

WAN JUNKANG<sup>1</sup>, LU XIAOFEI<sup>2</sup>

*1 SCHOOL OF MANAGEMENT, WUHAN UNIVERSITY OF TECHNOLOGY, WUHAN, HUBEI,  
P.R.CHINA / 2 BEIJING HYUNDAI MOTOR COMPANY CORPORATION, BEIJING, HEBEI,  
P.R.CHINA*

**Abstract** Government green procurement is both an institutional innovation and a management innovation on government procurement, which is adapt to the sustainable development in social economy. This paper examines on the implication of government green procurement, and emphases on the supplier selection issue of government green procurement. In addition, the paper presents the evaluation index system and the supervision model for supplier selection of government green procurement.

**Key words** Government green procurement, Environmental management, Supplier selection

## 1 Introduction

### 1.1 Implications of government procurement and green procurement

Human economic activities include production, allocation, exchange, consumption and others. The objects of production and consumption include public goods and private goods. Government, as the center of public institutions, provides public goods for society in her performance of economic function. Therefore, government is the main consumer of public goods, and its consumption behavior is based on government procurement.

Government procurement is one important part of national public finance system in market economy, and the significant means of strengthening financial support management and controlling economy by government as well, which is accepted as an international vulgate means. In another words, government procurement is the act of buying public goods, projects and services with the fiscal fund by legal methods and procedures, in the approach range of purchase, rent, principal and employment by the governments at various levels and their affiliates and other public entities to obtain cargoes.

Government green procurement is proposed with the issue of attentions and solutions to sustainable development in economy society in the process of government procurement activities, and the great pressure from human's survival and economy development based on the resource environment problem.

Government green procurement requires government to choose those products and services accordance with the national green certification standard. In addition, the green standard for government procurement not only ask for the terminal products should meet the environment-protection technical standards, but also require that all the products in the whole process of design, development, production, packaging, transportation, utilization, cycling and reutilization, until wasting, which is divided by the theories of product lifecycle should meet the environment requirements.

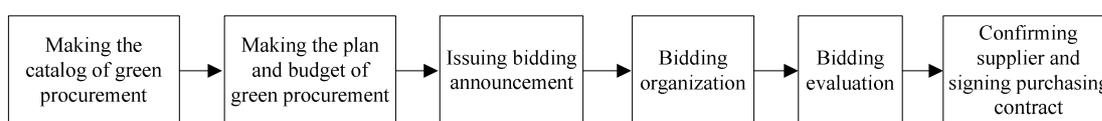
Government green procurement is the key content of fiscal expenditure management, and is both an institutional innovation and a management innovation on government procurement. The scope of procurement activities is very wide and the scale is very huge. Thus, government green procurement plays a crucial role in saving resources, protecting environment, promoting industrial structure optimizing and upgrading, guaranteeing society and economic sustainable development.

As the sustainable development strategy is brought into the objectives of government activities, substantive progress has been attained in government green procurement in North America, Japan and Korea.

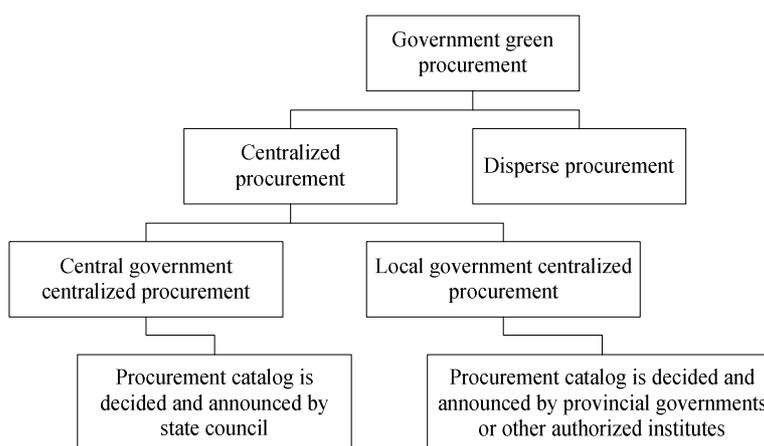
In 2006, Financial Ministry and Environmental Protection Administration of China announced “the government procurement implementation method for environment symbol products” and the first government green procurement list, which stipulates the governments, their affiliates and other public entities use the fiscal fund to procure products and services, and environment symbol products are preferred. This announcement is the formal and regulated start of our national government green procurement.

### 1.2 Parties and workflow of government green procurement

The parties of government green procurement are the organizations, which share authorities and take over responsibilities in the activities of government green procurement. In another word, the parties of government green procurement are the participants with directed function, which include procurement institutes, bidding agencies, purchasing units, suppliers, and other relevant intermediary organizations and capital management departments. The main process and mode of government green procurement are as shown in Figure 1 and Figure 2.



**Figure 1 The Main Process of Government Green Procurement**



**Figure 2 The Mode of Government Green Procurement**

Government green procurement continues to use the traditional government procurement mode, but greening relevant concrete links and forming the green characteristic procurement mode, which include two aspects, the first is that the green qualification requires all parties should set up a verified environment management system, and the second is that green standard requirements are raised up to different products and services, and the implementation of green evaluation is required for each procurement. In fact, government green procurement is a systematic greening process of all activities in government procurement on the basis of products greening requirements, that is, government green procurement includes greening institutions, greening organizations, greening mechanisms, greening products and suppliers.

