How external stakeholders drive the green public procurement practice? An organizational learning perspective

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Abstract

Purpose – This study aims to uncover the black box of the influence mechanism between external stakeholder drivers and green public procurement practice, and meanwhile to explore the moderating role of administrative level in this process. Green public procurement (GPP) has been widely implemented. Existing literature has found that external stakeholder drivers can affect public sectors' GPP practice, however, the definition of its connotation is still unclear, and how external stakeholders affect GPP practice has remained a black box.

Design/methodology/approach – After defining the major external stakeholders, this study develops a multiple mediation theoretical model using survey data from 142 Chinese local public sectors. It aims to uncover the black box of the influence mechanism between external stakeholder drivers and GPP practice and meanwhile explore the moderating effect of administrative levels in this process.

Findings – The results show that external stakeholder drivers have a positive relationship with GPP practices. The knowledge of GPP implementation policies and the knowledge of GPP benefits can both mediate this relationship. This study also finds that the administrative level of public sectors can positively moderate the mediating effect produced by the knowledge of GPP implementation policies and negatively moderate the mediation effect produced by the knowledge of GPP benefits.

Social implications – Local governments need to better encourage public sectors to implement GPP. Managers of public sectors need to pay attention to organizational learning to acquire relevant knowledge on GPP.

Originality/value – This study makes a theoretical contribution to a better understanding of the influence mechanism for GPP practice. This study also provides comparisons of GPP implementation policies between China and European Union.

Keywords Green public procurement (GPP), Stakeholders, Organizational learning, Triple bottom line (TBL), Moderated mediation, Procurement policy

Paper type Research paper

1. Introduction

Environment-friendly outputs and sustainability through public procurement are one of the important social goals of public procurement (De Giacomo *et al.*, 2019), also known as green public procurement (GPP). As international organizations (Hasselbalch *et al.*, 2014), developed regions (Ahsan and Rahman, 2017; Tsai, 2017), developing regions (Geng and Doberstein, 2008; Ho *et al.*, 2010) have widely implemented GPP, a sufficient practical foundation is laid for the topic of GPP practice. Therefore, this topic has further received extensive attention in academia (Cheng *et al.*, 2018).

One of the core issues of GPP practice is to explore why and how public sectors can better implement GPP (Sönnichsen and Clement, 2020). Most existing studies focus on the internal factors that motivate organizations to better practice GPP (Grandia and Voncken, 2019), such as knowledge (Liu *et al.*, 2019a; Testa *et al.*, 2016), training (Aragão and Jabbour, 2017), top management support/transformational leadership (Walker and Brammer, 2016), larger organizations (Testa *et al.*, 2012) and higher administrative levels (Liu *et al.*, 2019b). However, obstacles to GPP (Delmonico *et al.*, 2018; Walker *et al.*, 2008), such as cost/budget issues (McMurray *et al.*, 2014), priority conflicts (Brammer and Walker, 2011) and supplier acquisition issues (Dou *et al.*, 2014), make it difficult for public sectors to rely on internal motivation to better implement GPP (Alhola *et al.*, 2019). The external motivation of organizations also plays a crucial role.

Among the external factors, the legislation of central government is undeniably important (Ahsan and Rahman, 2017; Oruezabala and Rico, 2012; Thomson and Jackson, 2007). This may be because the main difference between public and private procurement is that public procurement is restricted and constrained by regulations (Lian and Laing, 2004; Liu *et al.*, 2019b; Loader, 2018). However, in the case that the current relevant regulations are voluntary (European Commission, 2016; Testa *et al.*, 2012) or a prior (Ministry of Finance, 2017; Standing Committee of the National People's Congress, 2014), the promoting role of the regulations is limited because of their lack of mandatory power (Mélon, 2020).

In this case, stakeholders of public sectors, especially external stakeholders, become more crucial drivers. Existing studies also noted this issue and conducted related research (Roman, 2017; Walker and Brammer, 2009; Zhu *et al.*, 2013a). They found that external stakeholder drivers can significantly affect GPP practice. However, the current definitions of the major external stakeholders of GPP in public sectors are still unclear. Also, how external stakeholders affect an organization's GPP practice has remained a black box. Particularly, the role of organizational knowledge in this black box is worth discussing. When analyzing the Chinese context, an important structural factor concerns the administrative level (Liu *et al.*, 2019b). And the administrative level represents the ability to allocate resources (Wang and Yeh, 2019). Therefore, it may play an important moderating role in the relation between external stakeholders and GPP practice. In response to these gaps, we raise the following research questions (*RQs*):

RQ1. What are the major external stakeholders in driving public sectors' GPP practice?

RQ2. From the perspective of organizational learning, what is the influence mechanism between external stakeholders and GPP practice? Does the organizational knowledge play a mediating role?

RQ3. Does the administrative level moderate the mediation process?

To answer these *RQs*, we focus on GPP practice in public sectors and develop a multiple mediation theoretical model from the perspective of organizational learning. This study aims to uncover the black box of the influence mechanism between external stakeholder

drivers and GPP practice, and meanwhile to explore the moderating role of administrative level in this process. This study has two major theoretical contributions. On the one hand, from the perspective of organizational learning theory, it deconstructs the black box between external stakeholder drivers and GPP practice, which adds to the existing knowledge (Roman, 2017; Walker and Brammer, 2009; Zhu *et al.*, 2013a), and responds to the call of Liu *et al.* (2019a). On the other hand, it explores the *knowledge of GPP benefits* based on triple bottom line (TBL) and *administrative level* with Chinese characteristics, which expands the research of Liu *et al.* (2019b).

The rest of this study is structured as follows. Section 2 is organizational context. Section 3 explores the theory and puts forth the hypotheses. Section 4 explains the methodology and the analysis. Section 5 includes discussion of the results. Section 6 presents the conclusions of this study. In Appendix 1, this study provides a comparison between new and previous GPP implementation policies in China. In Appendix 2, this study provides GPP implementation policies comparisons between China and European Union (EU).

2. Organizational context

The main purpose of this section is to define the types of organizations discussed in this study.

As a procurement policy tool, GPP needs to be implemented by procurement entities. Similarly, in the relevant academic research of GPP, it is necessary to have specific research objects. The research on GPP in developed countries can not only discuss the concept of public organizations as a whole (Roman, 2017) but also subdivide public organizations, for example, from the perspective of government (Preuss, 2009), education sector (Bala *et al.*, 2008) and public health sector (Ahsan and Rahman, 2017).

At present, the relevant GPP practice research in China mainly takes the government as the research object (Liu *et al.*, 2019b; Xu *et al.*, 2016; Zhu and Geng, 2013). However, according to the "Government Procurement Law of the PRC" (Standing Committee of the National People's Congress, 2014), there are three types of public organizations (contract entities) in procurement activities, namely government (such as finance bureau), public institution (such as public hospitals or schools) and public group organization (such as women's federation) (Figure 1). In other words, to explore the practice issue of GPP in China, in the selection of public organizations (research objects), we should not only consider government but also explore public institutions and group organizations.

