

Article

Toward Sustainable Development? A Bibliometric Analysis of PPP-Related Policies in China between 1980 and 2017

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Abstract: This article aims to fill the void in the literature regarding the sustainable development of public–private partnerships (PPPs) by answering the following research questions: (1) Between 1980 and 2017, what were the PPP-related policy priorities in the three different historical phases of the Chinese national agenda that we have identified herein? (2) Have the PPP-related policies shown a pattern of moving toward sustainable development, and if so, to what extent? Against a criteria framework of evaluating how PPP-related policies could contribute to sustainable development, this article conducted a quantitative bibliometric analysis of 299 PPP-related policy documents issued by the Chinese central government between 1980 and 2017. By visualizing the networks of policy keywords and policy-issuing departments, this article identified the PPP-related policy priorities in the following three distinct historical phases: Phase I (1980–1997), the encouragement of foreign investment in the public infrastructure; Phase II (1998–2008), the encouragement of the marketization of the urban public utilities; and Phase III (2009–2017), the intensive institutionalization and extensive application of PPPs for solving the local debt problem. Corresponding to the abovementioned policy priorities, this article found that the pattern of PPP-related policies has shifted from the total absence of sustainable development policies in Phase I, to a few sustainable development policy attempts in Phase II, and finally, to a tendency toward policies favoring sustainable development in Phase III.

Keywords: bibliometric analysis; China; PPPs; policy changes; sustainable development

1. Introduction

Public–private partnerships (PPPs) can be defined as “agreements where public sector bodies enter into long-term contractual agreements in which private parties participate in, or provide support for the provision of infrastructure and public service” [1]. Since the 1980s, China has adopted PPPs in the public service sector, particularly in the area of public infrastructure. Correspondingly, the Chinese central government has issued PPP-related policies since 1980. Based on a collection of 299 PPP-related policy documents from 1980 to 2017, this article aims to explore two specific research questions as follows: (1) Between 1980 and 2017, what were the PPP-related policy priorities in the different historical phases of the Chinese national agenda? (2) Have the PPP-related policies shown a pattern of moving toward sustainable development, and if so, to what extent?

By answering these two research questions, this article has two research objectives.

One research objective is to respond to the concerns about how to assess the extent to which PPP-related policies have contributed to sustainable development in China.

PPPs have been recognized internationally as an important tool of achieving sustainable development. The United Nations (UN), one of the most important international organizations to promote worldwide sustainability, called for the use and improvement of PPPs for sustainable development with UN Sustainable Development Goals (SDGs) and the 2030 Agenda for Sustainable Development [2]. In 2017, the UN Economic Commission for Europe (UNECE) published a conference room paper, which served as a draft of the guiding principles on people-first PPPs in connection to the UN SDGs; this conference room paper provided eight specific principles regarding PPPs for the purposes of working toward sustainable development [3].

China has actively responded to the advocacies of the UN. The first call for sustainable development in China was in the Chinese National Agenda 21 of 1994, which clearly raised the specific objectives of achieving sustainable development in China and echoed the principles of the UN Agenda 21 [4]. In 2016, responding to the UN's 2030 Agenda for Sustainable Development, China published the "National Plan on Implementation of the 2030 Agenda for Sustainable Development" [5]. This national plan stated for the first time that China will actively promote PPPs to facilitate the development of social resources for sustainable development. The political rhetoric above has raised concerns about how to assess whether the formal regulations and policies regarding PPPs have provided sufficient guidance for PPPs to influence sustainable development in China. This article aims to address this concern.

The second research objective is to fill in the research gap of PPPs, in the following two aspects.

Firstly, while there has existed a relatively well-developed body of research regarding PPPs, the perspective of sustainable development has not obtained enough attention in the current state of knowledge. In the last two decades, the extant literatures of PPPs have covered various aspects. Based on a bibliometric analysis of PPPs and PFI literature, de Castro e Silva Neto et al. figured out a list of research topics that covered the majority of the present PPPs' themes from 1990 to 2014, sequencing as contract performance, qualitative costs and benefits, contract design and risk sharing, PPP/PFI political and institutional issues, value for money (VFM, see Appendix A 1) test, stakeholder management, contract management, accountability, financing PPP/PFIs projects, procurement model, renegotiation and dispute resolution, literature review, environmental issues, and contract termination [6]. In the literature review of PPPs from public management perspective, Wang et al. identified the research focuses on PPPs concept, risk sharing amongst PPPs participants, the drivers of PPPs adoption and PPPs performance [7]. In the latest review of PPPs for the last two decades, Hodge and Greve concluded the following aspects of PPPs literatures: economics of PPPs; project finance and management of PPPs, which mainly look at the risk management, financial and economic visibility in the project level; and political, public management and social aspects of PPPs, mainly raised the issues about accountability, governance of PPPs. As shown in the above literature reviews, the perspective of sustainable development is not yet at the core of current research; however, it deserves much more attention in future research agendas. As Hodge and Greve pointed out that, the research ideas of PPPs have evolved from early technical issues and narrow disciplinary lenses towards far broader sets of concerns [8]. Obviously, as a cross-disciplinary governance issue, PPPs for sustainable development is one of these concerns. This article, by distinguishing "PPP for sustainable development" and "PPP via a sustainable approach" and connecting these two aspects to ecological, social and financial sustainability, aims to fill in this research gap.

Secondly, in the existing research regarding PPPs and sustainable development [9,10], there is little work exploring the institutional arrangements of PPPs, mainly consisting of policies and regulations, from the perspective of sustainability. The current relevant research has tended to focus on developing indicators from the concept of sustainability and applying them onto the evaluation of PPPs performance [10–12]; providing empirical assessment about whether and how PPPs lead to sustainable development [13–15]; and debating the role of PPPs in sustainable development [16–18]. While the above extant research has provided insightful thoughts on PPPs and sustainable development, an important aspect of understanding PPPs—policies and regulations for PPPs—has not obtained

more attention in the research agenda. As Koppenjan and Enserink argued, the contribution of PPPs to sustainability depends on the quality of the policies and regulations by which the private contributions are regulated and the extent to which regulation issues are recognized and acted on [16]. Hodge and Greve also argued that the attention of researchers ought to be turning to ‘politics of PPPs’—in which political governance and formal institutional arrangement to steer and regulate PPPs deserve future attention [19]. This article, with the focuses on PPP-related policies and sustainable development, aims to provide the first bibliometric analysis of PPP-related policies to explore whether and to what extent the institutional arrangements of PPPs have shown a pattern of moving toward sustainable development.

The article is structured as follows. In the next section, we design a criteria framework by which to evaluate the extent to which PPP-related policies move toward sustainable development. In Section 3, the research methods are presented. The findings are presented in Section 4, followed by our conclusions and discussions in Section 5.

2. PPP-Related Policies and Sustainable Development

In order to evaluate whether the policies have shown the pattern of moving toward sustainable development, this section aims to establish a criteria framework for determining what criteria could be developed to evaluate PPP-related policies for sustainable development in China. It is important to set up this framework, because although the role of PPPs for sustainable development has been justified in extant literature, how and in what way PPPs and PPP-related policies could contribute to sustainable development are still hard to identify due to the lack of a concrete criteria framework.

