

Building Resilient Sponge Communities through Government Interventions: Exploring the Role of Community and Stakeholder Participation in Sustainable Economic and Environmental Development

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Sponge communities, government interventions, and stakeholder participation are critical for achieving global economic and environmental development because they represent a unique intersection of local knowledge, policy-making, and collaborative action that can help balance competing demands for economic growth and environmental protection in a way that benefits both people and the planet. As a result, the study's goal is to evaluate the impact of community and stakeholder participation on long-term economic and environmental growth and the moderating role of regulatory interventions. Using questionnaires, the study collected data from relevant communities. The smart PLS was also employed to assess the data in the study. According to the study's findings, stakeholder and community participation has a good impact on sustainable development and the role of the government in providing support through policies and regulations. The research sheds light on mobilizing sustainable economic and environmental development via sponge communities. The study focuses on the difficulties and solutions sponge communities face, with implications for policymakers and others involved in implementing sustainable development projects.

Keywords: Sustainable economic development, sustainable environmental development, stakeholder participation, sponge communities, community participation, government interventions

Introduction

In recent decades, sustainability has emerged as a crucial global issue as the world's population continues to expand and resources become scarcer (Jury & Vaux Jr, 2007; Tzanakakis, Paranychianakis, & Angelakis, 2020). Sustainable development aims to balance economic growth and environmental protection (Birendra, Dhungana, & Dangi, 2021; Mensah, 2019). It has become a top policy priority for governments and other stakeholders around the globe. Sponge communities, which refer to communities that can absorb and store excess water during storms and other weather events, have emerged as a promising strategy for attaining sustainable development (Zevenbergen, Fu, & Pathirana, 2018). (Kirkby, O'Keefe, & Timberlake, 2023; Tracey & Anne, 2008) Sustainable economic development refers to the capacity of a community to flourish and prosper economically while minimizing negative impacts on the environment. Sustainable environmental development refers to a community's capacity to protect and enhance its natural resources, such as air, water, and land, to benefit current and future generations (Olalekan, Omidiji, & Williams, 2019). Participation of stakeholders is essential to sustainable development because it ensures that all community members have a voice in decision-making processes affecting their lives (Rendon, Osman, & Faust, 2021). Sponge communities are designed to absorb and store excess water during cyclones, reducing the likelihood of flooding and other water-related issues (Yin et al., 2022). Despite the potential benefits of sponge communities, their development faces several obstacles (Liu, Jia, & Niu, 2017). These obstacles include the high cost of

implementing green infrastructure, the lack of public awareness and comprehension of sponge communities, and policy barriers that impede their adoption (Yin et al., 2022). To overcome these obstacles, a variety of solutions have been proposed, such as increased investment in green infrastructure, education campaigns to raise awareness, and policy changes to incentivize sustainable development (L. Li et al., 2020; Redondo Bermúdez et al., 2022). There is a great deal of literature on sponge communities, but there are still several unanswered questions that the present investigation addresses. 1) The model, which includes elements such as community participation, stakeholder participation, government intervention, and sustainable economic and environmental development in China, has not been evaluated in recent years. 2) Nguyen et al. (2019) investigated water management in sponge cities in a socio-economic context. However, the current study will also focus on sponge communities and economic development and other variables, such as community participation, stakeholder participation, and government intervention, with a new sample set, particularly in China. 3) Butler et al. (2021) investigated sponge communities from an ecological standpoint; however, the current study will also focus on it and other variables such as community participation, stakeholder participation, and government intervention in Vietnam with a new sample set. 4) Ren et al. (2022) investigated the moderating role of government intervention; however, the current study will also investigate its moderating effect on the relationship between community participation, stakeholders' participation, government intervention, and economic and environmental development of sponge communities. China. 1) According to the concept of

sustainable economic and environmental development, the government leads the participation of other stakeholders in the construction of sponge communities (Wang et al., 2021). Accordingly, the purpose of the study was to 1) examine the sponge communities in the context of economic and environmental development; 2) although there is a great deal of literature on sponge communities, the present study will contribute to the literature on the topic in the context of China; and 3) provide a guideline as well as assistance to the economic and environmental professionals to review and provide support for the sponge communities to overcome the challenges they face.