In this study, the two kinds of public organizations, public institutions and group organizations, are discussed as the study object (Figure 1). The reasons are as follows. On the one hand, government is the sector with administrative management functions, while public institutions and group organizations are sectors that provide social services (Brødsgaard, 2002). Public institutions and group organizations are subject to the administrative management of the government (in this study, the government is regarded as
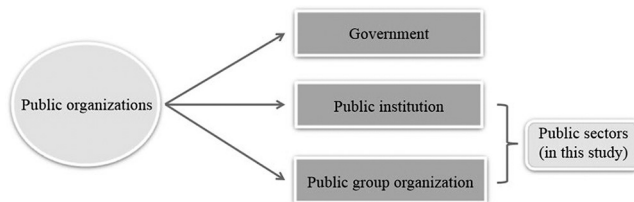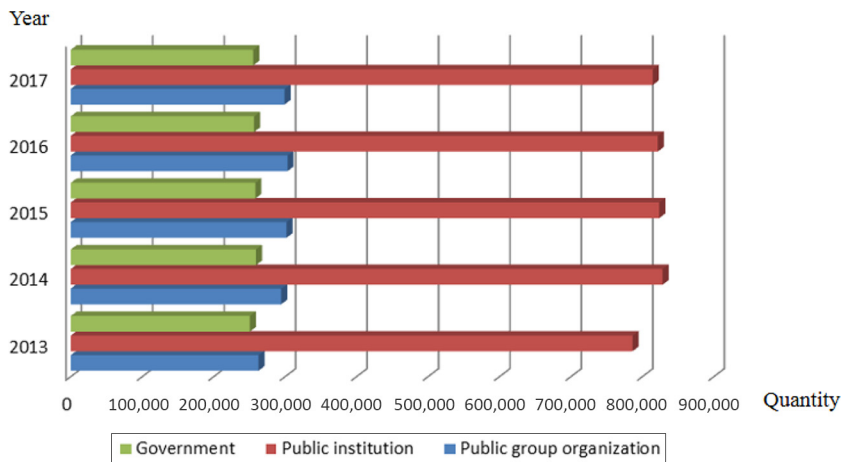

Figure 1.
Composition of public organizations in China

one of their major external stakeholders), and their motivation for green procurement is different from that of the government. However, there is a lack of relevant research (Liu *et al.*, 2019b; Xu *et al.*, 2016; Zhu and Geng, 2013).

On the other hand, according to the data of the National Bureau of Statistics of the PRC (National bureau of statistics, 2020), the number of public institutions and group organizations in China is significantly higher than that of government agencies (Figure 2), leading to a more widespread presence in society. To a certain extent, this shows that the number and amount of green procurement carried out by public institutions and groups may be much higher than that of governments, and their procurement preference will have a significant impact on the success of GPP. Therefore, it is quite important to explore the GPP practice of public institutions and group organizations.

To sum up, the public organizations discussed in this study are defined as public institutions and group organizations, and "public sector" will be used to refer to these two types of contract entities.

In addition, the discussion of public organizations also needs to clarify the administrative level of public organizations. The administrative level in western society mainly refers to a region, while in china each sector has an administrative level because of the historical issue leftover from the planned economy. For example, China's public schools and public hospitals also have different administrative levels (Brown and Theoharides, 2009; Du, 2016; Du *et al.*, 2020; Pepper, 1982). Public organizations in China have six administrative levels (Figure 3), which can be divided into national and local categories. The national level refers to the central governments/public sectors, and the local level refers to the local governments/public sectors at or below the provincial administrative level. As this study focuses on the local level, we sometimes use the concept of "local public sectors." Differences in administrative levels represent differences in the political power and the ability of resources acquisition and allocation (Wang and Yeh, 2019; Wei, 2015). Higher-level public sector has high political power and adequate financial funds, manpower and other resources, thus it may encounter fewer obstacles in practice (Liu *et al.*, 2019b).

Figure 2.
Numbers of three types of public organizations (contracting entities) in the last five years in China (2013–2017)

3. Theory and hypotheses

3.1 Stakeholder theory

As an important theory of strategic management (Adams *et al.*, 2011), stakeholder theory refers to *any group or individual who can affect or is affected by the achievement of an organization's objectives* (Freeman, 1984). Stakeholders are often divided into internal and external stakeholders (Dai *et al.*, 2014; Testa *et al.*, 2018). For a business organization, internal stakeholders (e.g. the management team and employees) can control its key resources. External stakeholders (e.g. shareholders, governments, social groups, etc). can affect its practices through financial investment, coercive pressures and the ability to mobilize public opinions (Sarkis *et al.*, 2010).

Although both external and internal stakeholders are important in the environmental field (Yu and Ramanathan, 2015), external stakeholders are considered to be more capable of driving organizations' environmental practices (Walker *et al.*, 2008). In both developed and developing countries, for public sectors, GPP is a procurement strategy mainly driven by external forces (European Commission, 2016; Ho *et al.*, 2010; Liu *et al.*, 2019a, 2019b; Ministry of Finance, 2019; Testa *et al.*, 2012). Therefore, in the GPP field, existing studies paid more attention to external stakeholders (Ahsan and Rahman, 2017; Roman, 2017; Zhu *et al.*, 2013a). Next, we discuss three major external stakeholders of GPP practice in public sectors: local government, green leading suppliers and society.

3.1.1 Local government as a stakeholder. Regarding the government as an external stakeholder, the existing studies mainly analyze it from the perspective of central government legislation (top-down) (Ahsan and Rahman, 2017; Oruezabala and Rico, 2012). However, with the background that the regulations are voluntary (European Commission, 2016; Testa *et al.*, 2012) and a priority (Ministry of Finance, 2017; Standing Committee of the National People's Congress, 2014), the legislation of the central government does not have much coercive effect on GPP practice. Especially in China, the relevant laws and regulations of GPP are scattered and general (Liu *et al.*, 2019a), which makes promoting the implementation of GPP by local public sectors mainly the work of local governments (Wang *et al.*, 2020a). In fact, local public sectors mainly deal with local governments. Local governments hold a much higher stake in local public sectors than the central government. Hence, we next explore the driving of the GPP practice of public sectors by local governments from three management aspects: budgets, personnel management and rules and supervision.
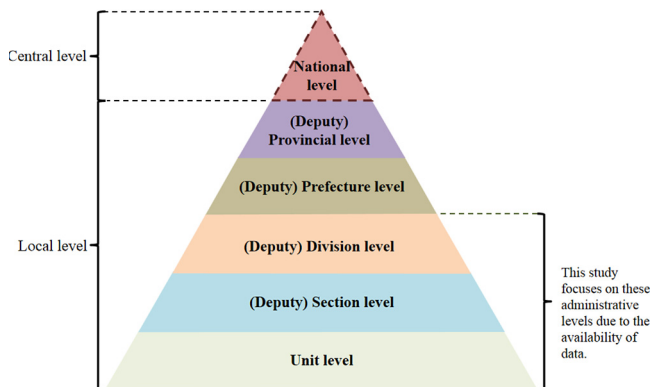
First, local governments can incentivize GPP practice through funding. Just as shareholders exert influence on enterprises through investment (Sarkis *et al.*, 2010), local governments, as a source of financial funds for public sectors (Mimba *et al.*, 2013), also have an important influence on their activities (Gelderman *et al.*, 2017). Lack of sufficient funds is a significant challenge and obstacle for public sectors to implement GPP (Ahsan and Rahman, 2017; McMurray *et al.*, 2014). Since most of the funding of public sectors come from local government budgets (Wong, 2009), the preference and support of local governments for GPP in the financial budgets will drive the GPP practice of public sectors to a greater extent.

Second, local government can conduct personnel management in public sectors by appointing top management. The top management of Chinese public sectors are often appointed directly by local governments, rather than the elected. Therefore, the top management/leaders attach great importance to the expectations of local governments. Also, the top management is a strong internal political force in an organization (Giunipero *et al.*, 2012) and holds the necessary status (Dai *et al.*, 2014; Liu *et al.*, 2020). Therefore, when local governments encourage GPP practice, in cases where priority conflicts with other policy tools (Brammer and Walker, 2011; Delmonico *et al.*, 2018), public sectors are also likely to act according to the will of local governments.

