The Analysis of the Barriers of Government Procurement Based on ISM

Zou Hao[1], Wang Dongwei[2]
1 Shenyang Government Procurement Center, Shenyang, P.R.China, 110003
2 Graduate School of Shenyang Ligong University, Shenyang, P.R.China, 110168
(E-mail:zrzh@ccgp-shenyang.com, huolongzhenren@163.com)

Abstract Based on recent research and analysis on the improvement of the efficiency of government procurement, the paper tries to analyze the interaction among key barriers, which badly hinder or prevent the application of the government procurement. Existing papers have so focused on identifying barriers separately that it is lack of a systematic view about the barriers. Based on these reasons, the Interpretive Structural Modeling(ISM) methodology is utilized to understand the mutual influences among the barriers. Through this model the most important factors of optimization of the government procurement can be found. And it is useful to improve the efficiency of current government procurement.
Key words Government procurement; Barriers; Interpretive structural model(ISM)

1 Introduction

The government procurement of China began relatively late, but develops very rapidly, and its problems are increasingly exposed.（Ma Haitao, Jiang Aihua, 2008）.Most of the current studies of government procurement of China focus on the identification of the barriers of government procurement which are useful at the beginning of the operation of government procurement. So the more important thing we need to do now is to look into the interaction of the key barriers so that we can figure out the most efficient way to improve the efficiency of Chinese government procurement.

2 Analysis of Barriers of Government Procurement Based on ISM

2.1 The identification of the barriers of government procurement

In the current situation, government procurement has played a positive role in saving money, building a clean government, improving the efficiency of financial funds, promoting the implement of national policy objectives, narrowing the gap between different regions. However, there are still many factors contributing to be the obstacles of the objectives above.

Based on the literature at home and abroad and participating the training course of government procurement held by Liaoning Province and business exchange of sub-provincial city on government procurement, we screen 24 obstacles out of 65 ones, which are the alternative elements in ISM method, as shown in Table 1.

The government procurement performance studied in this paper involves a comprehensive evaluation of the performance of government procurement. In addition to purchasing products, projects, service of the best quality at the lowest cost, we also hope to realize a more important objective which is to promote the implementation of the policy. (Ma Haitao Jiang Aihua, 2008)

2.1.1 The identification of the obstacles hindering the improvement of government procurement

In this investigation, we have distributed 60 pieces of questionnaires, which is exactly the number of questionnaires answered. The number of valid questionnaires we received is 53, which indicates that the probability of the valid questionnaires is 88.3%.

After the factors of the obstacles are identified, we screen the factor by investigation questionnaire. The questionnaires are distributed to 30 experts involving 10 professors of The Central University of Finance and Economics, Renmin University, Nankai University, Harbin Institute of Technology, and 20 students studying for a master degree or the Ph.D. graduates in school mentioned above. In addition to this, we also distribute the questionnaire to 34 leaderships of the government procurement center, in which there are 26 leaderships from Liaoning province and 8 leadership from other sub-province cities.

2.1.2 The assignation of weight and evaluation of the obstacles

Let the evaluation of the obstacles be below:

$X=\{X_1,X_2,X_3\}=\{$ordinary, relatively authoritative, authoritative$\}=\{0，0.5，1\}$

Let P^P indicate the weight of experts and scholars, P^l the weight of the leadership of the government procurement center. Then we assign the weights between experts and leadership, which are

shown in Table 2.

Table 1 The Obstacle of Hindering the Improvement of Government Procurement

The type of factor	NO.	Symbol	Factor
The kind of theory	1	S_1	The scale of government procurement is too small
	2	S_2	The coverage of government procurement is limited
	3	S_3	The system of laws and regulations is imperfect
	4	S_4	The nature of Government is unprofitable
	5	S_5	The binding of budget and plan is not strong
The kind of practice	6	S_6	The process of government procurement is complex
	7	S_7	The express of governmental information is vague
	8	S_8	Changes of parameters in the tender document is frequent
	9	S_9	Requirements of the basic management are not uniform
	10	S_{10}	The participator lack a deep understanding of government procurement
	11	S_{11}	The performance of the contract is not timely
	12	S_{12}	The operator of the agency of government procurement is not personnel
	13	S_{13}	The professionalization of the operator is not high enough
	14	S_{14}	The flow of purchasing information is not smooth
	15	S_{15}	The experts database is not updated in time
	16	S_{16}	Experts do not follow the market trends and the improvement ofnew technologies
	17	S_{17}	The suppliers are aware of the concept of full-service
	18	S_{18}	The behavior of the bidder is irregular
The kind of cross-type	19	S_{19}	The evaluation of the effectiveness of government procurement is not objective
	20	S_{20}	Rentseeking
	21	S_{21}	Administrative penalties are irrational
	22	S_{22}	The supervision and inspection are unreasonal
	23	S_{23}	The degree of E-government procurement is not mature
	24	S_{24}	The tender cost of nonlocal supplier is too high