Review of Literature

Sponge communities are a type of urban water management system that seeks to improve the quality of stormwater runoff while also providing flood control, urban cooling, and habitat creation (Nguyen et al., 2019; Stefanakis, 2019; Yin et al., 2022). These communities are constructed utilizing numerous green infrastructure techniques, including green roofs, rain gardens, permeable pavements, and bio-retention receptacles (Suresh & Biju, 2018). As part of the Chinese government's efforts to combat water contamination and urbanization, sponge communities emerged in the early 2010s (Y. Qi et al., 2020; Qi et al., 2021). Since then, the concept has gained popularity in other regions of the globe as cities seek innovative and sustainable water management solutions (Chan et al., 2022).

The concept of sponge communities is supported by two critical variables: sustainable economic and environmental development (Hawken et al., 2021). Sustainable economic development balances economic growth, environmental protection, and social equity. In contrast, sustainable environmental development promotes the sustainable use of natural resources and the protection of ecosystems (Duran et al., 2015). Sponge communities can contribute to both sustainable economic and environmental development by providing a variety of benefits, such as reducing the costs of stormwater management, enhancing the quality of water resources, and increasing the livability of urban areas (O'Donnell et al., 2020; Wu et al., 2020).

The participation of stakeholders is an additional essential variable in the evolution of sponge communities (Wang et al., 2021). In addition to government agencies, stakeholders include local communities, private sector organizations, and non-governmental organizations. In this context, Doria et al. (2021) examined whether stakeholders' participation influences the fisheries system's governance. The sample countries for the investigation were Spain, Bolivia, and Peru. The research was empirical. As a sample, the study utilized the information of fifty fisheries stakeholders. Using questionnaires, the sample information was gathered. According to the investigation's conclusions, local communities and private sectors are also stakeholders. Moreover, stakeholder participation influences the governance of the fisheries system. Participation of stakeholders in the design and implementation of sponge communities can help to ensure that the communities are adapted to the local context, that

the benefits are shared among various groups, and that the communities are maintained over time (Wang et al., 2021). Despite the prospective benefits of sponge communities, their development faces several obstacles. In this context, Liu et al. (2017) examined whether sponge cities solve urban water issues. In China, the investigation was conducted. The findings suggested that "sponge city" accurately describes an urban setting committed to identifying environmentally suitable alternatives to transform existing urban infrastructures into green infrastructures that can effectively collect, regulate, and utilize precipitation. The objective of a sponge city is to encourage the rehabilitation of drainage systems, the improvement of water system connections, the separation of rainfall and sewage piping networks, and other innovative engineering solutions to increase the city's capacity to deal with water issues. The dearth of awareness and comprehension among stakeholders regarding the benefits and potential of sponge communities is one of the greatest obstacles (Zevenbergen et al., 2018). The lack of technical expertise and institutional capacity to design and implement sponge communities is a further obstacle (He et al., 2019). In addition, social and economic barriers, such as the perception that sponge communities are expensive or impracticable, may prevent widespread adoption (Selerio et al., 2021). Thus, the hypothesis derived from the preceding discussion is as follows:

H1: *There is a significant association between communities' participation and sustainable economic and environmental development*

Numerous studies have investigated the issues and solutions associated with forming sponge communities. Population growth, urbanization, and climate change have resulted in floods, water pollution, ecological degradation, and water shortages in many regions of the globe, making urban stormwater management a pressing concern. To address these problems, numerous nature-based solutions (NBS) have been developed and implemented in numerous nations, including low-impact development, best management practices, sustainable drainage systems, water-sensitive urban design, green infrastructure, blue-green cities, and blue-green infrastructure. In this context, Fu et al. (2023) examined whether sponge cities are viable solutions to China's flooding problem. The findings suggested that sponge communities are crucial in preventing flooding in China. For instance, Zevenbergen et al. (2018) conducted a case study of a sponge community in Shanghai, China, and identified several management and maintenance challenges associated with the district. In addition, they proposed several solutions, including using information and communication technologies to monitor the community's performance and involve residents in its maintenance (Zevenbergen et al., 2018). Similarly, Wang et al. (2021) reviewed sponge city initiatives in China and identified several financial, administrative, and technical challenges. They proposed several solutions, including forming public-private partnerships and creating capacity-building programs for local officials (Wang et al., 2021).

