Research on Efficiency Evaluation of Provincial E-government Based on DEA

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ABSTRACT

On the basis of the existing research on the efficiency evaluation of government e-government, taking 31 provincial governments of China as the research object, this paper uses BCC model and Malmquist index model in data envelopment analysis method to measure and evaluate the change of e-government efficiency and total factor productivity of provincial governments in China from 2018 to 2020. The results show that the average of the comprehensive technical efficiency of the 31 provincial governments is 0.542, and the average annual growth rate of the total factor productivity index is 1%. The overall development trend shows a fluctuating growth, and there is still a large room for improvement. Inter-provincial e-government efficiency gap is obvious, unbalanced development. Technological progress is the key factor to improve the efficiency of e-government.

Keywords: *E-government, Data Envelopment Analysis, Efficiency Evaluation, Provincial Government*

1. INTRODUCTION

In June 2017, The General Office of the State Council issued the Guidelines for the Development of Government Websites. The development goal of the government website is to make it a more comprehensive platform for government affairs disclosure, a more authoritative platform for policy release and interpretation and public opinion guidance, a more timely response to concerns and convenient service platform. With the Chinese government network as the lead and the websites of departments and local governments at all levels as the support, we will build an online government that is integrated, efficient and beneficial to the people. Government affairs website is an important channel for the government to contact the masses, serve the masses and accept social supervision; It is a bridge of communication between the government and the masses; It is an important carrier for governments at all levels to promote openness of government affairs and optimize government services. The function and service level of government website represent the construction and development degree of government e-government and reflect the government's governance ability and level. "2020 United Nations E-government Survey report" shows that China's e-government development index increased from 0.6811 in 2018 to 0.7948 in 2020, ranking to 45th in the world, reaching a "very high" level, as a measure of the country's e-government development level of the core index of online services increased to 0.9059, The index ranks 9th in the world and ranks among the top 10 in the world. At present, due to different factors such as economic development and government environment, there are differences in the development of government e-government. It is of great practical significance to evaluate the efficiency of e-government objectively and accurately.

2. RELEVANT STUDIES

In order to adapt to the development of the era of big data and promote the modernization reform of government governance, governments at all levels have accelerated the construction of e-government and improved the efficiency of e-government. Therefore, domestic and foreign government departments, experts and scholars have conducted a lot of exploration and research.

Representative foreign research practices on e-government include: the EU's "eEurope" strategic assessment framework measures the impact of e-government from three aspects: efficiency, effectiveness and democracy [2]. The United Nations' Global Government Website Evaluation proposes an e-government performance evaluation system based on the status of government websites, infrastructure and human

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resources. Accenture uses service maturity indicators and customer relationship management to evaluate the overall maturity of government websites [7]. Brown University and World Market Research Center evaluated 2,288 government websites in 196 countries and regions from five aspects, including contact information, publications, databases, portals and online public services, and 22 indicators [10]. In addition, many foreign scholars have integrated multiple city government websites to conduct horizontal empirical research. For example, Ho collected the content of 55 most popular government portal websites in the United States, and found that the design of government websites in many cities reflects the customer-oriented and "one-stop" idea, and believes that the future city government websites can complete online communication Interaction and business management [5]. Torres et al. browsed the government websites of 33 cities in Europe and assessed the service capability of government websites through service maturity and delivery maturity [8].

Many domestic scholars have used the DEA model to study the efficiency of e-government. Chen Lan combined factor analysis and DEA method, and used the DEA super-efficiency model to evaluate the efficiency of e-government of 31 provincial governments in China [1]. Wan Li and Cheng Huiping used the DEA-BCC model and the Malmquist index method to measure the e-government efficiency and total factor productivity of the national provincial government from 2007 to 2011, and used the generalized least squares method to examine the factors affecting efficiency [9]. Han Lei and Hu Guangwei evaluated the input-output efficiency of 39 typical government data open platforms in China [6]. Deng Song and Yao Chenghui measured the efficiency of 13 provincial government data opening websites in China, and found that the effect of provincial government data opening was generally good, but the development of each province was still uneven [3]. Feng Chaorui and Xu Hongyu used the DEA-Tobit two-step model to measure the efficiency of e-government services in 31 provinces in China from 2014 to 2018, and found that the efficiency of e-government services in our country was generally low and the gap between regions was large. Efficiency played an important role in promoting the efficiency of e-government service [4].