Third, local governments can promote GPP practice through local rules and supervision. Local rules are different from national regulations. They tend to be more in line with local conditions, and more detailed. Local rules show the importance that local governments attach to GPP. In addition, local governments have a supervisory role in public sectors' GPP practice (Ministry of Finance, 2017). Without government supervision, public sectors may buy the wrong (green-washing) green products (Testa *et al.*, 2018), which may undermine the enthusiasm of GPP practice.

3.1.2 Green leading suppliers as stakeholder. Suppliers are important external stakeholders in the procurement practice of public sectors (Standing Committee of the National People's Congress, 2014) and green suppliers are important external stakeholders for public sectors to implement GPP. Green suppliers refer to environmentally conscious suppliers, whose designing, packaging, logistics and other activities conform to the relevant environmental criteria (Bala *et al.*, 2008; Giannakis *et al.*, 2019; Govindan *et al.*, 2015; Lee *et al.*, 2009; Zhu *et al.*, 2013a). GPP practice is inseparable from green suppliers. Public sectors need to select green suppliers, or even their collaboration, for getting the environmental benefits that green suppliers deliver through the supply chain. Thus, public sectors can improve environmental performance and achieve the expected environmental outcomes in society (Grandia and Meehan, 2017; Kannan *et al.*, 2013). Without the participation of green suppliers, it would be difficult to implement GPP (Ahsan and Rahman, 2017).

Green leading suppliers, are green suppliers with larger market share (Nakao, 1993), top technical and innovation skills (Oruezabala and Rico, 2012). Green leading suppliers are more capable and possess the resources and channels to influence the procurement preferences of public sectors. Hence, this study considers that green leading suppliers are one of the major external stakeholders of public sectors. Despite green leading suppliers being the main participant in GPP – to the best of our knowledge – little to no research explores this issue from the perspective of green leading suppliers as a driver/motivator (Roman, 2017). Public procurement is a large market (Reijonen *et al.*, 2016). As a demand-side policy tool (Cheng *et al.*, 2018), GPP can increase the demand for green products or services. Thus, it becomes an important market and growth point for green leading suppliers. If public sectors do not actively implement GPP, it may lead to a stagnation, even a decline in the market performance of green leading suppliers, which will further affect their financial performance. Therefore, to improve their market share and financial performance, and to find an outlet for green technology innovation, the green leading

suppliers will motivate the GPP practice of public sectors. They have the required capability and resources and can motivate public sectors through multiple channels, such as firms/industry alliances (e.g. association of industry and commerce) and multi-level Chinese People's Political Consultative Conference (CPPCC) proposals.

3.1.3 Society as a stakeholder. Society is also an important external stakeholder that drives GPP in public sectors. Society consists mainly of the public, non-governmental organizations (NGOs) and the media (Sarkis *et al.*, 2010; Zhu *et al.*, 2013a). The public is usually the end consumers of public procurement, whose expectations are a GPP driver (Ahsan and Rahman, 2017). Meanwhile, NGOs also play an important role in motivating GPP implementation (Akenroye *et al.*, 2013). With the increasing influence of environmental NGOs in China (Zhu *et al.*, 2013a), their driving force to GPP has also gradually increased. Due to media reports (Boykoff and Boykoff, 2007), their own feelings and functional requirements, the public and the NGOs pay more attention to GPP practice (Walker and Brammer, 2012). From this perspective, the expectations and requirements of society will also drive GPP practice.

When the public sector perceives the pressure from local government, it actively communicates with the local government to understand the GPP rules and budgets set by local government. After understanding, the public sector can make arrangements and plans for green procurement to avoid budget cuts (Mimba *et al.*, 2013), loss of political status and violations of local rules. When the public sector perceives the pressure from green leading suppliers, it may make sufficient use of the procurement budget to meet the expectations of green leading suppliers, which aims to avoid stagnation and increased proposals resulting from the decline in the financial performance of green suppliers. When the public sector perceives the pressure of society, it actively considers the expectations of society to avoid the decline of its credibility and the damage to its image (Gunningham *et al.*, 2004; Liu *et al.*, 2020), thus promoting the implementation of GPP.

In summary, the major external stakeholders, namely, local government, green leading suppliers and society, can drive the GPP practice of public sectors. Although this study defines three major external stakeholders that influence the GPP practice of public sectors, referring to the existing research (Zhu *et al.*, 2013a), this study refers to them as a single concept (construct) that represents external drivers, that is, external stakeholders. More importantly, by regarding external stakeholders as a concept, we can better analyze the follow-up influence mechanism, that is, the analysis of mediation and moderation effects. This is also supported by existing research (Sarkis *et al.*, 2010). Therefore, we propose the following hypothesis:

H1. External stakeholder drivers are positively associated with GPP practice.

3.2 Organizational learning theory

Knowledge is considered as an important resource of an organization (Lindner and Wald, 2011; Wang *et al.*, 2012). If an organization's core competitiveness is its knowledge (Wang *et al.*, 2012), then organizational learning is the best way to cultivate its core competitiveness (Hefner, 2014). Organizational learning can be defined as a change of organizational knowledge, which is a function of experiences (Fiol and Lyles, 1985). Recently, changes in public sectors have driven the need for researching organizational learning in public sectors (Dodgson, 1993; Rashman *et al.*, 2009).

The process of organizational learning (how to derive and absorb knowledge from experiences) is an important issue of discussion for OLT research (Crossan *et al.*, 1999; De Giacomo *et al.*, 2019; Sheng and Chien, 2016). However, why organizations should gain this experience and knowledge is equally important. Argote and Miron-Spektor (2011) suggest

that organizational experience is affected by environmental context. The reason for organizational learning is to adapt to the environment, especially to the changeable or turbulent environment (Fiol and Lyles, 1985). In other words, organizational learning can be regarded as the environmental background affecting organizational knowledge through experiences, which then further affects organizational behaviors or practices (Argote and Miron-Spektor, 2011). Environmental background refers to factors outside the boundaries of an organization. In this study, the external stakeholders of public sectors are considered as the environmental background. Organizational knowledge, as the core of OLT, will be divided into two types of knowledge in this study, namely, knowledge of GPP implementation policies and knowledge of GPP benefits.

3.2.1 Organizational learning theory and knowledge of green public procurement imple-mentation policies. OLT believes that changes in the external environment will motivate the need for organizational learning (Dodgson, 1993; Rashman *et al.*, 2009). With the popularity of GPP, the emphasis on GPP by external stakeholders has changed the external environment in which the public sector faces, leading the public sector to learn what GPP is and how to promote its implementation. GPP policies can provide clear guidance for GPP practice (European Commission, 2016) (Appendix 1 and Appendix 2). Knowledge of GPP policies is equivalent to "know-how" (Liu *et al.*, 2019a). If there is a lack of knowledge of GPP policies, the public sector may not know how to properly implement GPP practices (Testa *et al.*, 2016). Thus, the public sector's response to external stakeholders is hindered. Therefore, when the public sector faces pressure from external stakeholders, it is necessary to learn knowledge of GPP implementation policies.

Knowledge of GPP implementation policies is being widely discoursed (Ahsan and Rahman, 2017). Academics (McMurray *et al.*, 2014; Walker and Brammer, 2009) and practitioners (Bouwer *et al.*, 2011) find the lack of GPP knowledge as an obstacle to GPP practice. If public sectors lack knowledge of GPP policies, GPP may be seen as unnecessary bureaucratic red tape (Zhu *et al.*, 2013a). Empirical research from developed (Grandia, 2016; Testa *et al.*, 2012, 2016) and developing countries (Liu *et al.*, 2019b; Nadeem *et al.*, 2017) also shows that the more public sectors know about GPP policies, the more they can promote GPP practice.

