buildings

MDPI

Article

Exploring the Key Indicators of Social Impact Assessment for Sponge City PPPs: A Sustainable Development Perspective

Wei Li [1], Jiyue Guo [2], Jingfeng Yuan [1,*], Henry J. Liu [3] and David J. Edwards [4,5]

[1] Department of Construction and Real Estate, School of Civil Engineering, Southeast University, Nanjing 211189, China
[2] Department of Civil Engineering, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-8656, Japan
[3] School of Design and the Built Environment, University of Canberra, 11 Kirinari Str., Bruce, ACT 2617, Australia
[4] Department of the Built Environment, Birmingham City University, Millennium Point, Birmingham B4 7XG, UK
[5] Faculty of Engineering and the Built Environment, University of Johannesburg, Johannesburg 2092, South Africa
* Correspondence: jingfeng-yuan@seu.edu.cn

Abstract: Sponge city (SPC) is currently being promoted as an initiative under the principle of sustainable development to solve the urban water crisis across China. Moreover, with the introduction of the public-private partnerships (PPPs) in SPC development, the public's concern regarding SPC PPPs has increased in terms of their more sophisticated outcomes and greater social impacts than general urban development. Thus, to develop an effective set of SIA key indicators for SPC PPPs, this study uses social impact theory (SIT) to explore in greater detail the influencing mechanism for the social impact assessment (SIA) conceptual model proposed in the authors' previous studies. Confirmatory factor analysis (CFA) was applied to examine whether the hypothesized relationships in the influencing mechanism fit the empirical data and to further consolidate the SIA key indicators. Based on a survey questionnaire and CFA results, a verified and refined SIA framework using 23 key indicators and five corresponding dimensions was proposed, particularly within the context of SPC PPPs. Implications generated from the CFA were discussed to improve the comprehensive performance of sponge city PPPs. These 23 key indicators and the clarification of their relationships to the respective SIA dimensions and to the overall SIA results can be a useful tool for enhancing the social benefits of SPC PPPs. Moreover, this study also provides governments with insights into enabling the low-impact and sustainable development of infrastructure within urban areas.

Keywords: sponge city; public-private partnerships (PPPs); sustainable development; social impact theory; social impact assessment

Citation: Li, W.; Guo, J.; Yuan, J.; Liu, H.J.; Edwards, D.J. Exploring the Key Indicators of Social Impact Assessment for Sponge City PPPs: A Sustainable Development Perspective. *Buildings* **2022**, *12*, 1329. https://doi.org/10.3390/buildings12091329

Academic Editor: Kheir Al-Kodmany

Received: 29 June 2022
Accepted: 22 August 2022
Published: 30 August 2022

1. Introduction

Urban flooding triggered by extreme precipitation events is a global concern due to its threats to urban security, the economy, the environment and human society [1]. This is particularly the case in China, where cities have experienced excessively rapid urbanization and are susceptible to surface water flooding as an increasing amount of forest and prairie lands that are surrounded by predominantly impervious surfaces are being converted/occupied for residential or commercial purposes. These impervious areas prevent rainwater from infiltrating and replenishing groundwater storage, thereby engendering a higher risk of urban flooding [2]. Essentially, approximately 62% of the 351 cities in China have been and continue to be subjected to severe floods, causing economic losses of up to USD 100 billion over the past five years [3].

Against this contextual backdrop, a new Sponge City (SPC) policy initiative was proposed by the Chinese government in 2013 and aims at integrating urban water management

into urban planning under the principle of sustainable development [4]. The SPC initiative was established to manage water resources through ecological and sustainable methods to ensure that the "city has good 'resilience'" in coping with environmental issues and addressing natural disasters in a manner similar to a sponge—that is, an SPC can absorb rainwater to reduce the risk of flooding but can also store and purify water for future use [5]. As an integrated means of promoting water resilience and low-impact development (LID) in China, the SPC concept is being implemented as a key innovative methodology to deal with the urban water ecological crisis [6,7]. The Chinese central government has promoted SPC nationwide, focusing on facilitating the ability to handle adverse weather conditions and water environment and ecological issues [8,9].

Despite the government's intensive intention to develop SPCs, public budgets available for delivering such projects are limited [10]. Consequently, the central government has introduced private-sector organization social investment into SPCs through the public-private partnership (PPPs) model. PPPs are regarded as an effective means to provide infrastructure assets, e.g., transport, health care, education and recreation [10,11]. In a newly built SPC project, the selected private sector companies (usually consisting of a consortium formed by companies such as water service companies, construction companies, design institutes and landscaping companies, etc.) establish a special purpose vehicle (SPV) to sign the PPP agreement with the government. The SPV takes responsibility for the financing, design, construction, operation and maintenance of the urban stormwater infrastructure and facilities in the city (such as water system renewal, green building renovation, green land development and road/square reconstruction) and receives reasonable returns from the project [10,12]. SPC projects are infrastructure projects in nature, incorporating large-scale investments and having profound effects on city planning, therefore impacting social, cultural and economic life in communities [13]. Furthermore, with the participation of private entities, PPPs not only offer much-needed investment for the SPC but also provide significant discipline for the selection, construction and operation of projects [14]. With these features, SPC PPPs are complex projects, generating more sophisticated outcomes and greater impacts than general urban development [11]. There are increasing public concerns about SPCs in terms of the project's social costs, needs, problems and support [1,15]. Besides, owing to a notable lack of accurate evaluation of the project's economic, environmental and social benefits, the attractiveness of SPC for the private sector is ambiguous [13].

The United Nations' sustainable development goals (SDGs) of the 2030 Agenda include a pressing goal and challenge for countries all around the globe [16]. Many governments have become increasingly cognizant of their responsibility in this respect and ask that projects having great impacts on society, such as SPC PPPs, formulate effective strategies and actively ensure sustainable project development and successful implementation of SDGs [17,18]. Furthermore, among these SDGs, two important goals specifically related to these projects are proposed, as follows: "to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" and "to make cities and human settlements inclusive, safe, resilient and sustainable" [16]. Thus, it is crucial for government decision-makers and relevant sector decision-makers to ensure the contributions of SPC PPPs and to improve the public's acceptance of the social impacts yielded from these projects on communities [19]. Otherwise, key stakeholders could acquire a negative perception toward SPC PPPs, depressing private sector investment and hindering the success of the projects and the sustainable development of urban water ecological systems.

As addressed above, social impact is a concern within infrastructure development. From the sustainable development perspective, social impact assessment (SIA), as an effective technique, enables the estimation of the projects' positive and adverse impacts and the management and control of the social consequences of these projects [19,20]. However, there is no widespread consensus regarding (1) how to apply SIA effectively to understand the impacts of SPCs on human communities and (2) what critical variables should be considered in the SPC SIA process [21]. As one of the most prominent initiatives aiming

to enable urban sustainable development in China, SIA is pivotal for achieving the goal of SPC PPPs, for not only reducing the water crisis but also facilitating comprehensive sustainable development [19].

Despite its importance, the SIA of PPPs, particularly within the context of SPC, has received limited attention. The present study seeks to develop an effective set of key SIA indicators for SPC PPPs and enhance the social benefits of SPC PPPs. Based on the authors' prior study [22], the influencing mechanism for assessing the social impacts of SPC PPPs was further developed by using social impact theory (SIT). With the aid of confirmatory factor analysis (CFA), the relative significance of SIA indicators using a questionnaire survey was evaluated to identify key indicators and further examine relationships among SIA indicators, dimensions and the overall SIA results. The contributions of this research mainly focus on two aspects, namely, the following: 1) provide a systematic insight into the social impacts of SPC PPPs; 2) offer a useful tool to ensure governments develop appropriate strategies to enhance the social benefits and long-term sustainability of urban development in terms of the water resilience of local communities.

2. Literature Review

2.1. Social Aspects of PPPs

PPPs are a procurement method that encompasses the expertise of the public and private sectors, e.g., improved access to finance, enhanced knowledge of management and technology, stronger risk management capabilities, better service quality, greater asset sustainability and higher value-for-money for taxpayers [23,24]. Governments can relieve internal financial pressures by absorbing private-sector resources to develop public infrastructures in PPPs, while, conversely, private parties may gain long-term stable investment opportunities [25].

PPPs are based on the principle that governments and private entities share benefits and risks within the concession period of the projects undertaken. However, the public- and private-sector parties within PPPs have different goals and expectations. Governments are concerned with social benefits/impacts during the project's lifecycle. Put simply, there is a need for governments to ensure the public's interests and social utility through improved quality of public services provided by PPPs [23]. In contrast, private-sector entities are profit-pursuers with fewer social responsibility interests. They are not a 'gate keeper' ensuring the realization of public needs but a 'competitor' concentrating on enhancing market share.

