Quantitative SWOT Analysis of Public Housing Delivery by Public–Private Partnerships in China Based on the Perspective of the Public Sector

Jingfeng Yuan, Ph.D.[1]; Ming Guang, M.S.[2]; Xiaoxiao Wang, M.S.[3]; Qiming Li, Ph.D.[4]; and Mirosław J. Skibniewski, Ph.D., M.ASCE[5]

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Abstract: Facing the challenges of the global financial crisis, the Chinese government planned to build far more public housing than can be provided by the government alone. Meanwhile, the capability of Chinese governments to provide quality public housing on their own is being questioned and reassessed at various levels and in different forms. Accordingly, the introduction of private sector into the development of public housing should be promoted by the Chinese public sector by adopting the public-private partnership (PPP) model. In order to help the Chinese government formulate an appropriate strategy to develop PPP housing in a complex political, financial, legal, and regulatory environment, 16 strength, weakness, opportunity, and threat (SWOT) factors are identified on the basis of an extensive literature review. A structured questionnaire survey from the perspective of the public sector is conducted to analyze and integrate its perceptions of the SWOT factors. On the basis of a survey on SWOT factors, the methodology of quantitative SWOT analysis composed of analytic hierarchy process (AHP) is proposed to analyze strategy for the Chinese government to develop public housing by PPPs. The results indicate that the strongest facilitating factors are "solving the problem of public sector budget restraint" and the "huge needs for public housing," and the strongest hindering factors are "low profits for the private sector to participate in PPP housing" and the "inadequate legal framework and unclear responsibility for both the public and private sectors." The public strategic direction and intensity are consequently determined according to the results of the proposed method. Furthermore, an aggressive and active strategy formulation is carried out to help government facilitate the construction of public housing. The proposed suggestions to the public sector would be viewed as guidelines for the public sector to adopt PPPs in public housing appropriately, and also can be used to encourage the private sector to participate in public housing development.
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Introduction

Traditionally, public housing in China have been always provided, managed, and controlled by government (Stephens 2010; Zhang and Zhou 2011). Housing reform in China started in the 1990s and has successfully resolved the housing problems of the high- or middle-high-income group (Mostafa et al. 2006; Zhang et al. 2011). However, the affordability of public housing in China has been questioned greatly in recent years (Yu 2006; Qi et al. 2007; Tsou et al. 2008; Stephens 2010; Zhang and Zhou 2011). The complete abandonment of the socialist housing allocation system in the late 1990s has led to profound changes in housing delivery and consumption in urban China (Stephens 2010). Housing reform seems to be successful in increasing distributional inequality as a way to introduce market-based incentives and improve productivity (Mostafa et al. 2006). However, the global financial crisis (GFC) has greatly affected the housing provision in China, especially for those who formerly were not in power and poor (Schüller and Yun 2009; Zhang et al. 2011), because of which the Chinese government had to adjust macro control policies to protect and safeguard the benefits of low-income families to ensure that welfare can be protected and to stimulate the economy. Thus, the Chinese government released a 4 trillion Renminbi (CNY), which is the official currency of the People's Republic of China, stimulus package in late 2008 to finance programs in 10 major areas, in which low-income housing is a very important area (Schüller and Yun 2009).

In 2010, public housing was the most important issue in the field of infrastructure development in China. Meanwhile, private

[1]Lecturer, Dept. of Construction and Real Estate, School of Civil Engineering, Southeast Univ., Nanjing, Jiangsu Province 210096, P. R. China (corresponding author). E-mail: 101011337@seu.edu.cn

[2]Engineer, Guangdong Electric Power Design Institute, China Energy Engineering Group, Co. Ltd., Guangzhou, Guangdong Province 510663, P. R. China. E-mail: guangming_right@yahoo.cn

[3]Engineer, Zhejiang Shun-fa-heng-ye Co., Ltd., Wan-xiang Group, Hangzhou, Zhejiang Province 311215, P. R. China. E-mail: qiushuiyuer@163.com

[4]Professor, Dept. of Civil and Environmental Engineering, Univ. of Maryland, College Park, MD 20742, U.S.; Visiting Professor, Dept. of Management, Bialystok Univ. of Technology, 16-001 Kleosin, Poland. E-mail: mirek@umd.edu

[5]Professor and Head, Dept. of Construction and Real Estate, School of Civil Engineering, Southeast Univ., Nanjing, Jiangsu Province 210096, P. R. China. E-mail: njlqming@163.com

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investments, which were formerly only contractors in the process of construction and could not take responsibility to make decisions, manage, and earn some profits, were largely encouraged to develop public houses in 2010 [General Office of the State Council of the People's Republic of China (GOSC) 2010a]. Many policies were issued in 2010."The Notice for Health Development of Housing Market" was issued by the State Council in January 2010, which indicated that public housing for low-income people should be provided effectively and the construction of those houses should be facilitated (GOSC 2010b). Two months later, another official document, "The Notice to Strengthen Land Provision for Housing Development and Governance", was issued by the Ministry of Land and Resources (2010), which required that the land for developing low-income housing should be assured by local government. In the next three years, the central government intends to resolve the housing problems of low-income families, which are probably approximately 15,400,000 households based on the data of the Ministry of Housing and Urban-Rural Development (2011).

However, deficiencies in delivering quality public housing are currently occurring. The government can hardly achieve the goal that it set for itself for public housing according to the current capability of the public sector (Zhang and Zhou 2011). Government expects to build a large amount of public housing. However, capital gaps and management problems in project operation, resources utilization, and service delivery are great challenges for the public sector. In this case, private investments were encouraged in this area in March 2010, as presented in "The Advice to Encourage and Guide Private Investment to Develop Infrastructure" issued by GOSC (2010a). Therefore, external resources of capital, management, operation, and services are necessary and urgent for the government and public sector. Thus, public–private partnerships (PPPs) are good choices for government and the public sector to attract private investments, to use their advanced management and operation skills, to provide better services for the general public, and to achieve value for money (VFM) (Stewart 2005; Sengupta 2006; Abdul-Aziz and Kassim 2011).

This paper proceeds as follows: In "Global Financial Crisis, Public Housing in China, and PPPs," the reason for adopting PPPs in public housing in China is discussed with the background of GFC. In "Research Methodology," the research methodology used in the paper is presented. In "SWOT Factors Generation," the strengths, weaknesses, opportunities, threats (SWOT) of developing public housing by PPPs are identified. In "Research Survey," a questionnaire survey to investigate the opinions of government officials on SWOT factors is conducted. On the basis of identified SWOT factors, the methodology of quantitative SWOT analysis is used to analyze strategies for the Chinese government in "Conducting SWOT-AHP" and "Calculation of Strategy Value for PPP Housing." Subsequently, the public strategic direction is determined and the strategy formulation that can help government facilitate the development of public housing is made in "Strategy Formulation from the Results." A concluding discussion is followed in the last section.

Global Financial Crisis, Public Housing in China, and PPPs

Effect of Global Financial Crisis on China

The U.S. subprime crisis that broke out in the summer of 2007 evolved into a global economic crisis after the bankruptcy of Lehman Brothers in September 2008 (Regan et al. 2011). The subsequent liquidity squeeze and credit crunch caused a world wide economic slowdown (Zhang 2009). As the largest developing country and an export-driven economy, it would have been impossible for China to dodge the effect of the global financial and economic crisis. China is over dependent on exports to stimulate its economic growth and the weakening of external demand would be a heavy blow for the Chinese economy (Schüller and Yun 2009). The Chinese central bank also had high foreign exchange reserves worth US$1.95 trillion, of which a large part were denominated in U.S. dollars. The potential devaluation and downgrade of its U.S. treasury or agency bonds resulting from the deepening of the subprime crisis would strongly influence the international purchasing power of China's foreign exchange reserves (Yao et al. 2010).

To cope with the negative impact of the global financial crisis on the Chinese economy, the government announced a fiscal stimulus program of 4 trillion CNY (US$486 billion) in November 2008. Following public pressure to announce more details of the stimulus package, the National Development and Reform Commission subsequently published a breakdown of the package (Yu 2010). The largest share of the stimulus package, 38%, is intended for infrastructure projects; the second largest share, 25%, goes to the post-earthquake reconstruction of Wenchuan in Sichuan Province. Public utilities in rural areas and the construction of public housing in urban areas receive shares of 9.25 and 10%, respectively. The funding of the projects relies heavily on local governments and private companies because they are expected to cover approximately 70% of the 4 trillion CNY package (Schüller and Yun 2009).

The details of the stimulus package include very ambitious goals for the expansion of infrastructure and aim to support domestic consumption and job creation, with social infrastructure like public housing, health care utilities, and social welfare being more addressed by the Chinese government than before. The underlying reason for the large investments made by the Chinese government on infrastructure development in the stimulus package and other stimulus polices such as active fiscal policies, loose monetary policies, and stable exchange rate policies is to decrease the impact of the GFC by economic structure adjustment (Yu 2010). Another important goal to execute the stimulus policy is to cope with many social conflicts and inequity due to high-speed economic development in which housing provision and allocation is an important social problem (Zhang et al. 2011).

