Procurement innovation for a circular economy of construction and demolition waste: lessons learnt from Suzhou, China

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Abstract

Amidst the global trend of advocating a circular economy, various nations and regions in recent years have started to explore innovative procurement models (e.g., Public Private Partnership [PPP]) in dealing with beset issues related to construction and demolition (C&D) waste. However, PPP is suffering from problems such as 'long negotiation time', 'lack of transparency', and 'uneven risk and return allocation', which in turn lead to 'ineffective delivery' and 'poor value for money'. Using a case study, this paper reports some lessons learnt from innovative practices of procuring C&D management services in Suzhou, China. It is discovered that the public and private sectors, without prior knowledge, are operating based on a general concession framework instead of negotiating a clear-cut agreement from the outset.

Several key arrangements, such as price, concession period, and strategic operations, are based on relational contract-type of agreements, which are found particularly innovative for shortening the negotiation time, fostering the trust between the relevant parties, dealing with emerging *ad hoc* problems, and allowing sustainable development of the circular economy. To make such PPP work, it is critical to devise institutions to prevent corruption and opportunistic behaviors. This research provides useful references to developing a circular economy. Although they focus on C&D waste management, the research findings can be applied to other public procurement settings, such as municipal solid waste management service.

Keyword: Procurement innovation; Public Private Partnership; Relational contract; Construction and Demolition (C&D) waste; Circular Economy; China

1. Introduction

While construction is highly regarded as the pillar industry for materializing the built environment, it is also a major culprit in contributing to environmental degradation. A particular byproduct of construction activities leading to environmental degradation is construction and demolition (C&D) waste (Lu and Yuan, 2011; Shen et al., 2007). The term 'C&D waste', also simply called construction waste, refers to the solid waste generated from construction, renovation, and demolition activities (Kofoworola and Gheewala, 2009; Roche and Hegarty, 2006). The U.S. Environmental Protection Agency (EPA) (2018) classifies C&D waste into seven groups according to their composition: concrete, steel, wood products, gypsum wallboard and plaster, brick and clay tile, asphalt shingles and asphalt concrete. The European Waste Catalogue classifies C&D waste into eight categories including concrete bricks, tiles and ceramics, wood, glass and plastic (SEPA, 2015). In Hong Kong, C&D waste is classified as either inert or non-inert depending on whether or not it has stable chemical

properties (EPD, 1998). Inert materials, such as soil, slurry, rocks, and broken concrete, account for the vast majority of all C&D waste. Non-inert C&D waste normally includes metal, bamboo, paper, and timber.

Today's massive construction activities have exacerbated the C&D waste issue. The UK, for example, generated 131 million tons of C&D waste in 2014, accounting for over half of total UK municipal solid waste (MSW) (DEFRA, 2018). In the U.S., the Environmental Protection Agency (EPA) (2018) estimated that 548 million tons of C&D waste were produced in 2015, more than twice the amount of its MSW. In Hong Kong, the statistics issued by the Environmental Protection Department (EPD) (2018) show that the quantity of C&D waste produced in 2017 was 1.54 million tons, equivalent to 4,207 tons per day. Common practice for dealing with construction waste is to dispose of it into landfills (Lu et al., 2011). Landfilling not only gives rise to negative social-economic impacts, but also leads to environmental degradation due to anaerobic decay of the disposed materials and thus the production of carbon dioxide, methane and leachate (Lu et al., 2015). It also rapidly exhausts invaluable landfill space. Researchers and practitioners worldwide have thus endeavored to manage C&D waste effectively. One of the key strategies is to advocate a circular economy (CE).

A CE aims at extracting the maximum value from resources and minimizing waste and pollution (WRAP, 2019). It serves as the alternative to the conventional 'take-make-use-dispose' economic development system, so called linear economy, which has led to severe environmental deterioration either by removing natural capital from the environment or by reducing the value of natural capital via waste-connected pollution (Murray et al., 2017). A CE is inextricably intertwined with the well-known '3R' principles, i.e. reduce, reuse and recycle, which are ranked in a hierarchy according to their desirability (Peng et al., 1997). A plethora

of ‘reduction’ measures have been proposed. Such measures generally involve adopting low waste production technologies; reducing waste by design; and so on (Lu and Yuan, 2011, Zhang et al., 2012). Reuse means using the same material or materials more than once during construction either for the same function, e.g. formwork (Ling and Leo, 2000), or a new function, e.g. using cut-corner steel bar for shelves (Duran et al., 2006). When reduction and reuse become difficult, recycling offers a final option before disposal and a variety of new materials can be made from construction waste, e.g. recycled aggregate (Akhtar and Sarmah, 2018). Recycling is both the terminal process of the 3R principles and fundamental to CE, making the flow of materials circular and closed.