PPPs include the key stakeholder group of the public, which is commonly the residents of the communities. The public may challenge the price and quality of the services/products of PPPs as the asset end-user but also a recipient of the project's social impacts [26]. PPPs can provide better product or service quality than traditional projects through successful process monitoring and emphasizing value for money (VfM) and innovation [27]. Nevertheless, with the participation of profit-driven private sectors in safeguarding the social utility of infrastructure projects, PPPs may draw more criticism than traditional infrastructure projects [28]. It has been acknowledged that social issues are also one of the foci of the research on SPC PPPs. Wang et al. (2017) examined public perception of and understanding of SPC construction within PPP arrangements and the public's willingness to support these projects [1]. They found that residents show a positive attitude regarding implementing SPC initiatives with PPPs. In stark contrast, Li et al. (2017) proposed a broad range of challenges and multiple opportunities to promote China's sponge city development program by using a survey based on all 30 pilot sponge cities and recommended that economic and environmental benefits be fully measured and considered to ensure the success of these SPC PPP projects [11].

2.2. Social Impact Theory

Social impact theory (SIT) originates from social psychology. It describes social impacts as "any of the great variety of changes in physiological states and subjective feelings,

motives and emotions, cognitions and beliefs, values and behavior, that occur in an individual, human or animal, as a result of the real, implied, or imagined presence or actions of other individuals" [29]. In other words, SIT emphasizes the influences between individuals' interactions (e.g., behaviors, cognitions and motives) and aims to promote harmonious and sustainable relationships [30].

The objects of SIT are divided into targets and sources. *Sources* refer to the actions or presence of others, while targets relate to the influence of the *source* [31]. Social impact theory includes the following three important elements: *strength*, *immediacy* and *number* [29]. The *strength* element denotes the significance of the source's influences, which can be determined by socioeconomic status, power, previous relationships and sociodemographic factors [32]. SIT claims that actors with a high social status normally have a greater impact on others, e.g., application of SIT to leadership-related studies [33].

Immediacy additionally encompasses proximity in space/time between sources and targets [29]. It is defined as the "distances between individuals with specific spatial locations to illustrate that individuals involve some relationship with one another" [30,34]. SIT argues that an individual is likely to be influenced by the presence/actions near them in space/time. Furthermore, *number* refers to the number of sources. In studies on social density or group presence, this variable plays an important role in the total social influence [35]. However, the *number* can be neglected in a situation where the quantity of the source is fixed [31]. In this context of studying the social impacts of SPCs on the public, the influence of *number* can be omitted, as the source is regarding only the SPC, which is invariable.

SIT has been widely used to explore how the surrounding social environment influences people. For instance, Chang et al. (2018) investigated how people's attitudes can be influenced on Facebook by using SIT to explain the key factors [30]. Argo et al. (2005) discussed the impact of simple social activities on the attitudes and behaviors of consumers to refine SIT [36]. Despite its widespread use, there has been a paucity of research that applies SIT to infrastructure procurement, particularly in PPPs that are focused on six common themes (e.g., key success factors, roles of government, concessionaire selection, risk identification/allocation, cost/schedule efficiency and project finance) [37]. However, SIT can help policymakers clarify the wide-ranging and multidimensional content of the social impacts of infrastructure projects (i.e., SPC PPPs). Furthermore, the differences between various social impact categories can be analyzed clearly by combining SIT with traditional SIA, as shown in this paper.

2.3. Social Impact Assessment

Traditional stormwater management systems are always buried underground. In contrast, most SPC programs are constructed on the ground and dispersed over a large area, thus interfering with public life [11]. Vanclay (2003) defines the typology of social impacts in terms of people's lifestyles, culture, political systems, health and welfare, personal and property rights, fears and desires, etc. [38]. Thus, these SPC projects can have complex social impacts on local people and communities, the impacts of which are not only on the economic and environmental layers but also on their daily lives [11,19].

Social impact assessment (SIA) has been utilized to address how a project will affect its stakeholders to maximize the benefits and minimize the adverse impacts [19]. SIA is "the processes of analyzing, monitoring and managing the intended and unintended social consequences on the human environment of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions" [38]. SIA is now a significant component of environmental impact assessment (EIA) [39]. The role of SIA in enabling projects to better accommodate ecological systems has been acknowledged by both academia and industry.

However, the goal of SIA is to improve the outcomes and performance of projects; hence, it is essential to focus on sustainability, as sustainable development has been the priority of most countries and regions, and has even become a global strategy in the 21st century [40]. SIA is able to enhance social sustainability by considering key stakeholders'

needs in decision-making, which can contribute to reducing potential social and environmental risks and ensuring the economic profits and business values of projects [39]. Furthermore, SIA can facilitate project engagement with key stakeholders, particularly local people and communities, through early public involvement in the planning phase [19,41]. Public participation is of great significance to reduce the additional cost caused by project decision-making mistakes and improve the project's acceptability [19,42]. This is because it can reflect the demands of local communities and people and minimize the conflicts between them, ensuring more sustainable project development [39,43]. For example, to promote development strategies that address the most important problems for local populations and facilitate the long-term and sustainable development of dam projects, the SIA tool was applied to aid in understanding the impacts of large-scale dam projects on local human communities [44]. Moreover, Suopajärvi (2013) discussed SIA for mining projects and proposed that the foremost problem is that no effort was made to show the local communities' diversity and to analyze local people's benefit and disadvantage distribution [45]. In addition, to improve infrastructure efficiency and bring more social benefits for local people, an SIA indicator system was proposed to evaluate the social impacts of BOT/PPP projects [46]. SPC PPP projects are large-scale engineering projects and can also have social impacts on local communities and people; however, the SIAs of these projects have received little attention.

SIA has been classified into different categories. One of the most typical categorizations divides the impacts into social, economic and environmental impacts, which are defined as the triple bottom line of sustainable development [38,47]. Under the aforementioned dimensions, the *economic impacts* include the variables related to material wellbeing and resources, such as the income and consumption of an individual or family, business and market in the region. In addition, *environmental impacts* are referred to as the environmental damage and natural resource degradation of the surroundings that are caused by projects. Moreover, *social impacts* encompass the complex contents of local society, e.g., community, infrastructure, institutions, etc. In addition, the tendency of the recent literature on SIA is to concentrate on public participation and vulnerable people [48]. The intended and unintended impacts (e.g., social, economic and environmental) as a consequence of projects (i.e., one type of planned intervention) on the human environment will lead to social experiences involving the changes in individual feelings, thoughts or behaviors (i.e., human impacts), which are also referred to as the "influences" concept (in SIT) [29]. In other words, in SIT, the influences exerted by other individuals are the consequences of the social, economic and environmental changes reflected in an SIA, which are triggered by the interventions of projects and are also referred to as the social impacts on humans.

3. The influencing Mechanism of Social Impact in SPC PPPs

3.1. The Proposed Influencing Mechanism for the SIA Framework

In the authors' prior studies, an SIA conceptual model with five dimensions of SIA for SPC PPPs and the corresponding 33 SIA indicators were identified according to SIA theory [22]. However, social impacts are complex, and therefore, assessing them is challenging [39,49]. The premise of effectively assessing the social impact dimension in SPC PPPs is to clearly understand the mechanisms through which these five SIA dimensions and their related SIA indicators can affect the overall SIA results [37,50]. Thus, in this study, based on the SIA conceptual model proposed in the authors' prior studies, the influencing mechanism for assessing the social impacts of SPC PPPs can be further developed by using SIT, and the SIA key indicators can be further consolidated, which is more important for evaluating social impacts in practice for the sustainability of the project and society [51].

Typically, in SIT, social impact is experienced by an individual as the *target* as a function of the *strength*, *immediacy* and *number* of sources of impact [29]. In this way, by considering the transmission of social impacts from sources to targets, SIT provides insight into the connotation and mechanism of social impacts. Applying SIT for assessing the social impacts of SPC PPPs, the source of the social impact is the SPC PPP project itself, while the targets

are the local communities around the project. Additionally, the source changes along the three-dimensional direction in terms of (1) *strength*; (2) *immediacy*; (3) *number*.

Strength describes the authority or power of an individual or group over a *target*, and it encompasses the ability to influence others [30]. Given the characteristics of SPC PPP projects, *strength* refers to the intensity of their impacts on local society [31]. Therefore, *strength*'s new dimensions are estimated to appear as the functions of impact upon the SPC PPP projects, which are assumed to be the main measured components of SIA [47]. Practitioners of SIA argue that all problems that directly or indirectly affect people are related to the social impacts to be identified [38]. Furthermore, the general good practice in SIA is to accept that social, economic and environmental impacts are intrinsically interrelated, that is to say, impacts in one domain (social impacts) may trigger impacts across other two domains (economic and environmental impacts) [38,47]. Thus, based on the authors' prior studies [22], the present study utilizes the social impacts conceptualized by the SIA as the dimensions of strength-oriented influence. Specifically, the *strength* addressed in this study relates to the following several parts of the social impact categories: *economic impact*, *environmental impact* and *social impact* dimensions in the influencing mechanism for assessing the social impacts of SPC PPP projects. In this way, the *economic impact*, *environmental impact* and *social impact* dimensions in *strength* can affect the overall SIA results of SPC PPPs.