Table 2 The Weight of Expert and Leadership

	P^P	P^l
	Experts and Scholars	The leadership of government procurement
The kind of theory	0.6	0.4
The kind of practice	0.4	0.6
The kind of cross-type	0.5	0.5

2.1.3 Assess the importance of alternative factors of the obstacles of government procurement

Let r_i^P indicate the number of the experts and scholars who have checked the option, r_i^l the number of the leadership of the government procurement center who have checked the option. We can get evaluation according to the summary of the questionnaire and we can see the result shown in Table 3.

Table 3 The Evaluation of the Barriers of Improvement of Government Procurement

Code	The alternative factors	The evaluation of obstacles to improving government procurement			The evaluation of the factor	Sort of the factor	Code of the key factor
		X_1	X_2	X_3			
		$r^p_i \backslash r^I_i$	$r^p_i \backslash r^I_i$	$r^p_i \backslash r^I_i$	y_i		
S_1	The scale of government procurement is too small	10\0	14\4	8\20	0.637	5	A_5
S_2	The coverage of government procurement is limited	8\0	14\14	8\20	0.618	7	A_7
S_3	The system of laws and regulations is imperfect	4\2	12\8	14\24	0.73	1	A_1
S_4	The nature of Government is unprofitable	14\20	12\12	4\2	0.304	23	——
S_5	The binding of budget and plan is not strong	6\0	6\20	18\14	0.708	2	A_2
S_6	The process of government procurement is complex	10\4	16\14	4\16	0.563	10	——
S_7	The express of governmental information is vague	4\8	18\22	8\4	0.489	15	——
S_8	Changes of parameters in the tender document is frequent	14\8	10\20	6\6	0.425	22	——
S_9	Requirements of the basic management are not uniform	14\6	8\26	8\2	0.432	21	——
S_{10}	The participator lack a deep understanding of government procurement	6\6	18\18	6\10	0.533	13	——
S_{11}	The performance of the contract is not timely	10\12	16\8	4\14	0.476	17	——
S_{12}	The operator of the agency of government procurement is not personnel	12\6	12\20	6\8	0.475	18	——
S_{13}	The professionalization of the operator is not high enough	8\8	12\22	10\4	0.473	19	——
S_{14}	The flow of purchasing information is not smooth	2\14	12\20	16\0	0.469	20	——
S_{15}	The experts database is not updated in time	12\2	12\12	6\20	0.579	9	——
S_{16}	Experts do not follow the market trends and the improvement of new technologies	8\2	12\16	10\16	0.635	6	A_6
S_{17}	The suppliers are aware of the concept of full-service	8\6	12\22	10\6	0.512	14	——
S_{18}	The behavior of the bidder is irregular	2\8	10\10	18\16	0.675	3	A_3
S_{19}	The evaluation of the effectiveness of government procurement is not objective	8\8	20\14	2\12	0.4775	16	——
S_{20}	Rent seeking	2\16	14\8	14\10	0.5525	12	——
S_{21}	Administrative penalties are irrational	6\4	16\20	8\10	0.56	11	——
S_{22}	Supervision and inspection are unreasonable	4\4	10\18	16\12	0.66	4	A_4
S_{23}	The degree of E-government procurement is not mature	6\4	18\14	6\16	0.5875	8	——
S_{24}	The tender cost of nonlocal supplier is too high	12\18	12\14	6\2	0.2825	24	——

2.1.4 Instruct the matrix of the evaluation of the obstacles

Let R^p indicate the matrix of the result built according to what the experts and scholars have

checked; R^L the matrix of the result built according to what the leadership of government procurement center have checked; let $r_{i,j}^P$ indicate the number of experts and scholars who have checked the related factor, $r_{i,j}^L$ the number of leadership who have checked the related factor; let $\sum_{i=1}^{3} r_i^P$ indicate the total number of experts and scholars whose questionnaire is valid, $\sum_{i=1}^{3} r_i^L$ the total number of leadership whose questionnaire is valid. Based on the theory related, we firstly transfer the evaluation into related number, and instruct a matrix according to the related number, which is shown below.