External factors can indirectly motivate an organization's environmental practices by affecting its internal factors (Dai *et al.*, 2014). OLT posits that changes in the external environment will promote the need for organizational learning (Dodgson, 1993; Rashman *et al.*, 2009). Driven by the external environment of external stakeholders, GPP policies are the knowledge that public sectors need to possess (Günther and Scheibe, 2006; Testa *et al.*, 2012). Although external stakeholders can drive GPP practice, the possibility of eventual practice still depends to some extent on knowledge (Zhu *et al.*, 2013a). According to OLT, the knowledge acquired via organizational learning can provide the capability for organizational change (Cavaleri, 2004; Inkpen, 1998). To respond successfully to external stakeholders' drive for GPP practice, public sectors need to have knowledge of GPP policies. In summary, external stakeholders will drive public sectors' GPP practice by affecting their understanding of GPP implementation policies. Therefore, we propose the following hypothesis:

H2a. The knowledge of GPP implementation policies possessed by public sectors mediates the positive relationship between external stakeholder drivers and GPP practice.

3.2.2 Organizational learning theory and knowledge of green public procurement benefits. Public sectors should not only have the knowledge of GPP implementation policies but also an understanding of the benefits GPP brings (European Commission, 2019). According to

OLT, the external stakeholders as the external environment background of public sectors are an important driving force for them to acquire knowledge (Rashman *et al.*, 2009), especially the knowledge of GPP benefits. Specifically, when the public sectors perceive the expectations and appeals of external stakeholders to GPP, they are likely to think about why external stakeholders do so, and then learn the benefits of practicing GPP. In addition, the public sectors can learn about the environmental benefits and other benefits of GPP from motivating methods of external stakeholders such as media reports and public opinion (Zhu *et al.*, 2013a). This process can also be seen as a process for organizations to explore new knowledge (Crossan *et al.*, 2011). Eventually, organizations will store the learned knowledge as their resource (Argote and Miron-Spektor, 2011). Therefore, public sectors are motivated by external stakeholders to acquire knowledge of GPP benefits through learning.

Existing research believes that understanding the benefits of GPP is important because it offers "why to do GPP" (Liu *et al.*, 2019a). Conversely, the lack of knowledge of the benefits will limit GPP implementation (Ahsan and Rahman, 2017; Burja, 2009). To study GPP benefits more systematically, we introduce the concept of TBL, namely, the environment (earth), economy (profit) and society (people) (Elkington, 1998; Govindan *et al.*, 2013). Although TBL originates from firms, this concept can also be applied to public sectors (Ihamäki *et al.*, 2014; Wahid, 2012). This study will study GPP benefits from the three TBL perspectives.

First, environment refers to the environmental responsibility that organizations need to fulfill, that is, caring for and protecting the environment (Elkington, 1998; Prajogo *et al.*, 2012). Environment is the most important and significant goal of GPP practices (European Commission, 2019). GPP can reduce greenhouse gas emissions and carbon footprint, and improve the efficiency of resource utilization, so as to achieve the goals of environmental sustainability. This has been supported by empirical studies (Cerutti *et al.*, 2016; Rietbergen and Blok, 2013; Tsai, 2017).

Second, economy refers to the economic responsibilities of organizations, such as reducing costs and increasing profits. As public sectors themselves are less involved in production, their economic responsibilities are mainly to reduce costs and guide consumption and production. Reducing costs does not mean blindly lowering prices but ensuring value for money (VfM) (Grandia, 2018). The initial purchase cost of green products is higher, but their use, maintenance and disposal costs are lower. Therefore, the life cycle cost (LCC) may be lower (Liu *et al.*, 2019a). From the perspective of spillovers (Simcoe and Toffel, 2014), the GPP implementation of public sectors can promote sustainable consumption and production (Cheng *et al.*, 2018; Pacheco-Blanco and Bastante-Ceca, 2016). Public sectors play the role of "leaders" and guide the public to green consumption (Geng and Doberstein, 2008). This can create or expand the market for green companies, thus promoting the production of green products and improving the green market (Bala *et al.*, 2008; Li and Geiser, 2005).

Third, society refers to the social responsibilities, that is, developing stakeholder relations and social image. To achieve sustainability, organizations should consider not only economic and environmental issues but also the impact of their activities on society (Hollos *et al.*, 2012; Prajogo *et al.*, 2012). GPP can bring environmental benefits (Diófási-Kovács and Valkó, 2015) and social benefits (Burja, 2009; Rüdenauer *et al.*, 2007). GPP helps public sectors to maintain their relationships with various stakeholders and to develop a better public image (Pacheco-Blanco and Bastante-Ceca, 2016; Rüdenauer *et al.*, 2007). In summary, public sectors are more likely to improve GPP practice when they have knowledge of the environmental, economic and social benefits of GPP.

External drivers are crucial but internal factors should also not be ignored (Liu *et al.*, 2020; Sarkis *et al.*, 2010). Even if external stakeholders impose a driving force on an organization's implementation of environmental practices, the organization's response to

this driving force may be heterogeneous (Darnall, 2006). In the GPP practice of public sectors, this heterogeneity can be explained by the organization's lack of knowledge of GPP benefits. Based on OLT, the cognition and knowledge of an organization will affect its actions (Crossan *et al.*, 2011). When there is a lack of understanding of GPP benefits, public sectors may consider GPP implementation to be a formalized procedure and there is a risk of reducing procurement efficiency (Wang *et al.*, 2020b), which will hinder GPP practice. To sum up, external stakeholder drivers will in turn promote GPP practice by affecting public sectors' understanding of GPP benefits. Therefore, we propose the following hypothesis:

H2b. The knowledge of GPP benefits possessed by public sectors mediates the positive relationship between external stakeholder drivers and GPP practice.

3.3 Administrative level of public sectors

Administrative levels show a hierarchy established by the state for the purpose of administrative management (Hassan and Sheely, 2017). Many countries have administrative subdivisions, for example, America (Jenks and Wright, 1993), Ghana (Ayee, 2013), Vietnam (Malesky, 2009), Indonesia (Pierskalla, 2016) and China (Zhang *et al.*, 2020). China used to be a planned economy with a high degree of centralization, its long-term administrative hierarchy is deep-rooted and more representative (Wei, 2015). The administrative levels of local public sectors in China can be divided into unit level, section (township), division (country/district), prefectural and provincial levels (Chan, 2010). Usually, the administrative level corresponds to its power (Li *et al.*, 2015). Public sectors with higher administrative levels generally have greater political power and/or capacity for acquiring resources (Wang and Yeh, 2019; Wei, 2015). Considering the differences brought by administrative levels to public sectors, they may be related to GPP practice (Liu *et al.*, 2019b).

According to OLT, changes in the external environment drive the need for organizational learning (Dodgson, 1993; Rashman *et al.*, 2009). When public sectors are driven by external stakeholders, they will learn and acquire knowledge of GPP implementation policies. However, the degree of the positive relationship between external stakeholder drivers and the organization's knowledge of GPP implementation policies may be affected by administrative levels. Public sectors with higher administrative levels can gain greater political power (Wang and Yeh, 2019), and have the right to formulate rules or propose higher requirements (Li *et al.*, 2015; Wei, 2015). Driven by external stakeholders, higher-level public institutions are more likely to develop appropriate GPP implementation rules according to their actual situation and impose higher requirements on GPP (Ministry of Finance, 2019), rather than in accordance with national GPP implementation policies. In contrast, lower-level public sectors have less opportunity to develop their own GPP implementation rules and are more likely to rely on knowledge of existing GPP implementation policies. Therefore, the higher the administrative level of public sectors is, the weaker the positive relationship between external stakeholder drivers and knowledge of GPP implementation policies is. Thus, *H3a* is proposed:

H3a. The relationship between external stakeholder drivers and knowledge of GPP implementation policies is negatively moderated by administrative levels.