Real-life 3R practices, in particular recycling, cannot self-sustain without support from the public sector, e.g., subsidiaries from governments. This is in economics a typical ‘market malfunction’ phenomenon. To this end, rather than purely relying on market the ‘invisible hand’ to intervene, governments around the world have taken environmental management as their fiduciary responsibilities, e.g., by devising policies and regulations, imposing levies, law enforcement, and providing financial incentive, *inter alia*. A clear trend is that governments tend to procure environmental management services from the private sector. On the one hand, governments face with the challenge of financing and expertise to manage the increasing amount of C&D waste. On the other hand, very few in the private sector are keen to invest in the C&D waste recycling industry given its demonstrated low profits. In recent years, several pilot C&D waste recycling projects have been implemented by applying innovative procurement models such as Public Private Partnership (PPP), Private Financial Initiative (PFI), and Build-Operate-Transfer (BOT), which are different from traditional models (e.g., Design Bid Build/Delivery) in procuring pubic services. These procurement models, originated in the

100 construction industry to procure public service infrastructure, are not new at all to many, but
101 they might be innovative to the C&D waste recycling industry.
102
103 The advantages of adopting innovative procurement models comprise of securing sufficient
104 finance; making good use of the specialty of the private sector; long-term relationship and
105 remuneration; higher quality and timely provision of public services; and so on (Cheung et al.,
106 2003; HM Treasury, 2000; Hossain and Wu, 2009; Li et al., 2005). However, the downside of
107 PPP has also emerged after it was implemented for years. The HM Treasury in the UK has
108 been widely recognized as the pioneer to explore PPP in procuring pubic infrastructure and
109 services. Therefore, review reports on PPP issued by the HM Treasury every few years possess
110 a predominant status among investors, institutions and governments for their strategic guidance
111 across the globe. Particularly, the HM Treasury's (2012) review report seems a timely one
112 providing candid rethinking that has led to direction shifting in PPP development. As
113 summarized in the report, PPP is suffering some serious problems. It requires an excessively
114 long negotiation time to try to define the services scope, pondering the risks, and discussing
115 the price and concession; an inherently risky decision. The procurement process is thus often
116 slow. Once the PPP contract is signed, there is insufficient flexibility, even there is a genuine
117 need to change the public sector's service requirements. The delivery is often in the private
118 sector's hand without sufficient transparency to the client. The original idea of PPP is to transfer
119 the risks to the private sector, which is considered in a better position to handle the risk.
120 However, the private sector often charges a high risk premium therefore PPP is often reportedly
121 expensive. The goal to achieve value for money via PPP is largely unattained. Although all
122 these strengths and weaknesses are mainly about procuring construction projects, they could
123 also happen to environmental management services procurement. The key challenge here is to
124 avoid the downside of PPP meanwhile exploit its advantages to procure quality environmental

125 management services and achieve value for money. However, current literature covers rather
126 limited experience with regards to procurement innovation for achieving a CE of C&D waste,
127 particularly in developing economies.
128
129 Therefore, this paper reports some experience learnt from a case study of adopting procurement
130 innovation in recycling C&D waste in Suzhou, China. As will be elaborated later, the case
131 devised some innovative arrangements under the general PPP model and fostered trust, which
132 can largely alleviate the problems associated with PPP. The deliverables of this paper mean to
133 benefit both the public and private sectors, inspire the deployment of more targeted and
134 innovative procurement systems, and advance the operation of a circular economy of C&D
135 waste. The reminder of the paper is divided into five parts. Subsequent to this Introduction is a
136 detailed literature review to provide readers an understanding of the concepts involved. Next
137 is a methodology section introducing the research design. It is a case study involving a mixed
138 method approach including interviews, non-participatory observations, and qualitative and
139 quantitative data triangulation. The forth section elaborates on the detailed information of the
140 case. Fifth is a discussion of key findings followed by a conclusion in the sixth section.
141
142 **2. Literature review**
143 **2.1. A circular economy for C&D waste**
144 Circular Economy (CE) is a new model and economic paradigm that has gained momentum
145 over the past decades. The dominant interpretation of CE was defined "an industrial economy
146 that is restorative or regenerative by intention and design" (Ellen MacArthur Foundation, 2013).
147 Central to the concept of CE is the transformation of the status quo where production and
148 consumption remain based on a linear economy towards closing the loop of an industrial
149 ecosystem and circular flows (Larsson, 2018; Stahel, 2016). CE aims to decrease resource

consumption, reduce pollution emissions, minimize C&D waste generation, eliminate environmental impacts, and provide social benefits, e.g., increase employment (Dumlao-Tan et al., 2017; Ghisellini et al., 2018; Stahel, 2016). The objectives of CE can be achieved through the 3R principles, i.e., reduce, reuse, and recycle to improve the efficiency of resource use as well as the effectiveness of construction (Bu et al., 2013; Ghisellini et al., 2018; Peng et al., 1997).

Attempts to respond to increasing pressure on resources and the environment through a CE solution have been outlined in various international policies and programs, such as the UN-Habitat's New Urban Agenda. Recycling products to extend their useful lives is the critical link of closed-loop systems and has been in practice at the industrial scale since the 1940s, e.g., the pressing need to reuse car and truck scrap given the war-induced strain on virgin materials (Lieder and Rashid, 2016). Several developed economics, e.g., Sweden, Germany and Japan, began maturing C&D waste recycling programs in the 1990s (Lieder and Rashid, 2016). China, one of the major national consumers of natural resources, now faces a series of severe changes following its five decades of extensive economic growth. A shortage of virgin resources, excessive energy consumption and environmental degradation have compelled the Chinese government to issue its first guiding document for CE development in 2005 (Wen and Meng, 2015; Yuan et al., 2006; Zhang et al., 2008). The launch of "The Circular Economy Promotion Law" in 2009 promoted CE development in the form of national legislation (Mathews and Tan, 2011).