Public Housing in China and the Problems

In fact, the Chinese government postponed some structural adjustment policies that are necessary to ensure the sustainable growth of the Chinese economy (e.g., bursting the price bubble in the real estate sector), to prevent a slowdown of economic growth. The stimulus policy had shown positive effects on short-term economic development (Yao et al. 2010). However, long-term sustainable development for China was negatively influenced by stimulus policies. Housing prices in large cities kept rising after limited decline when the GFC was coming (Fig. 1) because almost one-third of the investments in the 4 trillion CNY was put into housing/real estate market in different ways. The initial goal of the stimulus policy to improve the housing conditions for low-income populations was not achieved (Xiao 2010). Many shortcomings accompanying Chinese economic development (e.g., inequality of social resources and unreasonable personal income structure) were further enlarged (Stephens 2010). Therefore, the focus of domestic social conflicts aimed at high housing prices. In this case, unstable factors would strongly influence sustainable economic development in the era of post-GFC. In order to cope with domestic social conflicts and facilitate the development, the Chinese government issued "The Notice to Hold Back the Speed of Housing Price Growth" (also

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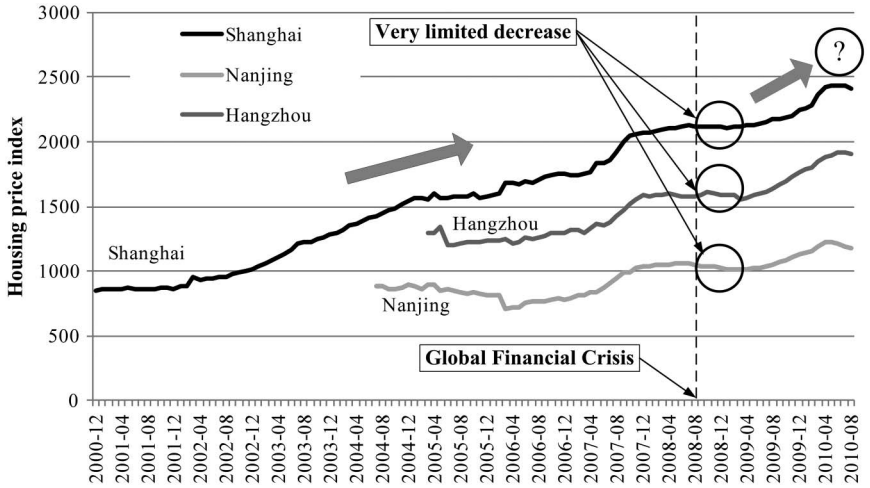

Fig. 1. The changes of housing price index before and after the GFC in China

called "Ten Country Regulations") in April 2010 (GOSC 2010c). The issued regulations aimed at cooling down the housing market by limiting speculative housing transactions. Meanwhile, strengthening the delivery of public housing for the low-income population was also continually addressed in "Ten Country Regulations." The Chinese government issued subsequent development policies in January 2011 to facilitate the construction of public housing and control speculative housing transaction, which named "The Notice to Further Strengthen Housing Market Control" (GOSC 2011). A series of adjustments reflected the determination of the government to resolve the housing problems for low-income population and ensure the social security system can provide a comfortable social environment for economic recession and recovery.

Prior to crisis, the housing problems had been paid attention to by Chinese government. Since 2006, the Chinese central government made great efforts to start new housing reform on the housing security system due to the social problems resulting from high-speed economic development in China (GOSC 2006). New housing reform is the policy to build more affordable and accessible social housing for urban poor to improve housing conditions on the basis of prior housing development policies (Qi et al. 2007).

Facing the challenges of GFC and new housing reform, the decision of the Chinese government was to provide a large amount of public housing. In the recent National People's Congress held in March 2011, the Chinese government planned to build 36 million units of public housing by 2015, and public housing will account for 20% of total residential housing, which is also recorded in the Twelfth Five Year Plan (Shier Wu Plan) (Ministry of Housing and Urban-Rural Development 2011). Based on the plan, the supply of public housing should reach almost 8 million units on average, and the annual investment would reach 1.3 trillion CNY. Actually, the delivery of new commercial housing in 2009 in China is just 9 million units (Tsou et al. 2008). China's program of constructing 36 million units of public housing in 2011–2015 is the largest government-led home-building program in world history. By doing so, China can at least avoid slums, redistribute national wealth, provide freedom to move, stimulate demand when national savings is in massive surplus, and bring about social stability.

Roles of PPPs in Public Housing Delivery in China

Quan (2006) presented that housing reforms have paved the way to changing Chinese housing conditions, accelerate urbanization, and facilitate economic reform in China, which deserve further investigation into improvement of the present housing provision system. In order to achieve the goal of New Housing Reform, Chinese central government and local government should make great efforts on delivery of large number of public housing.

To be sure, nothing is free (other than construction and operation costs) because government-led programs usually are linked to inefficiency in resource allocation and corruption. For many years, the capacity of Chinese governments to provide public goods and services on their own in an effective and efficient way has been questioned and reassessed at various levels and in different forms (Yuan et al. 2010). Public housing usually was not an important investment area. By 2009, the investments of public housing were much less than commercial residential housing in the market. As shown in Fig. 2, the percentage of public housing investments to commercial residential housing investments went down from 13% to 4% since 2000, which means more and more low-income families should buy or rent commercial residential houses in the market and cannot obtain social welfare. Fig. 2 also indicates that the capacity of the public sector to deliver public housing is weak. In the case of investing 1.3 trillion CNY per year (almost triple the investments in 2009) in public housing, the problems related to capital gap and poor management skill for the public sector to deliver public housing would be more significant than before.

In the last five years, trillions of investments have been put into infrastructure development like transportation, power plants, water plants, and urban regeneration. From a long-term perspective, the investments in public housing cannot be always kept on a high level. According to the report of J. P. Morgan, the challenges for developing public housing in China can be concluded as greater funding challenges, greater financial burden for local authority, and the needs for new mode of funding (Ulrich 2010). On the other hand, the public sector should be fully responsible for designing, building, and operating public housing, during which many problems have been reported. In many cities, public housing is poorly built, located in very inconvenient places, and do not have enough service facilities to meet the basic needs of residents (Tsou et al. 2008; Ulrich 2010). Owing to the limited financial budget and inefficient experiences in delivering public housing and related services involving only the public sector, Chinese policymakers should find new ways to improve the performance of public projects and services to meet the demands (Yuan et al. 2010). Therefore, "The Advice to Encourage and Guide Private Investments to Develop Infrastructure" was issued by the State Council in May 2010

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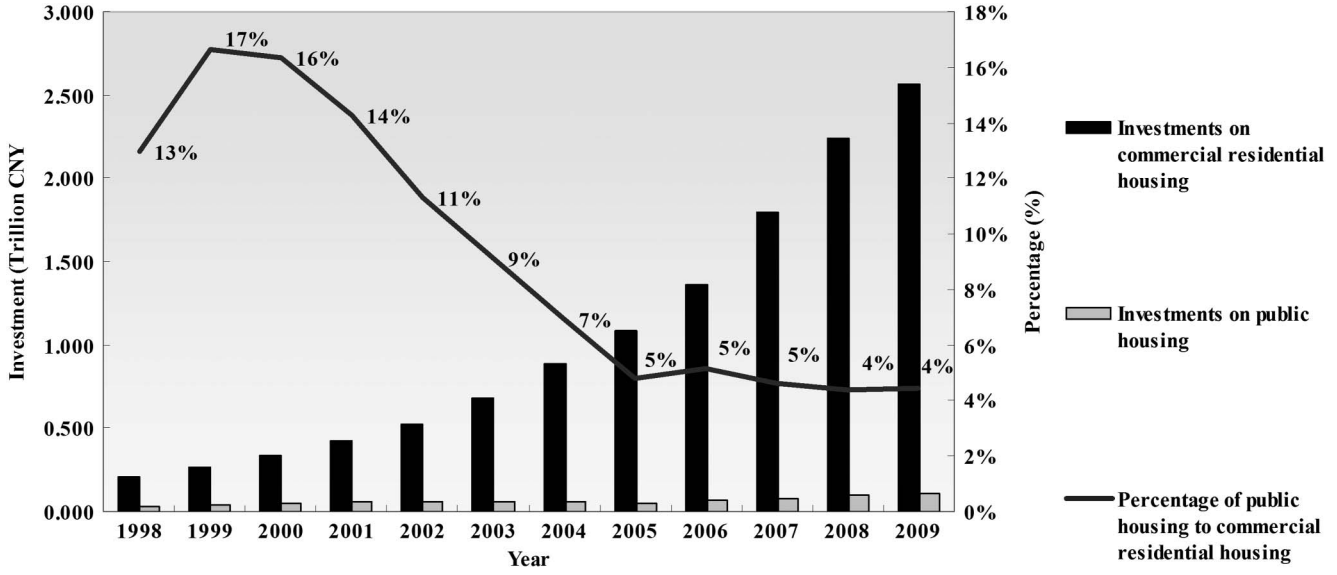

Fig. 2. The comparison of investments between commercial residential housing and public housing (1998–2009)

(GOSC 2010a). As a world wide solution to involve greater private sector participation in the development of infrastructure projects, PPPs are introduced to involve private sectors to finance, construct, and operate public housing at the right time.

PPPs have been adopted more extensively by governments and have gained importance as vehicles to finance public infrastructure around the globe (Ke et al. 2009; Tang et al. 2010). PPPs have been heavily utilized since 1997 in England followed by most of commonwealth countries, and then extended to many developing countries, like eastern Europe and east/south Asia. (Winch 2000). Specifically, the private sector has so far been involved in facilities development, including designing, financing, construction, ownership, and/or operation of a public sector utility or service (Tang et al. 2010). In China, PPPs have been used for many years because of their attractive characteristics to transfer risks to the private partners, reduce public sector administration cost, solve the problem of public sector budget restraint, provide higher quality public products and services, and save time in delivering the projects. (Yuan et al. 2010). However, the application of a PPP in housing is rare in China (Zhang and Zhou 2011). Before 2006, the need for public housing was not urgent for the government, because of which the policies for entering the area of public housing were not attractive for the private sector. Furthermore, the profits from public housing are much lower than other infrastructure projects (Zhang and Zhou 2011). In other countries (e.g., India, South Africa, the United States, and Canada), PPPs have been applied in the delivery of public housing, though PPPs have not been viewed as commonly adopted for social infrastructure provisions (Griffin 2004; Stewart 2005; Sengupta 2006; Abdul-Aziz and Kassim 2011).

The objectives for adopting PPPs in public housing are described by Abdul-Aziz and Kassim (2011) as to improve the reputation of the public sector, innovate, reduce related costs, transfer risks, and achieve value for money. The experiences from the United Kingdom, the United States, and southeast Asia demonstrate that a PPP is a feasible way to develop public housing in China to deal with two big problems of constructing public housing, which are capital gap and poor management skill. In the last three years, PPPs have been questioned for the dependency on financing and debts that were strongly influenced by the GFC (Burger et al. 2009; Kappeler and Nemoz 2010). Notwithstanding those problems, the prospects for PPP projects are reasonably good (KPMG 2009; Regan et al. 2011). PPPs are attractive to the public sector because historically, and where projects have been suitable for a PPP, they have provided strong VFM. In the context of public housing, PPPs would be more appropriate than in other areas because a large number of public houses with high quality and professional management now are extremely needed by the Chinese government.