3. MODEL AND DATA

3.1 Model Building

3.1.1 DEA-BCC Model

Data Envelopment Analysis (DEA) is a linear programming method to measure the effectiveness of inputs and outputs of the same type of decision-making units, and is an important analytical tool for efficiency evaluation in the field of public administration. The DEA-BCC model is applied to the research on efficiency evaluation under the assumption of variable returns to scale. The specific model is as follows:

Suppose there are n DMU_j (j=1,2...,n), each DMU has m inputs and s outputs, X_{ij} ($X_{ij}>0$, i=1,2...,m) represents the ith input of the jth decision-making unit, Y_{rj} ($Y_{rj}>0$, r=1,2,…,s) represents the rth output of the jth decision-making unit, then the BBC model of the kth DMU is as follows:

$$\begin{cases} \min\left[\theta-\varepsilon\left(\hat{e}^{T}S^{-}+e^{T}S^{+}\right)\right] \\ \sum_{j=1}^{n}\lambda_j X_{ij}+S^{-}=\theta X_{ik} \\ \sum_{j=1}^{n}\lambda_j Y_{rj}-S^{+}=Y_{rk} \\ \sum_{j=1}^{n}\lambda_j=1 \\ \lambda_j\geq 0; j=1,2,\ldots,n \\ S^{+}\geq 0; S^{-}\geq 0 \end{cases} \tag{1}$$

Among them, θ is the efficiency value, ε is the non-Archimedean infinitesimal, S^- and S^+ are the slack variables of input and output, respectively, and λ_j is the weight coefficient. When θ=1 and $S^-=S^+=0$, it means that the decision-making unit is on the production frontier, that is, DMU_j is DEA valid; when θ=1 and $S^-\neq 0$ or $S^+\neq 0$, DMU_j is weak DEA valid; When θ< 1, DMU_j is non-DEA valid. It can obtain technical efficiency (TE), pure technical efficiency (PTE), scale efficiency (SE) and return to scale, and the relationship among the three is TE=PTE×SE.

3.1.2 Malmquist Index Model

Malmquist index model expresses the total factor productivity index (TFP) by calculating the ratio of distance function in two different periods. Compared with static efficiency analysis of the BBC model, Malmquist index model analyzes the dynamic efficiency of each decision-making unit in different periods and considers the index changes brought by technological progress. Set different periods as t and t+1. The expression is as follows:

$$\mathrm{M}\left(x^{t+1},y^{t+1},x^{t},y^{t}\right)=\left[\frac{D^{t}\left(x^{t+1},y^{t+1}\right)}{D^{t}\left(x^{t},y^{t}\right)}\times\frac{D^{t+1}\left(x^{t+1},y^{t+1}\right)}{D^{t+1}\left(x^{t},y^{t}\right)}\right]^{\frac{1}{2}} \tag{2}$$

$$Effch = \frac{D^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D^{t}\left(x^{t}, y^{t}\right)} \quad (3)$$

$$Techch = \left[\frac{D^{t}\left(x^{t+1}, y^{t+1}\right)}{D^{t+1}\left(x^{t+1}, y^{t+1}\right)} \times \frac{D^{t}\left(x^{t}, y^{t}\right)}{D^{t+1}\left(x^{t}, y^{t}\right)}\right]^{\frac{1}{2}} \quad (4)$$

$$\begin{aligned} Tfpch &= Techch \times Effch \\ &= Techch \times Pech \times Sech \end{aligned} \quad (5)$$