CE has also been increasingly advocated in dealing with C&D waste generated from construction due to global urbanization and urban renewal. This is particularly urgent in emerging countries where economic development must be sustained by construction activities,

while the massive amount of C&D waste generated and accumulated as a grand challenge that the economies have not experienced before. In China, for example, Lu et al. (2017) estimated that approximately 1.13 billion tons of C&D materials were generated in 2014. Around twenty sizable professional recycling companies are handling C&D waste. Their capability for waste treatment is meager given the huge amount of waste generated by the construction sector. The C&D waste recycling rate, less than five percent in China, pales in comparison with Japan's 95% (Lu and Yuan, 2013). Previous studies and reports reveal how the C&D waste recycling industry encounters a number of practical issues. A prominent one is the current legal deficiencies in relation to C&D waste management; very few regulations stipulate the appropriate waste treatment procedures. The majority of C&D waste ends up dumped improperly, and often illegally, without proper segregation. Meanwhile, relevant policies issued by various authorities overall fail to form a unified policy system that fosters industrial movement. The inadequate investment funding and facility result in low efficiency and effectiveness in C&D waste disposal. In addition, it is difficult to form an industrial chain spontaneously under market conditions. The profitability of C&D waste recycling industry is relatively lower compared with other industries. Subsequently, C&D waste recycling in China, similar to other emerging economies, remains stagnant. The industry is still largely state-led, as they are traditionally perceived as the inherent responsibilities of governments. Introducing procurement innovation into the C&D waste recycling industry is high on the governments' agenda.

2.2. Procurement innovation applied in the context of C&D waste recycling industry

Various scholars have defined the concept of procurement in the construction sector by reflecting on the altering and expanding nature of the process' scope in achieving construction projects (Lu et al., 2013; Walker and Hampson, 2008). Kumaraswamy and Dissanayaka (1998)

200 see procurement as “the action or process of acquiring or obtaining material, property or
201 services at the operational level”; building procurement as “the amalgam of activities
202 undertaken by a client to obtain a building”; and construction procurement as “the framework
203 within which construction is brought about, acquired or obtained.” The concept of procurement
204 innovation can be understood as innovative procurement in contrast to the traditional
205 procurement system in construction. The traditional procurement system, normally perceived
206 as Design-Bid-Build (DDB), has been the prevailing choice of project delivery system for quite
207 a long time (Masterman, 2002; Miller et al. 2000; Pakkala, 2002). In this conventional system,
208 the procurement of public construction projects tends to be riddled with practical issues, such
209 as cost overrun, delays in delivery, excessive staff and inefficiency (Dubois and Gadde, 2002;
210 Lu et al., 2013). Governments around the world probe into mounting demands for innovative
211 procurement systems that can help to overcome these problems and thus improve value. There
212 is an opportunity for innovations surface in each aspect of the procurement process, e.g.,
213 ownership, selection means, price basis, responsibility for design, responsibility for
214 management, number of sub-contractors, and risk-sharing (Hughes et al., 2006). The
215 combination of these aspects tenders wider procurement options where innovations could occur.
216
217 Among these eligible innovative procurement models, PPP and its variations have gained wide
218 popularity as the leading innovative procurement system worldwide (Tang et al., 2010). PPP
219 is generally conceptualized as a long-term contractual arrangement between the public and
220 private sectors in order to provide infrastructure facilities or services once considered the sole
221 responsibility of the public sector (Alexandru, 2015; Bloomfield, 2006; Garvin, 2010; NCPPP,
222 2007). Compared with traditional procurement, where design, build and operation are
223 performed as separate contracts, PPP adopts the building of contracts, i.e. the whole execution
224 of the project is granted to one private sector entity (Ross and Yan. 2015). A special purpose

225 vehicle (SPV) is formed as the legal entity that acts as the concessionaire to implement the PPP
226 project. Both public and private sectors believe this innovative procurement system could
227 provide inherent advantages in risk sharing that manifests from following aspects (Chauhan
228 and Marisetty, 2019; HM Treasury, 2000; Lee, 2018; Li et al, 2005; Ross and Yan, 2015).
229 (1) The public sectors can relieve the financial liability on social infrastructure funding by
230 bringing in private investment and reduce the uncertainty of future cash flows.
231 (2) The private sectors can moderate their underinvestment.
232 (3) The public sectors can harness the expertise of private sector to deliver public facility and
233 services with greater efficiency, effectiveness and quality.
234 (4) The partnership between the public and private sectors can be enhanced under the long-
235 term contractual agreement.
236
237 The PPP model and its variations (e.g., Build-Operate-Transfer, BOT) are being implemented
238 to deliver infrastructure projects in a wide range of sectors, such as transportation (Verweij,
239 2015), water (Chen, 2009; Zheng and Tiong, 2010), healthcare (Acerete et al., 2011; English,
240 2005), prisons (Liu and Wilkinson, 2014), and power supply industries (Tam et al.,1994; Wang
241 and Tiong, 2000; Xu et al., 2015). Despite the popularity of the various PPP models worldwide,
242 these systems can prove inadequate. The drawbacks of PPP in real practice as reported by
243 various research and reports can be summarized as follows (Alexandru, 2015; Brinkerhoff and
244 Brinkerhoff, 2011; Qiao et al., 2001; Ross and Yan, 2015).
245 (1) 'Long negotiation time': It takes extremely long time for the public sector to define the
246 scope of services, the private sector to consider all the risks, before they can reach a clear-
247 cut, rigid contract;
248 (2) 'Lack of transparency' makes the delivery of the project a black box to the client;

(3) ‘Lack of flexibility’ may weaken the public sector’s ability to adapt to the altering demand; and

(4) ‘Uneven risk and return distribution’: The private sector desires to obtain compensation for counteracting risks and in turn will increase public sector expenses.