In the literature, the influence of government policies and regulations on sustainable economic and environmental development, stakeholder participation, and the formation of sponge communities has been extensively discussed (Di Vaio et al., 2021; Qiao, Kristoffersson, & Randrup, 2018; Wang et al., 2021). Di Vaio et al. (2021) conducted a literature review on the water management model within the context of sustainable development objectives. The research evaluated 118 publications to reach a logical conclusion. The publication's tenure spans the years 2015 to 2020. According to the study, cooperation, coordination, and stakeholder participation are crucial components of water governance models for addressing the problem of global sustainability. The literature has not sufficiently explored how these concepts could be implemented to improve local water resource management; consequently, there is no clear path to sustainability. Generally speaking, government policies and regulations play a crucial role in shaping the development of sustainable communities and mitigating negative environmental impacts (Di Vaio et al., 2021).

H2: *There is a significant association between stakeholder participation and sustainable economic and environmental development*

Using incentives and disincentives, government policies and regulations significantly impact sustainable development (Deakin, 2001). The government may, for instance, provide tax incentives to businesses that invest in sustainable practices or impose fines or penalties on businesses that violate environmental regulations. Cai et al. (2020) investigated whether environmental regulations can foster innovation in green technology in this context. The research was conducted in China. The focus of the investigation was the heavy pollution industry. The findings suggest that in highly polluting industries, direct environmental laws have a powerful and significant motivating effect on developing green technologies. Concerning the variety of firm ownership, it was discovered that direct environmental regulations had a greater impact on the adoption of green technology by state-owned listed companies. Considering industry heterogeneity compared to labor-resource-intensive industries, direct environmental law may successfully promote green technology advancements in businesses with a high proportion of technology capital. Similarly, Bendell (2022) examined the influence of competitors and the government on the environment-related investment decisions of family-owned businesses. The investigation was conducted on the Chinese populace. As a sample, the research utilized data from 1,919 firms. For analysis, the study used regression analysis. The analysis results suggested that companies were significantly less inclined to invest in an environmental innovation when it caused a negative image among their peers in the industry than when it reduced regulatory scrutiny. Environmental innovation to maintain good relations with the government, they are significantly more likely to forego such expenditures if doing so will damage their standing among peers, thereby increasing the competitive advantage of their rivals. These policies can

encourage businesses to adopt more sustainable practices and lessen their environmental impact (Bendell, 2022; Qi, Zou, & Xie, 2020).

H3: *Government intervention moderates the relationship between community participation and sustainable economic and environmental development.*

Government policies and regulations can also affect stakeholder participation in sustainable development initiatives (Ki, Chong, & Ha-Brookshire, 2020). In many instances, the government can be a protagonist in fostering stakeholder engagement and collaboration (Benites-Lazaro & Mello-Théry, 2019). This may involve providing funding or other resources to support community-led initiatives or establishing a platform for stakeholder dialogue and decision-making (Marx, 2019). In China, where accelerated urbanization and water pollution have created significant challenges for water management (Y. Qi et al., 2020), the concept of sponge communities has particular relevance. In recent years, the Chinese government has launched several initiatives to promote the development of sponge cities, aiming to achieve 80 percent urban stormwater retention by 2030 (Qi et al., 2021). These initiatives include financial incentives for local governments, design and construction guidelines for sponge cities, and capacity-building programs for local officials and stakeholders. Chan et al. (2022) investigated the transformation of green infrastructure interventions within the context of the sponge city program. The research centered on the positions, obstacles, and prospects. The research was conducted in China. The study's findings recommended using Ningbo, East China, one of the SCP's major pilot cities, as a case study to illustrate the positions, challenges, and opportunities. Ningbo is a prosperous and rapidly expanding coastal metropolis. This chapter provides recommendations and projections for SCP and GI development in the third stage (through 2030 and beyond) to alleviate future municipal water issues in Chinese cities. The development of sponge communities in China has been hindered by insufficient funding, a lack of technical expertise, and opposition from residents and businesses (Chan et al., 2022). However, there are also examples of successful sponge community development in China, such as the Lingang sponge city in Shanghai, which has significantly improved water quality and reduced the risk of inundation (Zou et al., 2021). Hu et al. (2022) analyzed the aggregate flood and rainfall data (from 2016 to 2018) in the Wufeng River Basin in Pingxiang City, China using the time-varying moment method. Using computer simulations to investigate the time-varying process of flood design, the authors concluded that floods by design decreased following the transformation of the sponge city (Hu et al., 2022; Zou et al., 2021). The experiences and lessons learned from these initiatives can provide valuable insights for other cities in China and worldwide facing similar water management issues (Qi et al., 2021). China's government actively promotes sustainable development and reduces environmental pollution (Chen et al., 2019). The Chinese government, for instance, has