However, the strategy to develop PPP housing for the Chinese government should be considered carefully. Public housing is a big issue in China right now. Social conflicts will sharpened if public housing can not be delivered well. Thus, a strategy development analysis should be conducted to identify SWOT in developing public housing when adopting PPPs as a useful vehicle.

Research Methodology

The SWOT analysis method is used in this study to analyze the current situation concerning the application of PPPs in developing public housing, and to formulate strategy for the Chinese government. SWOT analysis, is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective (Arslan and Er 2008).

Kurttila et al. (2000) point out the technical limitations of SWOT analysis due to its impreciseness and lack of a quantitative examination. Therefore, a SWOT–analytic hierarchy process (AHP) hybrid method is introduced to improve the usability of SWOT analysis (Jeon and Kim 2011). The AHP was initially developed by Saaty (1980) and has been widely used for solving multiple criteria decision making (MCDM) problems. The basic formula of AHP is paired comparisons in each criterion, and the results of paired comparisons can be used to evaluate the strategies. Consequently, AHP can provide a quantitative measure of the weights of SWOT factors in this study. The analysis based on the SWOT–AHP hybrid method has been used in various areas

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such as agriculture, hazardous materials, and tourism, but not in many cases for the PPP development (Kurttila et al. 2000; Arslan and Er 2008; Jeon and Kim 2011). This paper presents an improved SWOT–AHP method that integrates the opinions of multiple experts. The procedure involves the following steps: (1) SWOT factors generation, (2) research survey, (3) conducting SWOT–AHP, and (4) strategy formulation from the results. The detailed process for the implementation of SWOT–AHP method is shown in Fig. 3.

SWOT Factors Generation

Kwak et al. (2009) indicate that many PPP projects are either held up or terminated due to wide gaps between public and private sector expectations, lack of clear government objectives and commitment, complex decision making, poorly defined sector policies, inadequate legal/regulatory frameworks, poor risk management, low credibility of government policies, inadequate domestic capital markets, lack of mechanisms to attract long-term finance from private sources at affordable rates, poor transparency, and lack of competition. A series of SWOT factors are identified and presented in Fig. 4.

Strengths

The strengths can be described as variables associated with factors in which the organization shows certain strength; variables that should take advantage of in the growth and development of the organization (Kangas et al. 2001). For the public sector, the emphasis for adopting PPPs is not the procurement of public housing but the goods and services delivered by PPPs. PPPs address the effect of outcome, which could provide the opportunities and drivers for innovation (Yuan et al. 2010). Therefore, the private sector in PPPs to deliver public housing would do its best to reduce life cycle costs including design, construction, services, operation, maintenance, and regeneration costs (Bardhan and Barua 2005).

In China, public housing used to be a public regime. Due to the administrative and fiscal decentralization policy, the revenue of the central government has been falling. As a result, local authorities, who are actually responsible for the public housing development, must rely on their own revenues and the market mechanism to accommodate the big demand for public housing. Hence, new funding sources to invest in the new housing projects are necessary (Meng 2002). As a result, the private sector has an increasingly important role in public housing development, and PPPs can provide a vehicle for its participation in the traditional public regime. Meanwhile, Li et al. (2005) and Yuan et al. (2010) indicate that PPPs' attractive characteristics include reducing public sector administration cost, providing higher quality public products and services, and saving time in delivering the projects through advanced technology and high management skills. Furthermore, many risks will be transferred to or shared with the private sector when adopting PPPs in public housing. Transfer of financial, delay, defect, cost overrun, and sales risks are identified by Abdul-Aziz and Kassim (2011) as important objectives for government to develop PPP housing. Organization reputation and project reputation are also identified by Abdul-Aziz and Kassim (2011) as highly important objectives in the development of PPP housing in Malaysia. Actually, there is a similar situation in China. The private sector is encouraged to provide public goods through PPPs. In the area of public housing delivery, the private sector, like real estate developers, can obtain great social reputation, which would largely benefit them and increase their future competition in the market (Zhang and Zhou 2011). For instance, CHIXIA Development Co. Ltd. is a famous listed real estate developer in Jiangsu Province, China. Different with other commercial residential developers, CHIXIA Development Co. Ltd. keeps on building public housing for low-income residents. Therefore, CHIXIA Development Co. Ltd.

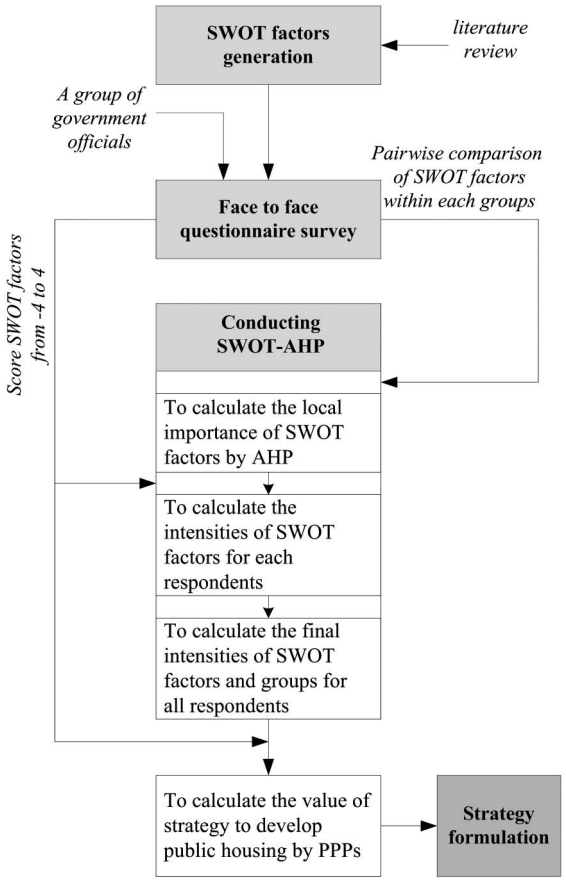

Fig. 3. The procedure to conduct SWOT–AHP

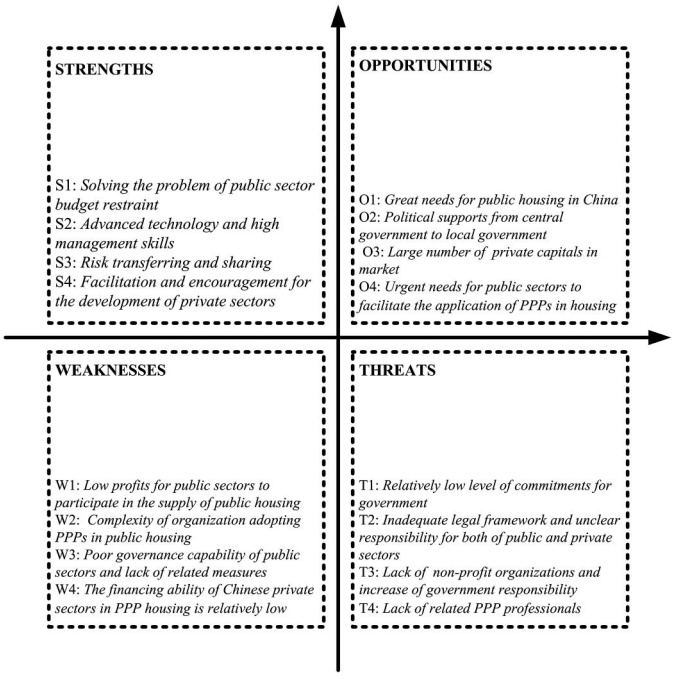

Fig. 4. The SWOT matrix

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has good relationships with local government and can obtain excess sponsorship from government (based on the information from www.chixia.com). Hence, the participation of the private sector in public housing by PPPs would facilitate its development. Thus, the priorities of PPPs in public housing can be concluded as shown in Fig. 4.

Weaknesses

The weaknesses can be described as variables associated with factors in which the organization shows certain weakness; variables that could impede or make difficult the growth and development of the organization (Kangas et al. 2001). When developing public housing, the critical obstacle for participation of the private sector is low profits (Wang et al. 2005; Logan et al. 2010). The primary objective to develop public housing for the public sector is to provide basic habitation for low-income residents (Abdul-Aziz and Kassim 2011). Although government would set aside certain profits for the private sector, the profits are also relatively low (about 3–5%) compared with other types of PPP projects (e.g., transportation and power plants) (Zhang and Zhou 2011). However, current policies to control the housing market could strongly influence the performance of some real estate developers (Zhang et al. 2011). Many real estate developers would therefore seek opportunities to participate in public housing in the future.

On the other hand, the participation of the private sector would increase organization complexity and management difficulty for the authority of public housing (Li et al. 2005). All public organizations for housing in China are associated with the social security policies and system. The relationships between public organization and different public sectors should be dealt with carefully. The involvement of the private sector make polices and relationships more complicated, which would result in conflicts among different stakeholders in PPP housing projects. The governance of PPP projects is very important, as presented by Bloomfield (2006) and Yuan et al. (2009). However, the government is used to addressing policy making and neglecting how to effectively implement policies in China (Yuan et al. 2009; Xu et al. 2010). Thus, the process control would be a great challenge for the public sector to monitor and govern PPP housing projects. Meanwhile, the financing ability for the private sector should be strong and stable because a large amount of housing will be built in the next five years. Thus, the weaknesses of PPPs in public housing can be concluded as shown in Fig. 4.

Opportunities

The opportunities can be described as variables associated with aspects that can be seen as opportunities that the organization could take advantage of for its growth and development (Kangas et al. 2001). The great demand for public housing has been mentioned previously. The ability to provide enough public housing for the public sector has to be questioned (Tsou et al. 2008). Thus, a large gap for public housing in China is obvious. The introduction of the private sector would greatly enhance the ability of government to deliver public housing. Since 2003, the private sector has been viewed as important by the Chinese government in infrastructure development. "The Advices to Improve the Development of Non-Public Economy in China" in 2005 determined to remove the obstacles for the development of the private sector and to permit the private sector to participate in infrastructure development (GOSC 2005). "The Advice to Encourage and Guide Private Investments to Develop Infrastructure" issued by the State Council further encourages the private sector to build and operate public housing (GOSC 2010a). At the end of 2010, many cities, such as Nanjing, Kunming, and Hangzhou, China, also issued local regulations to facilitate the participation of the private sector in public housing (detailed information can be obtained from www.investnanjing.gov.cn, gsl.km.gov.cn, and www.hangzhou.gov.cn). The political support from the central government and local governments has provided great opportunities for developing PPP housing.