Where, (x^t, y^t) and (x^{t+1}, y^{t+1}) are the input and output of t and t+1 respectively, D^t and D^{t+1} are the distance function between the decision-making unit and the efficiency frontier of T and T+1 respectively. When M>1, it means that the total factor productivity increases from period t to period t+1; M=1 indicates that the total factor productivity remains unchanged; M<1 indicates that the total factor productivity decreases. When the return to scale is constant, the total factor productivity index is decomposed into the technical efficiency index (Effch) and the technological progress index (Techch). Effch reflects the change of technical efficiency, Effch>1 indicates that technical efficiency is improving. Effch=1 means that technical efficiency remains unchanged; Effch<1 indicates reduced technical efficiency. Techch reflects changes in the degree of technological improvement, Techch>1 means technological progress; Techch=1 means that technology remains unchanged; Techch<1 means technological backwardness, M=Effch×Tech. When the returns to scale are variable, the technical efficiency index (Effch) is decomposed into pure technical efficiency index (Pech) and scale efficiency index (Sech), Effch=Pech×Sech, which can further explain the changes in technical efficiency.

3.2 Index Selection and Data Sources

In combination with several literatures on e-government efficiency research and based on the development status of e-government, this paper selects 31 provincial government e-government in China as the research object to analyze the effectiveness of input-output efficiency, with a time span of 2018-2021. Considering the availability of data and the need for quantification, capital investment and human resource investment are finally selected as input indicators, and the influence of website government affairs services and government affairs new media is output indicators [4], the specific indicators are defined and measured as follows (see Table 1).

Table 1: Input and Output Indicators of Provincial Government E-government Efficiency Based on DEA.

Primary Indicator	Secondary Indicator	Measurement Method
Input	Capital Investment	Proportion of General Public Service Expenditure
	Human Resource Investment	Proportion of Government Service Personnel
Output	Website Government Services	Overall Index of Online Service Capability
	Influence of New Media in Government Affairs	Government Weibo Competitiveness Index

In the input indicators, capital investment is measured by the proportion of government general public service expenditure in the province's general public budget expenditure; human resources investment is measured by the proportion of public sector related personnel in the province's total employment. Among the output indicators, the total index of online service capability reflects the level of government service integration; government microblog is an important channel for e-government work, which can test the quality of government services and the level of informatization.

The input index data of this paper are all from China Statistical Yearbook in each year, while the output index data are from the Survey and Evaluation Report of Online Government Service Capability of Provincial Governments and Key Cities and The Microblog Influence Report of Government Affairs Index in each year.

3.3 Results and Analysis

3.3.1 Static analysis of BCC model

EXCEL is used to establish the database, DEAP2.1 is used to process the input and output data of 31 provincial governments, and the evaluation results of e-government efficiency of 31 provincial governments in China from 2018 to 2021 are calculated (see Table 2).

Table 2: E-government Efficiency Values of 31 Provinces in China from 2018 to 2020.

firm	2018				2019				2020			
	crste	vrste	scale	irs/drs	crste	vrste	scale	irs/drs	crste	vrste	scale	irs/drs
Beijing	0.681	0.765	0.890	drs	0.738	0.824	0.896	drs	0.607	0.622	0.976	irs