In addition to *strength*, *immediacy* refers to the distance between the affected individuals (i.e., targets) and others or groups (i.e., sources). As a new planned intervention in the daily lives of local communities and residents, the poor adaptability of a project to the local community creates a distant/weak relationship with people; then, the *strength* of an SPC's influence (here, most are negative impacts) will be amplified [19,52]. This correlation confirms a principle of the SIT that the increase of one variable (*immediacy*) leads to an exponential increase in others (*strength*) [29,30]. These amplified negative impacts invariably lead to low public acceptance of the SPC, which in turn hinders its success [1]. Consequently, improving SPCs' *adaptability to local communities* to build up a close relationship with local people can enable the achievement of the promised project benefits in terms of urban environment improvement. In this way, *adaptability to local communities* should be viewed as one important dimension in the influencing mechanism contributing to the SIA of SPC PPP projects.

As addressed above, public behaviors and perceptions can affect SPC implementation in practice. Hence, the crux of public acceptance of the SPC initiative is the educational efforts by the government, for example, providing people and relevant organizations with assistance in understanding SPC PPPs [1,11]. For instance, such educational efforts need to be specific; for example, in terms of the local communities, education should be focused on delivering knowledge about how to adapt to and cope with potential influences. By contrast, for project governors and managers, relevant education must be concerned with building trust between the private entities and the public [11,19]. Consequently, *government performance* can play a critical role in establishing a close relationship between the projects and communities to ensure the public's support. It should be viewed as one of the most significant factors in the effect of immediacy on the social impact of SPC PPPs.

Number in SIT can be defined simply as the number of sources of impact [29]. In SPC PPPs, as addressed above, the source of social impact is the project itself. With this perspective in mind, it is reasonable to focus on the social impacts brought by only one SPC PPP in this study, i.e., *number* = 1.

Based on the authors' prior studies [22], by using the principles of SIT and SIA from the sustainable development perspective, the influencing mechanism of social impact in SPC PPPs incorporating five dimensions can be explored (see Figure 1). These dimensions include the following: (1) *social impacts (SOI)*; (2) *economic impacts (ECI)*; (3) *environmental impacts (ENI)*; (4) *adaptability to communities (AC)*; (5) *government performance (GP)*.

In summary, based on the influencing mechanism, the SIA framework for SPC PPPs includes five major dimensions (i.e., three dimensions of ECI, SOI and ENI in *strength*, and

two dimensions of AC and GP in *immediacy*), and the respective 33 influencing indicators in these five dimensions have been identified in the authors' prior studies [22].

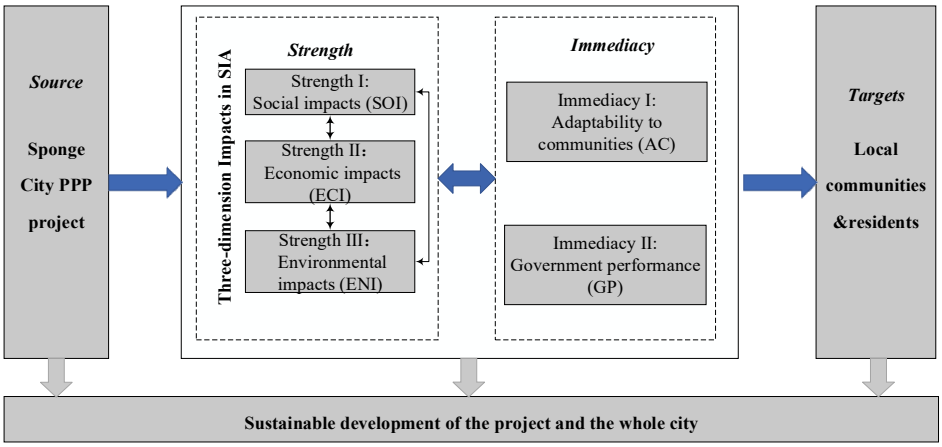

Figure 1. The influencing mechanism of social impacts in SPC PPPs using the principles of SIT and SIA.

3.2. Hypothesized Relationships in the Influencing Mechanism

An influencing mechanism incorporating the five dimensions (Figure 1) can represent the social impacts of SPC PPPs and the theoretical relationships within the SIA framework. In this way, the influencing mechanism can be used to analyze the social impacts of SPC PPPs where all five dimensions (i.e., the three dimensions of ECI, SOI and ENI in *strength*, and the two dimensions of AC and GP in *immediacy*) can contribute to the SIA of SPC PPPs. On this basis, after considering the above literature regarding the relationships between the five SIA dimensions and the overall SIA results of SPC PPPs, the following hypothesis can be concluded: As presented in Figure 2, all five dimensions contribute to SIA differently. Their contributions and pathways are different, while their influences on the SIA of SPC PPPs are all significant. In addition, the 33 SIA indicators are considered significant and the arrangement of these indicators into their corresponding SIA dimensions should be supported by empirical data. There may be causative relationships among different social impact dimensions as well, which will be explored in future studies.

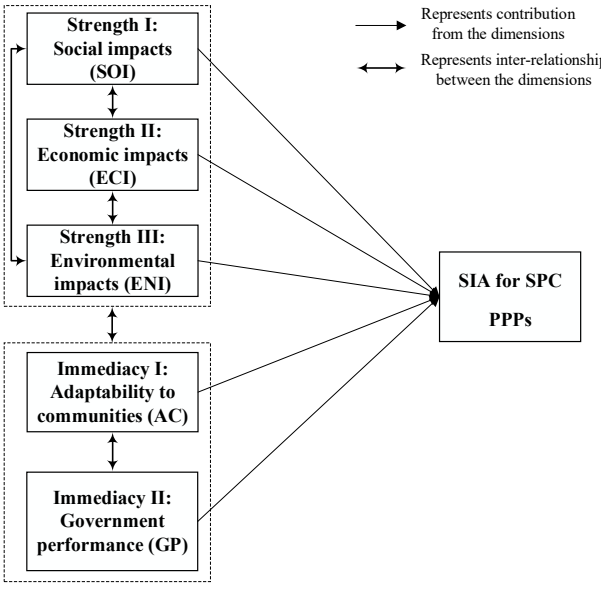

Figure 2. The hypothesized relationships between the dimensions and SIA for SPC PPPs.

4. CFA for the SIA Framework

4.1. Questionnaire Survey

A questionnaire survey was conducted to empirically test the rationality of the SIA indicators that were conceptually identified above. Three hundred questionnaires were issued to academics and PPP practitioners in the public and private sectors in China. A total of 110 completed questionnaires were returned, which has been acknowledged as being acceptable and sufficient [53,54]. Based on the 110 questionnaires returned, the basic demographic information of the respondents is shown in Table 1.

Table 1. Basic information of respondents.

Information	Options	Valid Questionnaires	Percentage
Roles in PPPs	Government	11	10.00%
	Private sector	19	17.27%
	Researcher	34	30.91%
	Consultant	29	26.36%
	Others	17	15.45%
	Total	110	100%
PPP experience	<5 years	62	56.36%
	5–10 years	37	33.64%
	10–15 years	8	7.27%
	> 15 years	3	2.73%
	Total	110	100%

The questionnaire contains two parts. The first part investigates the basic information of respondents and their experience in various similar PPP projects. According to the roles within PPPs, there are five groups among these respondents, as follows: (1) government; (2) private sector; (3) researcher; (4) consultant; (5) others (most are the general public) The researcher and consultant groups account for more than half of all respondents, viz. 30.91% and 26.36%, respectively. This is perhaps because researchers have a wealth of theoretical knowledge of social impacts and PPPs, and to offer consultation for public and private sectors, the consultants have a better understanding of aspects of the practical operation and management of PPP projects, which also include how to manage the social impacts of PPP projects to achieve social sustainability. In addition, practitioners in the private sector and government constitute 17.27% and 10.00%, respectively, of the sample. Overall, the distribution of industries in which these respondents work is relatively average, which reflects a thorough understanding of PPP generally, and thus, the survey responses are more reliable. Regarding the respondents' PPP-related experience, 56.36% of the respondents have <5 years of PPP experience. The main reason for this is that the large-scale facilitation of PPPs in China began after 2014 (<7 years ago), and SPC project implementation is still relatively new. However, 56.36% of respondents are actually involved in these projects, and they have rich experience with practical engineering. In addition, 43.64% of respondents have participated in PPPs for >5 years. Therefore, the data supported by the respondents' opinions are reliable because they have accrued adequate industry experience.

Moreover, the types of PPP projects in which the 110 respondents were involved varied, as shown in Figure 3. The respondents participated in different types of PPP projects, including water service, social public services, transportation, municipal infrastructure and urban comprehensive development. These various types of PPP projects, such as SPC PPP projects, are also large-scale projects and can have great social impacts on the public. Thus, during the development process of these projects, participants need to pay special attention to the social impacts of these projects. In this way, the different types of PPP projects in which these respondents are involved enable them to have adequate experience to evaluate the social impacts of SPC PPP projects.