launched the "Green Development Initiative" to promote sustainable economic growth and environmental protection (Yu et al., 2020). The initiative includes policies such as the promotion of low-carbon technologies, the improvement of energy efficiency, and the promotion of the use of renewable energy sources (Chen et al., 2022; Zhao et al., 2022). In addition, the Chinese government has enacted various environmental regulations to reduce pollution and promote sustainable practices (Yang et al., 2021). These regulations include limits on industrial emissions, quality standards for air and water, and requirements that businesses undertake environmental impact assessments (Du & Li, 2020). Despite these efforts, the Chinese government's approach to sustainable development has been criticized (Zhang et al., 2020). Perin et al. (2022); Yang et al. (2019) contend that there is a lack of transparency and accountability in implementing environmental policies and a need for increased public participation in decision-making processes. Some have also expressed concern that economic growth and development may take precedence over environmental protection (Hsu et al., 2021; Pang et al., 2019). In conclusion, the literature indicates that government policies and regulations are crucial in molding sustainable development outcomes, such as forming sponge communities. The Chinese government has taken measures to promote sustainable development and reduce environmental pollution, but there is room for improvement in transparency and public participation. Thus, the hypothesis derived from the preceding discussion is as follows:

H4: *Government intervention moderates the relationship between stakeholder participation and sustainable economic and environmental development.*

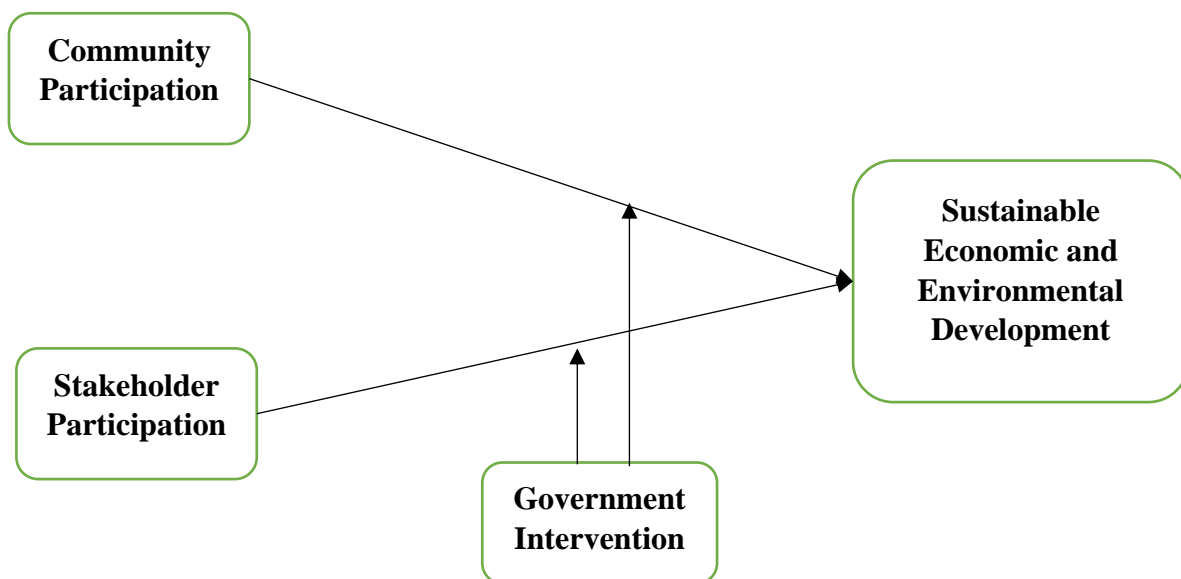


Figure 1: Theoretical Model

Research Findings

The research analyses convergent validity to determine the correlation between items. The results indicate that the composite reliability (CR) and Alpha values exceed 0.70.

Research Methods

This study aims to examine the impact of community participation and stakeholder participation on sustainable economic and environmental development, as well as the moderating effect of regulatory interventions. The study collected data from pertinent communities using questionnaires. The queries are used to measure the constructs. These queries were taken from previously published research. For instance, community participation is measured with five items from Jackson et al. (2018), stakeholder participation is measured with six items from Sisto, Lopolito, and Van Vliet (2018), government intervention is measured with six items from Joo, Seo, and Min (2018),. Sustainable economic and environmental development is measured with seven items from Li, Dai, and Cui (2020).