There are many other drawbacks making the value for money largely unattained in many PPP projects if not carefully planned and executed.

Amid the widespread advocate of a CE, innovative procurement models have also been increasingly adopted in procuring environmental management services. For example, Xu et al. (2015) presents a case study of PPP waste-to-energy incineration project by focusing on the critical risk factors, such as insufficient waste supply, disposal of non-licensed waste, environmental risk, payment risk, and lack of support infrastructure. It is considered that the C&D waste recycling business has its uniqueness such as low profitability, heavily regulated, and sporadic supply of recycled materials while it has commonalities (e.g., high initial investment) with other public service infrastructure procurement. It is thus envisaged that the problems of PPP, e.g., ‘long negotiation time’, ‘lack of transparency’, ‘ineffective delivery’, and ‘uneven risk and return allocation’, will have their reflections in the C&D waste recycling industry.

In summary, procurement innovation applied to the C&D waste recycling industry means BOT or other partnering models, which derive their sense of “innovative” by comparing with traditional DBB in a market without sufficient pricing and operation information. However, even PPP is not perfectly innovative and needs no improvements. Instead, it is some detailed,

innovative practices under the umbrella of PPP to make the model innovative and sensible for a C&D waste circular economy.

3. Research methods

To reiterate, this research aims at reporting some insights that can be used to improve procurement innovation in attaining a circular economy of C&D waste. The insights are derived from a case study conducted in Suzhou, China. Case study research allows the exploration and understanding of complex issues based on the primary data collected (Yin, 1994). It is a "research strategy which focuses on understanding the dynamics present within single settings." (Eisenhardt 1989, p. 534). Case study can be considered a robust research method, particularly when a holistic, in-depth investigation is required. A combination of qualitative methods suggested by Yin—including on-site observation, interviews, and triangulation—have been adopted in this case study.

3.1 Case descriptions

The case under investigation is a C&D waste recycling project located in Suzhou, China. Suzhou is a city with over 2,500 years of history and famous for its classical gardens. Meanwhile, the ancient city has also experienced fast urbanization, making it one of the most developed urban areas in China. Suzhou has achieved spectacular economic growth in the past decades with its Gross Domestic Product (GDP) stabilized in the top 10 among all the cities in China, ranked the 7th in 2017 (NBS, 2017). Suzhou is now also famous for the successful development of the China–Singapore Suzhou Industrial Park. The fast economic development, urbanization, and construction activities have pushed their associated C&D waste issues to the top of the local municipality government's agenda.

297 The case recycling project was initiated under this backdrop by Suzhou Government Urban
298 Management Bureau (called UMB hereafter) and operated by the Suzhou Construction
299 Material Recycling Co. Ltd. (called CMRC hereafter) by adopting a PPP model since August,
300 2013. Therefore, the year of opening is 6 years as of August, 2019. Here, the 'company' is used
301 interchangeably with the 'project' or the 'facility' to refer to the same thing. The project
302 occupies an area of 7.6 hectare and received an investment of RMB 113 million (USD 1 is
303 RMB 6.72 equivalent) injected by CMRC's two parent companies. During the 6 years of
304 opening of the facility, the medium value of C&D waste treated is 1,000,000 tons per year and
305 the medium values of recycled materials obtained include 150,000 m^3 of recycled bricks and
306 700,000 tons of recycled aggregates every year. The sources of the C&D waste received of the
307 facility mainly include new construction, demolition, and road reconstruction within the
308 territory of Suzhou. Specifically, types of recycled aggregates are characterized by the diameter
309 range of the aggregates, mainly including 0-5mm, 5-15mm, 15-30mm, and above 30mm, while
310 recycled bricks can be basically classified into two generic groups: wall bricks and floor bricks
311 according to their applications with various sizes available.
312
313 As the private entity, also the concessionaire of the project, CMRC is underpinned by
314 concession agreement with Suzhou UMB. The agreement specifies all the major rights and
315 obligations of the both parties. Under the agreement, CMRC is granted the franchise right of
316 the project, in relation to the concession given for design, planning, financing, building,
317 operation, maintenance and transfer of the project. The agreement covers a concession period
318 of 15 years excluding the construction period unless supplementary clauses modified by mutual
319 agreement between the parties if necessary. At the end of contract, the ownership of the
320 facilities will be transferred back to UMB in good condition for free without any indebtedness.

Therefore, this is typically a PPP project adopting BOT as a specific model. Figure 1 illustrates the principle bodies involved and contractual structure of the case.

<<Insert Figure 1>>

As the public agency, UMB is the authority in charge of supervising the project operation. It is obliged to provide at least 1 million tons of C&D waste every year for CMRC to process. If the annual supply of C&D waste is less than the guaranteed amount, the concession period will be extended automatically for one year. According to the national taxation regulation, CMRC can enjoy the value-added tax rebatement. In the current concession agreement, there is no clause regarding operation revenue guarantee or financial compensation. The project has operated for three years. It is considered a successful example of procurement innovation for the recycling industry in a rapidly developing municipality. Therefore, the project was chosen for a case study, which was unfolded in two successive and interconnected phases between October and December 2018. The first phase was a detailed site investigation of the company to more intuitively understand how it works. Following the site investigation, the second phase concerns semi-structured interviews with the director in charge of its routine management. Figure 2 shows the complete operational mode of the case.

