ismail S.	Critical success factors of public private partnership (PPP) implementation in Malaysia	2013	Asia-Pacific Journal of Business Administration
62	Al-Saadi R., Abdou A.	Factors critical for the success of public-private partnerships in UAE infrastructure projects: experts' perception	2016	International Journal of Construction Management
63	Cheung E., Chan A.P.C., Kajewski S.	Factors contributing to successful public private partnership projects: Comparing Hong Kong with Australia and the United Kingdom	2012	Journal of Facilities Management
64	Sanni A.O.	Factors determining the success of public private partnership projects in Nigeria	2016	Construction Economics and Building
65	Wibowo A., Alfen H.W.	Government-led critical success factors in PPP infrastructure development	2015	Built Environment Project and Asset Management
66	Wibowo A., Alfen H.W.	Identifying macro-environmental critical success factors and key areas for improvement to promote public-private partnerships in infrastructure: Indonesia's perspective	2014	Engineering, Construction and Architectural Management
67	Sihombing L., Latief Y., Rarasati A.D., Wibowo A.	Developing a toll road financing model with a hybrid of deep discount project bonds and land leases in Indonesia	2018	International Journal of Civil Engineering and Technology
68	Hou J., Xiao R.	Identifying critical success factors of linkage mechanism between government and non-profit in the geo-disaster emergency decision	2015	International Journal of Emergency Management
69	Osei-Kyei R., Chan A.P.C.	Implementing public-private partnership (PPP) policy for public construction projects in Ghana: critical success factors and policy implications	2017	International Journal of Construction Management
70	Mwakabole G.C., Gurmu A.T., Tivendale L.	Investigation of the challenges facing public-private partnership projects in Australia	2019	Construction Economics and Building
71	Osei-Kyei R., Chan A.P.C.	Public sector's perspective on implementing public-private partnership (PPP) policy in Ghana and Hong Kong	2018	Journal of Facilities Management
72	Sadullah M., Ghazali M., Rashid A.	Critical success factors in a public-private partnership highway project in Malaysia: Ampang–Kuala Lumpur elevated highway	2018	Proceedings of Institution of Civil Engineers: Management, Procurement and Law

S/N	Authors	Title	Year	Source Title
73	Helmy R., Khourshed N., Wahba M., El Bary A.A.	Exploring critical success factors for public private partnership case study: The educational sector in egypt	2020	Journal of Open Innovation: Technology, Market, and Complexity
74	Mallisetti V., Dolla T., Laishram B.	Motivations and Critical Success Factors of Indian Public-Private Partnership Unsolicited Proposals	2021	Journal of The Institution of Engineers (India): Series A
75	Aerts G., Grage T., Dooms M., Haezendonck E.	Public-private partnerships for the provision of port infrastructure: An explorative multi-actor perspective on critical success factors	2014	Asian Journal of Shipping and Logistics
76	Zheng C., Feng J., Lu Q.	Research into the influence of CSFS on the performance of PPP projects from a viewpoint of data mining	2016	RISTI—Revista Iberica de Sistemas e Tecnologias de Informacao
77	Shi S., Chong H.-Y., Liu L., Ye X.	Examining the interrelationship among critical success factors of public private partnership infrastructure projects	2016	Sustainability (Switzerland)
78	Mladenovic G., Vajdic N., Wündsch B., Temeljotov-Salaj A.	Use of key performance indicators for PPP transport projects to meet stakeholders' performance objectives	2013	Built Environment Project and Asset Management
79	Sehgal R., Dubey A.M.	Identification of critical success factors for public-private partnership projects	2019	Journal of Public Affairs
80	Nisar T.M.	Implementation constraints in social enterprise and community Public Private Partnerships	2013	International Journal of Project Management
81	Gupta A., Chandra Gupta M., Agrawal R.	Identification and ranking of critical success factors for BOT projects in India	2013	Management Research Review
82	Auguste L.	A comprehensive strategy of resilience: Veolia and Swiss Re partnership in New Orleans	2018	Field Actions Science Report
83	Bixler R.P., Yang E., Richter S.M., Coudert M.	Boundary crossing for urban community resilience: A social vulnerability and multi-hazard approach in Austin, TX, USA	2021	International Journal of Disaster Risk Reduction

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