Research of Transforming Grassroots Government Function Based On Principal Component Analysis

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Abstract. According to principal component analysis theory, through government functions of network platform, performance of organization departments, the software power and information reflected by public to participate in the government network platform construction, to improve the transformation of government function, establish a reasonable standard of government network platform. According to the four secondary indexes, it comprehensive develop 18 evaluation factors as the main factors and targets that influence transformation of town government functions, to get the weight proportion of each index, and analyze on the transformation of town government function in the network era.

Keywords. network platform; town government; principal component analysis; transformation of government function

1 Introduction

Computer network have a large number of users, according to 2014 statistics, Chinese internet users reached to 632 million, and mobile internet usage is growing fast. Government department consciously sorting and planning network platform, and its purpose are to constitute reasonable government networks. For now, the town government network platform is not very perfect, and lack of real-time attention and update for web information. In the internet age, the government network platform is effective channels and measures to reflect the public state and anticorrosive. Because ordinary petition or supervision need a long time and higher cost, so establish a efficient and reasonable government network platform is very important.

2 Construction of town government network platform

To speed up the urbanization construction is an important decision for coordinated developing urban and rural areas in China. Villages and towns function transformation is an important part of the change of government function[1]. With the further concept optimization of a service-oriented township government, to indicate the direction for town government to better serve the society, serve the public. So "service-oriented town government" is the functions orientation of town government in the new rural construction[2]. In terms of network system, the balance between individuals and organization market of network business and disciplinary and the township government is particularly important.

2.1 The reliability and selection of index

This article combine related research comprehensively developed multiple evaluation factors. But it basis on the correlation principle of the average index ≥ 2.5, selects a kind of index, on the condition of the economic factors, social factors, the network communication coexist[3], based on principal component analysis to quantify the establishment of the town government network platform. Set up relationship of the target layer, criterion layer and project layer, as shown in table 1.

Target layer: construction of town government network platform.

Rule layer: the influence factors of scheme, the functions of government network platform T_1, the performance of all kinds of organization department T_2, software power T_3, the situation reflect by public T_4.

Table 1. Town government function transformation indicator system

First index	Secondary index	Tertiary index
Construction of town government network platform U	Government network platform function T_1	Host page construction of government network platform K_1
		Troops construction K_2
		Collection of feedback information K_3
		Financial investment K_4
		Institution setting K_5
		Function planning K_6
	Performance of all kinds of organization department T_2	Main department influence K_7
		Government network platform scale K_8
		Network quiz held K_9
		Information uploading capacity K_{10}
		Community network platform develop K_{11}
		Public crisis handling ability K_{12}
	Software strength T_3	Index word matching ability K_{13}
		Authoritative information release timely K_{14}
		Network public opinion monitoring ability K_{15}
		Network public opinion early warning ability K_{16}
	Status reflected by public T_4	Resident browse, usage quantity K_{17}
		Message, petition feedback quantity K_{18}

2.2 Construction and analysis of hierarchical structure model

2.2.1 Principal component analysis model theory

Through the above account, this article can be drawn three levels of indicators system about function evaluation of town government network platform. Among them, every level's factor analysis is extracted by lead level, and the weight is combine factor analysis and hierarchical analysis to study reasonably.

In this paper, by applying the principal component analysis method to determine the weight allocation rate and its matching principle as follow:

Assuming it has n indicators, each indicator has p corresponding variable, thus has a $n \times p$ matrix form:

$$X = \begin{cases} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{cases} \tag{1}$$

If original factors be defined as $x_1, x_2, \ldots, x_p$, analyze them synthetically, so corresponding indicator is:

$$z_1, z_2, \ldots, zm \ (m \le p), \text{ so}$$

$$\begin{cases} z_1 = l_{11}x_1 + l_{12}x_2 + \cdots, + l_{1p}x_p \\ z_2 = l_{21}x_1 + l_{22}x_2 + \cdots, + l_{2p}x_p \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ z_m = l_{m1}x_1 + l_{m2}x_2 + \cdots, + l_{mp}x_p \end{cases} \tag{2}$$