Public sectors' knowledge of GPP implementation policies will stimulate GPP practice (Liu *et al.*, 2019a; Testa *et al.*, 2012, 2016), but the final level of GPP practice is also related to contextual factors (Zhu *et al.*, 2013a), such as the administrative level. As mentioned earlier, the higher the administrative level of public sectors that implement GPP is, the lesser

reliance on national GPP implementation policies there is. In other words, the higher the level of public sectors is, the weaker the positive relationship between the knowledge of GPP implementation policies and GPP practice is. Therefore, *H3b* is proposed:

H3b. The relationship between knowledge of GPP implementation policies and GPP practice is negatively moderated by administrative level.

Based on *H3a* and *H3b*, we assume that the relationship between external stakeholder drivers and knowledge of GPP implementation policies, as well as the relationship between knowledge of GPP implementation policies and GPP practice, will be negatively moderated by administrative level. Therefore, this study argues that for public sectors with higher administrative levels, the knowledge of GPP implementation policies may have a weaker mediating effect on the relationship between external stakeholder drivers and GPP practice:

H3. The administrative level of public sectors negatively moderates the mediating effect of knowledge of GPP implementation policies on the relationship between external stakeholder drivers and GPP practice.

The administrative level of public sectors will not only bring differences in political power but also differences in the acquisition and allocation of resources (Wang and Yeh, 2019; Wei, 2015). Administrative level of a public sector will affect its ability to acquire financial funds, manpower, and other resources (Henderson *et al.*, 2009). Firm size is similar to the administrative level. For firms, a larger size means that it has sufficient resources (Lin and Ho, 2011) and even has slack resources (Nybakk *et al.*, 2011). In contrast, the green practices of small size firms are easily limited by insufficient resources (Dai *et al.*, 2014).

Existing literature found that firm size can moderate the relationship between external and internal factors (Krammer, 2013). In view of the similar role of administrative level and firm/organization size (Liu *et al.*, 2019b), we argue that the administrative level of public sectors may also moderate the relationship between external stakeholder drivers and the knowledge of GPP benefits. In this regard, we speculate that lower-level public sectors, driven by external stakeholders, need to know more about the benefits of GPP because of their limited financial resources. For example, one of the significant obstacles to the implementation of GPP is the higher initial procurement cost (Ahsan and Rahman, 2017). Because lower-level public sectors do not have sufficient funds, they need to have a deeper understanding of the knowledge of GPP benefits (such as lower LCC) to have the motivation to overcome this difficulty. In other words, the lower the administrative level of public sectors is, the stronger the positive relationship between external stakeholder drivers and the knowledge of GPP benefits is. Therefore, *H4a* is proposed:

H4a. The relationship between external stakeholder drivers and knowledge of GPP benefits is negatively moderated by administrative level.

In addition to financial factors, the implementation of GPP is also vulnerable to a lack of other resources. As a relatively new procurement method, GPP implementation requires more resources from public sectors (such as green supplier selection process) (Liu *et al.*, 2019b). As a resource, manpower plays a very important role in the implementation of GPP (Liu *et al.*, 2019a; Testa *et al.*, 2012). Higher-level public sectors have more manpower, and it may be easier for them to implement GPP. Lower-level public sectors usually have a higher workload and limited manpower resources (General Office of the CPC Central Committee, 2019), so it may be more difficult for them to implement GPP. For lower-level public sectors, when they do not fully understand the benefits of GPP, they may not be willing to spend

extra manpower on GPP practice. That is, they need to rely more on knowledge of GPP benefits to implement GPP. Therefore, the lower the level of public sectors is, the stronger the positive relationship between the knowledge of GPP benefits and GPP practice is:

H4b. The relationship between knowledge of GPP benefits and GPP practice is negatively moderated by administrative level.

Based on *H4a* and *H4b*, this study assumes that the relationship between external stakeholder drivers and knowledge of GPP benefits, as well as the relationship between knowledge of GPP benefits and GPP practice, will be negatively moderated by administrative level. Therefore, this study argues that for public sectors with higher administrative levels, the knowledge of GPP benefits may have a weaker mediating effect on the relationship between external stakeholder drivers and GPP practice:

H4. The administrative level of public sectors negatively moderates the mediating effect of knowledge of GPP benefits on the relationship between external stakeholder drivers and GPP practice.

The theoretical model of this study is shown in Figure 4 below.

4. Methodology and analysis
4.1 Survey sample
Referred to Churchill (1979) and followed the practice of Dai *et al.* (2014). After a literature review, we selected the appropriate items, then directly use them or slightly modify them as the measurement items of variables. After completing the preliminary questionnaire, we invited three professors in the field of management and six PhD students and government procurement experts to evaluate its clarity, readability and content validity. According to their feedback, we have revised the questionnaire.

We chose Mianyang and Chengdu in Sichuan province of China as survey area. Because the procurement staff in public sectors are not easily accessible, the snowball sampling is used (Heckathorn, 2002). It is commonly used in the studies of public sectors (Brammer and Walker, 2011; Walker and Brammer, 2009; Zhu *et al.*, 2013a). We send questionnaires to public procurement officials (leader, deputy leader, office directors and procurement specialists)
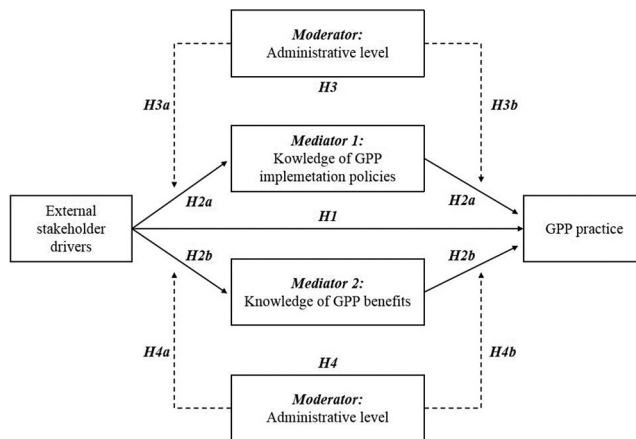
Figure 4.
Theoretical model

through familiar managers/directors from the government and public sectors. Then they were asked to continue sending questionnaires to appropriate participants in their social network. The questionnaires were allocated and recollected in November 2019 through online means.

To reduce the common rater effect (Zhu *et al.*, 2013b), besides the type of public sectors (public institution or group organization) and the industry of public sectors (education, health and others) as mandatory items, the respondents can choose not to provide other personal information and public sector information. In this way, anonymity will be guaranteed. Due to the sampling strategy, the questionnaire recovery rate cannot be accurately estimated (Walker and Brammer, 2009). A total of 155 questionnaires were collected in this study, of which 142 were valid and the effective rate was 91.61%. The attributes for public sectors under investigation are as follows. According to the types of public sectors, there were 125 public institutions, accounting for 88.03%. There were 17 groups, accounting for 35.92%. According to their industries, there were 51 education industries, accounting for 35.92% and 31 health industries, accounting for 21.83%. Then there were 60 other industries, accounting for 42.25%.