On the other hand, a large amount of capital from private organizations would be invested to developing PPP housing. In fact, the amount of private capital is very huge based on the assumption of Poncet et al. (2010) and Choi et al. (2010). Prior to control of the housing market, private investors preferred to invest incommercial residential housing, which further increases housing prices. In case of macroeconomic control, private capital would transfer to public housing by PPPs in order to ensure certain fixed profits. Thus, value for money could be achieved (Abdul-Aziz and Kassim 2011). The urgent needs of the public sector to introduce PPPs in the delivery of public housing would also be opportunities for adopting PPPs. As an innovative method to provide public housing, successful implementation of PPP housing would be of great importance for the public sector. Thus, the opportunities of PPPs in public housing can be concluded as shown in Fig. 4.

Threats

The threats can be described as variables that could represent a threat to the growth and development of the organization, variables whose effects look advisable to prevent or neutralize. In China, the experience of the public sector with PPPs has not always been positive (Kwak et al. 2009; Chan et al. 2011). The threats to successful PPP projects can be closely related to the influence of the public sector. Public commitment is a directed obligation from the public sector to the private sector to perform certain actions so as to bring about a certain state of affairs. However, the behavior of the public sector and its commitment to sustainable development of PPP housing is influenced by the incentives that are created by the broader institutional environment, macropolicies, and the specific agreements in the contract (Koppenjan and Enserink 2009). In this case, low levels of commitment for the public sector to the private sector must greatly influence the trust between them. Meanwhile, inadequate legal/regulatory framework is the root of low levels of commitment. The establishment of a sound legal/regulation framework is a prerequisite for PPPs (Pongsiri 2002). A well-structured framework can not only increase the willingness of the private sector to participate in public housing development, but also increase benefits to the government by ensuring that the projects operate efficiently (Zouggari 2003).

Furthermore, lack of nonprofit organization and lack of PPP professionals would hinder the development of PPP housing. Generally, there are no specific nonprofit organizations like charities as well as trade and professional organizations to help government deal with relationships with the general public. When adopting PPPs in public housing, the need for nonprofit organizations would increase. Nonprofit organizations can play important roles for lubricating the relationships among government, the general public, and the private sector (Savas 2008). Moreover, other services like professional training can be obtained from a nonprofit vendor (Kumar and Bauer 2010). Despite numerous negative experiences, Chinese governments continue to view PPPs as one of the key strategies for delivering public housing. Therefore, PPP professionals in the public and private sectors that can understand PPPs would continue to be important. During the implementation of PPP housing, a wide range of topics (e.g., how to select an appropriate concessionaire, what the critical factors for the success or failures of PPP

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projects are, and what roles the government should play in PPP projects) are related to financing, legal, and technology issues (Kwak et al. 2009). The PPP professionals should be responsible for things such as negotiation, process control, operation, risk management, and regulation. Therefore, a lack of PPP professionals is also crucial for PPP housing. The threats of PPPs in public housing can be concluded as shown in Fig. 4.

Research Survey

In order to find the importance and relative importance of the identified SWOT factors, a research survey was conducted face-to-face from December 20, 2010 to January 20, 2011. The survey targets officials with experience or interest in PPP housing. The final questionnaire comprises two parts. The first part deals with the opinions of respondents on SWOT factors about PPP housing. The second part aims at investigating the relative significance for SWOT factors within each SWOT group. All 21 respondents are from Jiangsu Province, China, government and Nanjing City, China, government. Eighteen respondents are currently serving public housing, and three respondents used to serve public housing. Because of their government background, the investigation of background is omitted.

In the first part, Likert-style rating questions, using a nine-point scale, are used to elicit respondents' opinions about each SWOT factors from −4 to 4. For the strength factors, 4 means extremely large strength, 3 means comparatively large strength, 2 means large strength, 1 means normal strength, and 0 means no strength. For the weakness factors, −4 means extremely large weakness, −3 means comparatively large weakness, −2 means large weakness, −1 means normal weakness, and 0 means no weakness. For the opportunity factors, 4 means extremely large opportunity, 3 means comparatively large opportunity, 2 means large opportunity, 1 means normal opportunity, and 0 means no opportunity. For the threat factors, −4 means extremely large threat, −3 means comparatively large threat, −2 means large threat, −1 means normal threat, and 0 means no threat.

In the second part, the respondents were asked to conduct a pairwise comparison of relative significance between SWOT factors within each SWOT group. According to Kurttila et al. (2000) and Pesonen et al. (2001), the questions in making the comparisons at stake are: (1) which of the two factors compared is a greater strength (opportunity, weakness, or threat), and (2) how much greater. With these comparisons as the input, the relative local priorities of the factors are computed using the eigenvalue method (described subsequently). These priorities reflect the decision maker's perception of the relative importance of the factors. The matrix of pairwise comparisons will be constructed as shown by Eq. (1).

$$\mathbf{A} = (a_{ij}) = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} = \begin{bmatrix} 1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & 1 & \cdots & w_2/w_n \\ \vdots & \vdots & \ddots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & 1 \end{bmatrix} \quad (1)$$

where a_{ij} = local relative importance for i to j in each SWOT group; and $a_{ij} = 1/a_{ji}$. Thus, when $i = j$, $a_{ij} = 1$. The value of w_i may vary from 1 to 9, and 1/1 indicates equal importance, while 9/1 indicates extreme or absolute importance (Taleai et al. 2009).

The integration of investigation on the opinions on SWOT factors and factor weights based on the pair-wise comparison will be used to calculate the intensity of each SWOT group for each respondent. Further integration on the opinions of each respondent will obtain the intensity of the strategic goal. Therefore, the strategy formulation can be explored according to the results.

Conducting SWOT–AHP

As shown in Fig. 5, an AHP hierarchy is constructed by using the factors derived from the SWOT analysis. For each respondent,

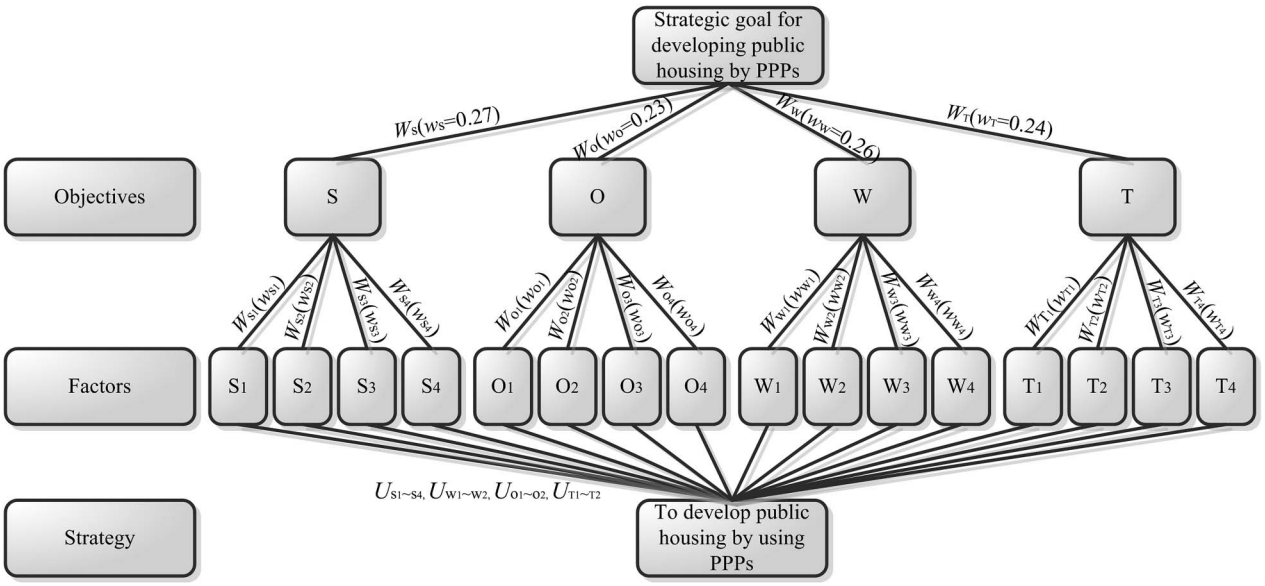

Fig. 5. The AHP hierarchies for SWOT factors

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the strategy herein is to develop public housing by using PPPs, where U_{S1}–U_{S4}, U_{W1}–U_{W4}, U_{O1}–U_{O4}, and U_{T1}–U_{T4} are the scores of each SWOT factor from questionnaire survey. In the level of factors, there are 16 SWOT factors, where w_{S1}–w_{S4}, w_{W1}–w_{W4}, w_{O1}–w_{O4}, and w_{T1}–w_{T4} are the local importance for each SWOT factor within their groups, and W_{S1}–W_{S4}, W_{W1}–W_{W4}, W_{O1}–W_{O4}, and W_{T1}–W_{T4} are the global importance for SWOT factors. In the level of objectives, there are four SWOT groups, where w_S, w_W, w_O, and w_T are only the importance for each SWOT group because there are no other levels above the objective level (Fig. 5).

V is defined as the global (relative) value of the strategy; thus, V can be obtained from Eq. (2) as follows:

$$V = w_S \sum_{i=1}^{4} w_{Si} U_{Si} + w_W \sum_{i=1}^{4} w_{Wi} U_{Wi} + w_O \sum_{i=1}^{4} w_{Oi} U_{Oi} + w_T \sum_{i=1}^{4} w_{Ti} U_{Ti} \tag{2}$$

where value of the strategy V is obtained from one questionnaire based on the opinion of one respondent.

The importance for SWOT groups can be obtained based on the all respondents'−4 to 4 scores on each SWOT factor in the survey by using a simplified method, where

$$w_S = \frac{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rSi}|}{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rSi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rWi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rOi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rTi}|} = 0.27$$

$$w_W = \frac{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rWi}|}{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rSi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rWi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rOi}||\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rTi}|} = 0.23$$

$$w_O = \frac{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rOi}|}{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rSi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rWi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rOi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rTi}|} = 0.26$$

$$w_T = \frac{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rTi}|}{|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rSi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rWi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rOi}|+|\sum_{r=1}^{21}\sum_{i=1}^{4} U_{rTi}|} = 0.24$$

U_{rSi}, U_{rWi}, U_{rOi}, and U_{rTi} mean the rth respondent's scores on the ith S, W, O, and T factor, respectively.