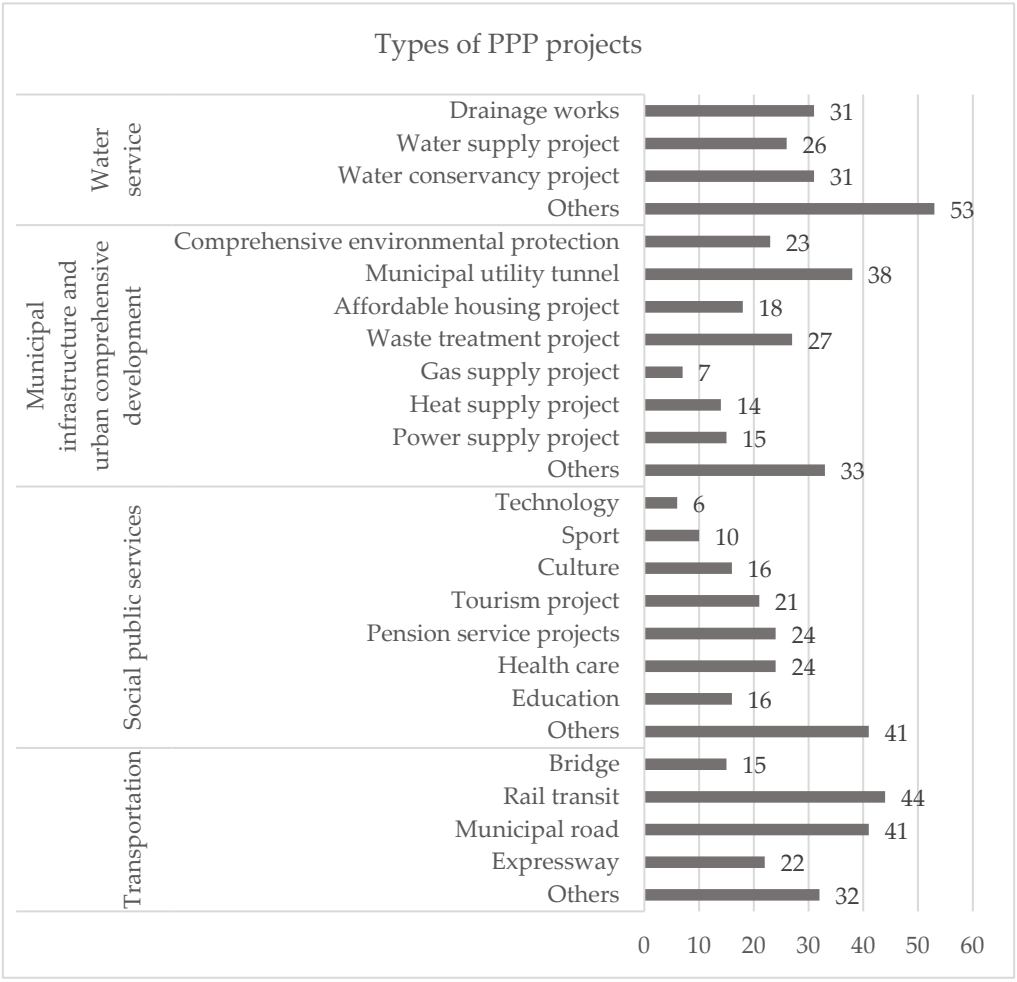

Figure 3. Distribution diagram of the types of PPP projects respondents involved in.

The second part of the questionnaire is based on a 5-point Likert scale. Hence, respondents were required to score each social impact indicator from 1 to 5 according to the significance of this indicator according to their opinion, where the significance increased with the number. The scales were arranged at intervals as follows: number "1" can be ignored or not be important, number "2" may be important, number "3" important, number "4" very important and number "5" most important [55,56]. The data collected were then analyzed using confirmatory factor analysis (CFA) to test the rationality of social impact indicators.

4.2. Data Analysis

A reliability test was run to ensure data consistency. The Cronbach's alpha value of this research is 0.954, which is higher than the recommended acceptable level of 0.70 of Nunnally [57]. Therefore, the CFA can be performed.

The descriptive analysis is presented in Table 2, including the mean and standard deviation for each SIA indicator. The lowest mean value is 3.06 specific for the *proportion of people in poverty* (SOI_9), while the highest value of *sharing of benefits and risks* (GP_7) is 4.14. In addition, only four indicators' standard deviations (SDs) were over 1, implying that most scores are relatively consistent [56]. This laid a solid foundation for further data processing and analysis.

Table 2. Descriptive analysis results.

Dimension	Indicator		Mean Value	Ranking of This Dimension	Standard Deviation
Economic impacts (ECI)	ECI_1	Income level	3.45	7	0.910
	ECI_2	Consumption level	3.47	6	0.902
	ECI_3	Engel coefficient	3.39	8	0.950
	ECI_4	Local GDP	3.80	1	0.918
	ECI_5	Industrial structure	3.65	3	0.926
	ECI_6	Fiscal revenue	3.80	1	0.979
	ECI_7	Foreign investment and advanced technology	3.49	5	0.929
	ECI_8	Large transregional infrastructure layout	3.57	4	0.996
Social impacts (SOI)	SOI_1	Complement to infrastructure	3.87	2	0.852
	SOI_2	Operational efficiency of infrastructure	3.77	3	0.860
	SOI_3	Daily life convenience of local communities	3.91	1	0.843
	SOI_4	Education, culture and sanitation facilities of local communities	3.52	4	0.911
	SOI_5	Proportion of agricultural activities in urban economic activities	3.18	8	0.988
	SOI_6	Proportion of urban population in population	3.43	5	0.978
	SOI_7	Local employment rate	3.43	5	0.890
	SOI_8	Rights protection of vulnerable groups	3.28	7	0.929
	SOI_9	Proportion of poverty population	3.06	9	0.982
Environmental impacts (ENI)	ENI_1	Water ecology	3.86	4	0.982
	ENI_2	Water environment	3.91	2	0.936
	ENI_3	Water resource	3.87	3	0.987
	ENI_4	Water safety	3.97	1	1.075
Adaptability to communities (AC)	AC_1	Approval rate for projects of local communities	3.94	2	0.990
	AC_2	Information disclosure of projects	3.76	3	0.996
	AC_3	Public participation in project decision making	3.61	5	1.140
	AC_4	Public dispute caused by the project	3.69	4	1.121
	AC_5	Risk prevention measures	3.98	1	1.056
Government performance (GP)	GP_1	Consistency and continuity of PPPs policy	4.05	4	0.978
	GP_2	Legal perfection of PPPs law	3.88	5	0.923
	GP_3	Coordination between relevant agencies	3.87	6	0.979
	GP_4	Government default	4.07	3	1.074
	GP_5	Unreasonable project change	3.74	7	1.019
	GP_6	Rationality of project objectives (GP_6)	4.11	2	0.972
	GP_7	Sharing of benefits and risks (GP_7)	4.14	1	0.973

According to Table 2, there are obvious differences among the different social impact dimensions. First, in the *economic impacts* (ECI) dimension, the mean values range from 3.39 to 3.80, which indicates the relatively gentle discrimination of significance among the indicators from ECI_1 to ECI_8. There are the following two indicators with the highest mean value of 3.80: the *level of local GDP* (ECI_4) and the *fiscal revenue of the local city* (ECI_6). In contrast, the lowest values relate to the *level of income* (ECI_1, 3.45), *Engel coefficient* (ECI_3, 3.39) and *level of consumption* (ECI_2, 3.47). It was found that the family level indicators are less significant than others, while the city level indicators are more significant in this dimension.

Second, the values of the *social impacts* (SOI) dimension ranged from 3.06 to 3.91, which varied the most among all dimensions. Obviously, the indicators related to public infrastructure improvement (*complement to infrastructure* (SOI_1, 3.87), *operating efficiency of infrastructure* (SOI_2, 3.77) and *daily life convenience of local communities* (SOI_3, 3.91) have been given high attention in this dimension, as they have the highest mean values. However, the indicator involving the protection of vulnerable people (*the proportion of people in poverty* (SOI_9, 3.06) is associated with a comparatively low value. Furthermore, the *proportion*

of agricultural activities in urban economic activities (SOI_5, 3.18) is another indicator of less concern according to the respondents.

The third *environmental impact* (ENI) dimension's values are uniform and all comparatively high, e.g., 3.86, 3.91, 3.87 and 3.97. The indicator of greatest concern is *water safety* (ENI_4), followed by the *water environment* (ENI_2). This conforms to the goal of the SPC strategy, which aims to provide a solution to serious water pollution and urban floods occurring in China [4]. Nonetheless, the indicators, *water ecology* (ENI_1) and *water resources* (ENI_3) are also important compared with those of other dimensions. It is concluded that the ENI dimension plays a vital role in the social impacts of SPC PPPs.