4.2 Measures and measurement model testing

This study measured six variables/constructs. The first variable/construct is external stakeholder driver *(ESH)*. Referring to Zhu *et al.* (2013a), this study measures the three different external stakeholders of public sectors with a single construct, namely, external stakeholders, which is helpful to better analyze the subsequent influence mechanism (Sarkis *et al.*, 2010). The remaining five variables/constructs are knowledge of GPP implementation policies [*KGIP*, Liu *et al.* (2019b)], knowledge of GPP benefits [*KGB*, Dou *et al.* (2014), Geng and Doberstein (2008); Prajogo *et al.* (2012)], practice level of GPP [*PLG*, Roman (2017), Walker and Brammer (2012), meanwhile, to better adapt to the Chinese background, the items are modified according to procurement experts' suggestions] and administrative level [*AL*, Liu *et al.* (2019b)]. Meanwhile, three control variables were used, namely, the industries of public sectors (education (*Con1*), health (*Con2*), others), the types of public sectors (public institution (*Con3*), group organization) and the areas of public sectors [Mianyang (*Con4*), Chengdu]. In addition, the respondents' job satisfaction [*JS*, Wanous *et al.* (1997)] was taken as a marker variable. The questions and measurement items are shown in Appendix 3.

Next, we tested Cronbach's-alpha and used confirmatory factor analysis (CFA) (Fornell and Larcker, 1981). According to the theoretical structure, second-order CFA was used to calculate the factor loadings, and their component reliability (CR) and average variance extraction (AVE) (Table 1). Meanwhile, we calculated the correlation coefficient between each variable and the square root of AVE (SRAVE) to check the discriminant validity (Table 2).

From Tables 1–2, the Cronbach's-alpha exceeded 0.7, the internal correlations are significant and CR exceeded 0.6. In addition, AVE also exceeded 0.5. This indicates that reliability and convergent validity are good (O'Leary-Kelly and Vokurka, 1998; Fornell and Larcker, 1981). Meanwhile, the correlation coefficient did not exceed the minimum SRAVE, indicating that the discriminant validity is good (Hair *et al.*, 2010).

In addition, we calculated the model fit indexes of the measurement model ($\chi^2 = 133.147$; df = 107; $\chi^2/df = 1.244$; CFI = 0.973; TLI = 0.966; RMSEA = 0.042), reached the standards (Kline, 2005) indicating that the measurement model fits well with the data. These show that the variables and scales have good reliability and validity.

4.3 Common method variance

We used marker variable (MV) (Lindell and Whitney, 2001) to detect CMV. There are two methods of correlation-based MV. One is to select smallest correlation coefficient as

Variables	1st SFL	2nd SFL	t	CA	CR	AVE
1. ESH				0.772	0.772	0.530
ESH-1	0.752		Fixed			
ESH-2	0.709		7.546			
ESH-3	0.722		7.666			
2. KGIP				0.803	0.803	0.505
KGIP-1	0.723		Fixed			
KGIP-2	0.713		7.317			
KGIP-3	0.696		7.176			
KGIP-4	0.709		7.291			
3. KGB					0.826	0.616
Environmental		0.661	Fixed	0.850		
KGB-1	0.826		fixed			
KGB-2	0.823		10.049			
KGB-3	0.779		9.593			
Social		0.792	5.349	(0.668**)		
KGB-4	0.772		Fixed			
KGB-5	0.865		8.193			
Economic		0.886	5.791	(0.721**)		
KGB-6	0.821		Fixed			
KGB-7	0.878		10.039			
4. PLG				(0.518**)	0.692	0.533
PLG-1	0.811		Fixed			
PLG-2	0.638		6.415			
5. AL	1.000		Fixed			
6. JS	/					

Notes: 1stSFL = first-order standard factor loading; 2nd = second-order; CA = Cronbach's-alpha. () = internal correlations; ** = $p \leq 0.01$, two-tailed; t = critical ratio; CR = composite reliability; AVE = average variance extraction

Table 1.
Scale items and factor loadings for the study variables

Variables	Mean	SD	1	2	3	4	5	6
1. ESH	3.033	0.999	*0.728*	*0.442***	*0.575***	*0.531***	*0.226***	/
2. KGIP	2.908	0.892	0.443**	*0.711*	*0.365***	*0.456***	*0.227***	/
3. KGB	2.927	0.923	0.576**	0.366**	*0.785*	*0.501***	*0.169**	/
4. PLG	3.046	1.011	0.532**	0.457**	0.502**	*0.727*	*0.285***	/
5. AL	2.831	1.010	0.228**	0.229**	0.171*	0.286**	/	/
6. JS	3.556	1.088	0.035	−0.040	0.085	−0.049	0.002	/

Notes: Cross diagonals represent the SRAVE; * = $p \leq 0.05$, ** = $p \leq 0.01$, two-tailed. The *italic* are CMV-adjusted correlation

Table 2.
Descriptive statistics and Pearson correlation analysis

MV after the survey (Liu *et al.*, 2020). The other is to prepare a MV that is not theoretically correlated with at least one research variables before the survey (Malhotra *et al.*, 2006). *JS* was selected as MV (Wanous *et al.*, 1997). In Table 2, we chose the smallest correlation coefficient between MV and other variables (*JS* and *AL*: 0.002) to adjust the correlation coefficient and its significance (*italic* in Table 2). The original significant correlation coefficients did not decrease after adjustment, CMV will not seriously affect our study.

4.4 Direct, mediation and moderated mediation effect testing
The hypotheses testing is divided into multiple mediation and moderation (including moderated mediation) analysis. For mediation analysis, causal steps approach has been questioned because of its lower testing power (Edwards and Lambert, 2007). The bootstrap estimation method directly examines the product term (a*b) in casual step approach to make it have higher testing power. In dealing with the influence mechanism (such as mediation analysis), the bootstrap estimation method is not inferior to the structural equation model (SEM) (Hayes *et al.*, 2017) and this method has been widely used in academia (Fisher *et al.*, 2012; Liu *et al.*, 2020). Therefore, the bootstrap estimation method was used (Zhao *et al.*, 2010), we use PROCESS macro version 3.1 based on SPSS 23 to conduct bootstrap estimation.

We set bootstrap of 2,000 repeated samples and the confidence interval (CI) was set at 95%. The sampling method adopted the bias-corrected percentile, if zero was not included between lower and upper CI, the effect is significant (Hayes and Rockwood, 2020). According to Table 3, *H1*, *H2a* and *H2b* are supported. Meanwhile, the direct effect was significant, indicating that the mediation effect is partially mediation.

For moderation analysis, hierarchical regression [OLS estimation method for testing *H3a*, *H3b*, *H4a*, *H4b* (using SPSS 23)] (Liu *et al.*, 2019a; Zhu and Sarkis, 2007) and bootstrap approach (for testing *H3* and *H4*) were used. The hierarchical regression results are shown in Table 4 (only shown in the final step: Step 3). Model 1 represents the moderating effect of *AL* on the relationship between *ESH* and *KGIP*. The coefficient of *ESH*AL* was neither significant nor was F for the step significant and R^2 was not significantly improved, indicating that moderating effect is not significant. Similarly, for Models 2–4, *AL* has no significant moderating effect on the relationship between *ESH* and *KGIP*, *KGIP* and *PLG*. However, *AL* has moderating effect on the relationship between *ESH* and *KGB*, *KGB* and *PLG*. Therefore, *H3a* and *H3b* are not supported while *H4a* and *H4b* are supported.