Tianjin	0.600	0.609	0.984	drs	0.640	0.703	0.910	irs	0.565	0.657	0.860	irs
Shanghai	1	1	1	-	1	1	1	-	1	1	1	-
Chongqing	0.578	0.620	0.933	irs	0.621	0.625	0.993	irs	0.621	0.687	0.905	irs
Hebei	0.458	0.478	0.957	irs	0.480	0.486	0.989	drs	0.482	0.529	0.911	irs
Shanxi	0.452	0.518	0.874	irs	0.476	0.542	0.878	irs	0.472	0.554	0.851	irs
Liaoning	0.505	0.557	0.906	irs	0.549	0.570	0.964	irs	0.538	0.613	0.876	irs
Jilin	0.433	0.537	0.807	irs	0.476	0.584	0.815	irs	0.519	0.590	0.880	irs
Heilongjiang	0.575	0.667	0.863	irs	0.622	0.750	0.830	irs	0.669	0.780	0.859	irs
Jiangsu	0.859	1	0.859	drs	0.909	1	0.909	drs	0.589	1	0.589	drs
Zhejiang	0.594	0.792	0.751	drs	0.695	1	0.695	drs	0.478	1	0.478	drs
Anhui	0.724	1	0.724	drs	0.789	0.969	0.814	drs	0.752	0.857	0.878	drs
Fujian	0.483	0.507	0.952	irs	0.499	0.519	0.963	irs	0.477	0.511	0.934	irs
Jiangxi	0.474	0.475	0.998	drs	0.537	0.579	0.927	drs	0.547	0.548	0.999	irs
Shandong	0.590	0.804	0.734	drs	0.600	0.736	0.815	drs	0.527	0.609	0.866	drs
Henan	0.505	0.668	0.756	drs	0.503	0.577	0.871	drs	0.455	0.460	0.990	drs
Hubei	0.438	0.450	0.973	drs	0.491	0.523	0.938	drs	0.515	0.527	0.978	drs
Hunan	0.381	0.411	0.926	irs	0.478	0.521	0.919	drs	0.434	0.451	0.963	irs
Guangdong	0.671	1	0.671	drs	0.807	1	0.807	drs	0.461	1	0.461	drs
Hainan	0.471	0.537	0.877	irs	0.485	0.563	0.863	irs	0.502	0.568	0.883	irs
Sichuan	0.656	1	0.656	drs	0.775	1	0.775	drs	0.748	1	0.748	drs
Guizhou	0.448	0.674	0.665	drs	0.459	0.469	0.978	irs	0.510	0.529	0.965	irs
Yunnan	0.420	0.430	0.977	drs	0.498	0.521	0.956	drs	0.485	0.529	0.918	irs
Shaanxi	0.535	0.639	0.838	drs	0.585	0.660	0.886	drs	0.537	0.561	0.956	drs
Gansu	0.490	0.493	0.995	drs	0.502	0.525	0.957	drs	0.474	0.500	0.948	irs
Qinghai	0.415	0.550	0.755	irs	0.512	0.634	0.809	irs	0.504	0.630	0.801	irs
Inner Mongolia	0.631	0.696	0.906	drs	0.590	0.625	0.945	irs	0.535	0.613	0.872	irs
Guangxi	0.395	0.444	0.889	irs	0.468	0.486	0.963	drs	0.485	0.548	0.885	irs
Tibet	0.228	0.306	0.747	irs	0.279	0.344	0.812	irs	0.283	0.346	0.819	irs
Ningxia	0.614	0.687	0.893	irs	0.592	0.672	0.882	irs	0.624	0.697	0.895	irs
Xinjiang	0.316	0.478	0.660	irs	0.399	0.506	0.789	irs	0.410	0.535	0.767	irs
mean	0.536	0.638	0.852		0.583	0.662	0.889		0.542	0.647	0.862	

(1) Comprehensive efficiency analysis. Comprehensive efficiency, also known as technical efficiency, reflects the production efficiency of a decision-making unit under certain (optimal scale) input factors, and is a comprehensive calculation of resource allocation ability and resource utilization efficiency of decision making unit. If the value reaches 1, it indicates that the unit is DEA effective; otherwise, it means non-DEA effective. From the calculation results, the average comprehensive efficiency of provincial e-government in China from 2018 to 2020 is 0.536, 0.583, and 0.542, with low overall efficiency and an up-and-down trend, and has never reached DEA effectiveness, indicating that there is input redundancy or output insufficiency in e-government of each province. Specifically, among the 31 provincial governments, only Shanghai has maintained a comprehensive e-government efficiency of 1 for three years, that is, the government's input and output of e-government has achieved the optimal effect, and its achievements and experience are worth learning from other provinces. In addition, the other 30 provincial governments have not reached the DEA effective. Among them, Jiangsu, Guangdong, Sichuan, Zhejiang and Anhui failed to achieve DEA effective due to scale efficiency in

some years. Such provincial governments should appropriately control the scale of investment and strive to reduce waste of resources to achieve technical effectiveness. The remaining provincial governments have not achieved effective scale efficiency and pure technical efficiency, so on the one hand, they should improve their management level and optimize resource allocation; on the other hand, they should adjust the scale of investment and improve scale efficiency.