There are two main parties in government green procurement, one is government, another is suppliers. Government plays an critical role in government green procurement activities, because that, on one hand, from the fiscal expenditure angle, government is the main body of management, that is, government is manager of government procurement activities, who has great management functions; on the other hand, from the fundermental procurement activities, government is the main body of demand, and also the consumer of products and services, who also play an important role in society responsibilities. Consequently, government is

regarded as a very key actor in government green procurement activities, which decides how much the quality level of government green procurement is and how great the society functions are. For the second parties, suppliers, this is defined by the law of government procurement as the corporates, its affiliations and nature persons who offer goods, projects or services to purchasers. Moreover, suppliers' characteristics and their behaviors are required to be greened.

## 2 Supplier Selection in Government Green Procurement

Suppliers are the main body providing green public goods. Supplier selection is the most important implication of government green procurement, which impacts the result of government green procurement directly. This paper proposes a set of evaluation index system for government green procurement based on the characteristics of government green procurement, and aims at offering a correct approach for supplier selection, as shown in Table 1.

**Table 1 Evaluation Index System for Government Green Procurement**

Index	Concrete index	Evaluation content
Environment index	Environment property index	Certified by environment symbol
	Environment management index	Certified by environment management system
Economy index	Price index	Compared with market, competitors Cost analysis
	Expense index	Project properties Rationality
	Capital index	Bank credit
Management index	Quality management system	Certified by quality management system
	Human resource management	Personnel, qualification, education degree, post title, professional training, society security
Quality index	Qualified product rate and duration	Tested qualified products rate Revision rate
	Technical improvement on product	New product development cycle Technical content
Service index	Service commitment	Service security, satisfaction, necessary guarantee fund
	Service project	Full-scale, meeting all requirements
	After service	Quality security period, service network, fast response
	Information feedback	Special demand, crisis measurement, complaint treatment
	Hardware level of service	Complete and advanced infrastructure
Supplying index	On-time supply rate	Deliever on time
	Accurate supply rate	Meeting the requirement of the contract
	Safety supply rate	Non-hidden trouble

## 3 Supervision Model of Government Green Procurement

Whether the products provided by supplier are qualified or accorded with green standard, is the key point of government green procurement.

Let supervision cost be  $C$ , the profit of qualified products provided by supplier is  $E$ , the profit of qualified and unqualified products provided by supplier is  $E'$ , all of which fortunately been accepted, and  $E' > E$ ,

meanwhile, the payoff given by supervision department is caused by the negative impact on society by accepted unqualified products from supplier. On the basis of the above assumptions, supervision game theory model can be set up. The game space and payoff matrix of supervision model for government green procurement are as follows:

**Table 2 The Game Space and Payoff Matrix of Supervision Model for Government Green Procurement**

		Supplier	
		Qualified	Unqualified
Supervision department	Payoff		
	Supervision	-C, E	-C, 0
	Non-supervision	0, E	-D, E'

There are two countermeasures in game space for supervision department, that is, supervision or non-supervision, at the same time, supplier also faces with two different game spaces, which includes providing qualified products or providing unqualified products. Data information is the separately utility of corresponding games. From the above payoff matrix, we may find that: (1) the payoff utilities of supervision department or supplier are decided by their strategies and the other party's strategy; (2) supervision department only implement its supervision function, for example, if the supervision utility is 100%, then when supplier provides unqualified products, supervision department will find and stop them; (3) if supervision department doesn't implement its supervision function, then when supplier provides unqualified products, supervision department will accept them.

Herein, we need to consider whether mixed strategy Nash equilibrium exists in this game. We suppose that: (1) the supervision probability is  $p$ , the non-supervision probability is  $1-p$ ; (2) the probability of qualified products provided by supplier is  $q$ , the probability of unqualified products provided by supplier is  $1-q$ ; (3)  $U_g$  is the expected utility function of supervision department, and  $U_r$  is the expected utility function of supplier. Then, we may get:

$$U_g = p \{(-C) \times q + (-C) \times (1-q)\} + (1-p) \{0 \times q + (-D) \times (1-q)\} = -pC - (1-p)(1-q)D$$

$$U_r = q \{E \times p + E \times (1-p)\} + (1-q) \{0 \times p + E' \times (1-p)\} = qE + (1-p)(1-q)E'$$

Based on differential equations, we may get one-step condition of optimization:

$$U_g'(p) = -C + (1-q)D = 0, \text{ then } q^* = 1 - C/D \tag{1}$$

$$U_r'(q) = E - (1-p)E' = 0, \text{ then } p^* = 1 - E/E' \tag{2}$$

The above formula is mixed strategy Nash equilibrium. Supervision department's supervision probability is  $p^*$ , supplier's qualified products probability is  $q^*$ , that is to say, if supplier's qualified products probability is over  $q^*$ , then supervision department will choose non-supervision; if supervision department's supervision probability is over  $p^*$ , then supplier will choose providing qualified products. Theoretically, supervision behavior is decided by the profits of qualified products or unqualified products from supplier, therefore, supervision department implements efficient management probability is  $p^* = 1 - E/E'$ .

### Reference

[1] Arrowsmith, Susan L. *Regulating Public Procurement: National and International Perspectives*, Kluwer Law International, 2000. 10  
 [2] Carter C. R. Kale R. and Grimm C. M. *Environmental Purchasing and Firm Performance: An Empirical*

Investigation. Transaction Research Part E, 2000, (36): 219-288

- [3] Wang Yaxin. Institutional Innovation on Government Procurement. Beijing: China Economy Publishing House, 2002, 3, 16-20
- [4] Chen Yanping. Sustainable Development Consumption Brought by Government Green Procurement. Environment Economy, 2007(Z1)