The results of bootstrap estimation (for moderated mediation analysis) are shown in Table 5. The mediation effect (mediator: *KGIP*) was significant at high and medium levels of *AL*, and the mediation effect decreased with the decrease of *AL* level. Therefore, *AL* plays a positive role in moderating this mediation effect, thus, *H3* is not supported. Similarly, *AL* plays a negative role in moderating the mediation effect (mediator: *KGB*), thus, *H4* is supported.

5. Discussion
5.1 Discussion on empirical results
The results suggest that both mediating variables show the effects of partial mediation. Thus, in addition to the factor of organizational knowledge, there may be other internal

Mediation model	Effect	SE	95% CI Lower	95% CI Upper	Hypotheses
Total effect	0.542	0.074	0.396	0.689	
Direct effect	0.288	0.088	0.114	0.463	*H1*: supported
Indirect effects-total	0.254	0.064	0.132	0.379	
Indirect effects-KGIP	0.111	0.037	0.041	0.186	*H2a*: supported
Indirect effects-KGB	0.143	0.051	0.045	0.249	*H2b*: supported
Indirect effect contrast (KGIP vs KGB)	−0.032	0.061	−0.158	0.084	

Notes: SE = Standard error; CI = Confidence interval; the effects are non-standardized effects

Table 3.
Mediation effects of
KGIP and *KGB*

	Model 1 (Step 3) DV: *KGIP*		Model 2 (Step 3) DV: *KGB*		Model 3 (Step 3) DV: *PLG*		Model 4 (Step 3) DV: *PLG*	
	b	SE	*b*	SE	*b*	SE	*b*	SE
Intercept	−0.272	0.202	−0.145	0.189	3.107**	0.201	3.107**	0.201
Con1	−0.140	0.165	0.086	0.155	0.156	0.165	0.156	0.165
Con2	−0.021	0.192	0.038	0.180	−0.013	0.191	−0.013	0.191
Con3	0.372	0.232	0.155	0.218	−0.107	0.233	−0.107	0.233
Con4	−0.151	0.241	0.047	0.227	−0.055	0.238	−0.055	0.238
ESH	0.364**	0.069	0.516**	0.066	0.210*	0.090	0.210*	0.090
KGIP					0.263**	0.089	0.263**	0.089
KGB					0.269**	0.089	0.269**	0.089
AL	0.117^	0.071	0.067	0.066	0.172*	0.071	0.172*	0.071
*ESH*AL*	0.054	0.060	−0.153**	0.057				
*KGIP*AL*					0.088	0.104	0.088	0.104
*KGB*AL*					−0.205*	0.085	−0.205*	0.085
F for the step	0.795		7.301**		0.715		5.832*	
R²-change	0.005		0.034		0.003		0.025	
F for the regression	6.072**		11.453**		10.217**		10.217**	
R²	0.241		0.374		0.438		0.438	
Adj-*R²*	0.201		0.341		0.395		0.395	
Hypotheses	*H3a*: Not supported		*H4a*: Supported		*H3b*: Not supported		*H4b*: Supported	

Table 4.
Moderation effects of *AL*

Notes: ^ = $p \leq 0.1$, * = $p \leq 0.05$, ** = $p \leq 0.01$, two-tailed; each model only represent step 3

Moderated mediation model	Moderate	Effect	SE	95% CI Lower	Upper	Hypotheses
At different levels of *AL*, the effect of *ESH* on *PLG* via *KGIP*						*H3a*: not supported
−1 SD (*AL*)	−1.010	0.054	0.052	−0.036	0.176	
Mean	0	0.096	0.036	0.036	0.172	
+1 SD	1.010	0.147	0.020	0.020	0.313	
At different levels of *AL*, the effect of *ESH* on *PLG* via *KGB*						*H3b*: supported
−1 SD (*AL*)	−1.010	0.320	0.085	0.143	0.489	
Mean	0	0.139	0.048	0.045	0.233	
+1 SD	1.010	0.023	0.047	−0.074	0.118	

Table 5.
Conditional process of *ESH* on *PLG* at different levels of *AL*

Notes: SE = Standard error; CI = Confidence interval; *ESH*, *KGIP*, *KGB*, *AL* has been mean-centered before calculation; the effects are non-standardized effects

factors acting as mediators, such as top management support (Brammer and Walker, 2011; Delmonico *et al.*, 2018), training (Aragão and Jabbour, 2017) and affective commitment to change (Grandia and Voncken, 2019). This study compared the two mediating variables (*KGIP* and *KGB*). The difference of their mediating effects is not significant. This indicates that the two factors are similarly important, which updates the previous view that knowledge of policies is the most important factor (Liu *et al.*, 2019a). It highlights the importance of the knowledge of GPP benefits, as we have newly proposed.

H3a and *H3b* are not supported. One possible explanation is that even if a public sector has its own GPP implementation rules, it should be guided by national policies. The green items lists and certification bodies can provide a reference for public sectors to formulate higher GPP implementation rules. Also, public sectors can reduce the possibility of punishment for violations by improving their knowledge of national-level policies (Nadeem *et al.*, 2017).

Surprisingly, the bootstrap results show that the administrative level of public sectors significantly and positively moderates the mediating effect of knowledge of GPP policies (Table 5). This once again shows that the bootstrap method has higher testing power (Edwards and Lambert, 2007). This means that although *H3a* and *H3b*'s tests are not significant, *H3*'s testing can still be significant (although the moderation direction is opposite to the hypothesis put forth in this study).

A reasonable explanation is that it may be caused by the unique public procurement agency mechanism of China. In China, public sectors can not only purchase by themselves but also entrust the procurement to agencies (Standing Committee of the National People's Congress, 2014). Existing agencies can be divided into centralized procurement agencies (government procurement centers) and decentralized procurement agencies (social intermediary agencies) (Ministry of Finance, 2018). Many Chinese public sectors tend to choose agencies for procurement (Xu *et al.*, 2016).

For higher-level public sectors, will pay more attention to their own procurement needs and tend to implement by themselves as they have more resources, such as time, professionals and procurement departments. In this case, they need to better understand the relevant policies to promote better GPP implementation. Also, higher-level public sectors may dominate the procurement even if they entrust it to the agencies. The agencies only need to assist them to complete the procurement, so higher-level public sectors need to fully understand the GPP implementation policies. Conversely, lower-level public sectors tend to choose agencies for improving procurement efficiency due to their limited resources (Liu *et al.*, 2019b). When entrusting agencies, lower-level public sectors may only need to indicate their own procurement requirements and less participate or guide specific procurement details. The details of GPP implementation is likely to be handled by the agencies. Therefore, in this case, a lower-level public sector may not need to have in-depth knowledge of GPP implementation policies.

5.2 Study contributions

The theoretical contributions of this study mainly include the following four aspects.

First, this study uncovers the black box relationship between external stakeholder drivers and GPP practice from the perspective of OLT. This study develops an "outside to inside" theoretical model to better understand the influence mechanism from the perspective of organizational learning. This adds to existing knowledge (Roman, 2017; Walker and Brammer, 2009; Zhu *et al.*, 2013a) and responds to Liu *et al.* (2019a)'s call for mediation analysis.

Second, this study explores the knowledge of GPP benefits based on the TBL. Although knowledge is considered to be an important factor (Sönnichsen and Clement, 2020), existing studies focus more on the knowledge of policies and ignore other knowledge (Ahsan and Rahman, 2017; Nadeem *et al.*, 2017; Testa *et al.*, 2012). The results show that knowledge of GPP benefits is equally important as knowledge of policies.