Fourth, the range of *adaptability to communities* (AC) dimension's mean value was from 3.61 to 3.98. The highest mean value was for *risk prevention measures* (AC_5), followed by the *approval rate for projects of local communities* (AC_1). Not well-controlled project risks would impair the social benefit of the project and even eventually cause social failure. Hence, sufficient risk prevention measures were highly important within this dimension. Meanwhile, public approval of the project was another key element in the social success of SPC PPPs, as high public approval ratings could reduce the possibility of social conflicts between the public and the project. However, the mean value of the indicator of *public participation in decision-making of the project* (AC_3, 3.61) is the lowest among all indicators of this dimension. As cities are developed for residential purposes, the residents inside are clear regarding their actual requirements and expectations for the SPC projects [2]. Moreover, as the most affected people and the end users of the projects, the impacted general public are rights-holders with legal rights and interests and they ought to possess the right to participate in the decision-making and contribute to the projects that will disrupt their lives [19,56]. Unfortunately, this right is normally disregarded by decision-makers, and the lowest mean value (AC_3, 3.61) confirmed this point. In these situations, local people may think that their participation is meaningless and unavailing, and they may protest against the project to express their emotions and dissatisfaction [39]. Accordingly, it is more sustainable for public authorities and project managers of private entities in the SPC PPPs to attach greater importance to genuine and meaningful public participation. Thus, community support should be obtained to develop the projects to ensure that no protests occur [19].

The final dimension is *government performance* (GP), which sheds light on the partnership between the public sector and the private sector. The average level of the mean values in this dimension was the highest, ranging from 3.74 to 4.14. For example, the value of the indicator of the *sharing of benefits and risks* (GP_7) is as high as 4.14, followed by the *rationality of project objectives* (GP_6, 4.11). This is because PPP risk and benefit allocation are pivotal for the project's success. Nonetheless, a rational project objective can reduce project change and claim compensation during construction and operation. Therefore, the indicator *unreasonable project change* (GP_5, 3.74) is less important.

4.3. Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) model was constructed to identify the linkages between the developed dimensions and their relevant identified indicators (Figure 4). The CFA has been widely used to test whether the theoretical hypothesis can be verified by survey data [58]. By setting up the observed and latent variables, CFA can estimate the different contributions of these indicators to their relevant dimensions as well as the contribution of these dimensions to the social impact level of SPC PPPs. Correspondingly, there are five latent variables (dimensions) established in the CFA model, e.g., *ECI*, *SOI*, *ENI*, *AC* and *GP*. A total of 33 observable variables corresponding to the identified indicators are contained in this model. By using AMOS 21.0, the results of the CFA model fit index are summarized in Table 3.

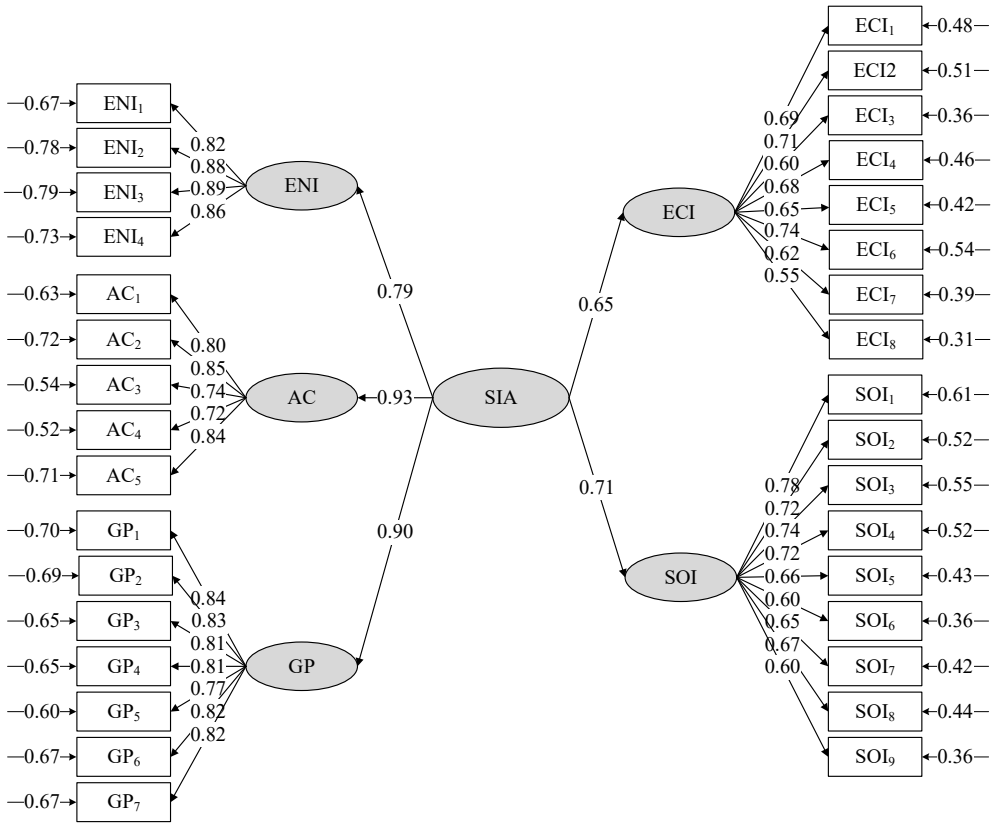

Figure 4. CFA model.

Table 3. Model fit index.

Test Statistic	Fit Criteria	Test Result	Model Fit Estimate
χ^2/Df	<2.00	1.76	YES
RMSEA	<0.08	0.07	YES
GFI	>0.90	0.99	YES
SE	Not high	0.05~0.23	YES
t statistic	$t > 2.58$, reached a significant level of 0.01	3.32~8.29	YES

The indices used to examine the CFA model fits include the χ^2/Df (Degree of freedom), GFI and RMESEA, which possess different ranges of acceptable values (e.g., $\leq$2.00, $\geq$0.08 and $\leq$0.08, respectively), as shown in Table 3 [59]. The *t* statistic and *SE* are also used to test the structural fitness of the model, and the relevant criteria are also indicated in Table 3. Based on the estimates, the CFA model developed fits well, demonstrating that the dimensions and indicators embedded into the SIA indicators developed within the context of SPC PPPs are reasonable. It is also noted that all path coefficients are between 0.50 and 0.95, confirming the rationality of the indicator index.

4.4. Refinement of Key Indicators for SIA of SPC PPPs

To further refine the key SIA indicators for SPC PPPs, the mean values generated by the data analysis and the factor loadings from CFA were taken into consideration at the time. The indicators with mean values <3.50 or factor loadings <0.60 are eliminated from the initial model. Among these excluded indicators above, if their mean values are >3.8 or factor loadings are >0.80, they are kept. For instance, the mean value of ECI_1, ECI_2, ECI_3 and ECI_7 is <3.50, but their factor loadings are <0.80, so these indicators are eliminated. Consequently, the excluded indicators and maintained key indicators for SIA are presented

in Table 4, where 10 indicators were excluded. Accordingly, 23 key SIA indicators of SPC PPPs were identified.

Table 4. Refinement of key indicators for SIA of SPC PPPs.

Dimensions	Mean Value < 3.50	Factor Loading < 0.60	Mean Value > 3.80 or Factor Loading > 0.80	Excluded Indicators	Kept Key Indicators
Economic impacts (ECI)	ECI_1, ECI_2, ECI_3, ECI_7	ECI_8	N/A	ECI_1, ECI_2, ECI_3, ECI_7, ECI_8	ECI_4, ECI_5, ECI_6
Social impacts (SOI)	SOI_5, SOI_6, SOI_7, SOI_8, SOI_9	N/A	N/A	SOI_5, SOI_6, SOI_7, SOI_8, SOI_9	SOI_1, SOI_2, SOI_3, SOI_4
Environmental impacts (ENI)	N/A	N/A	N/A	N/A	ENI_1, ENI_2, ENI_3, ENI_4
Adaptability to communities (AC)	N/A	N/A	N/A	N/A	AC_1, AC_2, AC_3, AC_4, AC_5
Government performance (GP)	N/A	N/A	N/A	N/A	GP_1, GP_2, GP_3, GP_4, GP_5, GP_6, GP_7

5. Discussion and Practical Implications

5.1. How to Enhance the Social Benefits of SPC PPPs

The SIA of SPC PPPs needs effective guidelines and frameworks to raise awareness of a comprehensive and clearer understanding of the social impacts on human communities and lead to improved assessments and practices accordingly. Compared with the existing SIA studies of infrastructure projects, which mainly considered how the public would be affected by the projects, the framework of SIA for SPC PPPs in this study investigated the reciprocal effects of local communities and residents on the projects with an emphasis on the *strength* and the *immediacy* (the closeness of relationships). Moreover, to enhance the social benefits of infrastructure projects, most of the existing research pays attention to the typically triple bottom line of sustainability (social, economic and environmental sustainability). However, this study provides a new perspective and proposes that the improvement of social benefits (or reduction of the negative impacts) of SPC PPPs is strongly dependent upon the lower negative and higher positive *strength* in social, economic and environmental impacts, as well as the better *immediacy* of high adaptability to communities and great government performance.