The cornerstone of AHP is the logic of pairwise comparison. The pairwise comparisons allow for the production of the relative importance value, which is called weight (Kurttila et al. 2000). According to Eq. (1), some inconsistencies can be expected and accepted in the comparisons matrix. When matrix **A** contains inconsistencies, the estimated priorities or weights can be obtained by using the eigenvalue technique as shown in Eq. (3):

$$(\mathbf{A} - \lambda_{\max}\mathbf{I})w = 0 \tag{3}$$

which can be transformed to Eq. (4):

$$\lambda_{\max} = \frac{1}{w}\sum_{j=1}^{n} a_{ij} w_j, \qquad \sum_{i=1}^{n} w_i = 1 \tag{4}$$

where $\lambda_{\max}$ = largest eigenvalue of matrix **A**; w = vector of weights; and **I** = identity matrix. The detailed calculation of w and $\lambda_{\max}$ can be found in Saaty (1980) in Saaty and Vargas (1990).

The data from one respondent in the survey will be used as an example to calculate local importance (w_{S1}–w_{S4}, w_{W1}–w_{W4}, w_{O1}–w_{O4}, and w_{T1}–w_{T4}) for each SWOT factors within their groups. Table 1 shows the compassion matrix from one respondent.

Step 1 To calculate the local importance of w_{Si}, it is shown in Eq. (5) based on Saaty (1980) and Saaty and Vargas (1990):

$$w_{si} = \frac{\bar{W}_i}{\sum_{i=1}^{4} \bar{W}_i} \tag{5}$$

where

$$\bar{W} = \sqrt[4]{\prod_{j=1}^{4} s_{ij}}\ (i = 1, 2, 3, 4)$$

Therefore, w_{Si} can be obtained as $w_{S1} = 0.650$, $w_{S2} = 0.046$, $w_{S3} = 0.233$, and $w_{S4} = 0.071$.

Step 2 The largest eigenvalue $\lambda_{\max}$ of matrix **S** can be obtained by Eq. (6):

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Table 1. AHP Pairwise Comparison Matrix for PPP Housing (One Respondent)

Strength	S1	S2	S3	S4	Weakness	W1	W2	W3	W4	Opportunity	O1	O2	O2	O3	Threat	T1	T2	T3	T4
S1	1	9	5	8	W1	1	5	5	4	O1	1	5	3	6	T1	1	1/3	5	5
S2	1/9	1	1/6	1/2	W2	1/5	1	1/2	1	O2	1/5	1	1/3	3	T2	3	1	7	7
S3	1/5	6	1	5	W3	1/5	2	1	2	O3	1/3	3	1	4	T3	1/5	1/7	1	1/2
S4	1/8	2	1/5	1	W4	1/4	1	1/2	1	O4	1/6	1/3	1/4	1	T4	1/5	1/7	2	1

$$\lambda_{\max} = \sum_{i=1}^{4} \frac{\sum_{j=1}^{4} S_{ij} \cdot w_{Si'} (i' = 1, 2, 3, 4)}{4 \cdot w_{Si}} \tag{6}$$

Therefore, $\lambda_{\max}$ of matrix **S** is 4.213.

Step 3 The consistency index of a matrix of comparisons is given by Eqs. (7) and (8). The consistency ratio (CR) is obtained by comparing the consistency index (CI) with the random consistency index (RI). According to Saaty and Vargas (1990), the value of RI is 0.90 when $n = 4$, and a CR value of 10% or less is considered to be acceptable.

$$\text{CR} = \frac{\text{CI}}{\text{RI}} \tag{7}$$

$$\text{CI} = (\lambda_{\max} - n)/(n - 1) \tag{8}$$

Consequently, CR for matrix **S** is $0.079 < 0.1$, which indicates that the results are acceptable. Therefore, the results for other groups can also be obtained based on a similar method to Eqs. (5)–(8). For **W** matrix, $w_{W1} = 0.601, w_{W2} = 0.107, w_{W3} = 0.180, w_{W4} = 0.113$, $\lambda_{\max} = 4.086$, and $\text{CR} = 0.032 < 0.1$. For **O** matrix, $w_{O1} = 0.559$, $w_{O2} = 0.121$, $w_{O3} = 0.257$, $w_{O4} = 0.062$, $\lambda_{\max} = 4.147$, and $\text{CR} = 0.054 < 0.1$. For **T** matrix, $w_{T1} = 0.282$, $w_{T2} = 0.579$, $w_{T3} = 0.057$, $w_{T4} = 0.081$, $\lambda_{\max} = 4.134$, and $\text{CR} = 0.049 < 0.1$.

Step 4 The intensities of different SWOT groups can be obtained on the basis of the scores of SWOT factors in the same questionnaire, which are shown in Table 2 based on Eq. (9).

$$I_S = w_S \sum_{i=1}^{4} I_{Si}, \quad I_W = w_W \sum_{i=1}^{4} I_{Wi},$$
$$I_O = w_O \sum_{i=1}^{4} I_{Oi}, \quad I_T = w_T \sum_{i=1}^{4} I_{Ti} \tag{9}$$

where $I_{Si} = U_{Si} \cdot w_{Si}$, $I_{Wi} = U_{Wi} \cdot w_{Wi}$, $I_{Oi} = U_{Oi} \cdot w_{Oi}$, $I_{Ti} = U_{Ti} \cdot w_{Ti}$

The group intensities reflect the strategic development tendency of PPP housing for one respondent (Shinno et al. 2006). On the basis of Table 2, the value of the strategy V is obtained from one questionnaire on the basis of Eq. (3). $V = I_S + I_W + I_O + I_T = 0.498 > 0$, which means the strategy to develop PPP housing can be acceptable and the strength of developing PPP housing is large. However, the previously mentioned conclusion is drawn from one respondent. Further analysis will use the data from all respondents to obtain a reasonable strategy formulation.

Calculation of Strategy Value for PPP Housing

Based on previously mentioned presentation, the intensities of SWOT factors for all 21 respondents can be obtained as shown in Table 3. Furthermore, the intensities of SWOT groups can be obtained according to the mean value of SWOT factor intensities from Table 3. The intensities of SWOT groups are shown in Table 4. The final strategy value V_F can be obtained by Eq. (10).

$$V_F = I_{FS} + I_{FW} + I_{FO} + I_{FT}$$
$$= w_S I_{mSi} + w_W I_{mWi} + w_O I_{mOi} + w_T I_{mTi} \tag{10}$$

Table 2. Intensities of SWOT Groups in PPP Housing (One Respondent)

Objectives	Importance/ weights of objectives (w_S, w_W, w_O, w_T)	Factor	Local importance/ weights of factors (w_{Si}, w_{Wi}, w_{Oi}, w_{Ti})	Scores of factors (U_{Si}, U_{Wi}, U_{Oi}, U_{Ti})	Factor intensities ($I_{Si} = U_{Si} \cdot w_{Si}$, $I_{Wi} = U_{Wi} \cdot w_{Wi}$, $I_{Oi} = U_{Oi} \cdot w_{Oi}$, $I_{Ti} = U_{Ti} \cdot w_{Ti}$)	Group intensities (I_S, I_W, I_O, I_T)
S	0.27	S1	0.650	4	2.600	$I_S = 0.27 \cdot \sum I_{Si} = 0.941$
		S2	0.046	1	0.046	
		S3	0.233	3	0.699	
		S4	0.071	2	0.142	
W	0.23	W1	0.601	−3	−1.802	$I_W = 0.23 \cdot \sum I_{Wi} = -0.510$
		W2	0.107	−1	−0.107	
		W3	0.180	−1	−0.180	
		W4	0.113	−1	−0.113	
O	0.26	O1	0.559	4	2.237	$I_O = 0.26 \cdot \sum I_{Oi} = 0.893$
		O2	0.121	3	0.364	
		3	0.257	3	0.771	
		O4	0.062	1	0.062	
T	0.24	T1	0.282	−3	−0.847	$I_T = 0.24 \cdot \sum I_{Ti} = -0.826$
		T2	0.579	−4	−2.315	
		T3	0.057	−2	−0.115	
		T4	0.081	−2	−0.163	

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Table 3. Factor Intensities of SWOT Groups (All Respondents)