Respondents of the study are community members who participate in economic and environmental development activities. The respondents were chosen using systematic sampling. Personal visits were made to the pertinent respondents to distribute the questionnaires. 465 surveys were sent out, but only 292 were returned for a response rate of approximately 62.80 percent. In addition, clever PLS was used to analyze the study's data. It is a powerful instrument that efficiently handles small and large data and provides the best estimation using complex models (Hair et al., 2017). The research employed two predictors, including community participation and stakeholder participation. In addition, one moderating variable, government intervention (GIN), and one dependent variable, sustainable economic and environmental development (SEED), were employed in the study. Figure 1 depicts the presented variables.

In addition, the results demonstrated that both the factor loadings and average variance extracted (AVE) values are greater than 0.50. These numbers revealed a strong correlation between products. These values can be seen in Table 1.

Table 1: Convergent validity

Constructs	Items	Loadings	Alpha	CR	AVE
Community Participation	CP1	0.931	0.930	0.947	0.783
	CP2	0.931			
	CP3	0.851			
	CP4	0.844			
	CP5	0.861			
Government Intervention	GIN1	0.953	0.959	0.968	0.834
	GIN2	0.829			
	GIN3	0.951			
	GIN4	0.954			
	GIN5	0.828			
	GIN6	0.954			
Sustainable Economic and Environmental Development	SEED1	0.875	0.907	0.927	0.647
	SEED2	0.769			
	SEED3	0.820			
	SEED4	0.602			
	SEED5	0.844			
	SEED6	0.803			
	SEED7	0.884			
Stakeholder Participation	SHP1	0.861	0.927	0.943	0.732
	SHP2	0.865			
	SHP3	0.864			
	SHP4	0.872			
	SHP5	0.855			
	SHP6	0.816			

The discriminant validity is examined to determine the correlation between variables. The Heterotrait Monotrait (HTMT) ratio was used to investigate the correlation between variables. The results demonstrate that the values are less than 0.90. These numbers revealed a low correlation between variables. Table 2 contains the values in question.