This framework firstly developed the concept of sustainability into ecological sustainability, social sustainability and financial sustainability [20]. Then these three aspects of sustainability are integrated into two dimensions. The dimension of “PPPs for sustainable development” refers to whether the PPP-related policies encourage PPPs to be used for ecological and social sustainable development. The dimension of “PPPs via a sustainable approach” refers to whether the PPP-related policies encourage PPPs to be used via ecologically, socially, and financially sustainable approaches. Therefore, five criteria are developed in this framework (see Table 1). PPPs for financial sustainability are not applicable here, as financial sustainability is a concept regarding the approach rather than the sector. We discuss these five criteria below, drawing on the extant literature regarding the benefits and limitations of PPPs, and the management of PPPs in various countries in achieving sustainable development.

Table 1. Criteria framework for identifying and categorizing PPP-related policies moving toward sustainable development.

Sustainability	PPPs for Sustainable Development	PPPs via a Sustainable Approach
Ecological sustainability	Policies that encourage PPPs to be used for ecological/environmental protection projects.	Policies that demand that PPPs be used via an environmentally friendly approach, such as the innovative use of a resource or environmentally friendly technologies.
Social sustainability	Policies that encourage PPPs to be used for social infrastructure and service projects.	Policies that demand that PPPs be used via a transparent and due process approach.
Financial sustainability	Not applicable.	Policies that demand that PPPs be used via a financially sustainable approach, such as the VFM test and the financial affordability test and forbidding government guarantees

2.1. PPPs for Sustainable Development

The dimension of “PPPs for sustainable development” contains two criteria, examining whether PPP-related policies have encouraged PPPs to be applied to 1) ecological infrastructure and services, which refer to projects and services for protecting the natural environment; 2) social infrastructure and

services, which refer to projects and services for households, intending to improve the quality of life and welfare in a community, such as schools, hospitals, and health services.

These criteria are inspired by the increasing trend of using PPPs in social and ecological sector in various countries. With the rise of the concern regarding sustainable development and the benefits and advantages of PPPs in ecological and social infrastructure and services provision [21], the practices of PPPs in various countries have increasingly moved from the traditional economic sector to the provision of ecological and social infrastructure and services [17,21]. For example, the European Union (EU) countries and the United States of American (USA) have promoted PPPs as an approach to environmental protection and poverty eradication [22]. Australia is one of the most advanced countries in adopting PPPs to deliver social services, covering health, education, social housing, correction, and justice [23,24]. In Canada, the Ministry of Finance carried out a 10-year investment plan for social infrastructure starting from 2016, including affordable housing, early learning and childcare, cultural and recreational infrastructure, and safe public health care facilities. For developing countries, although economic infrastructure is still the priority of PPPs, the social and environmental sectors were gradually considered into plans. In Chile, there are three phases of the PPPs concessions development. From 1991 to 1994 Chile focused on expanding its highway networks. From 1995 to 2002, Chile's government focused on the construction of urban highways and airports. From 2003 to 2010, Chile's government started to pay attention on building social infrastructure such as hospitals, prisons, and public buildings [23]. In India, so far, although private investment has been confined to economic infrastructure with high value, governments have started to include social and environmental sectors such as water and wastewater services into PPP plans to attract the attention of private capital [25,26].

2.2. PPPs via Sustainable Approach

Although the benefits claimed above, a significant number of studies have raised concerns over the limitations and problems of PPPs, such as the ambiguous outcome, high transaction costs between stakeholders or the cost compared to government borrowing [18,27,28]. Such mixed evidence shows that the benefits of PPPs in environmental and social infrastructure and services do not automatically contribute to sustainable development, unless the limitations and problems occurred in the design and management of PPPs can be mitigated, in other words, unless the management of PPPs itself is sustainable. This is where the dimension of 'PPP via a sustainable approach' is derived from.

PPP via an ecologically sustainable approach evaluates whether the policies have encouraged environmentally friendly technologies such as the innovative use of natural resources or environmentally friendly technologies in the process of implementing a PPP project. This criterion is derived from the experience from various countries. For example, the United Kingdom (UK) published "green public-private partnerships" outlining steps that can be taken within a PPP or PFI project, to incorporate environmental considerations. These steps in incorporating green issues, such as reducing the use of energy, water and other resources, minimizing waste and controlling pollution and other quality objectives, are required to be instigated at the specification stage, and selecting bidders and awarding contracts stage [29]. Also, in USA, Canada, Europe, Japan, and South Korea, incentives such as certification payment, tax reduction, financial support for green component technologies, and interest rate reduction have been incorporated into policies [30].

PPP via a socially sustainable approach evaluates whether the policies have guaranteed the transparency and due process that ensure equal and effective collaboration among the stakeholders, that are, the public sector, the private partners, and citizens. PPPs are complex organizational structures embedded in the intensive tension among stakeholders with different knowledge, divergent goals and values, and stark differences in organizational experience [31]. Either the public sector or the private sector has the tendency to show opportunistic behavior owing to information asymmetry [32,33]. Furthermore, "in the absence of the information, the political purchase of huge infrastructure projects will continue to leave citizens open to political and commercial trade off. If the price is higher than it needs to be, citizens inevitably pay" [34]. Echoing on the above reflection, many countries have realized

the necessity of setting up a clear and transparent process for procurement and implementation of PPPs projects. Australia sets up a clear and transparent procurement process for large-scale social infrastructure projects with well-understood procurement policy methodologies and guidelines [35]. Chile establishes a concession process in order to remain clear, transparent and fair so that the private sector can know the criteria in the evaluation of the offer and contracts that are open for the public access [23]. The India government has specifically emphasized the need for promoting sustainable and inclusive growth and mandated the need to involve people in PPPs projects, and proposed the need to structure an innovative procurement model in the form of PPPP (People Public–Private Partnership) [10,36].

PPPs via financially sustainable approach evaluates whether the policies have required the VFM test, long-term financial affordability test in project design and forbidding government guarantees on private returns at the cost of the financial interests of future generations. This approach draws on the discussion about the project finance of PPPs, which is one of the critical issues in PPPs literatures [8]. Originating in the UK, VFM test has become a common method to justify PPPs approach in international experience [37–39]. Also in the UK, before any VFM tests are performed, a long-term affordability test is required to detect whether the government has the ability to keep its responsibilities without jeopardizing the economic sustainability of the system [40]. In Australia, Canada, Ireland, and the Netherlands, the VFM, which requires time and cost efficiency, great assurance of income, innovation, and the effort to release public sector resources, has become one of the key factors for government adopting the PPPs model [23,41–45]. In South Africa, a VFM test is mandatory before bids are presented [40]. In India, the decision to opt for PPPs as the preferred route is primarily based on the outcome of VFM test [10]. Furthermore, the criterion of forbidding government guarantees is derived from the review of the overuse of guarantees at the price of future finance interests in many countries, such as water projects in Bolivia, Chile, Argentina, and Hungary, Sydney Airlink BOOT project in Australia, and Channel Tunnel project in the UK and France [46–50].

3. Methodology

This article collected 299 PPP-related policies and regulations promulgated by the Chinese State Council and its affiliated departments between 1980 and 2017 as the sample for this research. The policy documents between 1980 and 2012 were mainly collected from the Law-lib Database (see Appendix A 2) and supplemented by resources collected from the official websites of various ministries and departments. The major collection of PPP-related policies since 2013 were mainly from the website of China Public–Private Partnerships Center (CPPPC) under the Ministry of Finance (MoF) (see Appendix A 3) and the website of PPPs Column under the National Development and Reform Commission (NRDC) (see Appendix A 4).