	Factor intensities of S group				Factor intensities of W group				Factor intensities of O group				Factor intensities of T group			
Respondent	S1	S2	S3	S4	W1	W2	W3	W4	O1	O2	O3	O4	T1	T2	T3	T4
1	2.207	0.203	0.879	0.054	−2.234	−0.783	−0.265	−0.048	2.192	0.260	0.836	0.043	−0.665	−2.452	−0.225	−0.053
2	0.362	0.836	1.628	0.352	−1.054	−1.379	−0.447	−0.143	0.740	0.819	0.869	0.962	−0.728	−2.487	−0.129	−0.142
3	2.736	0.361	0.088	0.184	−2.715	−0.416	−0.080	−0.033	2.008	0.184	0.885	0.111	−2.073	−0.198	−0.851	−0.099
4	2.145	0.224	0.929	0.085	−1.753	−0.037	−0.523	−0.234	0.270	1.815	0.113	0.746	−1.335	−1.636	−0.207	−0.043
5	0.743	0.177	0.248	0.921	−0.550	−0.365	−0.175	−0.560	0.727	0.233	0.385	0.507	−0.925	−0.355	−0.103	−0.552
6	1.331	0.084	1.250	0.625	−2.898	−0.208	−0.144	−0.268	0.177	2.418	0.386	0.143	−1.414	−1.317	−0.051	−0.297
7	1.729	0.223	0.578	0.668	−1.607	−0.239	−0.414	−0.138	0.140	2.463	0.648	0.247	−0.615	−1.876	−0.238	−0.209
8	0.565	0.565	0.788	1.365	−1.820	−0.423	−0.423	−1.051	0.565	0.565	0.788	1.365	−0.758	−0.451	−0.569	−0.637
9	2.311	0.128	0.713	0.241	−1.764	−0.371	−0.624	−0.247	0.335	1.729	0.867	0.167	−0.585	−2.274	−0.148	−0.176
10	2.485	0.160	0.415	0.321	−1.729	−0.289	−0.167	−0.223	2.754	0.523	0.234	0.118	−1.190	−1.586	−0.119	−0.088
11	2.599	0.046	0.700	0.141	−1.802	−0.107	−0.180	−0.113	2.237	0.364	0.771	0.062	−0.847	−2.315	−0.115	−0.081
12	0.405	0.096	1.255	1.730	−2.164	−0.055	−0.811	−0.268	0.995	1.668	0.322	0.091	−0.929	−2.069	−0.239	−0.053
13	1.147	1.360	0.641	0.128	−1.877	−0.697	−0.471	−0.284	2.293	0.849	0.213	0.037	−1.498	−1.156	−0.254	−0.254
14	2.118	0.171	0.909	0.164	−2.197	−0.860	−0.201	−0.064	1.565	0.718	0.172	0.306	−1.063	−2.004	−0.060	−0.169
15	2.288	0.137	0.833	0.245	−1.664	−0.626	−0.274	−0.100	2.322	0.423	0.454	0.255	−0.917	−2.275	−0.044	−0.163
16	2.166	0.209	0.834	0.076	−2.093	−0.833	−0.282	−0.058	2.212	0.240	0.806	0.058	−0.909	−2.183	−0.201	−0.051
17	0.703	0.242	1.251	1.292	−1.979	−0.405	−0.357	−1.005	0.565	0.423	0.788	1.365	−0.722	−0.549	−0.526	−0.653
18	0.743	0.177	0.495	0.921	−0.576	−0.299	−0.205	−1.122	0.731	0.215	0.334	0.535	−0.884	−0.438	−0.125	−0.533
19	2.354	0.113	0.833	0.155	−1.735	−0.110	−0.186	−0.251	2.260	0.402	0.749	0.051	−0.749	−2.268	−0.122	−0.107
20	2.363	0.172	0.658	0.208	−1.601	−0.647	−0.238	−0.132	2.131	0.519	0.584	0.200	−0.871	−2.329	−0.042	−0.170
21	0.449	0.109	1.211	1.718	−2.292	−0.052	−0.777	−0.232	0.995	1.668	0.322	0.091	−0.898	−2.093	−0.242	−0.057
Sum	33.949	5.793	17.136	11.594	−38.104	−9.201	−7.244	−6.574	28.214	18.498	11.526	7.460	−20.575	−34.311	−4.610	−4.587
Mean value	1.617	0.276	0.816	0.552	−1.814	−0.438	−0.345	−0.313	1.344	0.881	0.549	0.355	−0.980	−1.634	−0.220	−0.218

where I_{FS}, I_{FW}, I_{FO}, and I_{FT} = final group intensities for all respondents; and I_{mSi}, I_{mWi}, I_{mOi}, and I_{mTi} = mean factor intensities in each groups; and

$$I_{mSi} = \frac{\sum_{r=1}^{21}\sum_{i=1}^{4} w_{Si}U_{rSi}}{21}, \qquad I_{mWi} = \frac{\sum_{r=1}^{21}\sum_{i=1}^{4} w_{wi}U_{rWi}}{21},$$

$$I_{mOi} = \frac{\sum_{r=1}^{21}\sum_{i=1}^{4} w_{Oi}U_{rOi}}{21}, \qquad I_{mTi} = \frac{\sum_{r=1}^{21}\sum_{i=1}^{4} w_{Ti}U_{rTi}}{21}$$

The final strategy value V_F is 0.290, which means the positive facilitating influences are greater than the negative hindering influence for developing public housing by PPPs in China. Although $V_F > 0$, the value is small, which indicates that present obstacles to development are still large in spite of abundant strengths and considerable opportunities to build and operate public housing by PPPs. When more and more PPP projects would be conducted and related policies, regulations, and laws would be issued, the priorities of PPP housing should become more obvious.

The final intensities of different SWOT factors in all groups can be obtained by $w_S I_{mSi}$, $w_W I_{mWi}$, $w_O I_{mOi}$, and $w_T I_{mTi}$ as shown in Table 2 and Fig. 6. The strongest facilitating factors (strengths and opportunities) are S1 [solving the problem of public sector budget restraint (0.434)] and O1[large gap for public housing in China (0.349)]. In the mean time, S3 [risk transferring and sharing (0.220)] and O2 [political support from central government to local government (0.230)] are also strong driving factors for developing public housing by PPPs. The realistic situation in China make PPPs to be an optimal selection to develop public housing. On the other hand, the strongest hindering factors (weaknesses and threats) for PPP housing are W1 [low profits for the public sector to participate in the delivery of public housing (−0.417)], T2 [inadequate legal framework and unclear responsibility for both the public

Table 4. Final SWOT Group Intensities and Final Strategy Value in PPP Housing (All Respondents)

Objectives	Importance/weights of objectives	Factor	Mean factor intensities within groups (I_{mSi}, I_{mWi}, I_{mOi}, I_{mTi})	Final factor intensities in all groups ($w_S I_{mSi}$, $w_W I_{mWi}$, $w_O I_{mOi}$, $w_T I_{mTi}$)	Final group intensities for all respondents	Final strategy value, V_F
S	0.27	S1	1.617	0.434	$I_{FS} = 0.27 \cdot \sum I_{mSi} = 0.878$	0.290
		S2	0.276	0.075		
		S3	0.816	0.220		
		S4	0.552	0.149		
W	0.23	W1	−1.814	−0.417	$I_{FW} = 0.23 \cdot \sum I_{mWi} = -0.669$	
		W2	−0.438	−0.101		
		W3	−0.345	−0.079		
		W4	−0.313	−0.072		
O	0.26	O1	1.344	0.349	$I_{FO} = 0.26 \cdot \sum I_{mOi} = 0.813$	
		O2	0.881	0.229		
		O3	0.549	0.143		
		O4	0.355	0.092		
T	0.24	T1	−0.980	−0.235	$I_{FT} = 0.24 \cdot \sum I_{mTi} = -0.732$	
		T2	−1.634	−0.392		
		T3	−0.220	−0.053		
		T4	−0.218	−0.052		

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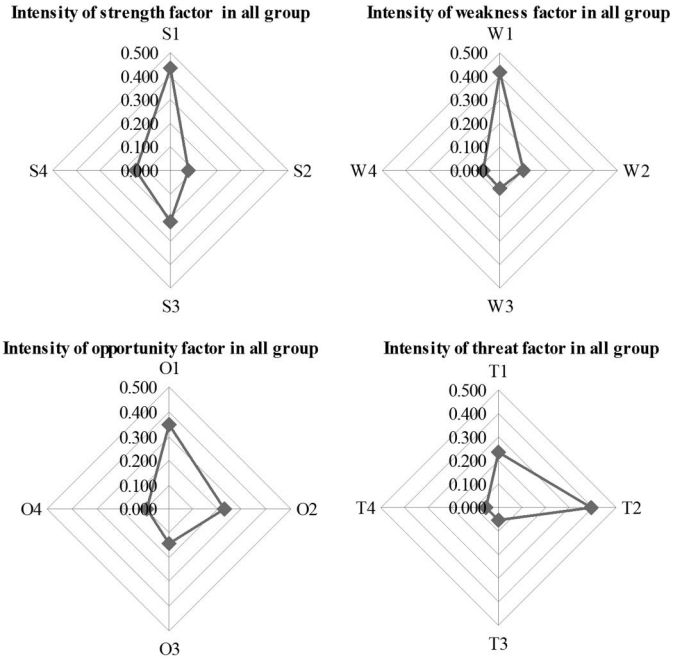

Fig. 6. The intensities for different SWOT groups

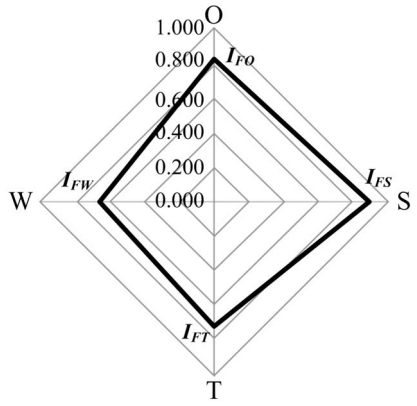

Fig. 7. Final intensities for SWOT groups

and private sectors (−0.392)], and T1 [relatively low level of commitment for government (−0.235)]. The incentives for the private sector to participate in PPP housing and the inherent problems of the Chinese government would harm healthy development of PPP housing. The most important finding from the comparison between facilitating factors and hindering factors is that the sum of the intensities of W1 and T2 are larger than those of S1 and O1, which indicates that low profits and inadequate legal framework are critical problems and the actions to deal with related problems should be done as soon as possible.

Strategy Formulation from the Results

Strategic Quadrangle

A strategic quadrangle can be drawn on the basis of the final strength intensity I_{FS}, final weakness intensity I_{FW}, final opportunity intensity I_{FO}, and final threat intensity I_{FT}. The intensity of S, W, O, and T can be coordinate axes in a new coordinate system. The intensity of S and W ($I_{FS} - I_{FW}$) is the x-axis, and intensity of O and T ($I_{FO} - I_{FT}$) is the y-axis. The strategic quadrangle is shown in Fig. 7.

The ranking for intensities of SWOT groups is strength > opportunity > threat > weakness. The superiorities of PPP itself are obvious, within which private capital is especially important. Meanwhile, project risks can be transferred to the private sector and shared with the private sector by using PPPs, which are also paid attention to by the public sector. The opportunities to develop public housing by PPPs are from the perspective of needs and policy supports, which demonstrate that development of PPPs is extremely urgent. However, the intensity of threats is close to that of opportunities, which means challenges can not be ignored. Providing adequate legal framework, emphasizing training of professional talents, and optimizing the public organization structure should be conducted to support the development of PPP housing. The negative influences from the weakness group are the least. Although many shortcomings of PPPs have been widely reported by Miraftab (2004), Li et al. (2005), and Regan et al. (2011), the positive influences from strengths and opportunities are more attractive for the public sector.