$$R^P = \begin{vmatrix} \frac{r_{1,1}^P}{\sum_{i=1}^{3} r_i^P} & \frac{r_{1,2}^P}{\sum_{i=1}^{3} r_i^P} & \frac{r_{1,3}^P}{\sum_{i=1}^{3} r_i^P} \\ \frac{M}{\sum_{i=1}^{3} r_i^P} & \frac{r_{i,j}^P}{\sum_{i=1}^{3} r_i^P} & \frac{M}{\sum_{i=1}^{3} r_i^P} \\ \frac{r_{24,1}^P}{\sum_{i=1}^{3} r_i^P} & \frac{r_{24,2}^P}{\sum_{i=1}^{3} r_i^P} & \frac{r_{24,3}^P}{\sum_{i=1}^{3} r_i^P} \end{vmatrix} \quad (1)$$

$$R^L = \begin{vmatrix} \frac{r_{1,1}^L}{\sum_{i=1}^{3} r_i^L} & \frac{r_{1,2}^L}{\sum_{i=1}^{3} r_i^L} & \frac{r_{1,3}^L}{\sum_{i=1}^{3} r_i^L} \\ \frac{M}{\sum_{i=1}^{3} r_i^L} & \frac{r_{i,j}^L}{\sum_{i=1}^{3} r_i^L} & \frac{M}{\sum_{i=1}^{3} r_i^L} \\ \frac{r_{24,1}^L}{\sum_{i=1}^{3} r_i^L} & \frac{r_{24,2}^L}{\sum_{i=1}^{3} r_i^L} & \frac{r_{24,3}^L}{\sum_{i=1}^{3} r_i^L} \end{vmatrix} \quad (2)$$

2.1.5 Calculate the evaluating values of the obstacle and screen the key factor

We calculate the evaluating value by the expressions below, and the results of the calculation are already shown in Table 3.

$$Y^P = R^P \times X^T \times P^P \quad (3)$$

$$Y^L = R^l \times X^T \times P^L \quad (4)$$

The operator of the expressions is simple multiplier operator, and we'll get the evaluating value of obstacles y_i^P, y_i^L, which are shown in Table 3.

2.1.6 Build the correlation matrix

Table 4 Correlation Matrix

	A_1	A_2	A_3	A_4	A_5	A_6	A_7
A_1	0	1	1	1	1	0	1
A_2	0	0	0	0	0	0	0
A_3	0	0	0	0	0	0	0
A_4	0	0	0	0	0	1	0
A_5	0	0	0	0	0	0	1
A_6	0	0	0	0	0	0	0
A_7	0	0	0	0	1	0	0

Correlation matrix indicated the direct causal relationship between the elements. We get the indirect causal relationship through the matrix multiplication.

The instruction of the evaluation matrix is based on this principle: if A_1 have a direct influence on A_2, but A_2 doesn't have a direct influence, then we let A_{12} be 1 and A_{21} be 0. If the 2 factors have mutual influence on each other, we let A_{12}, which is equal to A_{21}, be 1. If the 2 factors have no relationship between each other, we let A_{12}, which is equal to A_{21}, be 0. The impact on its own is not marked temporarily. According to the assumption above, we will get the correlation matrix as Table 4 shows.

2.1.7 Build the reachability matrix

Let A be correlation matrix, and B be A+E, in which E indicates the unit matrix. And the operation of the matrix is according to Boolean algebra algorithms. When we get $B^r=B^{r+1}$, we name the matrix B^{r+1} be reachability matrix in which r indicates how many media we have taken in order to place a causal relationship. We can see the reachability matrix shown in Table 5.

Table 5 Reachability Matrix

A_i \ A_i	A_1	A_2	A_3	A_4	A_5	A_6	A_7
A_1	1	1	1	1	1	1	1
A_2	0	1	0	0	0	0	0
A_3	0	0	1	0	0	0	0
A_4	0	0	0	1	0	1	0
A_5	0	0	0	0	1	0	1
A_6	0	0	0	0	0	1	0
A_7	0	0	0	0	1	0	1

We will get the relationship between any two elements through limited media, which is the key process of the analysis based on ISM.

2.2 The decomposition of reachability matrix

2.2.1 The construction of reachablity set, antecedent set, and common set

Let the reachablity matrix be M, and let the element of the matrix be m_{ij}, $R(A_i)$ be reachability set, A（A_i）be antecedent set, $R(A_i)\cap A（A_i）$ be common set, in which we can see :

$R(A_i)=\{A_i\in M \mid m_{ij}=1\}$，$A（A_j）=\{A_j\in M \mid m_{ij}=1\}$. We will get all the set above shown in Table 6.