In this study, the relationships between the SIA of SPC PPPs, dimensions and the SIA indicators are clearly presented based on the conceptual framework developed in prior studies and the influencing mechanism of social impact, as shown in Figure 4, and the number of indicators is further consolidated to 23 key indicators. These CFA results and the identified key indicators are useful tools that can indicate how the SIA indicators influence the social impact and then help decision-makers find an effective path to detect the weaknesses in the conduct of SPC PPPs. Different means to improve social benefits can be proposed, viz.

- Enhancing the social benefits from *strength*. In this case, there are three dimensions representing the *strength* element, namely, *social impacts* (SOI), *economic impacts* (ECI) and *environmental impacts* (*ENI*). It is noted that the ENI variable has the highest path coefficient of 0.79, followed by SOI (0.71) and ECI (0.65). More emphasis on SIA for SPC PPPs should be placed on higher water ecology, water environment and water resource performance because of the close relationship between SIA and the ENI dimension. This also confirms that the unique purpose of the SPCs is to strengthen water ecology in urban areas [4]. Therefore, the ENI dimension is more significant than the other two dimensions. Additionally, the four key indicators SOI_1–SOI_4 in the SOI

dimension are also critical for the final SIA results. Considering the contribution from SOI_1–SOI_4 to SOI and SIA, enhancing the degree of SPCs' *complement to infrastructure* would better help to improve the social benefits of SPC PPPs by facilitating public infrastructure improvement and livability [10,60]. In addition, infrastructure assets are paramount for supporting people's daily lives, and thus, it is necessary to evaluate whether the assets can meet the demands of communities. Furthermore, SPCs can provide local communities with some social leisure services and facilities through landscape reconstruction, such as roof gardens and green land [1]. Therefore, social impacts should focus on people's feelings/perceptions of their living environment, where daily life convenience should be given more attention. In the case that PPPs are adopted for the SPC, operating efficiency is also significant since the improvement of the efficiency of public service is an important strength of PPPs [56]. With the lowest path coefficient of 0.65, the least significant dimension, ECI, consists of three key indicators, ECI_4–ECI_6. SIA is a method focusing on social issues rather than economic benefits, especially for infrastructure, although some indicators in the SOI dimension are more difficult to measure quantitatively than those in the ECI dimension [61]. It has been acknowledged by many studies that traditional SIA has the shortcoming of focusing only on variables that are easy to quantify [62].

- Enhancing the social benefits of *immediacy*; in this case, there are two dimensions representing the *immediacy* element, including *adaptability to communities* (AC, 0.93) and *government performance* (GP, 0.90). The latent variable *adaptability to communities* (AC) measured by AC_1-AC_5 with the highest path coefficient can be considered the most significant component that could influence the SIA results. Considering the contribution from AC to the SIA results, SPC PPPs should be managed to enable higher adaptability to urban environments through enhanced respect for local communications [5,19]. Education, information dissemination and public involvement in analysis alternatives about SPC PPPs should be carefully considered [1,11] (AC_2, AC_3); in this way, the residents to be impacted will be more likely to accept such impacts (e.g., social) (AC_1) due to a better understanding of the necessity of the project's intervention in producing long-term benefits to their lives [19]. Otherwise, the projects will be subjected to a higher risk of strikes, protests and sabotage (AC_4, AC_5), which may lead to project delays, severe financial problems and other adverse social consequences [2,4]. Therefore, more attention should be given to the indicators of the AC dimension to build positive interaction between the project and the local community. In addition, *government performance* is another significant dimension, leading to a close distance between SPC PPPs and the public, which is ranked second (0.90) and underlies seven significant indicators, including GP_1–GP_7. Considering the contribution of GP to the SIA results, SIA indicators in government performance are vital to the success of SPC PPPs, in which the consistency and continuity of the PPP policy (GP_1, 0.84) is the most important indicator influencing the SIA results. Since the SPC PPPs are the arrangements underpinned by exploiting the competitiveness of private-sector organizations to address increasingly serious urban flood disasters [7,10]. More attention to consistently continuing the PPP policy (GP_1, 0.84) and government credit (GP_4, 0.81) can ensure a satisfactory profit for private entities, earn recognition and trust from the public, and enhance the sustainable development of SPC projects [11,19]. Considering the government's authority as the supervisor and manager in PPPs, people's attitude to PPPs can be influenced by the reputation of the government largely [10,63]. Simultaneously, a sounder regulatory environment with clear legal norms and institutional arrangements regarding PPPs (GP_2, 0.83; GP_3, 0.81) and appropriate sharing of benefits and risks (GP_6, 0.82; GP_7, 0.82) should also be carefully implemented to attract private sectors to address social problems and increase the positive effects of SPC PPPs for the general public and the whole city [64].

For the SPC PPPs in practice, the aforementioned situations may arise iteratively or concurrently. SIA practitioners are obliged to understand how the core components

influence the way potential social impacts are generated by SPC PPPs and address them. Basic ways to enhance the social benefits of SPC PPPs have been proposed through the implementation of responding measures in the SIA dimensions. Managers in SPC PPPs and concerned officials in the government can use these different measures to enhance the social consequences of SPC PPPs.

5.2. Practical Implications for Sustainable SPC PPPs

The SPC concept has been a popular topic for many governments worldwide. The facilitation of the private sector in the development of SPC projects can be an effective method to facilitate low-impact development in developing countries. Practical implications for governmental authorities and practitioners can be proposed based on the two most significant influencing factors for SIA of SPC PPPs, namely, *adaptability to communities* (AC, 0.93) and *government performance* (GP, 0.90).

For governments to achieve sustainable development of SPC PPPs, a solid foundation of policy guarantees for the private sector must first be built. Inappropriate strategies may lead to the failure of PPPs. As shown in the SIA indicators of *government performance* (GP, 0.90), legal documents and institutional arrangements related to PPPs are essential for attracting private sectors to SPC PPPs and promoting the smooth development of SPCs in the region [7,65]. Further, during the construction and operation of SPC PPPs, local governments should pay attention to public participation in decision making as shown in the SIA indicators of *adaptability to communities* (AC, 0.93). The encouragement of public participation in the projects can bolster public support and reduce social conflicts, which in turn leads to social equitability, environmental sustainability and economic viability (of the projects) [15,19]. As addressed above, SPC encapsulates an infrastructure project initiated with the aim of bringing social benefits to the water ecological system. Thus, SPC should focus less on 'asset profitability' than on other traditional economic infrastructure projects (e.g., roads, railways and bridges) [61]. However, governments also need to develop sound policies/legislation and regulations to guarantee reasonable returns and appropriate risk sharing in the PPP agreement to prevent the opportunistic behavior of concessionaires in terms of the maximization of profits [66,67].

Private-sector entities in SPC PPPs should satisfy the general public's demand for high-quality public facilities and services by means of their knowledge and expertise. Besides, considering the projects' *adaptability to communities* (AC, 0.93), they also need to establish good relationships with the local affected communities to benefit from their payoff strategy and further sustainable collaborations in SPC PPPs. In practice, the private sector may take more responsibilities in the development and operation of the projects over their life cycles to realize reasonable profits in SPC PPPs. However, the achievement of sustainable SPC PPPs depends on various factors. Private sector investors should not only fund SPC development but also devote their specific knowledge, skills and experience to generate innovation and provide sustainable assets [68,69]. Put simply, to avoid public dispute during the projects' development and win community support for project objectives, the private sector's expertise in technological innovation should ensure the projects are delivered efficiently and enhance benefits and project-related opportunities for the residents and the whole city.

6. Conclusions

The conceptual model of SIA for SPC PPPs presented in the authors' prior work [22] was further developed into an influencing mechanism for assessing the social impacts of SPC PPPs by using the principles of SIT and sustainable development perspective. Moreover, the theoretical relationships of the influencing mechanism among indicators, dimensions and the SIA of SPC PPPs were hypothesized. Then, whether the five dimensions and their indicators are significant is empirically tested by using CFA. The CFA results owned good fitness, which shows that all 33 SIA indicators can contribute to their respective dimensions and all SIA dimensions can contribute to the ultimate SIA results of SPC PPPs.

Moreover, their contributions are different. The classification of SIA indicators for the five dimensions is supported by the CFA results. Moreover, based on the survey results and the factor loadings of CFA results, 33 indicators were refined to 23 key indicators. On this basis, the 23 key indicators and their clarification relationships to the respective SIA dimensions and to the overall SIA results offer a useful tool for enhancing the social benefits of SPC PPPs and measuring possible risks in SPC development.