(2) Pure technical efficiency analysis. Pure technical efficiency reflects the efficiency impact brought by technology and management investment. If the value reaches 1, it means that the government's e-government investment resource allocation is reasonable and effective, otherwise, it is invalid. The calculation results show that the average pure technical efficiency of e-government of 31 provincial governments in China from 2018 to 2020 is 0.638, 0.662, and 0.647, with a small increase and decrease, showing a fluctuating trend and a large gap with the frontier of production. There is still a large space for improvement of government technology and management level. Among them, the pure technical efficiency of e-government in Jiangsu, Guangdong, Sichuan, and Shanghai is effective in the study period, indicating that these four provincial governments are in a leading position in the ability to manage and utilize e-government resources. Among the 26 provincial governments that failed to achieve pure technical efficiency in 2020, Tianjin, Chongqing, Heilongjiang, Anhui, and Ningxia was higher than the average level, while that of the remaining 21 provincial governments was lower than the average level. The reason lies in the lack of technical level and management ability, and insufficient use of input resources, so that the service effect has not reached expectations.

(3) Scale efficiency analysis. Scale efficiency reflects the efficiency impact brought by the scale of investment. The value of 1 indicates that the government's e-government investment scale is optimal, and the scale is effective, otherwise, it is invalid. The calculation results show that from 2018 to 2020, the average scale efficiency of e-government of 31 provincial governments in China is 0.852, 0.889, and 0.862, showing a trend of up and down fluctuations. Although it is relatively close to the optimal scale, it has not yet achieved scale efficiency. Only Shanghai has a scale efficiency value of 1 and always maintains the best scale. From the perspective of changes in returns to scale, Beijing, Tianjin, Chongqing, Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Fujian, Jiangxi, Hunan, Hainan, Guizhou, Yunnan, Gansu, Qinghai, Inner Mongolia, Guangxi, Tibet, Ningxia, and Xinjiang 21 provincial governments in the state of irs, indicating that the insufficient scale of e-government investment leads to its low efficiency, and the efficiency can be improved by expanding the scale of investment. The nine provincial governments of Jiangsu, Zhejiang, Anhui, Shandong, Henan, Hubei, Guangdong, Sichuan, and Shaanxi are in the state of drs, showing that their e-government investment is large, and the input is not proportional to the output, and the scale investment should be appropriately reduced. By 2020, the scale efficiency of 20 provincial governments, including Beijing, Chongqing, and Hebei, is higher than the average level. Among them, the scale efficiency of Beijing, Jiangxi, Henan, Hubei, Hunan, Guizhou, and Shaanxi is above 0.95, which is very close to the optimal scale. The scale efficiency of 10 provincial governments including Tianjin, Shanxi and Heilongjiang is lower than average. If the scale efficiency is not achieved, there may be a waste of resources or unreasonable use due to excessive input scale, which will reduce the scale efficiency.

3.3.2 Dynamic Analysis of Malmquist Index

On the basis of static analysis, DEAP2.1 software is used to measure input and output data, and the analysis results of e-government efficiency index of 31 provincial governments in China from 2018 to 2020 are obtained as shown in Table 3.

Table 3: Decomposition of Changes in DEA-Malmquist Index of Provincial Government E-government.

firm	effch	techch	pech	sech	tfpch
Beijing	0.944	1.029	1.024	0.921	0.971
Tianjin	0.970	0.982	0.994	0.976	0.953
Shanghai	1	1.028	1	1	1.028
Chongqing	1.037	0.975	1.007	1.030	1.011
Hebei	1.026	0.990	1.045	0.982	1.015
Shanxi	1.021	1.015	0.994	1.027	1.037
Liaoning	1.032	0.991	1.003	1.029	1.023
Jilin	1.095	0.981	1.051	1.041	1.074
Heilongjiang	1.079	1.009	0.996	1.084	1.089
Jiangsu	0.828	1.039	1	0.828	0.860
Zhejiang	0.896	0.995	1.005	0.892	0.892
Anhui	1.019	0.996	0.987	1.033	1.015
Fujian	0.994	0.942	0.999	0.996	0.937
Jiangxi	1.075	0.996	1.020	1.054	1.070
Shandong	0.945	0.996	0.996	0.949	0.941
Henan	0.949	0.996	1.017	0.933	0.945
Hubei	1.084	0.996	1.039	1.044	1.080
Hunan	1.068	0.996	1.010	1.057	1.063
Guangdong	0.829	1.066	1	0.829	0.884
Hainan	1.032	0.992	1.010	1.022	1.024
Sichuan	1.068	0.996	1	1.068	1.063