Table 6 The Reachablity Set, Antecedent Set and the Common Set

A_i	$R(A_i)$	A（A_i）	$R(A_i)\cap A（A_i）$
1	1、2、3、4、5、6、7	1	1
2	2	1、2	2
3	3	3	3
4	4、6	1、4	4
5	5、7	1、5、7	5、7
6	6	1、4、6	6
7	5、7	1、5、7	5、7

2.2.2 The element classification

Based on the process above, we are ready to perform the element classcification. L indicates the level, in which $L_i(i=0,1,2\cdots\cdots,5)$indicates the corresponding level of the element. Let L_0 be Φ, and full set be P, we will perform the element classification through the process below.

（1）$L_1=\{A_i\in P\text{-}L_0 \mid R_0(A_i)\cap A_0（A_i）=R_0(A_i)\}=\{A_2，A_3，A_5，A_6，A_7\}$, and let L_1 be the first level .

Checking: $P\text{-}L_0\text{-}L_1\neq\Phi$,and the classification needs to be continued;

（2）$L_2=\{A_i\in P\text{-}L_0\text{-}L_1 \mid R_1(A_i)\cap A_1（A_i）=R_1(A_i)\}=\{A_4\}$, and let L_2 be the second level

Checking: $P\text{-}L_0\text{-}L_1\text{-}L_2\neq\Phi$,and the classification needs to be continued;

（3）$L_3=\{A_i\in P\text{-}L_0\text{-}L_1\text{-}L_2 \mid R_2(A_i)\cap A_2（A_i）=R_2(A_i)\}=\{A_1\}$, and let L_3 be the third level

Checking:$P\text{-}L_0\text{-}L_1\text{-}L_2\text{-}L_3\text{-}L_4\text{-}L_5=\Phi$, and the classification is finished.

Based on the classification above, we separate all the elements into 3 levels, in which the first level is the highest level and the third level is the lowest level. In this classification, the lower the level is, the more basic the elements play in the whole system. The purpose of this process is to simplify the structure of the system, which is exceedingly useful for us to perform the analysis next.

2.2.3 Rebuild the reachability matrix

After the elements classification, we can rebuild the reachability matrix according to the classification, and we can get the new matrix, shown in the Table 7 below.

Table 7 Reachability Matrix after the Element Classification

	A_2	A_3	A_5	A_6	A_7	A_4	A_1
A_2	1	0	0	0	0	0	0
A_3	0	1	0	0	0	0	0
A_5	0	0	1	0	1	0	0
A_6	0	0	0	1	0	0	0
A_7	0	0	1	0	1	0	0
A_4	0	0	0	1	0	1	0
A_1	1	1	1	1	1	1	1

Now, we get the simplest relationship between the elements, based on which we can easily perform the analysis according to ISM.

2.3 Build the model of ISM

2.3.1 Build the model

According to the element classification and Table 7, we can draw the figure as figure 3 describes.

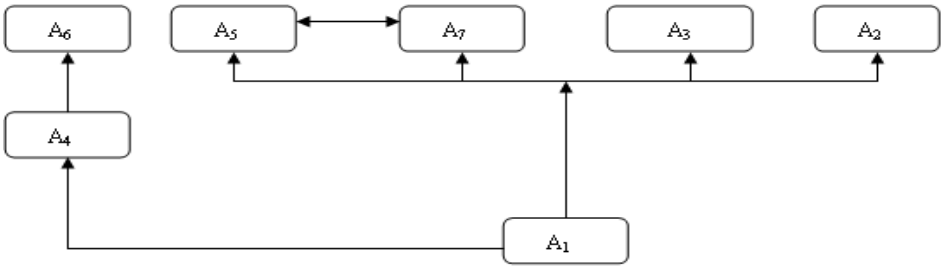

Figure 3 The Model of the Key Obstacle based on ISM

2.3.2 Model interpretation

Bring the name of the key elements in Figure 3, and we will get the interpretation of the model as Figure 4 describes.