Meanwhile, new insights acquired also gave some inspiration to the practical pilot work. That is, different ways of measuring the SIA indicator improvement, the dimension improvement in *strength* and *immediacy*, and the overall SIA results improvement can offer a useful tool for managers and government departments involved in addressing any potential negative impacts and improving the social benefits of SPC PPPs. Besides, based on the results of the CFA model, it has been identified that *adaptability to communities* and *government performance* variables in *immediacy* with the higher path coefficients should deserve more attention in SIA. In other words, it is a real necessity for the government to improve its governance capacity and create a favorable environment of a market for the implementation of SPC delivery by PPPs. Further, enabling a close relationship with local communities is critical for the SIA of SPC PPPs. This can be achieved by private sectors and governments involved in the following aspects: (1) encouraging public participation; (2) ensuring extensive support from the general public; (3) satisfying the general public's demands for SPC PPPs.

In addition to China, the perspectives and key indicators of SIA proposed for SPC PPPs in this present research are useful for other countries, providing them with an insight into dealing with urban flooding or waterlogging issues. Such countries may need to extend their attention from the typically triple bottom line of sustainability to improve government performance and the adaptability of the SPC projects to local communities. Then, SPC PPPs can achieve sustainable development in the long term to solve social problems, meet the social needs of local residents and reduce public opposition.

Although the key indicators in the SIA indicator system and their significance have been established and identified respectively, there are still some limitations to the study. For example, the novel research presented lacks an analysis of the cumulative effect within the system. Measuring the interactive relationships between different indicators would enable an understanding of the internal formation mechanism of social impacts, which will be discussed further in future studies. Moreover, more efforts should be made on how to design detailed evaluation criteria for different SIA indicators, which need extensive further investigation work with industries in future research.

Author Contributions: Conceptualization, methodology, software, validation, writing—original draft preparation, W.L.; Data curation, investigation, writing—review and editing, J.G.; Supervision, project administration, writing—review and editing, J.Y.; Supervision, formal analysis, writing—review and editing, H.J.L.; Supervision, writing—review and editing, D.J.E. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Qinglan Project of Jiangsu Province of China and the Graduate Research and Innovation Projects of Jiangsu Province (No. KYCX18_0201).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors' special thanks go to all reviewers of the paper and to the Qinglan Project of Jiangsu Province of China and the Graduate Research and Innovation Projects of Jiangsu Province (No. KYCX18_0201) for financially supporting this research.

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

References

1. Wang, Y.; Sun, M.; Song, B. Public Perceptions of and Willingness to Pay for Sponge City Initiatives in China. *Resour. Conserv. Recycl.* **2017**, *122*, 11–20.
2. Dai, L.; van Rijswick, H.F.M.W.; Driessen, P.P.J.; Keessen, A.M. Governance of the Sponge City Programme in China with Wuhan as a Case Study. *Int. J. Water Resour. Dev.* **2018**, *34*, 578–596.
3. National Bureau of Statistics of China (NBSC). *China Statistical Yearbook 2015*; National Bureau of Statistics of China: Beijing, China, 2015.
4. Chan, F.K.S.; Griffiths, J.A.; Higgitt, D.; Xu, S.; Zhu, F.; Tang, Y.-T.; Xu, Y.; Thorne, C.R. "Sponge City" in China—A Breakthrough of Planning and Flood Risk Management in the Urban Context. *Land Use Policy* **2018**, *76*, 772–778.
5. Jiang, Y.; Zevenbergen, C.; Fu, D. Understanding the Challenges for the Governance of China's "Sponge Cities" Initiative to Sustainably Manage Urban Stormwater and Flooding. *Nat. Hazards* **2017**, *89*, 521–529.
6. Nguyen, T.T.; Ngo, H.H.; Guo, W.; Wang, X.C.; Ren, N.; Li, G.; Ding, J.; Liang, H. Implementation of a Specific Urban Water Management-Sponge City. *Sci. Total Environ.* **2019**, *652*, 147–162.
7. Wang, Y.; Jiang, Z.; Zhang, L. Sponge City Policy and Sustainable City Development: The Case of Shenzhen. *Front. Environ. Sci.* **2022**, *9*, 577.
8. Bae, C.; Lee, D.K. Effects of Low-Impact Development Practices for Flood Events at the Catchment Scale in a Highly Developed Urban Area. *Int. J. Disaster Risk Reduct.* **2020**, *44*, 101412.
9. Yin, D.; Chen, Y.; Jia, H.; Wang, Q.; Chen, Z.; Xu, C.; Li, Q.; Wang, W.; Yang, Y.; Fu, G. Sponge City Practice in China: A Review of Construction, Assessment, Operational and Maintenance. *J. Clean. Prod.* **2021**, *280*, 124963.
10. Zhang, L.; Sun, X.; Xue, H. Identifying Critical Risks in Sponge City PPP Projects Using DEMATEL Method: A Case Study of China. *J. Clean. Prod.* **2019**, *226*, 949–958.
11. Li, H.; Ding, L.; Ren, M.; Li, C.; Wang, H. Sponge City Construction in China: A Survey of the Challenges and Opportunities. *Water* **2017**, *9*, 594.
12. Xia, J.; Zhang, Y.; Xiong, L.; He, S.; Wang, L.; Yu, Z. Opportunities and Challenges of the Sponge City Construction Related to Urban Water Issues in China. *Sci. China Earth Sci.* **2017**, *60*, 652–658.
13. Jiang, Y.; Zevenbergen, C.; Ma, Y. Urban Pluvial Flooding and Stormwater Management: A Contemporary Review of China's Challenges and "Sponge Cities" Strategy. *Environ. Sci. Policy* **2018**, *80*, 132–143.
14. Wang, L.; Yan, D.; Xiong, Y.; Zhou, L. A Review of the Challenges and Application of Public-Private Partnership Model in Chinese Garbage Disposal Industry. *J. Clean. Prod.* **2019**, *230*, 219–229.
15. Wang, S.; Palazzo, E. Sponge City and Social Equity: Impact Assessment of Urban Stormwater Management in Baicheng City, China. *Urban Clim.* **2021**, *37*, 100829.
16. United Nations. The Sustainable Development Goals Report 2018. Available online: https://unstats.un.org/sdgs/report/2018 (accessed on 20 June 2022).
17. Chen, C.; Yu, Y.; Robert, O.K.; Chan, A.P.C.; Xu, J. Developing a Project Sustainability Index for Sustainable Development in Transnational Public Private Partnership Projects. *Sustain. Dev.* **2019**, *27*, 1034–1048.
18. Köhler, J. Globalization and Sustainable Development: Case Study on International Transport and Sustainable Development. *J. Environ. Dev.* **2014**, *23*, 66–100.
19. Vanclay, F.; Esteves, A.M.; Aucamp, I.; Franks, D.M. *Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects*; International Association for Impact Assessment: Fargo, ND, USA, 2015.
20. Vanclay, F. Conceptualising Social Impacts. *Environ. Impact Assess. Rev.* **2002**, *22*, 183–211.
21. Li, Q.; Wang, F.; Yu, Y.; Huang, Z.; Li, M.; Guan, Y. Comprehensive Performance Evaluation of LID Practices for the Sponge City Construction: A Case Study in Guangxi, China. *J. Environ. Manag.* **2019**, *231*, 10–20.
22. Guo, J.; Li, W.; Yuan, J. Social Impact Assessment for Sponge City PPPs: Framework and Indicators. In *Sustainable Buildings and Structures: Building a Sustainable Tomorrow*; Taylor & Francis Group: Abingdon, UK; CRC Press: London, UK, 2019; pp. 319–328, ISBN 1003000711.
23. Koppenjan, J.F.M.; Enserink, B. Public–Private Partnerships in Urban Infrastructures: Reconciling Private Sector Participation and Sustainability. *Public Adm. Rev.* **2009**, *69*, 284–296.
24. Zheng, S.; Xu, K.; He, Q.; Fang, S.; Zhang, L. Investigating the Sustainability Performance of PPP-Type Infrastructure Projects: A Case of China. *Sustainability* **2018**, *10*, 4162.
25. Van Ham, H.; Koppenjan, J. Building Public-Private Partnerships: Assessing and Managing Risks in Port Development. *Public Manag. Rev.* **2001**, *3*, 593–616.
26. Yuan, J.; Li, W.; Guo, J.; Zhao, X.; Skibniewski, M.J. Social Risk Factors of Transportation PPP Projects in China: A Sustainable Development Perspective. *Int. J. Environ. Res. Public Health* **2018**, *15*, 1323.
27. Yuan, J.; Zeng, A.Y.; Skibniewski, M.J.; Li, Q. Selection of Performance Objectives and Key Performance Indicators in Public–Private Partnership Projects to Achieve Value for Money. *Constr. Manag. Econ.* **2009**, *27*, 253–270.
28. Grimsey, D.; Lewis, M.K. Evaluating the Risks of Public Private Partnerships for Infrastructure Projects. *Int. J. Proj. Manag.* **2002**, *20*, 107–118.
29. Latané, B. The Psychology of Social Impact. *Am. Psychol.* **1981**, *36*, 343.