We selected these policies and regulations based on three criteria that policies can fall into. (1) Specific policies that directly guide or restrict PPPs introduction, employment and operation, such as the policy entitled “Notice on Attracting Foreign Investment via Build-Operate-Transfer (BOT)” issued by the Ministry of Foreign Trade and Economic Cooperation (MFTEC) in 1995 and the policy in name of “Notice on Promoting Public–Private Partnership Model” issued by the MoF in 2014 which offer guidance for the operation of PPP projects. (2) Macro financial regulation policies that generally facilitate PPPs development through investment, fiscal and financial system reform, such as the policy entitled “Notice on the Issuance of a Recent Plan of Investment Management System Reform” in 1988 and the policy of “Notice on Strengthening Local Government Financing Vehicles (LGFVs) Management” (see Appendix A 5) issued by the State Council in 2010 which paved the way for further PPPs development. (3) Specific local government debts regulation policies, calling for PPPs as a substitution to local government debt in providing financial resources, such as the policy of “Notice on Strengthening LGFVs Management” issued by the State Council in 2010, the policy of “Advice on Strengthening Management of Local Government Debts” released by the State Council

in 2014, and the policy of “Notice on Budgetary Controlling and Cleaning Up the Stock of Local Government Debts” put forward by the MoF in 2014.

For the interest of the research questions, this article conducted a bibliometric analysis on these policy documents. These 299 policy documents contained information about the date, title, policymaking department(s), content, and effective status of the policies at issue. Therefore, the patterns of PPP-related policies in each phase were mapped out by social network analysis (SNA) through visualizing the co-keyword network of the policy contents and the interdepartmental cooperation network of the policies.

To present the co-keyword network of the policy contents, we started by labeling no more than three keywords for each policy. The keywords were mainly extracted from the titles and inferred from the policy contents, particularly the paragraphs of introduction, which clearly convey policy intention. For those keywords conveyed the same meaning but were expressed in different ways, we assigned them the same name. For the other keywords abstracted, we just left them as same as expressed in the original policies. The keywords were selected and crosschecked by the authors after several rounds of discussion and screening. We used SATI 3.2 (see Appendix A 6) to construct a co-occurrence matrix of keywords and then imported the matrix into UCINET 6 (see Appendix A 7) to visualize the co-occurrence network of the keywords, in which the different subgroups were clustered. Within these networks, the nodes represented the keywords, and the links represented the co-occurrence among the keywords. These nodes were sized by their degree centrality, which was viewed as an important index of the central position in the network. The degree centrality measures the frequency of a given keyword’s co-occurrence with other keywords [51,52]. The bigger the size of the nodes, the higher the degree centrality of the keywords, which meant that these keywords had more co-appearance with other keywords in different policy documents and received more attention by the policymakers. Furthermore, we conducted cluster analysis based on Girvan–Newman’s algorithm (see Appendix A 8) in UCINET 6, to cluster these connected keywords into different subgroups, marked with different colors. The cluster analysis was derived from the concept of betweenness centrality, which measured the time a node represented as an intermediary pathway between two other nodes. This meant that the keywords that were more connected to other keywords had a higher probability of staying in one subgroup [53,54]. As a result, these visualized clusters helped us easily identify the various focuses of the policies in the whole network. By analyzing the changes of the keywords with high degree centrality and the changes of the clusters between different phases, the researchers could observe the shifts of the policy priorities throughout these years.

To display the interdepartmental cooperation network, we used SATI 3.2 to calculate frequency statistics and construct a co-occurrence matrix of the policymaking departments. The co-occurrence matrix was then imported into UCINET 6 to visualize the interdepartmental policy-issuing network. The nodes in the network represented the departments, and the links represented the joint issuance of policies (see Appendix A 9). These nodes were sized by the number of policies issued by the department. The larger the size of a node, the more policies the department had issued individually or jointly and the more active and dominant the role the department(s) had played in certain phases. With further analysis of the functions of these active departments, this visualization contributed to identifying the policy priorities of each phase and the changes in priorities between different phases.

We used SNA methods rather than descriptive statistic in our bibliometric analysis for three reasons. (1) Although the descriptive statistics can illustrate the emergence and proliferation of keywords, co-word analysis of SNA has the advantage of measuring relationship between keywords in the documents, and then locating the cluster of keywords according to different level of relationship. The higher the degree centrality of the keyword, the more important the keyword in policies. The more connections between certain keywords, the more obvious the policy priority is emerged in certain period. Therefore, the pattern of policies can be identified [55,56]. (2) SNA has the advantage of presenting the power network between policy issuing departments in China [54,56,57]. Policies and regulations in China are individually or jointly issued by several departments, which implies a power

network between departments: the more the policies and regulations issued or leading issued by certain department, the more significant power certain department possessed in this policy area. Furthermore, the rank of jointly issuing departments implies the connection between departments. The more co-presence in the policies, the stronger connections are between certain departments in the policy area. Therefore, different clusters of departments can be identified through mapping out the connections. (3) SNA has the function of visualization for identifying and comparing the different clusters, which is the advantage that the descriptive statistics does not have. This is why co-word analysis and cluster analysis of SNA are commonly used in mapping out research topics or tracing policy patterns [55,56,58–60].

In order to provide a comprehensive picture of the policy priorities, we provided in-depth qualitative analyses of certain important policies and historical events in each phase to supplement the quantitative analysis above. Furthermore, applying the criteria framework above, this article further identified the pattern of the policies to explore whether and to what extent such policies have contributed to sustainable development.

4. Findings

Figure 1 and Table 2 illustrate the annual number of PPP-related policies released in China between 1980 and 2017. These policies can be divided into three phases, considering the annual distribution of the policies and some specific historical events. Phase I lasted from 1980 to 1997, beginning with the era of China's economic reform and opening to foreign investors and ending with the Asian financial crisis of 1997 (see Appendix A 10). In this phase, the number of new policies released annually varied from one to three, with a few, very small fluctuations. Phase II extended from 1998 to 2008, starting with the campaign to 'clean up' illegal foreign-invested BOT projects and the rapid development of China's urbanization and ending with the global financial crisis of 2008. This period saw an obvious wave of policymaking, peaking in 2002 and falling until 2008. Phase III covered the period from 2009 to 2017, with the rise of policies aiming to relieve the local government debts that stemmed from LGFVs and promoting PPPs development. This period was characterized by the explosion of PPP-related policies, with a sudden rise from 2014 to 2017, which has not yet slowed down. The number of PPP-related policies promulgated during these four years accounted for as much as 78% of the total 299 PPP-related policies released in the past 36 years. The following sections provide the findings and discussion based on the presentation of the co-keyword networks, the networks of the policy-issuing departments, and the rankings of the policy-issuing departments by the number of policies promulgated in these three historical phases, respectively.