<<Insert Figure 2>>

3.2 Site investigation

Site investigation refers to research undertaken in the real world, where the confines of a laboratory environment are abandoned in favor of a natural setting (Salkind, 2010). A variety of disciplines recognize it as an effective way of collecting qualitative data. Authors of this paper attended a site visit to Suzhou CMRC in October 2018. The site investigation mainly comprised two parts. The first was conducted on site where direct observation of the current

practices of recycling C&D waste was applied. Figure 3 shows one of the initial processes to deal with the raw materials. Some of the equipment are imported from European countries. Some are supplied by Suzhou local industry. Figure 4 is the equipment the company used to sort and/or crush the C&D waste in the preliminary stage. The equipment is allocated in different rooms to process different sizes of the waste. The environment is rather dusty covered with glass wall. The photo in Figure 4 was taken behind the glass wall to reflect the dusty environment, to which workers were not directly exposed. After the C&D waste being sorted and crushed by using the equipment, aggregates in different sizes can be obtained. Figure 5 illustrates the equipment that turns the processed C&D waste materials into bricks. With the equipment shown in Figure 5, part of the recycled aggregates treated by the equipment in Figure 4 can be pressed under high pressure to make recycled bricks.

<<Insert Figure 3>>

<<Insert Figure 4>>

<<Insert Figure 5>>

Since turning the C&D waste on site into the final recycled product requires a series of treatments, different workshops responsible for each step in the process were visited. Each workshop's personnel in charge elaborated on the techniques and machines applied in the treatment of C&D waste. Many questions were asked throughout the visit and answered directly and in detail by the accompanying professional personnel. The first part of the site investigation significantly deepened the authors' understanding of how in reality C&D waste is turned into recycled products. Afterwards, the director in charge of the routine management of the company led a group discussion in the office, introducing the company's development state, operational status, and prospects.

371 **3.3 Interviews**

372 Semi-structured interview, as a research method, is defined as a qualitative data collection
373 method where the researcher asks informants a series of planned but open-ended questions
374 (Given, 2008). Given the versatility of semi-structured interview, it has become one of the most
375 commonly adopted means of data collection for qualitative research (Cook, 2008). Based on
376 the understanding gained from the site investigation, a series of semi-structured interviews with
377 the director and managers of CMRC were conducted. In total, two rounds of interviews were
378 conducted. The first round was mainly to have an overall impression on their procurement
379 system, therefore the questions asked were more open-ended, for example:

380 (1) Why was PPP chosen to operate this project?
381 (2) Can you describe the negotiation process with the government on the contractual
382 agreement?
383 (3) What is the collaboration mechanism of the company with other stakeholders,
384 particularly local government agencies such as Land Department, Tax Department,
385 Finance Department, UMB, EPD; financing institutions, and insurance companies?
386 (4) What obstacles did you encounter when operating this project?
387 (5) What has been the general profitability of this project to date?

388

389 The second round of interviews was conducted a week after. It was meant to both validate the
390 data collected from the first round of interviews and collect more targeted and in-depth
391 information. The questions asked in the second were more targeted to the details of the
392 concession contracts of the project, for example:

393 (1) Why does it stipulate in the contract that the government should provide at least a
394 million tons of C&D waste to the company annually?
395 (2) Why is the concession period of the company stipulated as fifteen years?

(3) How do you ensure the authenticity and validity of the data of the audit?

(4) How exactly does the government financially subsidize the company?

The two rounds of interviews were conducted between November and December 2018. The first lasted roughly two hours, while the second lasted an hour and a half. Detailed notes were taken during the interviews in lieu of an audio-recording. Data collected from the second phase is triangulated with the first phase to uncover the innovative procurement system. Also, data collected from the first phase helps the second phase proceed more smoothly and precisely.

4. Lessons learnt from the case

With reference to the information presented in the case description through site investigation and semi-structured interviews, the lessons learnt from the case could be summarized and elaborated below.

4.1. Adopting a relational contract-type of concession framework

Unlike the traditional PPP practices trying to stipulate all the clauses as detailed as possible in a formal contract, the case herein is operating based on a general concession framework. The contract between the public agency and private entity in the case tends to be informal and based on verbal agreement. A few innovative arrangements have been observed. First, the framework does not exactly stipulate the way and the amount of the public agency to subsidize the private entity financially during the concession period. That means the critical issues related to pricing and concession period are not fixed when the agreement was signed. It may not be easy to decide such clauses in emerging economies where past information for decision-making is absent. In China, C&D waste recycling industry is still in its infancy, which exists a myriad of

uncertainties. Likewise, the market for trading recycled construction materials is still immature (Lu and Yuan, 2010). The director of CMRC in the interview explained that:

> *"The market prices of our recycled products are only approximately 50-60% that of ordinary products and thus our profitability is rather poor."*

Even for developed markets such as Hong Kong, pricing waste recycling services through competitive bidding and tendering, is rather random. It thus makes sense that verbal agreement is adopted in this case due to the specificity of the C&D waste recycling industry. This arrangement also saves the long negotiation time to ponder price and concession period. Second, it is contracted that every three years, the public agency will designate a third-party institute to audit the company about its business, finance, risk, and so on. Based on the results of a thorough audit, both public and private parties are committed to re-negotiating the contractual agreement governing the project. The director of the company added that:

> "*The C&D waste recycling business is the rarely high-tech industry in China, and thus honestly in nature our behavior appears more in a public welfare manner compared with its low profitability given the stringent regulations, massive initial investment, sporadic waste supply, immature market, unprofitable guaranteed-return and other uncertain risks."*

This actually overcomes the problem of 'lack of transparency' of traditional PPP. The arrangement here provides an appropriate window of opportunity to revisit the agreement and the risks allocation between the parties. Third, the contracting clauses are possible to be amended during the concession period through renegotiation between the parties. Therefore, it overcomes the problem of 'lack of flexibility' of traditional PPP. For example, the two parties can further negotiate the capacity of processing C&D waste when there is a need. The

arrangements can also foster the trust between the two parties to allow a virtuous circle for the project delivery. The director of the company further added that:

> *"Traditionally, the treatment of C&D waste is believed to be the inherent duty of government. In this project, we explore to apply PPP as a new model for sharing risks with the public sectors, and further to take it as a starting point for exploring the feasibility of PPP in C&D waste recycling industry. That's why so many clauses in our agreement are flexible in case necessary adjustments can be made in time in response to the uncertainties."*

Economics theories, particularly the relational contract (RC), provide an explanation to the innovative procurement in this case. Both academia and practitioners have come to realize the drawbacks of the traditional contract whereby all relevant future contingencies should be presented and detailed. Given the myriad of uncertainties associated with a PPP project, it would be extremely costly (i.e., high transaction cost [Williamson, 1985]) if not entirely impossible, to articulate every contingency in a rigidly drafted formal contract. RC is defined as a transaction specific and ongoing administrative contracting, emerging in response to the ever-increasing requirements of prolonged duration and high complexity of products/services (Macneil, 1974, 1978). RC contracting parties value the contracting relationships and manage their transactions within certain mutually accepted social guidelines or norms of behavior, instead of simply following the given contract clauses exclusively (Lyons and Mehta, 1997). Compared with traditional contract, RC stressed the importance of informal institutions, such as trust, culture and collaborative atmosphere in reducing the opportunistic behaviors. The way of verbal agreement reflected in this case is underpinned by the trust and collaborative atmosphere between the parties. Additionally, Chinese culture entails that informal factors, such as verbal agreement are more effective to avoid disputes between the parties because in

China the authority of local government will surpass the spirit of contract, which is widely recognized in the western countries as the key to sustaining the healthy development in PPP. Therefore, adopting a relational contract-type of concession framework is a notable lesson learnt from this case to develop C&D waste recycling industry.

4.2. Mechanisms to protect the interests of both parties

Another lesson learnt is the intangible mechanisms to protect the interests of both parties. First, it is agreed that the overall concession period is 15 years excluding construction time. That allows a reasonably long period of time to foster the long-term relationship, and to experience the learning curve, which are widely propagated benefits of PPP procurement. Meanwhile, the three-years interval review is also a good mechanism to protect the interests of both parties. Second, the specific contracting clause to stipulate the minimal supply of 1 million tons every year is another mechanism to attain the win-win situation. One manager of the company added that:

> "*C&D wastes were delivered to our plant by the UMB without any transport charge and we determined this amount, e.g. 1 million tons by estimating Suzhou's future construction magnitude."*

Notably, both the public agency and private entity reach the consensus to set the minimum level of C&D waste supplied by the public agency as the threshold rather than the direct finance subsidy. If this clause is not reached, then the concession period will be extended one year more automatically. On the one hand, the public agency, Suzhou local government has a highly pressing need to tackle C&D waste problems owing to the massive economic growth and the urgency to achieve the mission of sustainability as the top of the government's agenda. The manager further added that:

"*As the project was initialed by Suzhou government, they expected to launch of the plant as soon as possible. The government did provide great support to facilitate reaching the agreement.*"

Therefore, recycling 1 million tons of C&D waste every year can significantly release local government's pressure. On the other hand, for the private entity, sporadic waste supply could be a major business risk, which has also been listed as a critical risk factor in many waste-to-energy incineration projects (Xu et al., 2015). The manager further added that:

"We are very thankful for their great support. For example, the UMB took a lead to communicate and coordinate with private sectors and also other government departments so that the efficiency of administrative procedures is significantly improved. Besides that, the land for the plant was offered by Land Department almost free; the value-added tax was rebated by Tax Department. All these conditions do release the cost pressure to a large extent from our side."

Therefore, the mechanisms to set an overall 15-years concession period with 3-years reviews, and to set the 1 million tons of minimal supply of C&D waste per annum are innovative arrangements that can overall the problems of traditional PPP, such as 'lack of flexibility', 'uneven risk and return allocation', and 'ineffective delivery'.