30. Chang, J.-H.; Zhu, Y.-Q.; Wang, S.-H.; Li, Y.-J. Would You Change Your Mind? An Empirical Study of Social Impact Theory on Facebook. *Telemat. Inform.* **2018**, *35*, 282–292.
31. Miller, M.D.; Brunner, C.C. Social Impact in Technologically-Mediated Communication: An Examination of Online Influence. *Comput. Human Behav.* **2008**, *24*, 2972–2991.
32. Daunt, K.L.; Greer, D.A. Unpacking the Perceived Opportunity to Misbehave: The Influence of Spatio-Temporal and Social Dimensions on Consumer Misbehavior. *Eur. J. Mark.* **2015**.
33. Oc, B.; Bashshur, M.R. Followership, Leadership and Social Influence. *Leadersh. Q.* **2013**, *24*, 919–934.
34. Nowak, A.; Szamrej, J.; Latané, B. From Private Attitude to Public Opinion: A Dynamic Theory of Social Impact. *Psychol. Rev.* **1990**, *97*, 362.
35. Harris, L.C.; Ezeh, C. Servicescape and Loyalty Intentions: An Empirical Investigation. *Eur. J. Mark.* **2008**, *42*, 390–422.
36. Argo, J.J.; Dahl, D.W.; Manchanda, R.V. The Influence of a Mere Social Presence in a Retail Context. *J. Consum. Res.* **2005**, *32*, 207–212.
37. Liu, H.J.; Love, P.E.D.; Smith, J.; Sing, M.C.P.; Matthews, J. Evaluation of Public–Private Partnerships: A Life-Cycle Performance Prism for Ensuring Value for Money. *Environ. Plan. C Politics Space* **2018**, *36*, 1133–1153.
38. Vanclay, F. International Principles for Social Impact Assessment. *Impact Assess. Proj. Apprais.* **2003**, *21*, 5–12.
39. Esteves, A.M.; Franks, D.; Vanclay, F. Social Impact Assessment: The State of the Art. *Impact Assess. Proj. Apprais.* **2012**, *30*, 34–42.
40. Esteves, A.M.; Vanclay, F. Social Development Needs Analysis as a Tool for SIA to Guide Corporate-Community Investment: Applications in the Minerals Industry. *Environ. Impact Assess. Rev.* **2009**, *29*, 137–145.
41. O'Faircheallaigh, C. Public Participation and Environmental Impact Assessment: Purposes, Implications, and Lessons for Public Policy Making. *Environ. Impact Assess. Rev.* **2010**, *30*, 19–27.
42. He, G.; Yeerkenbieke, G.; Baninla, Y. Public Participation and Information Disclosure for Environmental Sustainability of 2022 Winter Olympics. *Sustainability* **2020**, *12*, 7712.
43. Wu, Y.Y.; Ma, H.W. Challenges for Integrating Strategic Environmental Assessment to Enhance Environmental Thinking: A Case Study of Taiwan Energy Policy. *Sustainability* **2019**, *11*, 609.
44. Tilt, B.; Braun, Y.; He, D. Social Impacts of Large Dam Projects: A Comparison of International Case Studies and Implications for Best Practice. *J. Environ. Manag.* **2009**, *90*, S249–S257.
45. Suopajärvi, L. Social Impact Assessment in Mining Projects in Northern Finland: Comparing Practice to Theory. *Environ. Impact Assess. Rev.* **2013**, *42*, 25–30. [CrossRef]
46. Zhao, G.; Wang, S. Indicators of Social Impact Assessment for BOT/PPP Projects. *Soc. Soc. Manag. Syst. Internet J.* **2007**, *3*, 1–9.
47. Vanclay, F. Principles for Social Impact Assessment: A Critical Comparison between the International and US Documents. *Environ. Impact Assess. Rev.* **2006**, *26*, 3–14. [CrossRef]
48. Arce-Gomez, A.; Donovan, J.D.; Bedggood, R.E. Social Impact Assessments: Developing a Consolidated Conceptual Framework. *Environ. Impact Assess. Rev.* **2015**, *50*, 85–94. [CrossRef]
49. Kirchherr, J.; Charles, K.J. The Social Impacts of Dams: A New Framework for Scholarly Analysis. *Environ. Impact Assess. Rev.* **2016**, *60*, 99–114. [CrossRef]
50. Liu, H.; Pan, W. Efficiency Evaluation of Public Rental Housing Policy Based on DEA. In Proceedings of the International Conference on Management Science and Innovative Education, Xi'an, China, 12–13 December 2015; Atlantis Press: Paris, France, 2015; pp. 271–274.
51. Padilla-Rivera, A.; Morgan-Sagastume, J.M.; Noyola, A.; Güereca, L.P. Addressing Social Aspects Associated with Wastewater Treatment Facilities. *Environ. Impact Assess. Rev.* **2016**, *57*, 101–113. [CrossRef]
52. Esteves, A.M.; Factor, G.; Vanclay, F.; Götzmann, N.; Moreira, S. Adapting Social Impact Assessment to Address a Project's Human Rights Impacts and Risks. *Environ. Impact Assess. Rev.* **2017**, *67*, 73–87. [CrossRef]
53. Pereira, E.; Ahn, S.; Han, S.; Abourizk, S.M. Finding Causal Paths between Safety Management System Factors and Accident Precursors. *J. Manag. Eng.* **2019**, *36*, 4019011–4019049. [CrossRef]
54. Lu, Z.; Peña-Mora, F.; Wang, S.Q.; Liu, T.; Wu, D. Assessment Framework for Financing Public–Private Partnership Infrastructure Projects through Asset-Backed Securitization. *J. Manag. Eng.* **2019**, *35*, 4019027. [CrossRef]
55. Brown, J.D. Likert Items and Scales of Measurement. *Statistics* **2011**, *15*, 10–14.
56. Yuan, J.; Li, W.; Zheng, X.; Skibniewski, M.J. Improving Operation Performance of Public Rental Housing Delivery by PPPs in China. *J. Manag. Eng.* **2018**, *34*, 04018015. [CrossRef]
57. Nunnally, J.C. *Psychometric Theory*, 3rd ed.; Tata McGraw-Hill Education: New York, NY, USA, 1994; ISBN 0071070885.
58. Schreiber, J.B.; Stage, F.K.; King, J.; Nora, A.; Barlow, E.A. Reporting Structural Equation Modeling and Confirmatory Factor Analysis Results: A Review. *J. Educ. Res.* **2006**, *99*, 323–338.
59. Ng, S.T.; Wong, Y.M.W.; Wong, J.M.W. A Structural Equation Model of Feasibility Evaluation and Project Success for Public–Private Partnerships in Hong Kong. *IEEE Trans. Eng. Manag.* **2010**, *57*, 310–322.
60. Zhang, S.; Gao, Y.; Feng, Z.; Sun, W. PPP Application in Infrastructure Development in China: Institutional Analysis and Implications. *Int. J. Proj. Manag.* **2015**, *33*, 497–509.
61. Singh, R.K.; Murty, H.R.; Gupta, S.K.; Dikshit, A.K. An Overview of Sustainability Assessment Methodologies. *Ecol. Indic.* **2009**, *9*, 189–212.

62. Hiruy, K.; Wallo, M.T. Impact Assessment: Assessing the Social Dimensions of Fisheries Research Projects in the Asia-Pacific Region. *Impact Assess. Proj. Apprais.* **2018**, *36*, 444–455.
63. Tawalare, A.; Balu, Y. Performance Evaluation of Implementation of Continuous Water Supply Projects: Two Case Studies from India. *Procedia Eng.* **2016**, *161*, 190–194.
64. Liu, J.; Love, P.E.D.; Davis, P.R.; Smith, J.; Regan, M. Conceptual Framework for the Performance Measurement of Public-Private Partnerships. *J. Infrastruct. Syst.* **2015**, *21*, 04014023.
65. Pfisterer, S.; Van Tulder, R. Navigating Governance Tensions to Enhance the Impact of Partnerships with the Private Sector for the SDGs. *Sustainability* **2020**, *13*, 111. [CrossRef]
66. El-Gohary, N.M.; Osman, H.; El-Diraby, T.E. Stakeholder Management for Public Private Partnerships. *Int. J. Proj. Manag.* **2006**, *24*, 595–604. [CrossRef]
67. Mok, K.Y.; Shen, G.Q.; Yang, J. Stakeholder Management Studies in Mega Construction Projects: A Review and Future Directions. *Int. J. Proj. Manag.* **2015**, *33*, 446–457.
68. Doloi, H. Assessing Stakeholders' Influence on Social Performance of Infrastructure Projects. *Facilities* **2012**, *30*, 531–550.
69. Yuan, J.; Zhang, L.; Tan, Y.; Skibniewski, M.J. Evaluating the Regional Social Sustainability Contribution of Public-private Partnerships in China: The Development of an Indicator System. *Sustain. Dev.* **2019**, *28*, 259–278.