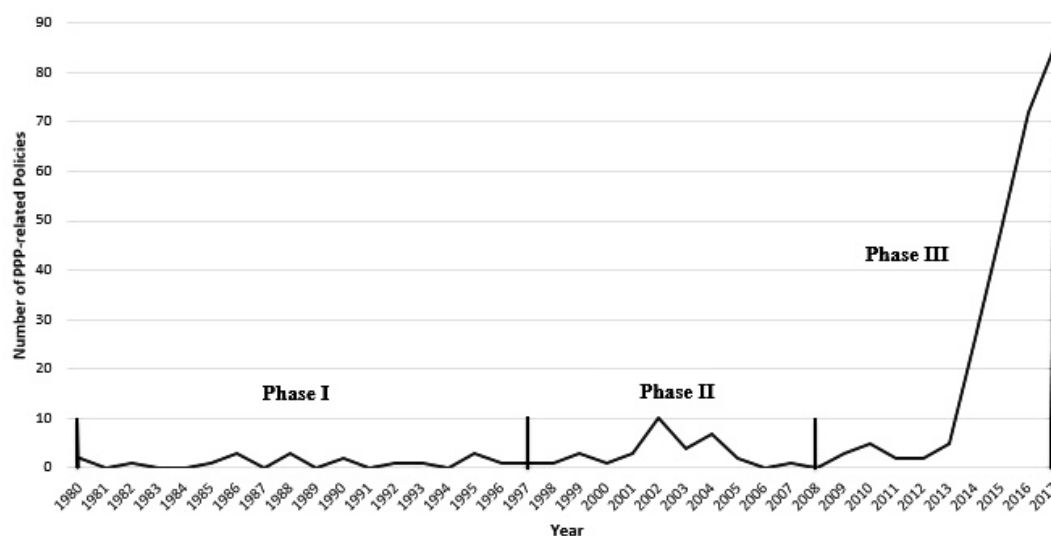


Figure 1. Annual number of released PPP-related policies in China, 1980–2017.

Table 2. Number of PPP-related policies in China from 1980 to 2017.

Phase I: 1980–1997		Phase II: 1998–2008		Phase III: 2009–2017	
Year	Number	Year	Number	Year	Number
1980	2	1998	1	2009	3
1982	1	1999	3	2010	5
1985	1	2000	1	2011	2
1986	3	2001	3	2012	2
1988	3	2002	10	2013	5
1990	2	2003	4	2014	26
1992	1	2004	7	2015	48
1993	1	2005	2	2016	72
1995	3	2007	1	2017	85
1996	1				
1997	1				
18 Years	19	11 Years	32	9 Years	248

Note: The data for the PPP-related policies database from 1980 to 2017 was self-collected. There were no PPP-related policies released in 1981, 1983, 1984, 1987, 1989, 1991, 1994, 2006 and 2008, so these years are not listed in the table.

4.1. Phase I, 1980–1997: Encouragement of Foreign Investment and No Relevance to Sustainable Development

As indicated in Figure 1 and Table 2, there were only 19 PPP-related policies that were issued during this period. The result of the bibliometric analysis for these 19 policies, provided below, shows that Phase I presented a policy priority of encouraging foreign investment in the public infrastructure, accompanied by fiscal and investment system reforms. These policy features were not relevant to the concept of sustainable development.

This policy priority was identified through the keyword clusters, which consisted of two subgroups (see Figure 2): (1) The major subgroup of keywords, which is shown in red in Figure 2, related to encouraging foreign investment. This subgroup reveals how the policies encouraged the influx of foreign and overseas capital—particularly from Hong Kong, Macao, and Taiwan—by giving preferential treatment to foreign investors, promoting cooperation approaches (BOT, joint ventures, and franchised projects), stipulating that certain industries receive or restrict foreign investment (e.g., infrastructure is allowed while utility network is forbidden), and reforming supportive procedures (administrative approval and open bidding). The keywords ‘encourage’ and ‘foreign investment’ had the highest degree centrality among the keywords, implying that “encouraging foreign investment” was the core value of Phase I. (2) A subgroup of keywords about investment system reform and economic development, as shown in blue in Figure 2, also emerged. This subgroup revealed that, in the pursuit of economic development, during the transition from a state-planning economy to a market economy, the Chinese central government turned to investment system reform, creating a fiscal-contracting system and a tax distribution system related to revenue sharing between the central and local governments, which incentivized the local governments to employ PPPs for local infrastructure development.

The policy network above reveals that foreign investors (investors from Hong Kong, Taiwan, Macao and overseas) were the major resource of the private actor in this phase (see subgroup in red). This finding was supported by the understanding of the specific historical changes in this phase. Since 1978, supported by the economic reform and opening-up policies and the central–local fiscal contracting reform, the Chinese local governments have been extraordinarily eager for foreign investments to solve the problems presented by the public infrastructure needs and the local public finance shortages. The PPP-related policies encouraging foreign investment and employing BOT in the public infrastructure areas were evoked by the abovementioned need. In 1986, the State Council published the policy of “Decision on Encouraging Foreign Investment”. In 1988 and 1990, the State Council specifically issued policies to open market for foreign investors from Taiwan, Hongkong and Macao. As a result, the first booming phase of private participation in infrastructure development in China began in the 1990s, and foreign investors were the major players [61]. In this phase, foreign investors mainly played the role of capital and technology provider in BOT infrastructures particular in toll roads, energy and water supply areas, such as the Laibin B power plant, Chengdu no. 6 water supply BOT plant and the Changsha Wangcheng power BOT plant [62]. On the other hand, the local government’s unprincipled guarantees of a fixed or even minimum return to foreign partners also led to severe financial risks at local level, and resulted in policy restriction in the end of 1990s. For example, the MFTEC came up with a series of policies forbidding government guarantees in BOT, such as the policy entitled “Notice on Attracting Foreign Investment via BOT” of 1995. Affected by this top-down policy restriction and by the Asian financial crisis of 1997, foreign private actors gradually exited PPPs market in China [61].

Having identified the policy priority of encouraging foreign investment in the public infrastructure, we argue that the policies in this phase neither promoted PPPs for sustainable development nor provided sustainable approaches for PPPs. With respect to ecological sustainability, all the 19 PPP-related policies were aimed at areas of economic infrastructure rather than environmental protection projects, and no ecologically sustainable approach was mentioned in any of the policies. In terms of social sustainability, there were no social infrastructure projects or services encouraged by these policies. Although the quality of life of the public could be improved through economic infrastructure, this was not the intent of the policies; instead, the main goal was economic development. This was identified through the frequent connection between the keywords about economic development and the keyword “PPP”. For example, in the “Notice Regarding the Permission of Trail Foreign Investment Concession” issued by the SDPC, the Ministry of Electricity, and the Ministry of Transport, it was clearly stated that, for a long time, transportation, energy, and other infrastructures have been the bottleneck of China’s national economy. Foreign investment was to be facilitated to develop these infrastructure areas. Also, there were few socially sustainable approaches mentioned, except the keyword “open bidding”, which represented the socially advantageous concept of transparency. Furthermore, concerning financial sustainability, there was only one keyword referring to financial affordability, “forbidding government guarantees”, which only appeared in one policy at the end of Phase I to prohibit serious government borrowing with a guaranteed return. This policy was “Notice on Attracting Foreign Investment via BOT”, issued by the MFTEC in 1995.