Guizhou	1.067	0.992	0.988	1.080	1.058
Yunnan	1.075	0.996	1.011	1.063	1.070
Shaanxi	1.001	0.996	0.998	1.004	0.997
Gansu	0.983	0.996	1	0.983	0.979
Qinghai	1.102	0.992	1.036	1.063	1.093
Inner Mongolia	0.921	0.962	1.011	0.911	0.886
Guangxi	1.108	0.994	1.008	1.099	1.101
Tibet	1.114	0.992	1.058	1.054	1.105
Ningxia	1.008	0.992	1.005	1.003	0.999
Xinjiang	1.140	0.992	1.087	1.049	1.130
mean	1.013	0.997	1.013	1.001	1.010

According to Table 3, from 2018 to 2020, the technical efficiency index and pure technical efficiency index of e-government of 31 provincial governments in China increased by 1.3% on average, the scale efficiency index increased by 0.1%, and the technological progress index decreased by 0.3%. The three growth indexes boosts TFP growth, while the technological progress index moderates TFP growth to some extent.

In terms of changes in total factor productivity, there are 19 provincial governments in our country's 31 provinces that are higher than the national average of 1.01, accounting for 61%, and the overall development trend is relatively good. The top three are Xinjiang, Tibet, and Guangxi, with larger increases of 13%, 10.5%, and 10.1%, respectively, indicating that these three provinces have increased investment in e-government in recent years, and their efficiency and level have been significantly improved. The total factor productivity index of other 12 provincial governments such as Jiangsu and Guangdong is less than 1, among which Beijing, Tianjin, Shaanxi, Gansu, and Ningxia are all above 0.95, with no significant decline. From the perspective of changes in technical efficiency, a total of 18 provincial governments have a technical efficiency index of e-government that is higher than the national average of 1.013, and 21 provincial governments have a technical efficiency index greater than or equal to 1. The top three are Xinjiang, Tibet and Guangxi, the technical efficiency has been greatly improved. From the perspective of changes in technological progress, there are a total of 6 provincial governments whose e-government technological progress index is higher than the national average of 0.997, and only 6 provincial governments have a technological progress index greater than or equal to 1. The top three are Guangdong, Jiangsu and Beijing, the technology update speed is fast, and the management level is advanced. In general, only the five indices in Shanghai are 1 or above, and the rest of the provincial governments have deficiencies in different aspects.

Table 4: Changes in DEA-Malmquist Index of Provincial E-government from 2018 to 2020.

year	effch	techch	pech	sech	tfpch
2018-2019	1.094	0.889	1.005	1.089	0.973
2019-2020	0.939	1.118	1.020	0.920	1.049
mean	1.013	0.997	1.013	1.001	1.010

Table 4 illustrates the changes in the time series. From 2018 to 2020, the average total factor productivity index of provincial e-government is 1.01, showing an upward trend. It has achieved steady growth, with no significant changes. The technical efficiency index, pure technical efficiency index and scale efficiency index fluctuated between 0.9 and 1.1, with relatively stable development and generally in a rising state. Although the technological progress index has increased greatly, it is still relatively backward compared with other indexes, which means that the technological progress of government e-government is inefficient. Therefore, it is particularly important to improve the government's technology application and management level in the process of e-government.