The l_{ij} must be:

$$\lambda^{(1)}_{max} = 3.31, \omega^{(1)}_1 = \begin{cases} 0.252 \\ 0.089 \\ 0.66 \end{cases} \quad \lambda^{(2)}_{max} = 3.12, \omega^{(1)}_2 = \begin{cases} 0.575 \\ 0.286 \\ 0.139 \end{cases}$$

$$\lambda^{(3)}_{max} = 3.30, \omega^{(1)}_3 = \begin{cases} 0.624 \\ 0.240 \\ 0.136 \end{cases} \quad \lambda^{(4)}_{max} = 4.05, \omega^{(1)}_4 = \begin{cases} 0.185 \\ 0.240 \\ 0.575 \end{cases}$$

Test with consistency index: $\quad CI = \dfrac{\lambda_{max} - n}{n - 1}, \ CR = \dfrac{CI}{RI}$

Table.2 RI value

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Get matrix A, $\lambda^{(0)}_{max} = 4.073, RI = 0.9$

$$CR = \frac{CI}{RI} < 0.1$$

The inconsistency test of A is valid, and movement in allowed range, weight vector can be substituted for A feature vector.

Principal component analysis method calculated as followed:

(1) Construct factor sets U,

(2) Construct judge sets V,

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \tag{3}$$

Construct weigh sets, $A = (a_1, a_2, \cdots, a_n)$, meet the condition:

$$\sum_{i=1}^{n} a_i = 1 \quad a_i \geq 0$$

$$\sum_{i=1}^{n} r_{ij} \quad j = 1, 2, 3, \cdots, m$$

$$B = A \cdot R$$

$$= (a_1, a_2, a_3, \cdots, a_n) \cdot \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

$$= (b_1, b_2, b_3, \cdots, b_n)$$

In the type, x_i and x_j related original variables are corresponding coefficient r_{ij} （i，j$=1,2,\ldots,$ p）, so its calculation formula is:

$$r_{ij} = \frac{\sum_{k=1}^{n} (x_{ki} - \bar{x}_i)(x_{ki} - \bar{x}_j)}{\sqrt{\sum_{k=1}^{n} (x_{ki} - \bar{x}_i)^2 (x_{ki} - \bar{x}_j)^2}} \tag{4}$$

Deriving eigenvector, eigenvalue:

In allusion to $|\lambda I - R| = 0$ calculate the corresponding characteristics values λ_i （i$=1,2,\ldots,$ p）, and make corresponding arrangement $\lambda_1 \geq \lambda_2 \geq \ldots, \geq \lambda_p \geq 0$ .Then calculate the corresponding eigenvectors with:

$$e_i（i = 1, 2, \cdots, p)$$

It calculates the contribution rate of main composition factor, and the total contribution rate in the process of accumulation, as shown below:

$$r_i / \sum_{k=1}^{p} \gamma_k (i = 1, 2, \cdots, p) \tag{5}$$

The total contribution is

$$\sum_{k=1}^{m} \gamma_k / \sum_{k=1}^{p} \gamma_k \tag{6}$$

Above all are the principal component analysis steps to calculate the objective weighting, and will specifically apply it.

2.3 Determination of factor index

By using the detection method of factor analysis for testing, the result is 0.879. It shows that factor analysis can be done, but also proved that the factor analysis method is effective, according to the relevant data of each index, by using the method of principal component analysis to get the variance cumulative rate, as shown in table 3:

Table 3. Eigenvalue and contribution rate

Index	Characteristic root	Variance contribution rate (%)	Accumulative contribution rate (%)
1	4.523	26.104	63.214
2	6.958	36.829	36.579
3	1.461	7.126	84.071
4	2.719	13.997	77.161

2.4 Model of factor loading calculation

On the basis of factor loading model, in view of the initial load, make a maximum variance rotation, and the results as shown in table 4:

Table 4. Factor loading matrix, factor score coefficient matrix

Variable	Factor loading matrix				Factor score coefficient matrix			
	F1	F2	F3	F4	F1	F2	F3	F4
Main department influence Y_1	0.935	0.214	0.049	0.145	0.237	-0.022	0.009i	-0.045
Government network platform scale Y_2	0.935	0.215	0.049	0.165	0.228	-0.024	-0.018	-0.051
Network quiz held Y_3	0.958	-0.187	0.055	0.158	0.236	-0.019	-0.011	-0.049
Information uploading capacity Y_4	0.920	0.189	0.044	0.169	0.215	-0.026	-0.014	-0.039
Community network platform develop Y_5	0.080	0.325	0.891	0.043	-0.045	0.114	0.489	-0.035
Public crisis handling ability Y_6	0.842	0.489	-0.123	0.184	0.253	0.167	-0.082	0.059
Host page construction of government network platform Y_7	-0.005	0.454	0.856	0.086	-0.058	0.169	0.497	0.005
Troops construction Y_8	0.062	0.071	0.098	0.847	-0.025	-0.004	0.032	0.512
Collection of feedback information Y_9	0.064	0.734	-0.025	-0.085	-0.035	0.279	-0.045	-0.523
Financial investment Y_{10}	0.165	0.862	0.024	0.076	-0.096	0.336	0.018	-0.114
Institution setting Y_{11}	0.866	-0.041	-0.086	0.187	0.432	-0.014	-0.057	0.105
Function planning Y_{12}	0.154	0.219	0.795	0.068	-0.091	-0.013	0.462	0.059
Index word matching ability Y_{13}	0.054	-0.006	0.165	0.809	0.442	-0.017	0.079	0.461
Authoritative information release timely Y_{14}	-0.084	0.936	-0.017	0.055	-0.078	0.345	-0.002	0.039
Network public opinion monitoring ability Y_{15}	0.010	0.878	0.005	-0.041	0.005	0.341	-0.025	-0.089
Network public opinion early warning ability Y_{16}	0.164	0.812	0.142	0.015	-0.031	0.221	0.049	-0.049
Resident browse, usage quantity Y_{17}	0.113	0.798	0.061	0.046	-0.023	0.298	0.023	-0.036
Message, petition feedback quantity Y_{18}	0.055	-0.016	0.845	0.079	0.006	-0.016	0.459	0.045

Through the above table we can get: the larger load on functions of network platform are Y8, Y13; the bigger load on software power are Y5, Y7, Y12, Y18; the bigger load on the performance of all kinds of town government organization department are Y9, Y10, Y14, Y15, Y17; bigger load on public information are Y1, Y12, Y3, Y4, Y6, Y11. So we mainly study the multiage participation in network governance[4], get the corresponding secondary indexes: network platform function, software, load reported by all the people, the performance of all kinds of organization department. Government network platform is based on the propagation theory and governance theory[5], is not only the embodiment of the government management system, but also a kind of medium.

Have above knowable, we can get the corresponding characteristic values for the four indicators, $\lambda^{(1)}{}_{max} = 1.268$, $\lambda^{(2)}{}_{max} = 2.756$, $\lambda^{(3)}{}_{max} = 4.733$, $\lambda^{(4)}{}_{max} = 7.121$. After a hierarchical analysis, it can get matching contribution rate of each index, which is $0.080, 0.170, 0.306, 0.445$. So the evaluation index of town government network system functions is:

$$F = 0.080F1 + 0.170F2 + 0.306F3 + 0.445F4$$

From the table we can score each factor coefficient matrix respectively, and using the matrix, respectively get scores of observation variable factor, as shown below:

$$F1 = 0.241Y1 + 0.232Y2 + 0.235Y3 + \cdots - 0.025Y17 + 0.007Y18$$
$$F2 = -0.032Y1 - 0.031Y2 - 0.018Y3 + \cdots + 0.289Y17 - 0.014Y18$$
$$F3 = 0.011Y1 - 0.013Y2 - 0.009Y3 + \cdots + 0.021Y17 + 0.472Y18$$
$$F4 = -0.046Y1 - 0.039Y2 - 0.050Y3 + \cdots + -0.035Y17 + 0.046Y18$$

By the above calculation process, we obtain the evaluation index system of the town government network system functions, shown in the table below:

Table 5. Town government function transformation indicator system

First index	Secondary index	Tertiary index
		K_1(0.138)
		K_2(0.137)
	Government network platform function T_1(0.445)	K_3(0.134)
		K_4(0.136)
		K_5(0.207)
		K_6(0.239)
		K_7(0.122)
		K_8(0.198)
	Performance of all kinds of organization department T_2(0.306)	K_9(0.246)
		K_{10}(0.148)
		K_{11}(0.125)
		K_{12}(0.187)
		K_{13}(0.325)
Construction of town government network platform U	Software strength T_3(0.167)	K_{14}(0.409)
		K_{15}(0.015)
		K_{16}(0.243)
	Information reflected by public T_4(0.082)	K_{17}(0.472)
		K_{18}(0.531)