Third, this study explores the factor of administrative levels with the characteristics of Chinese public sectors. We extend the study of Liu *et al.* (2019b) by introducing administrative level as a moderator. In addition, this study identifies three external stakeholders for public

sectors to implement GPP, adding existing literature (Ahsan and Rahman, 2017; Akenroye *et al.*, 2013; Oruezabala and Rico, 2012; Zhu *et al.*, 2013a).

6. Conclusion

This study focuses on the GPP practice of public sectors and develops a multiple mediation theoretical model from the perspective of organizational learning. It aims to uncover the black box of the influence mechanism between external stakeholder drivers and GPP practice and explore the moderating effect of administrative level in this process.

The results suggest that external stakeholder drivers have a positive relationship with GPP practice. Both the knowledge of GPP implementation policies and the knowledge of GPP benefits mediate this relationship. Also, this study shows that the administrative level of public sectors positively moderates the mediating effect produced by the knowledge of GPP implementation policies, and negatively moderates the mediating effect produced by the knowledge of GPP benefits. These findings answer our *RQs*.

In addition, this study provides a comparison between new and previous GPP implementation policies in China in Appendix 1. In Appendix 2, this study also provides GPP implementation policies comparisons between China and EU. This will facilitate international researchers to better understand China's GPP policies.

This study also has certain limitations. The stakeholder theory and organizational learning theory are relatively incomprehensive for interpreting the GPP practice. Meanwhile, the survey sample is small and the sampling method may also be biased. Therefore, the applicability of the conclusions requires further study. In addition, because this study focuses on the influence mechanism, the three major external stakeholders are studied as a single concept. Future research will be more specific and explore the impact of each of these three external stakeholders on GPP practices to find whether a particular external stakeholder is more important or relevant, and the interactions between them. Furthermore, the size of public sectors is a similar factor to administrative level (Liu *et al.*, 2019b) and the size of public sectors is widely explored in EU (Michelsen and de Boer, 2009; Testa *et al.*, 2012). Although this study is based on China, we call for similar studies to be conducted in other institutional contexts.

6.1 Practice and policy implications

For public sectors. First, public sectors should increase the knowledge of GPP benefits. Public sectors can use internal training (Aragão and Jabbour, 2017) to ensure that the knowledge of GPP-related benefits is deeply embedded in the members of the sectors. Public sectors can also invite experts from developed countries to share knowledge of GPP benefits and refer to the publicity methods of developed countries (European Commission, 2019). Second, public sectors should reduce their dependence on social intermediary agencies. Excessive use of agencies may lead to agency problems. That is, agencies may do harmful to the clients' interests for their own gain (Bebchuk and Fried, 2003). It results in the difficulty of better GPP practice. As a commercial organization, the operation goal of an agency is to maximize profits. Hence, it may focus more on its own interests and ignore public sectors' higher requirements pertaining to the environment. For example, agencies may accept bribes from potential suppliers (Tadelis, 2012), to ignore objective evaluation criteria, including environmental criteria, in the process of selecting suppliers.

For policymakers. Local governments should take effective measures to drive better GPP practice in public sectors. First, local governments can increase the budgets of public sectors. Second, local governments should strengthen the management of GPP practice in public sectors, such as formulating stricter local GPP policies or assigning GPP as an important task to top managers of public sectors. Finally, local governments should

strengthen the supervision of GPP implementation through special inspections and other means. Also, local governments should more reasonably allocate resources among public sectors at different administrative levels. Although administrative levels are difficult to change, resource availability at the same administrative level can be adjusted.

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Further reading

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Appendix 1: China's GPP implementation policies comparisons

In April 2019, China has implemented new GPP implementation policies. The new and previous policies has significant differences. The differences between China's GPP product list (Liu *et al.*, 2019a) and items list (Ministry of Finance, 2019) are shown in Table A1.

Comparison	Green product list (previous)	Green items list (new)	Comparison explanation
Core composition	Green products	Green standards	/
List content	Over 10,000 pages are embodied in each of the two lists, including the name of product manufacturer, brand, product name and model, certification number and certification expiration date	Around 4 pages are embodied in each of the two lists, only including product category and standard on which it is based	Less requirements are included in the items list, which turn to be simpler and clearer
Certification process	Energy-saving products can only be certified by the government-appointed authority. The same goes for environmental-labeling products	Products can be certified by 17 energy-saving product certification authorities and 4 environmental-labeling product certification authorities	The items list expands the scope of certification authorities, breaks monopoly, improves certification efficiency and cuts enterprise certification costs, which will increase the number of suppliers participating in certification, thereby enhancing the competitiveness of public contracts
Green procurement requirements	The purchaser or the procurement agency entrusted should specify the requirements for using energy-saving products and environmental-labeling products in the procurement documents and contracts	For products in the items list, purchasers are encouraged to put forward higher requirements about green procurement. For products excluded from the items list, purchasers are encouraged to put forward requirements about green procurement in accordance with relevant standards	The items list boosts green procurement of public sectors and enhances the discretion of green procurement
Evaluation process	The evaluation expert verifies the product certificates and reviews the manufacturer's name, product name and model, etc. based on the product list	The evaluation expert only needs to verifies product certificates	Some evaluation process is eliminated in the items list, by which alleviating the burden on evaluation

Table A1.
China's new and previous GPP implementation policies

Appendix 2: GPP implementation policies comparisons between China and EU

This study incorporated the comparison of China's GPP items list with GPP criteria of EU in Table A2.

Comparison	Green items list (China)	GPP Criteria (EU)	Comparison explanation
Dependency on environmental labeling or environmental standards (eg. ISO14024)	Higher	Lower	The green items list is mainly created on the basis of environmental labels and the energy-saving labels, while GPP criteria are self-formulated, only recognizing environmental labeling or environmental standards in some criteria
Implementation and operational convenience level of basic GPP	Very high	higher	In the implementation of basic GPP, the green items list boasts operational simplicity, while GPP criteria (Core criteria) tend to be more complicated
Implementation and operational convenience level of advanced GPP	Lower	Higher	In the implementation of advanced GPP, the items list can only be used as a reference, without explicit and specific guidance for specific higher GPP requirements. However, the GPP criteria (comprehensive criteria) provide very detailed guidance and standards
The extent to which GPP implementation policies penetrate the entire procurement process	General	Very high	The green items list is mainly used in the Award stage; green requirements can also be put forward during the qualification evaluation and specification stages Generally speaking, GPP criteria are mainly decomposed into selection criteria, technical specifications, award criteria and contract performance clauses as well, deeply penetrating the entire procurement process
The discretion of GPP implementation in the public procurement	Higher	Very high	For the green items list, requirements about score increase (such as increase 1 to 10 points) and price discounts (such as 1% to 10%) can be proposed in the award stage; requirements about eliminating environmentally polluting enterprises can be proposed in the qualification stage; requirements about green technical parameters can be proposed in the specification stage. Then the list boasts high discretion For GPP criteria, at each stage of procurement, corresponding core criteria and/or comprehensive criteria are provided for EU criteria. These criteria can be fully or partially used by purchaser, with a very high degree of discretion
Future development potential: the mechanism of GPP implementation policies	Higher	General	There is a significant gap between the green items list and EU criteria, particularly in the implementation mechanism and rules formulation
Future development potential: coverage of GPP implementation policies	Higher	Higher	Currently, there are 68 categories of the green items list (50 of which belong to the environmental-labeling product items list and 18 belong to the energy-saving product items list). Then there are 19 categories of GPP criteria. Engineering and PPP are excluded from the coverage of the green items list, and the number of GPP criteria coverage categories remain to be increased. In this case, the coverage of China-Europe GPP implementation policies boasts great development potential in the future

Table A2.
China and EU GPP implementation policies comparison