Two factors have contributed to our understanding of the complete lack of connection between PPPs and sustainable development in Phase I. One is that Phase I was embedded in the period of China’s economic take-off. This explains why keywords such as “economic development” and economic system reform obtained high degree centrality in the network. In other words, the PPP-related policies in Phase I were created for economic development rather than for other reasons. Furthermore, since the concept of sustainable development was not introduced in China until the Agenda 21 by 1994, it would have been impossible to see any policies intending to promote PPPs based on the concept of sustainable development.

and encourage the growth of the domestic private sector. As the major department for macro-regulation, the NRDC (for which the SDPC was the precursor) occupied an important connecting position by coordinating the MoF, the Ministry of Water Resources, the Ministry of Construction, and the State Environmental Protection Administration (SEPA) to propel the marketization of the urban sewage and waste disposal industry and by organizing the Ministry of Commerce and the State Economic and Trade Commission to facilitate the access to the market by foreign investors.

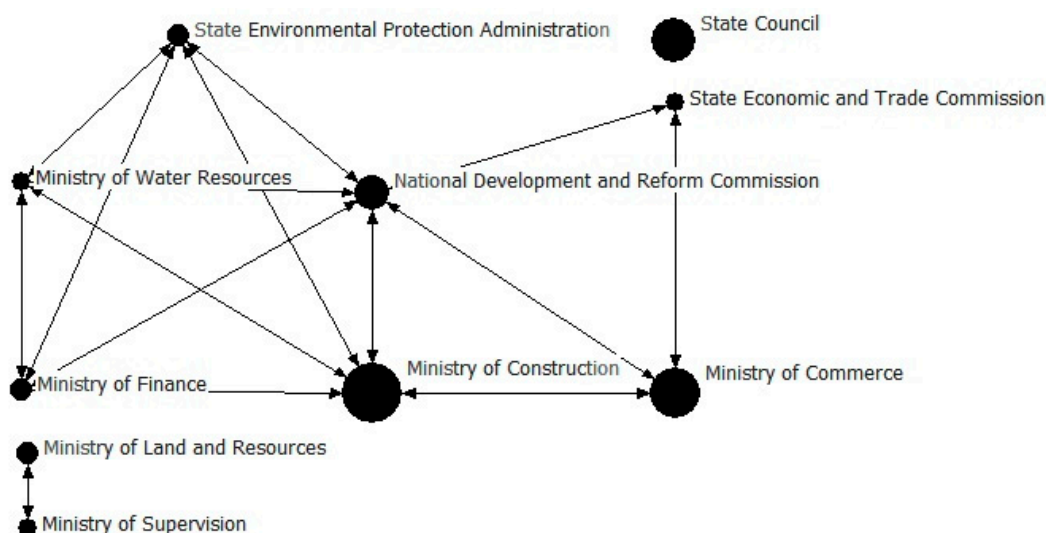


Figure 5. Network of the PPP-related policymaking departments in Phase II.

Table 4. Number of PPP-related policies issued by each department in Phase II.

Department	Number
Ministry of Construction	14
Ministry of Commerce	11
State Council	9
National Development and Reform Commission	6
State Environmental Protection Administration	2
Ministry of Land and Resources	2
Ministry of Finance	2
State Economic and Trade Commission	1
Ministry of Water Resources	1
Ministry of Supervision	1

The policy network of Phase II also exposed the change of government’s attitude toward private investors, that is, encouraging domestic investors and strengthening regulations on foreign investors (see subgroup in red). These policies took effect in practice: Phase II witnessed the exit of foreign investors and the growth of domestic private investors. On one hand, numerous foreign companies have been either reducing their business or have retreated from the market [63]. On the other hand, domestic private enterprises started to play an increasing important role of urban developers and competed with foreign investors for PPPs projects in municipal infrastructure areas [64]. until 2007, the provision of public infrastructure and services had been steadily moving away from the realm of government to that of domestic private sector through PPPs [65].

Two significant historical events accounted for this change in Phase II. The first was a continuous campaign launched by the central government to “clean up” local BOT projects with guaranteed repurchase or payment contracts, which expelled the majority of foreign investors [66]. This campaign, aiming to mitigate the financial risks of such guarantees, led to the explosion of a series of PPP-related policies forbidding government guarantees, as shown in yellow in Figure 4. One of the most powerful examples was the policy entitled “On Properly Dealing with BOT Projects that Promise Guaranteed

Return of Investments for Foreign Capital”, issued by the State Council in 2002. Together with the Asian financial crisis in 1997, this campaign expelled the majority of the foreign capital, originating from Hong Kong, Macao, and Taiwan, out of the mainland market and affected the activity of foreign investment in China.

The second event was the rapid urbanization in China that has been occurring since the end of the 1990s, which intensified the serious public financial shortage problem and facilitated the policies of encouraging the partnerships with domestic private actors [67,68]. A series of PPP-related policies on the marketization of the municipal public utilities through domestic private investment, as we identified in blue in Figure 4, were issued. For example, in 2001, the SDPC issued a policy entitled “On Promoting Domestic Private Investment”, encouraging domestic private actors participate in urban public utilities. With the withdrawn of foreign investors, the domestic private actors became the major partners in PPPs projects.

Considering the prominence of the policies encouraging the marketization of the municipal public utilities and domestic investment, it is argued here that the policies in this phase made only a few attempts toward achieving sustainable development.

Regarding ecological sustainability, keywords such as “waste treatment”, “urban sewage”, and “urban water supply” were found to have high degree centrality, connecting with the keyword “marketization”. This implies that these policies encouraged PPPs to be employed in areas critical for environmentally sustainable development. The typical example is “Notice on Accelerating the Industrialization of Urban Sewerage and Waste Treatment”. This policy acknowledged the negative impact of rapid urbanization on environmental protection. Therefore, the encouragement of private participation in the urban sewage and waste treatment was one of the main approaches to solve such environmental protection problems. This policy was jointly issued by the NRDC, the Ministry of Construction, and the SEPA, the last of which appeared in the network for the first time during this phase. However, there were no keywords mentioning ecologically sustainable approaches, such as environmentally friendly technologies or the innovative use of natural resources to implement PPPs.

With respect to social sustainability, the policies in this phase mainly took effect in the area of municipal public utilities, which have a direct impact on the quality of life of urban citizens. In contrast with Phase I, these policies showed the intention to meet citizens’ needs, although economic development was still the priority. For example, in “Opinion about Accelerating Marketization of Public Utilities” issued by the Ministry of Construction, it was stated that, “urban public utilities are the carrier of urban economic and social development, it is directly related to the public interest, the citizens’ quality of life, and the sustainable development of urban economy and society”. On the other hand, the policies in Phase II provided socially sustainable approaches to implementing PPPs, by asking for open bidding, citizen participation, and public hearings to ensure the fair completion and social supervision of the PPPs process. Keywords such as “citizen participation” and “public hearing” appeared in the network for the first time during Phase II. Furthermore, the policies in this phase started to encourage domestic private investment, which can be regarded as a socially sustainable approach to PPPs, because they provided equal treatment for domestic investors, who had suffered from policy discrimination for a long time.

In Phase II, the policies made attempts to provide financially sustainable approaches, consisting of foreign exchange and debt management, asset equity transfer management, financial risk prevention, and foreign investment regulation. Furthermore, the high degree centrality of keywords such as “forbidding guaranteed ROI”, “forbidding guarantees”, and “forbidding disguised borrowing”, illustrated the government’s reaction against the problem of using PPPs without considering the long-term financial affordability of such actions. Moreover, it is interesting to note that this is the first time that the MoF, as a critical department for PPPs development, appeared in the network, although it only issued one PPP-related policy. The policy was entitled “Notice on Further Promoting Reform of Urban Water Supply Price” and jointly issued by the NRDC, the MoF, the Ministry of Construction, the Ministry of Water Resources, and the SEPA in 2002.