Unified planning, unified standards, and integration of resources, global services are the goal of network information construction[6]. It aware that the composition analysis of the network functions transformation in the construction of towns network platform, can effectively assign responsibilities, allocate task. Based on shown in table 5, in order to clearly show the weight relationship between the network system function of towns government, the paper get as shown in the figure below:
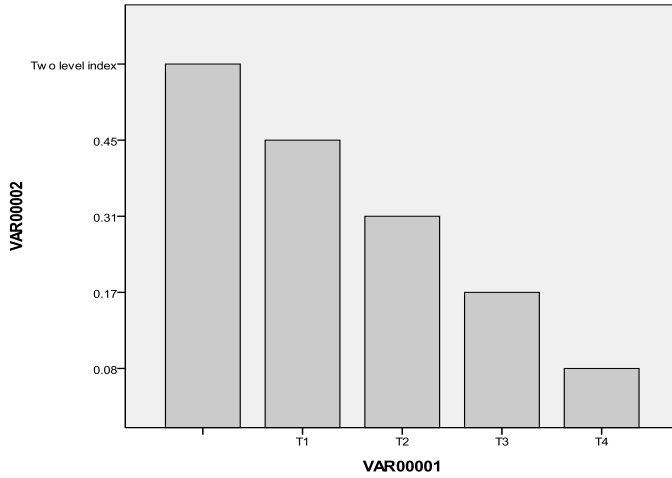
Figure 1. Secondary index

Figure 1 is the weight analysis diagram of secondary indicators. From the picture we can see clearly each index ranking of functions of the government network platform, the performance of all kinds of organization departments, software power and public information. Since we analyze the weight of three levels indicators, drawing graphics as shown in figure 2:
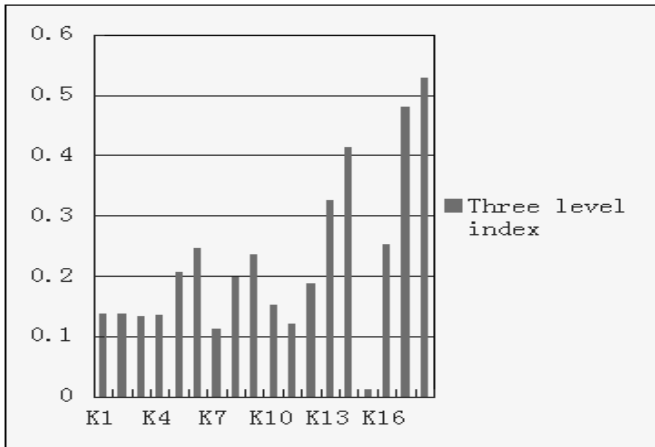

Figure 2. Tertiary index

Through the tertiary index figure 2, we can get ranking of the18 indexes.

3 Conclusions

Network media is the media based on the internet to spread information. And it reflects the government's decision-making and the real-time dynamic. Network platform is the most important media, also reflects the government image[7][8]. In the era of network, the construction of a reasonable government network platform is the effective channels and measures to react public information, anti-corrosion. This article based on principal component analysis to get the information reflect by various levels indicators of the government network platform functions, performance of all kinds of organization department, software power and information reflect by public, to study for the towns government function change. Through core unit's influence and

information uploading indexes' composition proportion, which established in this paper, we can get main aspect and evaluation system in town government platform.

References

1. Wang Yancheng. Study for town government function in the process of urbanization [D]. East China Normal University.
2. Yang Luqiao. Service-oriented town government: The government functions positioning on new rural construction of villages and towns [J]. Chu Xiong normal college journal, 2007.
3. Zhou Dingcai. Town government function transformation research Under the administrative ecology observes - in Subei QY, FC, and so on a number of villages and towns [J]. Shaanxi administration institute journal, 2010(02).
4. Yao Yinliang, Liu Bo, Wang Shaojun, Zu Xiaofei, Wang Yingluo. Research on local government network governance multi-agent cooperation effect factors [J]. Chinese Soft Science. 2010(01).
5. Zhang Baoru. Study for government network consensus management based on transmission mechanism [D]. Suzhou university. 2013.
6. Li Jian. The key to information construction---unified planning, unified standards, integrate resources, global services [J]. Chinese educational informationization. 2010(23).
7. Jia Dongjun. The rapid development of network media influence on government image shaping and countermeasure [J]. Hainan NPC. 2012(11).
8. Bai Ranran. Introduction to the Chinese government network image building - the Revelations from the government on the Internet [J]. Nei Monggol science-technology and economy. 2010(19).