4.3. Transparent information sharing platform

To avoid the divergence of the parties and reduce the room for opportunistic behaviors to a maximum degree, the transparent information sharing platform, perceived as a formal way to work concurrently with the informal way (e.g., verbal agreement) is an important innovation in this case. In the digital platform, some basic information, such as the weight of C&D waste

every time delivered by the truck from the site to the company and the track taken by the truck with the aid of positioning technologies such as Global Positioning System, is shared and updated in a real-time manner. Another manager of the company explained that:

> *"Since the re-negotiation process of the contractual agreement and compensation will be largely based on the interval review every three years, therefore it is of particular importance to record the data and archive the files in a transparent manner so that the interests of both parties can be protected."*

This can not only prevent the illegal dumping cases of C&D waste, but also provide a direct reference for both sides to check whether it fulfills the requirement of 1 million tons of C&D waste as stipulated in the contract. From the amount of C&D waste intake, the amount of the products made from it and finally the revenue of the company can be approximately estimated. Furthermore, it also forms the basic data from the shop-floor when conducting the auditing to determine the new pricing clauses or subsidy after the concession period. This platform helps the government to monitor the ground truth of the operation. The manager admitted in the interview that:

> *"To be honest, with this platform, both government and us can save tremendous efforts to check the data and archive the files, which we think is beneficial to our continuous collaboration. From this sense, the platform does enhance our trust and relationship with the government."*

Therefore, the third lesson worthy of learning from this case is the existence of transparent information sharing platform.

5. Discussion

5.1 Challenges to prevent opportunistic behavior

Williamson (1985) argued that future contingencies pertaining to a transaction should be presented and detailed in a contract. When the presentation failed to exhaust the future uncertainties, the contract would make room for opportunistic behaviors (Williamson, 1985). The RC-type of concession framework adopted in this case, although having various advantages, may give rise to opportunistic behaviors, such as poor management, inferior quality of the recycled materials and price, claims, and disputes, since the profits are by and large guaranteed by the subsidies to be calculated when the concession period is finished. The three-year review and the information sharing platform, together with the technical means, provide a window of opportunity to gauge the operation and prevent such opportunistic behaviors. The director of CMRC said that:

> *"At the initiative stage of this plant, the government was also concerned we may not work so hard to operate the company as so many clauses in the agreement are flexible. That's why the government proposed to install the information sharing platform."*

However, how to monitor the company's behavioral operation is a new challenge. If the monitoring exceeds a certain degree, it will jeopardize the autonomy of the private entity in its day-to-day operation. It will further damage the trust and collaborative atmosphere between the parties, which actually are the basic foundation the case is built on. If the monitoring is not close enough, then very likely opportunistic behaviors could happen, leading the public agency to suffering a loss.

570 **5.2 Challenge to prevent corruptive behavior**

571 A major concern to use traditional procurement models (e.g., DBB) is to prevent corruption,
572 which is not uncommon in public procurement. The RC-type of concession framework
573 shortened the negotiation time, lowered the transaction costs, provided the flexibility and trust
574 to deal with emerging *ad hoc* problems, and allowed sustainable development of the circular
575 economy. The manager of the company explained that:

576 *"As so many clauses in the agreement are flexible, the government can spare no effort*
577 *to help us launch the plant as soon as possible so that the plant can be put into*
578 *production very quickly to solve the ingrained C&D waste issues."*

579

580 Rather than based on a clear-cut contract, the operations of the project relied heavily on
581 "shaking-hand" agreements. However, such arrangements may propagate corruptive behavior,
582 mainly from the public sector, e.g., bribery, lack of quality assurance, shirk-off, and so on. The
583 audits can alleviate the issue to a certain extent, but how to prevent potential corruptions in
584 numerous verbally agreed transactions is a particular challenge to impact the delivery of the
585 PPP procurement.

586

587 **6. Conclusion**

588 C&D waste, due to its adverse impacts on the environment, has been receiving continuous focal
589 attention worldwide. The key to tackling the issues arising from C&D waste is to integrally
590 apply the well-known "3R" (i.e., reduce, reuse, and recycle) principles to achieve a circular
591 economy. However, 3R, in particular C&D waste recycling, is still in its infancy. Guaranteeing
592 that the industry develops sustainably requires an innovative procurement system, and this
593 paper seeks to draw upon some lessons from a case study based in Suzhou, China where an
594 innovative procurement system is adopted to procure a circular economy.

The lessons learnt from this case can be summarized into three key points, namely, (1) Adopting a relational contract (RC)-type of concession framework; (2) Mechanisms to protect the interests of both parties; and (3) Transparent information sharing platform. First, the RC-type of concession framework avoids the long negotiation time to articulate and stipulate every contingency in a rigidly drafted formal PPP contract. The RC-type of concession framework also helped foster the trust between the relevant parties, dealing with emerging *ad hoc* problems, as well as allowing sustainable development of the circular economy. Second, there are several innovative mechanisms to protect both parties' interests to avoid uneven distribution of risks and returns in traditional PPP projects. A notable mechanism is a 15-years overall concession period but a review in every three years to allow injecting flexibility, transparency, and re-negotiation of the project delivery and profits. Another innovative mechanism is the guarantee of a minimal annual supply of 1 million tons of C&D waste; this is similar to a stabilizer that can be seen from some PPP toll-gated road projects, where sufficient traffic flow is often an issue. Third, there is a transparent information sharing platform where some basic data are shared and updated in a real-time manner. The information forms the truth for daily operations, reviews, gauging the contract enforcement, as well as determining the profits of the project. The platform, perceived as a formal way to work concurrently with the informal way, verbal agreement, guarantees the healthy development of this case. Nevertheless, there are some loopholes that should be paid special attention to make the procurement innovation work. Major challenges include how to prevent opportunistic behaviors from the private entity, and corruptive behaviors from the public agency.