4. CONCLUSION

E-government has become more and more mature in the era of big data. Accelerating the construction of e-government and changing the government's service and management model not only reduces administrative costs, but also improves the efficiency of government services and promotes the modernization reform of government governance. Using the DEA-BCC model and the DEA-Malmquist index model, this paper conducts an empirical study on the e-government efficiency of 31 provincial governments in China from 2018 to 2020, and draws the following conclusions.

First, the overall efficiency of e-government in China is low and needs to be improved. The overall average value of the comprehensive efficiency of e-government from 2018 to 2020 is 0.554. There is still a certain gap to achieve efficient e-government. Compared with scale efficiency, pure technical efficiency is far from achieving DEA effectively, and is generally lower than scale efficiency within three years, which is the key to improving overall efficiency.

Second, e-government is developing in an upward trend, and technological progress is the key factor to improve the efficiency of e-government. From 2018 to 2020, the average annual growth rate of provincial government e-government total factor productivity is 1%, and the growth rate is slow. Although the total factor productivity of some provinces is greater than 1, the low efficiency of technological progress in many provinces is also the main reason for the low total factor productivity.

Therefore, in the follow-up work, we should attach importance to the technological innovation of e-government.

Third, the efficiency gap of e-government between different provinces is obvious. Among the 31 provincial governments, Shanghai is the only one that realizes the effective DEA. Its technology and management level are advanced, and the input and output have achieved optimal results. In the future, technological innovation can be further increased. The four provinces of Jiangsu, Zhejiang, Guangdong and Sichuan have reached the advanced level in technology and management, but there is still too much or too little investment in scale investment. In the future, attention should be paid to the rational use of input resources. Most of the remaining provinces are ineffective for DEA, and there is a waste of resources in technology, management and scale investment. There are obvious gaps in the efficiency of e-government between provinces, exposing the drawbacks of unbalanced development of e-government.

5. SUGGESTIONS

One is to improve e-government technology and management level. On the one hand, strengthen the use of Internet technology in e-government. Improve the construction of e-government infrastructure, make full use of modern technologies such as computers and the Internet in e-government work, and improve service efficiency. On the other hand, improve the government administration, improve the government e-government management ability. Optimize e-government management methods, increase professional skills training for personnel, and improve resource management capabilities. From the analysis results, accelerating technology update and improving management level will help provincial governments that have not achieved DEA to improve their e-government efficiency.

The second is to optimize the allocation of e-government resources. The optimization of resource allocation helps to improve the scale efficiency of government e-government. Provincial governments with increasing returns to scale can increase investment appropriately, while provincial governments with decreasing returns to scale should not increase investment too much to avoid wasting resources. It can be improved from two aspects: capital input and human resource input. The first is to refine and rationally allocate the investment budget for e-government construction, so as to achieve the best allocation of the places where the investment funds are used. The second is to plan the investment of human resources, assign personnel positions according to actual needs and talent characteristics, and improve the matching degree of specific positions and personnel.

The third is to give play to the exemplary role of leading provinces and balance regional development. Provinces with a relatively high level of e-government development generally have the characteristics of a high degree of informatization, complete infrastructure construction, sufficient professional talents, and rich practical experience, such as Shanghai, Beijing, Zhejiang and other places. Such governments should continue to maintain a steady level of e-government. Increase the investment in capital, technology, talents and other resources, and give full play to the leading role. Other provincial governments should attach importance to and encourage the construction of e-government, learn from successful experience, and combine with their own development characteristics, introduce advanced technology and management talents, and form their own government service model, so as to achieve the best resource allocation and improve the efficiency of e-government services.

The last is to improve the e-government supervision mechanism. A sound and efficient e-government is inseparable from a sound supervision mechanism. On the one hand, it is necessary to optimize the functions of the government's internal regulatory departments, clarify the boundaries of powers and responsibilities, formulate a systematic supervision procedure and a performance evaluation system, and put supervision in place. On the other hand, all parties in the society are encouraged to effectively supervise the e-government service process, strengthen public participation, invite experts to conduct assessments regularly, and open scoring and message channels for enterprises and the public. Use big data technology to master and analyze government data, understand the needs of the public, and continuously improve to improve the efficiency of e-government services.

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