4.3. Phase III, 2009–2017: The Institutionalization of PPPs and an Obvious Tendency toward Sustainable Development

As showed in Figure 1 and Table 2, the number of PPP-related policies during this period increased dramatically with a total of 248 policies issued, accounting for nearly 83% of total amount of PPP-related policies. This phase presented the policy priority of the intensive institutionalization and extensive application of PPPs, bearing an obvious tendency toward sustainable development.

As with Phases I and II, the cluster analysis of keywords (see Figure 6) helped identify the policy priority of this phase via the visualization of subgroups with different colors:

(1) The largest subgroup of keywords were those promoting PPPs and encouraging ‘social capital’ (see Appendix A 11) in multiple infrastructure and public service areas, as shown in red in Figure 6. This cluster presents not only the traditional economic infrastructure areas in which PPPs would continue to be employed, such as toll roads and transportation energy, but also multiple novel environmental and social infrastructure and services consisting of elderly care, tourism, education, healthcare, culture, sports, environmental protection, and so on, which were connected with the keywords “promote PPP”. Compared with Phases I and II, these environmental and social areas were presented in the network extensively for the first time, implying that there was a shift in PPP-related policies from those supporting traditional economic infrastructure to those introducing more ecological and social infrastructure and services. Furthermore, in contrast with Phases I and II, the keywords “encourage social capital to participate” occupied the central position for the first time, indicating a stronger policy emphasis on mobilizing private funds in this phase.

(2) The second largest subgroup, as shown in blue in Figure 6, included keywords regarding the institutionalization of PPPs through due process. The keyword “PPP” in English, was centered in the subgroup and surrounded by keywords representing due process, such as “government procurement”, “PPP project assessment”, “VFM” and “financial affordability assessment”, “example PPP cases”, and “contract management”, which were absent in the previous phases. Moreover, compared with Phase I, in which the keyword “BOT” was used to refer to PPPs, and Phase II, in which the keywords “marketization”, “BOT”, and “concession” were used, Phase III was the first time that the English expression of PPP appeared in the network, showing an effort to institutionalize the concept of PPPs by transferring standardized international concepts and procedures [69].

(3) The third largest subgroup of keywords relating to PPPs information disclosure is shown in green in Figure 6. This subgroup was centered on the keyword “information disclosure” and was connected to other high degree centrality keywords, such as the “National PPP Integrated Information Platform”, “fair competition”, “social supervision”, “information resource sharing”, and so on.

(4) The minor subgroup of keywords regarding the cleaning-up of local debts, as shown in yellow in Figure 6, centered on the keyword “local government debt” and was connected with other high degree centrality keywords, such as “local government financing vehicles”, “forbidding illegal financing”, and “forbidding illegal guarantees”, which illustrated an obvious aim in this phase to use PPPs to relieve the increasing financial pressure especially associated with local government debts [70].

Table 5. Number of PPP-related policies issued by each department in Phase III.

Department	Number
Ministry of Finance	106
National Development and Reform Commission	73
State Council	68
Ministry of Housing and Urban–Rural Development	34
China Banking Regulatory Commission	20
Ministry of Land and Resources	19
Ministry of Transport	17
People’s Bank of China	16
Ministry of Agriculture	16
Ministry of Environmental Protection	14
Ministry of Water Resources	12
National Health and Family Planning Commission	9
State Forestry Administration	8
Ministry of Human Resources and Social Security, Ministry of Industry and Information Technology, Ministry of Commerce, China Securities Regulatory Commission	7
China Insurance Regulatory Commission, National Energy Administration, Ministry of Science and Technology	6
National Railway Administration, Civil Aviation Administration of China, China Development Bank	5
Ministry of Culture, State Administration of Industry and Commerce, Ministry of Education, State Oceanic Administration	4
National office for aging, General Administration of Sport, State Administration of Taxation, National Tourism Administration	3

Note: For departments that issued only one or two PPP-related policies, see Appendix A 12.

The policy network above revealed a new change regarding the resource and role of private actor in Phase III. Compared with the policy priority on foreign investors in Phase I and priority on domestic investors in Phase II, policies in Phase III released the signal of welcoming any capitals, including foreign capital, domestic private capital and even capitals from state-owned enterprises (SOEs) to join in PPPs. In Phase III, the keyword with highest degree centrality is “social capital” in subgroup in red, which refers to the “private” of PPPs, and was defined as the enterprises duly organized, validly existing, and in good standing as a legal person under the law of the People’s Republic of China (P.R.C.), consisting of domestic private enterprises, foreign enterprises and even SOEs. In other words, the “private” of the PPPs in this phase includes not only private enterprises but also SOEs. The inclusion of SOEs in the resource of private actor in this phase resulted in debates on whether there are ‘public–public partnerships’ or ‘public–private partnerships’, when the second “P” is from SOEs. Although subsequent policies restricted the participation of SOEs capitals by forbidding SOEs participate in PPPs projects launched by the local governments that the SOEs belonged to, the data so far has shown that the SOEs were still the major players and have the largest market share in most of infrastructure sectors, while domestic private enterprises and foreign investors were only active in several sectors and with smaller market share [71].

In Phase III, the major role of ‘private’ actors is to relieve the long term accumulated local government debts through injecting capitals into the partnership projects. The evidence could be found from the keyword subgroup in yellow, visualizing the central government’s motivation of using PPPs to solve local government debts (see Appendix A 13). The local government debts were derived from the local government’s overinvestment in infrastructure areas since 2008, under the incentive of “4 Trillion Investment Plan” designed by central government to deal with the global financial crisis in 2008 [70]. As a result, the solution was to use PPPs to replace the traditional governmental investment, and swap the government debt for equity in PPPs projects.

Having identified the primary policy priority of the institutionalization of PPPs, it is argued here that the PPP-related policies in Phase III have shown an obvious tendency toward sustainability in both aspects of sustainable development and sustainable approach. This argument is strongly supported by China's promotion of "New Urbanization". In 2014, the Communist Party of China (CPC) and the State Council officially issued the "National Plan on New Urbanization (2014–2020)", attaching more importance to the sustainable development of urban areas, especially to sustainable basic public service systems and sustainable urbanization financing approaches.

Regarding ecologically sustainable development, we identified policies promoting PPPs in environmental protection areas, from the traditional environmental projects including sewage and waste treatment and water pollution treatment, to newly emerging projects, such as sea and bay protection and "sponge city" (see Appendix A 14) projects [72]. Keywords such as "environmental protection" and "forestry ecology" appeared in the network. Although ecologically sustainable approaches were still rare in the network, keywords such as "green finance" had at least been given some policy attention in this phase. In 2016, the People's Bank of China, the MoF, the NRDC, the Ministry of Environmental Protection (for which the SEPA was the precursor), the CBRC, the CSRC, and the CIRC jointly launched a policy known as "Guidance on Constructing Green Finance System" under the context of promoting an ecological civilization. The term "green finance" refers to the financial services, consisting of project financing and operation and risk management provided for projects in areas such as environmental protection, energy saving, clean energy, green building, and so on.