Table 2: Discriminant validity

	CP	GIN	SEED	SHP
CP				
GIN	0.701			
SEED	0.528	0.507		
SHP	0.435	0.403	0.420	

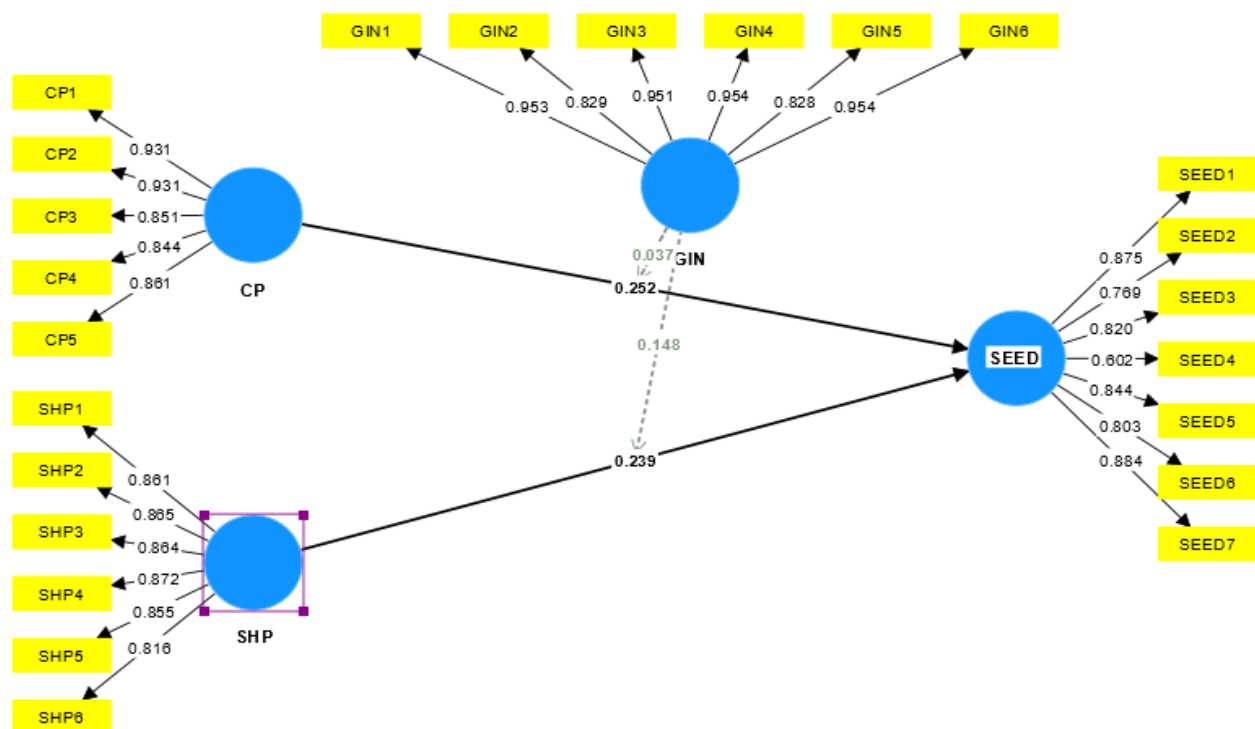


Figure 2: Measurement model assessment

Finally, the study examines the association among constructs using path analysis. The study exposed that stakeholder and community participation positively impact sustainable development and accept H1 and H2. In addition, the study also exposed the government's role in

providing support through policies and regulations and positively moderate the association among stakeholder participation and sustainable development and accept H4. These linkages are mentioned in Table 3.

Table 3: Path analysis

Relationships	Beta	S.D.	T statistics	P values
CP -> SEED	0.252	0.103	2.456	0.016
GIN -> SEED	0.237	0.087	2.724	0.008
SHP -> SEED	0.239	0.054	4.419	0.000
GIN x SHP -> SEED	0.148	0.055	2.675	0.009
GIN x CP -> SEED	0.037	0.070	0.534	0.594