The research could provide useful reference for the industry to inspire the development of more targeted and innovative procurement systems and foster the development of a CE. Although it

620 focuses on C&D waste management, the findings can be also applied to other settings,
621 particularly when the world is searching for innovative models to procure many public services
622 that are traditionally provided by the public sector.
623
624 **7. Acknowledgement**
625 This research is supported by the General Research Fund (GRF) (Project No.: 17201917) from
626 the Hong Kong Research Grants Council (RGC) and Public Policy Research (PPR) (Project
627 No.: 2018.A8.078.18D) and Strategic PPR (Project Number: S2018.A8.010) Funding Schemes
628 from the Policy Innovation and Co-ordination Office of the Government of the Hong Kong
629 Special Administrative Region.
630
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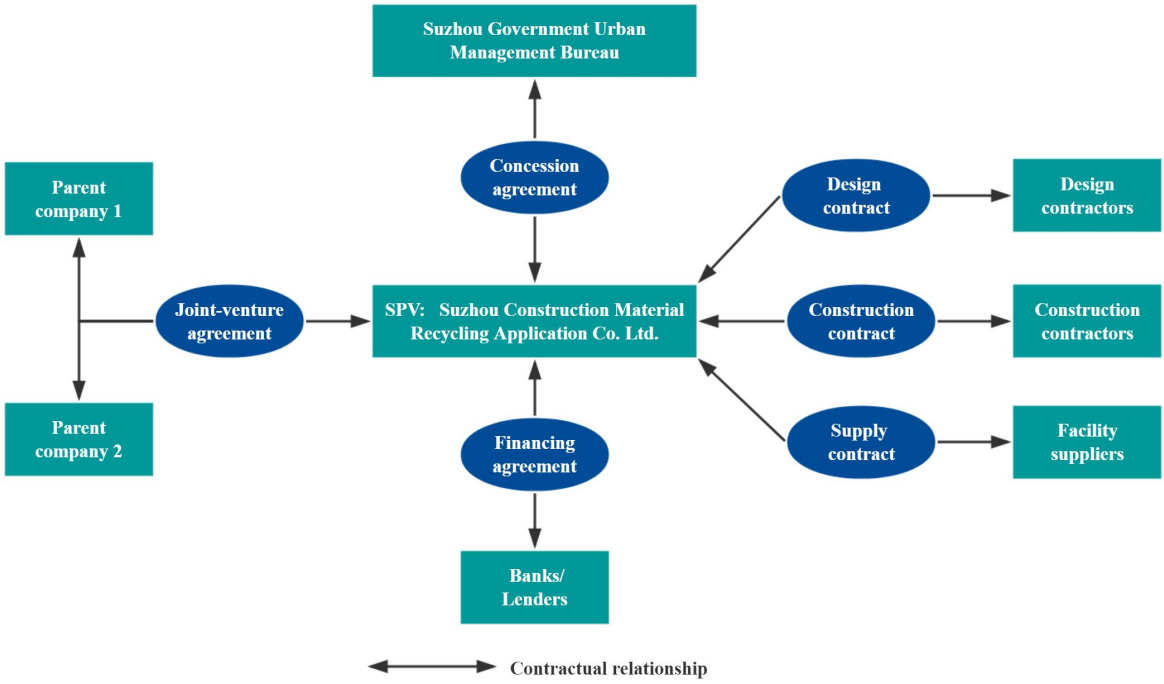

Figure 1 Principle bodies and contractual structure of the project

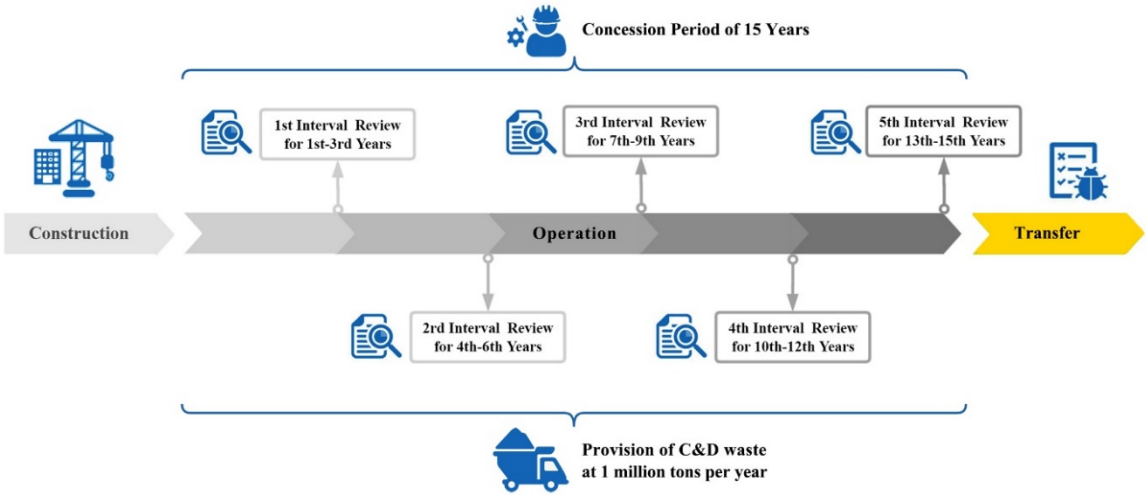

Figure 2 Operation of the PPP project

Figure 3 Raw material processing equipment

Figure 4 C&D waste treatment equipment

820

821 Figure 5 Brickmaking equipment

822