Furthermore, the emergence of multiple environment-related government departments was the more evidence of the tendency to promote sustainable development. Phase III was the first time that the environmental protection departments, such as the Ministry of Water Resources, the National Energy Administration, the State Oceanic Administration, the Chinese Earthquake Administration, and the China Meteorological Administration, had a major presence in the network; however, the presence of such departments was nonexistent in Phase I and relatively rare in Phase II.

Concerning social sustainability, PPPs were strongly advocated in the social infrastructure and service areas, which are vital to improve the quality of life. The keywords regarding "elderly care", "tourism", "education", "healthcare", "culture", and "sports" were highly connected with the keyword "PPP". Departments functioning in social service areas were also more frequently shown in the network, such as the Ministry of Civil Affairs, the National Health and Family Planning Commission, the Ministry of Human Resources and Social Security, the Ministry of Culture, the Ministry of Education, and the National Office for Aging, to name a few. There was also an obvious advancement regarding the prevalence of socially sustainable approaches, as shown in the subgroup of keywords regarding PPPs information disclosure and the subgroup of keywords involving the institutionalization of PPPs through due process, such as "fair competition", "social supervision", "equal treatment", and "project assessment". Compared with Phases I and II, in which only a few such relevant keywords were shown in the network, Phase III formed two subgroups relevant to social sustainability, reflecting a strong policy tendency to utilize socially sustainable approaches in PPPs.

Phase III, in particular, witnessed the growth of a tendency toward using PPPs via financially sustainable approaches. The process of using PPPs was regulated by a more structured and deliberate financially sustainable approach, as shown by the appearance of keywords such as "VFM", "financial affordability assessment", "debt-for-equity swap", "asset securitization", "forbidding illegal guarantees", "forbidding illegal financing", and, especially, "financial risk prevention". More strong evidence was reflected in the dominance of the MoF in the policy-issuing department network. Shifting from its total absence in Phase I and a supporting role in Phase II, the MoF assumed the most dominant role in directing PPPs toward financial sustainability in Phase III.

5. Conclusions and Discussion

This article aims to answer two specific research questions: (1) Between 1980 and 2017, what were the PPP-related policy priorities in the different historical phases of the Chinese national agenda? (2) Have the PPP-related policies in China shown a pattern of moving toward sustainable development, and if so, to what extent? As revealed in the analysis above, PPP-related policy development in China has gone through three historical phases: in the early 1980s, PPPs were used to develop public/economic infrastructure; in the late 1990s, PPPs were used to encourage the marketization of the urban public utilities; and then, in recent years, there has been intensive institutionalization and extensive application of PPPs in public services.

The policy priorities in each phase also shaped the resource and the role of private actors, and how they evolved over time. In Phase I, with the policy priority of encouraging foreign investment for public infrastructure, foreign investors were the main resource of private actor in PPPs, and played the role of providing capitals and technologies. In Phase II, due to gradual exit of foreign investors and the urgent need of urban development, domestic private sector became a new resource of private actors in PPPs, and played the role of urban public utility developers. In Phase III, with the aim of intensive promoting PPPs to relief local government debts, policies in this phase released the signal of welcoming any capitals, either from foreign investors, domestic investors or even from SOEs to join the PPPs. In this phase, “private” actors played the role of relieving local government debts.

Corresponding with the policy priority changes, there was also a trajectory showing how PPP-related policies gradually began to comply with the principles of sustainable development: in Phase I, there was a total absence of any commitment to the concept of sustainability; in Phase II, there were only a few policy attempts to pursue sustainable development; and in Phase III, there developed an obvious pattern of encouraging the use of PPPs for sustainable development and implementing PPPs via sustainable approaches.

Furthermore, the policy priorities identified by our analysis clearly show that PPPs have been utilized by policymakers as pragmatic financial tools, either for economic development in Phase I, for urban development in Phase II, or for solving urgent local debt problems in Phase III. Although the keywords relevant to ecological, social, and financial sustainability have gradually begun to increase, they have never been the top keywords in any of the three phases. Also, the role of private actors in each phase played as the finance provider, revealed the government’s pragmatic attitude toward PPPs. This means that the principles of sustainable development, rather than being treated as the ultimate goals, are the side products of PPP-related policies that were aimed to achieve economic development and public financial problem-solving.

This could be explained from the common features that China shared with other countries in PPPs development, and the specific institutional features that China possessed.

It is a common feature in various countries that, PPPs were used as a pragmatic financial tool for solving public finance problems before it was understood as the governance scheme in which the sustainable development is considered. For most countries we reviewed above, developed countries such as the UK, USA, and European countries have more initiative to apply PPPs in environmental and social sectors, and implement PPPs via sustainable approaches, while they have passed through the stage in which PPPs were taken as the financial tool [73]. However, for developing countries, such as Chile and India, economic development is still the priority for which PPPs were the approach to invite private capitals, and the concept of sustainability is gradually taken into policies. Therefore, China is not a unique case for its PPP-related policies development toward sustainable development.

On the other hand, China has its context-specific institutional obstacles against PPPs achieving sustainable development. As revealed by the policymaking department network above, while the increasingly complicated keywords network and policy-issuing departments network that have evolved in Phase III have shown the growing attention of the government on PPPs, they have also exposed the fragmented, authoritarian policymaking system that exists in China. These 299 policy documents were mainly issued or joint-issued by the State Council and its tens of affiliated

ministries and departments. As the highest administrative authority, the State Council leads the all administrative ministries and organizations and takes charge of national planning, leading and managing infrastructure construction and public service supply, and allocating functions, tasks and resources to local governments [74]. Promoting and regulating PPPs development is one of its tasks. Under the State Council, various ministries and departments play crucial roles, such as the Ministry of Construction, the Ministry of Commerce, the NRDC, the MoF, etc. Such diversity of the policy issuing authorities reflects the China's context-specific fragmented bureaucratic structure, which, although policy making power related to consensus building is concentrated in central government, it is actually fragmented among the State Council and its affiliated departments, resulting into a policy process that is protracted, disjointed, and incremental [68]. Situated in Chinese political context and institutional arrangements, China's PPPs development in past nearly four decades is also sensitive to various, changing, and even conflicting PPP-related policies and regulations [74]. For example, the frequent policies issued by the MoF and the NRDC, respectively, have exposed the conflict of interest between them and their fight for dominance in the field of PPPs development and regulation, and have resulted in the aimless local implementation of PPPs.

Therefore, it is suggested here that, in terms of establishing sustainable development as the core value of PPPs, a fundamental change in the understanding of PPPs as governance scheme rather than a pragmatic economic tool is required [8]. In such a governance system, a broader criterion of sustainability should be raised as the fundamental measure of the success of PPPs. This means that ecological, social, and financial sustainability would be stated by all PPP-related policies as the primary goal of the PPPs and that governmental support, departmental integration, and public accountability would be the focus of such PPP-related policies.