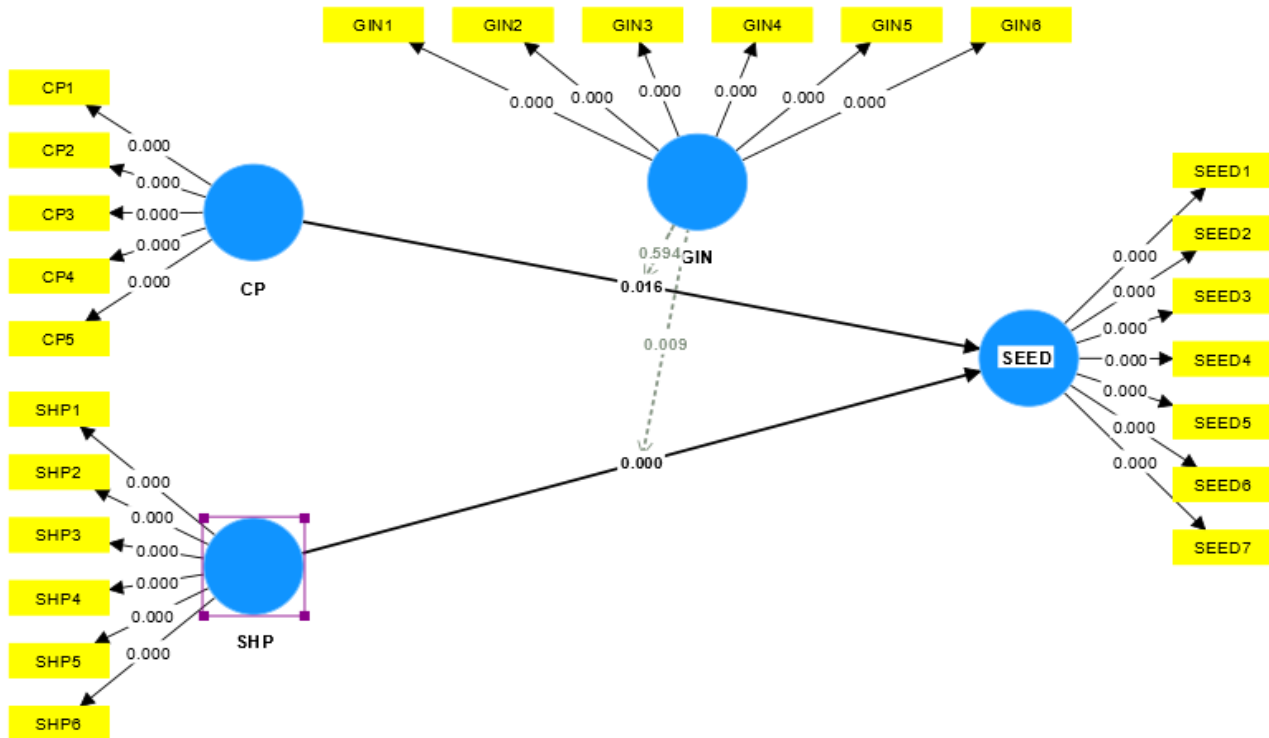


Figure 3: Structural model assessment

Discussions

Under the concept of sustainable economic and environmental development, where the government leads the participation of other stakeholders, the present study intended to investigate the problems and solutions associated with building sponge communities. Sustainable economic development, sustainable environmental development, stakeholder participation, and sponge communities were the independent variables of this study. The dependent variables were issues faced by sponge communities and their respective resolutions. This review's findings indicate that sustainable economic and environmental development is crucial in forming sponge communities. Sustainable economic development should emphasize the promotion of environmentally favorable practices. In addition, stakeholder participation is essential for the success of sponge community development. Local communities, enterprises, and government agencies can contribute to developing more effective and resilient sponge communities. Community participation was discovered to be a mediator variable, in which the community's active participation in sponge community building can considerably influence the initiative's success. Local communities know their region's geography and climate and can provide valuable insights that can contribute to the success of sponge community construction. Therefore, the study suggests that additional

research should concentrate on the significance of community participation as a moderating variable.

Government policies and regulations have been identified as a moderator variables that can influence the viability of sponge community construction. The government should play an active role in developing sponge communities, and policies and regulations should be devised to promote sustainable growth. However, the study also determined that government policies and regulations should be flexible and adaptable to the region's requirements. The study also identified some challenges that sponge communities might confront, including land acquisition, a lack of funding, and a lack of public awareness. These issues can hinder the development of sponge communities. Therefore, it is necessary to develop solutions to resolve these issues, such as investigating alternative funding sources, expanding public awareness campaigns, and promoting the benefits of sponge communities.

In conclusion, the present study highlights the significance of sustainable economic and environmental development, stakeholder participation, community involvement, and government policies and regulations in constructing prosperous sponge communities. The study demonstrates the need for additional research into mediator and moderator variables, such as community participation and government policies and regulations, to create more effective and sustainable sponge communities. Overall, the construction

of sponge communities can result in significant benefits, including reducing flood hazards, enhancing water quality, and promoting sustainable development. Future research should investigate sustainable economic development's influence on sponge communities' growth (Hawken et al., 2021; Xia et al., 2021; Yin et al., 2022). It is necessary to identify the main factors contributing to sustainable economic development and how they can be incorporated into the development of sponge communities. Sustainable Environmental Development: Additional research is required to determine the influence of sustainable environmental development on the growth of sponge communities (Hawken et al., 2021; Luo et al., 2022). The research should focus on identifying the key factors that contribute to sustainable environmental development and integrating these factors into the development of sponge communities (Hawken et al., 2021).

Participation of Stakeholders: Research is required to investigate the role of stakeholder participation in developing sponge communities (Wang et al., 2021). Key stakeholders and their responsibilities in developing sponge communities should be the focus of research (Yin et al., 2022). Future research should focus on identifying the key characteristics of sponge communities and determining their function in promoting sustainable economic and environmental development (Lashford et al., 2019). Additionally, research should investigate the possibility that sponge communities could serve as a paradigm for sustainable development in other regions.

Community Participation: Additional research is required to investigate the effect of community participation on the growth of sponge communities (Hawken et al., 2021; Li et al., 2022). **Government Policies and Regulations:** Research is required to determine the effect of government policies and regulations on the growth of sponge communities (Wang & Palazzo, 2021; Yin et al., 2022). The focus of research should be on identifying the key policies and regulations that contribute to the growth of sponge communities and determining how these policies and regulations can be enhanced to support sustainable development better.

Theoretical and Practical Implications

This review article's findings have several implications for promoting sustainable economic and environmental development via establishing sponge communities.