Strategic Formulation for PPP Housing in China

According to the results mentioned previously, the strategies to develop public housing by PPPs in China can be described as that public sectors should actively and aggressively bring all positive factors into play. In addition, aggressive strategies using strengths and opportunities are preferred to defensive options, simply minimizing weaknesses and threats when selecting strategy options (Rauch 2007). For formulating the strategies, the SWOT groups have to be searched for logical SWOT combinations that answer the following questions (Rauch 2007): (1) Which strength fits with which opportunity (SO combination)? (2) Which strength fits with which threat (ST combination)? (3) Which weakness fits with which opportunity (WO combination)? and (4) Which weakness fits with which threat (WT combination)? The formulation of strategies starts with finding the combinations. Therefore, SO, WO, ST, and WT strategies can be formulated as follows:

- SO strategies: internal strengths can be used to realize external opportunities.
  - Combination of S1/S2/O1: The public sector should take advantage of dominations of PPPs to grasp current opportunities. The utilization of private investment as well as advanced technologies and management skills would greatly benefit construction and operation of public housing (Yuan et al. 2009). Housing and services provided by the private sector would meet the increasing need for public housing.
  - Combination of S1/S2/S3/S4/O2: The public sector should firmly support PPP housing because policy supports from the central government to local government are very important. From a long-range perspective, a series of laws and regulations to facilitate PPP housing can be issued (Zhang and Zhou 2011). From a short-range perspective, local government can provide certain conveniences for specific PPP housing projects, like favorable taxes.
  - Combination of S1/O3: The public sector should provide a proper investment approach for the public sector. Hence, a large amount of capital from private organizations can be invested in public housing.
  - Combination of S1/S2/S3/S4/O4: An effective incentive mechanism should be designed by the public sector. Thus, the private sector can put its efforts in to constructing PPP

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housing to obtain sustainable competition and social reputation (Zhang and Zhou 2011).

- WO strategies: external opportunities can be used to reduce internal weaknesses.
  - Combination of O1/O2/O3/W1: Public housing in China means a huge market in which a large number of low-income residents should be further divided by the public sector into different groups on the basis of extensive measurement of payment ability of national and local residents (Hui 2001; Zhang et al. 2011). Currently, public housing in China includes low-rent housing, public rental housing, and affordable housing. Thus, appropriate housing types should be selected by the private sector in PPPs to make them earn certain profits. On the other hand, government subsidies and favorable policies should also be provided to the public sector to encourage it to build PPP housing.
  - Combination of O2/O4/W2/W3: The problems of public management have a very close relationship with public organization and governance. Thus, both the public and private sectors should make their efforts to explore optimal models for cooperation in PPPs to improve efficiency by using policy supports and private capitals. Additionally, the policies (e.g., incentive policies and sponsorship of government) should be carried out to protect the enthusiasm of the private sector (Xu et al. 2010).
  - Combination of O2/O3/W4: Although the financing capability of Chinese small-middle enterprises is relatively weak, they could make profits from housing PPP projects because there are no market risks in public housing, not like in commercial residential housing (Zhang et al. 2011). In this case, the public sector can provide a guarantee for the private sector to the financing organization to absorb private investments.
- ST strategies: internal strengths are used to minimize external threats.
  - Combination of S1/S2/S3/S4/T1/T2/T3: The external threats are mainly related to the problems of government itself. Therefore, the countermeasures for T1, T2, and T3 can be integrated. It is necessary to strengthen the government's legal framework and commitment mechanism, which includes adequate legal documents and usable legal clauses and would afford useful guidelines that can effectively use capital, advanced technologies, and management skills of the private sector (Quan 2006). At the same time, an appropriate risk allocation mechanism is also needed when negotiating and when the concession agreement is being assigned, which would utilize respective superiorities of the public and private sectors. Consequently, responsibilities between the public and private sectors would be explicit.
  - Combination of S2/T4: Establishment of platform for knowledge transfer has been proposed by Carrillo et al. (2006). Existing priorities of the private sector in human resources like technology professionals and management professionals can be used to help the public sector train related PPP professionals to achieve transferring knowledge.
- WT strategies: reduce the internal weaknesses to avoid external threats.
  - Combination of W1/W2/W3/W4/T1/T2/T3/T4: Shared ownership has been widely applied in the United Kingdom as one type of property right in developing public housing (Her Majesty's Treasury 2009). In China, public housing can be purchased or rented by low-income residents currently (Zhang and Zhou 2011). In any case, the private sector would not benefit from the change of ownership. Shared ownership means the private sector will share partial ownership that can be used to obtain more revenue, by which the interests of the private sector for PPP housing could be protected. Furthermore, the public and private sectors would work together in combination because of shared ownership, which would strengthen their relationships. In this case, the obligations and rights for both the public and private sectors would be clearer than before. Contemporarily, the development of nonprofit organizations could be facilitated by shared ownership because the allocation of ownership would better be conducted by a nonprofit organization.

Conclusions

In order to formulate the strategy to develop public housing by PPPs in China, the SWOT factors were identified on the basis of extensive literature review. Based on the identification of SWOT factors, the survey of a group of government officials was conducted. The respondents were asked to score and pairwise compare SWOT factors, which were used to analyze the strategy by the proposed improved SWOT–AHP method. Based on the results of the proposed method, the intensity for SWOT factors and group were calculated, which indicates that the strongest facilitating factors (strengths and opportunities) are solving the problem of public sector budget restraint and the large needs for public housing in China, and the strongest hindering factors (weaknesses and threats) for PPP housing are low profits for the private sector to participate in the delivery of public housing and the inadequate legal framework and unclear responsibility for both the public and private sectors. Furthermore, the strategy intensity was obtained according to the proposed method, which means positive facilitating influences are slightly greater than negative hindering influences for developing PPP housing. Finally, an aggressive and active strategy was determined based on the calculated results, through which a series of SO, WO, ST, and WT strategies are formulated to develop PPP housing. The discussion based on the proposed useful SWOT–AHP method in this paper is expected to generate interest in a more thorough understanding of the application of PPPs to facilitate the development of public housing in China, and hence, a series of strategies to develop PPP housing is hopefully useful for the public sector in the public housing system in the Chinese context.

Although the research on SWOT factors is helpful to understand the strategy to deliver public housing by PPPs in China, there are some limitations. First, the survey data used in this paper are from Jiangsu Province, China, government and Nanjing, China, local government, which could influence the representativeness of the paper. Second, SWOT analysis is just focusing on whole PPPs that can be divided in many submodels by different situations. Therefore, further research should extensively collect data from the national level and the comparison between different regions (e.g. east and west China) can be conducted. Moreover, future research should also focus on sub-PPP models.

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References

Abdul-Aziz, A. R., and Kassim, P. S. J. (2011). "Objectives, success and failure factors of housing public–private partnerships in Malaysia." *Habitat Int.*, 35(1), 150–157.

Arslan, O., and Er, I. D. (2008). "A SWOT analysis for successful bridge team organization and safer marine operations." *Process Saf. Prog.*, 27(1), 21–28.

Bardhan, A. D., and Barua, S. K. (2005). "Real estate industry: Creating value through public private partnerships." *India infrastructure report 2004: Ensuring value for money*, S. Morris, ed., Oxford University Press, Oxford, UK, 103–114.

Bloomfield, P. (2006). "The challenging business of long-term public–private partnerships: Reflections on local experience." *Public Admin. Rev.*, 66(3), 400–411.

Burger, P., Tyson, J., Karpowicz, I., and Coelho, M. D. (2009). "The effects of the financial crisis on public-private partnerships." *International Monetary Fund Working Paper*, Washington, DC ⟨http://www.ioe-emp.org/fileadmin/user_upload/documents_pdf/globaljobscrisis/generaldocs/2009_July_IMF_paper_on_crisis_impact_on_PPPs.pdf⟩ (Mar. 29, 2011).

Carrillo, P. M., Robinson, H. S., Anumba, C. J., and Bouchlaghem, N. M. (2006). "A knowledge transfer framework: the PFI context." *Constr. Manage. Econ.*, 24(10), 1045–1056.

Chan, A. P. C., Yeung, J. F. Y., Yu, C. C. P., Wang, S. Q., and Ke, Y. (2011). "An empirical study of risk assessment and allocation of publicprivate partnership (PPP) projects in China." *J. Manage. Eng.*, 27(3), 136–148.

Choi, J. H., Chung, J., and Lee, D. J. (2010). "Risk perception analysis: Participation in China's water PPP market." *Int. J. Project Manage.*, 28(6), 580–592.

General Office of the State Council of the People's Republic of China (GOSC). (2005). "The advices to improve the development of non-public economy in China." ⟨http://www.gov.cn/zwgk/2005-08/12/content_21691.htm⟩ (Mar. 28, 2011) (in Chinese).

General Office of the State Council of the People's Republic of China (GOSC). (2006). "The options to adjust housing provision structure to stabilize housing prices." ⟨http://www.gov.cn/gongbao/content/2006/content_327959.htm⟩ (Mar. 28, 2011) (in Chinese).

General Office of the State Council of the People's Republic of China (GOSC). (2010a). "The advice to encourage and guide private investments to develop infrastructure." ⟨http://www.gov.cn/zwgk/2010-05/13/content_1605218.htm⟩ (Mar. 28, 2011) (in Chinese).

General Office of the State Council of the People's Republic of China (GOSC). (2010b). "The notice for health development of housing market." ⟨http://www.gov.cn/zwgk/2010-01/10/content_1507058.htm⟩. (Mar. 28, 2011) (in Chinese).

General Office of the State Council of the People Republic of China (GOSC). (2010c). "The notice to hold back the speed of housing price growth." ⟨http://www.gov.cn/zwgk/2010-04/17/content_1584927.htm⟩ (Mar. 28, 2011) (in Chinese).

General Office of the State Council of the People's Republic of China (GOSC). (2011). "The notice to further strengthen housing market control." ⟨http://www.gov.cn/zwgk/2011-01/27/content_1793578.htm⟩ (Mar. 28, 2011) (in Chinese).

Griffin, L. (2004). "Creating affordable housing in Toronto using public private partnerships." *FES Outstanding Graduate Student Paper Series*, 9(2), Faculty of Environmental Studies, York Univ., Toronto, Canada ⟨http://www.yorku.ca/fes/research/students/outstanding/docs/lara-griffin.pdf⟩ (Mar. 28, 2011).

Her Majesty's Treasury. (2009). "Report of shared equity task force." ⟨http://www.eukn.org/E_library/Housing/Housing_Policy/Privately_Owned_Housing/Report_of_the_Shared_Equity_Task_Force⟩, (Mar. 28, 2011).