By providing the findings and discussions above, this article aims to provide theoretical contributions to the current state of knowledge regarding PPPs and sustainable development. This article is the first to establish a criteria framework of evaluating the sustainability of PPP-related policies, and the first to conduct bibliometric analysis of PPP-related policies in China. As China is a country ruled by department-made policies and regulations, by identifying the priorities of the policies and their changes over time, a bibliometric analysis of the policy documents could help to discern the unspoken intention and rhetoric of the policymakers, which were usually a "black box" to the public. Moreover, by revealing the China's context-specific institutional features in PPPs policy making, this article aims to add value to the research concern of the politics and institutional arrangements of PPPs, which have not been paid much attention in extant PPPs literatures.

Considering the contributions above, the article has some limitations which will serve as the stimulus for future work. The first limitation is that, the application of criteria framework to other countries requires further observation and adjustment. For example, this article adopted "whether policies encouraged VFM test and long-term financial affordability test" as the criterion of financial sustainability. This is derived from the reflection on the lack of financial evaluation in Chinese PPP-related decisions. However, the VFM test has been debated in scholarship regarding its purpose and technical complexity, and whether government could perform rigorous VFM test [75–77]. These insightful thoughts should be brought into the future evaluation. The second limitation is that, although the issue of private actor is important in PPPs studies, this article could only explore the policy contents regarding the issue of private actor, as it is constrained by the unit of analysis and research method. A comprehensive analysis of private actors requires further empirical research in the future.

Furthermore, it must be acknowledged that, because actual PPPs practices usually fall short of what is mandated by formal institutions, the evaluation of the central policies by this article has offered an upper boundary of the estimation of the existence of PPPs that contribute to sustainable development in China. This means that further empirical research about the implementation of PPPs for sustainable development will be necessary in the future.

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Appendix A

1. The VFM test is a two-fold analysis conducted prior to the PPPs implementation. First, the calculation of the benchmark cost of providing the specified service under traditional procurement and, second, a comparison of this benchmark cost with the cost of providing the specific service under a PPPs scheme. More details see Grimsey, D.; Lewis, M. Are public private partnerships value for money? Evaluating alternative approaches and comparing academic and practitioner views. *Accounting Forum*. 2005, 29(4), 345-378.
2. Law-lib Database is an influential Chinese database of laws and regulations, recording all the policies, laws, and regulations since 1949. It is available at the following link: <http://www.law-lib.com/law/bbdw-zy.htm>.
3. The CPPPC was established by the MoF in December 2014. It is responsible for policy research, consulting training, information statistics, and the international cooperation of PPPs. The PPPs project database, expert database, consultancy organization database, and policy database are available at this official website: <http://www.cpppc.org/zh/pppzczd/index.jhtml>.
4. The PPPs column is a special column built by the NRDC. A second source of PPPs projects, example PPP cases, and PPP-related policies are available at this official website: <http://tzs.ndrc.gov.cn/zttp/PPPxm/>.
5. LGFVs is short for local government financing vehicles. As quasi-government entities, LGFVs are used by local governments to borrow from banks or issue bonds, while the money collected is used in urban infrastructure areas. For more details, see [70].
6. SATI 3.2 is a domestic tool designed by researchers of Zhejiang University, China for bibliographic statistical analysis. More details see Liu, Q.; Ye, Y. A Study on Mining Bibliographic Records by Designed Software SATI: Case Study on Library and Information Science. *Journal of Information Resources Management*. 2012, 1, 50–58. (In Chinese)
7. A UCINET 6 tutorial by Bob Hanneman and Mark Riddle is available at the following link: <http://faculty.ucr.edu/~jhanneman/nettext/>. More details see Borgatti, S.P., Everett, M.G. and Freeman, L.C. *Ucinet for Windows: Software for Social Network Analysis*. Harvard, MA: Analytic Technologies. 2002.
8. The Girvan–Newman’s algorithm detects communities by progressively removing edges from the original graph. The algorithm removes the “most valuable” edge, traditionally the edge with the highest betweenness centrality, at each step. As the graph breaks down into pieces, the tightly knit community structure is exposed and the result can be depicted as a dendrogram. More details are available at the following link: <https://networkx.github.io/documentation/latest/reference/algorithms/community.html>.
9. In Phase III, several PPPs policies were jointly issued by more than 10 departments. For the better effect of visualization, for each policy, we only presented the connection between the leading policy-issuing department and the other non-leading departments, and did not present the connection amongst the other non-leading departments.
10. We selected 1980 as the starting year for analysis, as it was at that time that China started to engage in PPPs development under the reform and opening-up policies.
11. In 2014, the MoF created a policy entitled “Guidance on Regulating PPPs Contract Management” and defined the concept of ‘social capital’ (she hui zi ben) in detail. Social capital refers to enterprises duly organized, validly existing, and in good standing as a legal person under the law of the People’s Republic of China (P.R.C.), consisting of domestic private enterprises, SOEs,

and foreign enterprises. However, LGFVs affiliated with native local governments and other SOEs controlled by native local governments are not allowed to act as the social capital to participate in PPP projects launched by native local governments. For example, regarding the SOEs controlled by the Beijing municipal government. This company cannot take part in PPPs projects launched by the Beijing municipal government, for it is not ‘social capital’ relative to the Beijing municipal government. However, it can participate in PPPs projects launched by the Shanghai municipal government, because the company is not affiliated to or controlled by the Shanghai municipal government.

12. Considering the length of the paper, the policymaking departments that issued only one or two PPP-related policies during Phase III are not listed in the Table. The details are as follows. (1) The policymaking departments that issued two PPP-related policies during Phase III consisted of the National Office for Agricultural Comprehensive Development, the State-Owned Assets Supervision and Administration Commission, the China Railway Corporation, the National Bureau of Statistics, the State Administration of Science, Technology, and Industry for National Defense, the State Council Poverty Alleviation Office, the General Administration of Quality Supervision Inspection and Quarantine, and the State Administration of Cultural Heritage. (2) The policymaking departments that issued only one PPP-related policy during Phase III consisted of the National Government Offices Administration, the Supreme People’s Court, the Chinese Academy of Engineering, the State Administration of Work Safety, the State Administration of Foreign Exchange, the Ministry of Justice, the State Tobacco Monopoly Administration, the China Earthquake Administration, the State Administration of Grain, the General Administration of Customs, the State Intellectual Property Office, the State Food and Drug Administration, the All-China Federation of Industry and Commerce, the Agricultural Development Bank of China, the State Administration of Traditional Chinese Medicine, the Ministry of Public Security, and the China Meteorological Administration.
13. Some examples can be seen in the policy of “Notice on Strengthening LGFVs Management” issued by the State Council in 2010, the policy of “Advice on Strengthening Management of Local Government Debts” issued by the State Council in 2014, and the policy of “Notice on Budgetary Controlling and Cleaning up the Stock of Local Government Debt” issued by the MoF in 2014. The policy of “Notice on Strengthening LGFVs Management”, issued by the State Council in 2010, clearly required using PPPs for solving local government debt problems. The policy of “Notice on Promoting Debt for Equity swap by Using Governmental Funds”, issued by Commission of National Development and Reform, raised the guidance to swap local government debt into equity in PPPs.
14. In 2015, the State Council issued a policy entitled “Guidance on Promoting Sponge City Construction” to minimize the side effects of urban construction on the ecological condition and to accelerate the absorption and use of rainfall. The term ‘sponge city’ refers to cities that can adapt flexibly, similar to sponges, to changes in the environment, such that they absorb, store, permeate, and purify rainwater and are able to make use of stored water when needed.

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