First, the significance of stakeholder involvement cannot be overemphasized. It is essential to involve all relevant actors, including the government, the private sector, and local communities, in sponges' planning and implementation initiatives. Effective stakeholder engagement can raise awareness and comprehension of the significance of sustainable development, enhance the design and implementation of sponge community projects, and improve the long-term effectiveness and sustainability of these initiatives.

Second, government policies and regulations are crucial in promoting sustainable economic and environmental development. The government should provide policies and regulations to encourage and promote sustainable development practices. This includes providing financial

and technical assistance, establishing legal frameworks enabling sustainable development practices, and enforcing sustainability regulations.

Third, it is impossible to overstate the significance of community participation as a mediator variable. Community involvement can facilitate the identification of community-specific requirements, provide local knowledge and resources, and encourage community ownership and engagement in the development process. Effective community participation can also promote social inclusion, increase trust and cooperation among community members, and cultivate a sense of community ownership and pride in community projects.

Finally, this review article's findings have substantial implications for establishing sponge communities in the Chinese context. Rapid urbanization is occurring in China, and as a result, its cities are facing a growing number of problems associated with waterlogging and urban inundation. Establishing sponge communities can assist in mitigating these issues by enhancing the absorption and retention of rainwater, enhancing urban ecosystems, and fostering sustainable development practices. The Chinese government should continue to support the establishment of sponge communities by providing the required policy and regulatory framework, involving all relevant stakeholders, and encouraging effective community participation.

This study's policy and practical implications can be substantial, particularly in the Chinese context. Recent accelerated economic growth in China has resulted in various environmental and ecological issues, including flooding, water scarcity, and air pollution. Sponge communities can be an effective response to these problems, and the findings of this study emphasize the significance of sustainable economic and environmental development, stakeholder participation, community engagement, and effective government policies and regulations.

Sponge communities could assist China in dealing with a growing population, rapid urbanization, and significant environmental degradation, mitigate the effects of extreme weather events, such as flooding and drought, and reduce pollution levels. The government has recognized the need for sustainable development and taken several measures to promote this concept, including promoting green urbanization, investing in green technologies, and establishing green finance mechanisms.

However, there is still much room for improvement in government policies and regulations. This study highlights the significance of effective government policies and regulations to encourage stakeholder participation in constructing sponge communities. The government should provide tax rebates, grants, and subsidies to encourage communities to participate in sponge city initiatives. Additionally, the government should establish specific guidelines for designing and implementing sponge cities, including land use, construction, and maintenance regulations.

In addition, this study emphasizes the significance of community participation in forming sponge communities. Community engagement and participation are essential for

the success of sponge cities, as they ensure that solutions are tailored to the community's particular requirements and circumstances. Therefore, The government should provide communities with opportunities to participate in planning and implementing sponge city initiatives.

According to the implications of this study, environmental and ecological problems can be effectively addressed by constructing sponge communities, particularly in the context of China. Nevertheless, the success of these initiatives is contingent on sustainable economic and environmental development, stakeholder participation, community engagement, and effective government policies and regulations.

Limitations and Future Recommendations

Even though this study has contributed to our comprehension of sustainable economic and environmental development and the role of stakeholder participation in constructing sponge communities, some limitations must be addressed. First, this review article's scope was limited to English, which may have resulted in the exclusion of some relevant studies published in other languages. Second, the sample size of the included studies was relatively small; only 40 of the 60 relevant studies were included in the final analysis. Therefore, it is possible that the findings do not completely represent the larger body of literature on the subject. Thirdly, the scope of this study is limited to the concept of sponge communities in general and does not delve into the specific application of such communities in various contexts.

Despite these limitations, numerous avenues for future research can expand upon the findings of this article. First, future research could investigate the role of cultural and social factors in promoting sustainable economic and environmental development and stakeholder participation in sponge community construction. Such research may concentrate on particular nations or regions to capture the nuances and distinctions of cultural and social contexts. Future research can also examine sponge communities' specific implementation and impact in various contexts, such as urban and rural communities. Future research may also investigate the potential for technological advancements to improve the performance and sustainability of sponge communities. Fourth, additional research is required to examine the moderating effect of government policies and regulations on the efficacy of stakeholder participation and the implementation of sponge communities. Future research can then concentrate on developing a standardized method for evaluating the effectiveness of sponge communities in addressing environmental and economic sustainability issues.

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