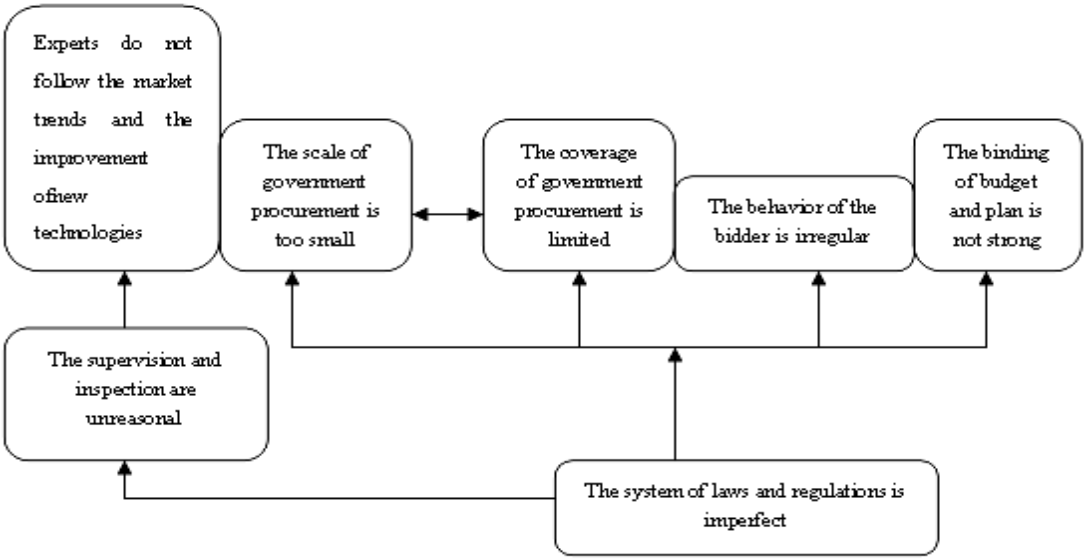

Figure 4 Interpretation of the Model

3 Conclusions

In this paper, we firstly screen 24 elements out of 65 elements through expert interview, which is the alternative element to be the key element used to build the model. Then we screen 7 key elements out of the 24 alternative elements by questionnaire. In accordance with the basic principles of

Engineering, we explain the formation of structural modeling. Based on process above, we can reasonably arrive at the conclusion below:

(1) That the system of laws and regulations is imperfect is crucial to the performance of government procurement of China. We can see that this aspect affects almost every element of the system. That is to say to build a healthy, scientific system of law is the first step to improve the system of government procurement. That is why some of the advance can not be performed completely.

(2) As far as that experts do not follow the market trends and the improvement of new technologies is concerned, we think the fundamental reason is that the legal system is imperfect, which leads to the behavior of the experts lack of instruction and regulation and the immediate cause is that the supervision and inspection are unreasonable. In the specific procurement projects, the experts play an important roll, which has an immediate influence on whether the result of the procurement is scientific. We think there are several reasons leading to it: Firstly, most of the experts are alien from the market, that is too say, some experts are too theoretical, and the actual situation of the certain market is not the domain field of the expert. Secondly, the current focus of the supervise concentrates mostly on the agency of government procurement, which makes us pay little attention to the experts. Last, but certain not the least, is the unevenness of the regional development that most of the underdeveloped region are lack of genuine experts. So how to construct a sharing mechanism of the experts is the new focus of the agency of government procurement.

(3)That the scale of government procurement is too small has a mutual influence on the phenomenon that the coverage of government procurement is limited, which is exactly same to the fact. And, that the system of laws and regulations is imperfect have worsened the behavior of the bidder and the limited regulation of the budget and plan.

(4) From Table 3, we can see the difference in opinion between the experts and scholars from school and the leadership from the government procurement center. So we suggest that the communication of the two participators must be held frequently enough in order to get a more scientific plan to improve the whole performance of government procurement of China.

References

[1] Yang Yanying. The Problems and Advice of the Mechanism of Chinese Government Procurement [J]. China Government Procurement, 2008,12(91):73-75(In Chinese)

[2] Wang Yingluo. System Engineering [M]. Peking: China Machine Press , 1982 (In Chinese)

[3] Ma Haitao, Jiang Aihua. Research on Government Procurement of China [M]. Peking: Peking University Press, 2007 (In Chinese)

[4] Ma Haitao, Jiang Aihua. A Study on China's Government Procurement Institution [M]. Peking: Peking University Press, 2007 (In Chinese)

[5] Li Xiaofeng, Shi Hua. Problems and Proposals of Government Purchase of our Country [J]. East China Economic Management, 2006, 20(1):35-38 (In Chinese)

[6] Chen Lichu. The Analysis of Disadvantages and Countermeasures of China's Government Procurement [J]. Guangdong Science & Technology, 2005,12(148):46-47 (In Chinese)

[7] Yu Yuanbiao. The Disadvantages and Countermeasures of China's Government Procurement [J]. Sichuan Public Finance, 2002(9):30-31 (In Chinese)

[8] Niu Haixia. A Probe into the Major Existing Drawbacks in Governmental Procurement: Analysis and Treatment [J]. Journal of Zhejiang University (Humanities and Social Sciences), 2000, 30(2):125-130 (In Chinese)

[9] Xue Sunli, Xu Yu, Yi Wen. Interpretive Structural Modeling of Barrier Factors in Reverse Logistics [J]. Logistics Technology, 2006(2):39-41(In Chinese)