Hui, E. C. M. (2001). "Measuring affordability in public housing from economic principles: Case study of Hong Kong." *J. Urban Plann. Dev.*, 127(1), 34–49.

Jeon, Y. A., and Kim, J. (2011). "An application of SWOT-AHP to develop a strategic planning for a tourist destination." *16th Graduate Students Research Conf.*, Conrad N. Hilton College of Hotel and Restaurant Management, Univ. of Houston, and School of Hotel and Tourism Management, The Hong Kong Polytechnic Univ, Houston, Texas.

Kangas, J., Pesonen, M., Kurttila, M., and Kajanus, M. (2001). "A'WOT: Integrating AHP with SWOT analysis." *Proc. of the Sixth Int. Symp. on the Analytic Hierarchy Process*, Institute for Accounting and Controlling, University of Berne, Berne, Switzerland, 189–198.

Kappeler, A., and Nemoz, M. (2010). "Public-private partnerships in Europe—Before and during the recent financial crisis." *European Investment Bank Economic and Financial Report*, Luxembourg ⟨http://www.eib.org/attachments/efs/efr_2010_v04_en.pdf⟩ (Mar. 28, 2011).

Ke, Y., Wang, S. Q., Chan, A. P. C., and Cheung, E. (2009). "Research trend of public-private partnership in construction journals." *J. Constr. Eng. Manage.*, 135(10), 1076–1086.

Koppenjan, J. F. M., and Enserink, B. (2009). "Public–private partnerships in urban infrastructures: Reconciling private sector participation and sustainability." *Public Admin. Rev.*, 69(2), 284–296.

KPMG Company. (2009). "Financing Australian PPP projects in the global financial crisis." ⟨http://www.kpmg.com.au/Portals/0/Infrastructure_PPP-Projects-GFC200905.pdf⟩ (Mar. 28, 2011).

Kumar, S., and Bauer, K. F. (2010). "Exploring the use of lean thinking and six sigma in public housing authorities." *Qual. Manage. J.*, 17(1), 29–46.

Kurttila, M., Pesonen, M., Kangas, J., and Kajanus, M. (2000). "Utilizing the analytic hierarchy process (AHP) in SWOT analysis—A hybrid method and its application to a forest-certification case." *For. Policy Econ.*, 1(1), 41–52.

Kwak, Y. H., Chih, Y. Y., and Ibbs, C. W. (2009). "Towards a comprehensive understanding of public private partnerships for infrastructure development." *Calif. Manage. Rev.*, 51(2), 51–78.

Li, B., Akintoye, A., Edwards, P. J., and Hardcastle, C. (2005). "Perceptions of positive and negative factors influencing the attractiveness of PPP/PFI procurement for construction projects in the UK: Findings from a questionnaire survey." *Eng., Constr. Archit. Manage.*, 12(2), 125–148.

Logan, J. R., Fang, Y., and Zhang, Z. (2010). "The winners in China's urban housing reform." *Hous. Stud.*, 25(1), 101–117.

Meng, X. (2002). "Guarantees for contractor's performance and owner's payment in China." *J. Constr. Eng. Manage.*, 128(3), 232–237.

Ministry of Housing and Urban-Rural Development. (2011). "Further strengthen housing market control and improve housing conditions for low-income residents." ⟨http://www.mohurd.gov.cn/bldjgzyhd/201103/t20110310_202785.html⟩ (Mar. 28, 2011) (in Chinese).

Ministry of Land and Resources. (2010). "The notice to strengthen land provision for housing development and governance." ⟨http://www.mlr.gov.cn/zwgk/zytz/201003/t20100310_140797.htm⟩ (Mar. 28, 2011) (in Chinese).

Miraftab, F. (2004). "Public-private partnerships: The Trojan horse of neoliberal development?" *J. Plann. Educ. Res.*, 24(1), 89–101.

Mostafa, A., Wong, F. K. W., and Hui, C. M. E. (2006). "Relationship between housing affordability and economic development in mainland China—Case of Shanghai." *J. Urban Plann. Dev.*, 132(1), 62–70.

Pesonen, M., Kurttila, M., Kangas, J., Kajanus, M., and Heinonen, P. (2001) "Assessing the priorities using A'WOT among resource management strategies at the finnish forest and park service." *For. Sci.*, 47(4), 534–541.

Poncet, S., Steingress, W., and Vandenbussche, H. (2010). "Financial constraints in China: Firm-level evidence." *Chin. Econ. Rev.*, 21(3), 411–422.

Pongsiri, N. (2002). "Regulation and public-private partnerships." *Int. J. Public Sect. Manage.*, 15(6), 487–495.

Qi, C., Kreibich, Volker, and Baumgart, Sabine (2007). "Informal elements in urban growth regulation in China—Urban village in Ningbo." *ASIEN*, 103(S), 23–44.

Quan, Z. X. (2006). "Institutional transformation and marketisation: The changing patterns of housing investment in urban China." *Habitat Int.*, 30(2), 327–341.

Rauch, P. (2007). "SWOT analyses and SWOT strategy formulation for forest owner cooperations in Austria." *Eur. J. For. Res.*, 126(3), 413–420.

J. Manage. Eng. 2012.28:407-420.

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Regan, M., Smith, J., and Love, P. E. D. (2011). "Impact of the capital market collapse on public-private partnership infrastructure projects." *J. Constr. Eng. Manage.*, 137(1), 6–16.
Saaty, T. L. (1980). *The analytic hierarchy process*, McGraw-Hill, New York.
Saaty, T. L., and Vargas, L. G. (1990). *Models, methods, concepts and applications of the analytic hierarchy process*, Kluwer Academic, Boston.
Savas, E. S. (2008). "Privatization and public–private partnerships for local services." *Encyclopedia of public administration and public policy*, 2nd Ed., E. M. Berman, J. Rabin, and T. A. Wachhaus, eds., Taylor & Francis Inc., Florence, Kentucky.
Schüller, M., and Yun, S. Z. (2009). "China's economic policy in the time of the global financial crisis: Which way out?" *J. Curr. Chin. Affairs*, 38(3), 165–181.
Sengupta, U. (2006). "Government intervention and public–private partnerships in housing delivery in Kolkata." *Habitat Int.*, 30(3), 448–461.
Shinno, H., Yoshioka, H., Marpaung, S., and Hachiga, S. (2006). "Quantitative SWOT analysis on global competitiveness of machine tool industry." *J. Eng. Des.*, 17(3), 251–258.
Stephens, M. (2010). "Locating Chinese urban housing policy in an international context." *Urban Stud.*, 47(14), 2965–2982.
Stewart, J. (2005). "A review of UK housing policy: Ideology and public health." *Public Health*, 119(6), 525–534.
Taleai, M., Mansourian, A., and Sharifi, A. (2009). "Surveying general prospects and challenges of GIS implementation in developing countries: A SWOT–AHP approach." *J. Geog. Syst.*, 11(3), 291–310.
Tang, L. Y., Shen, Q. P., and Cheng, E. W. L. (2010). "A review of studies on public–private partnership projects in the construction industry." *Int. J. Project Manage.*, 28(7), 683–694.
Tsou, J. Y., Yu, H., and Hui, H. S. C. (2008). "Challenges for the implementation strategy of affordable China housing." *China Task Force Meeting of Initiative for Policy Dialogue*, Brooks World Poverty Institute at the University of Manchester, Manchester.
Ulrich, J. (2010). "China's housing imbalance—Is affordable housing the cure?" *J. P. Morgan's Hands-On China Reports*, 1–8.
Wang, Y. P., Wang, Y., and Bramley, G. (2005). "Chinese housing reform in state-owned enterprises and its impacts on different social groups." *Urban Stud.*, 42(10), 1859–1878.
Winch, G. M. (2000). "Institutional reform in British construction: Partnering and private finance." *Build. Res. Inf.*, 28(2), 141–155.
Xiao, Q. (2010). "Crashes in real estate prices: Causes and predictability." *Urban Stud.*, 47(8), 1725–1744.
Xu, Y., Yeung, J. F. Y., Chan, A. P. C., Chan, D. W. M., Wang, S. Q., and Ke, Y. (2010). "Developing a risk assessment model for PPP projects in China—A fuzzy synthetic evaluation approach." *Autom. Constr.*, 19(7), 929–943.
Yao, S., Luo, D., and Morgan, S. (2010). "Impact of the US credit crunch and housing market crisis on China." *J. Contemp. Chin.*, 19(64), 401–417.
Yu, Y. D. (2010). "The impact of the global financial crisis on the Chinese economy and China's policy responses." TWN Global Economy Series No. 25, ⟨http://www.twnside.org.sg/title2/ge/ge25.pdf⟩ (Mar. 28, 2011).
Yu, Z. (2006). "Heterogeneity and dynamics in China's emerging urban housing market: Two sides of a success story from the late 1990s." *Habitat Int.*, 30(2), 277–304.
Yuan, J. F., Skibniewski, M. J., Li, Q. M., and Shan, J. (2010). "The driving factors of China's public–private partnership projects in metropolitan transportation system: Public sector's viewpoint." *J. Civ. Eng. Manage.*, 16(1), 5–18.
Yuan, J. F., Zeng, Y. J., Skibniewski, M. J., and Li, Q. M. (2009). "Selection of performance objectives and key performance indicators in public–private partnership projects to achieve value for money." *Constr. Manage. Econ.*, 27(3), 253–270.
Zhang, J., Yuan., J. F., and Skibniewski, M. J. (2011). "The analysis on the policy of access to economically affordable housing in China by using incentive mechanism design." *Int. J. Strategic Prop. Manage.*, 15(3), 231–256.
Zhang, J., and Zhou, L. (2011). "Incentive mechanism design of access management policy in affordable housing and analysis." *Cities*, 28(2), 186–192.
Zhang, M. (2009). "The impact of the global crisis on China and its reaction (ARI)." ⟨http://www.realinstitutoelcano.org/wps/portal/rielcano_eng/Content?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/asia-pacific/ari62-2009⟩ (Mar. 28, 2011).
Zouggari, M. (2003). "Public–private partnerships: Major hindrances to the private sector's participation in the financing and management of public infrastructures via delegated management." *Int. J. Water Resour. Dev.*, 19(2), 123–129.

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